# CONIFER: A Model of Carbon and Water Flow Through a Coniferous Forest. Revised Documentation

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# CONIFER: A MODEL OF CARBON AND WATER FLOW THROUGH A CONIFEROUS FOREST

Revised Documentation

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# ABSTRACT

CONIFER simulates water, carbon, and energy dynamics of a coniferous forest. The model consists of 29 nonlinear difference equations. Measured driving variables include air temperature, dew point temperature, precipitation, solar radiation, and wind speed. Water and energy variables are updated daily; carbon variables are updated weekly. This report contains a detailed description of the model including all equations, parameter values, and initial conditions. Cross-reference tables list the equations in which each variable and parameter appear. Listings of the driving variable data, computer implementation, and corresponding output are also provided. Information sources and model behavior are discussed elsewhere.

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This report is a revision of Forest Biome Bulletin No. 8 published in 1977. A vertical bar (|) in the right-hand margin of this text indicates revision, and a minus sign (-) indicates major deletion.

# 1. INTRODUCTION

In this report we present documentation for CONIFER, a model of water and carbon flow through a coniferous forest. We have tried to provide in this report all the information needed to implement the model on a computer and to obtain output. The report is intended for ecologists with interest in specific details of the model, for the programmer or ecologist interested in implementing the model, and for those of us in our own project who work with CONIFER.

Only a description of the model is provided herein. The ecological assumptions, sources from which parameters were calculated, and behavior of the model are discussed elsewhere (Sollins et al. 1974, Edmonds and Sollins 1974, Sollins et al. 1979, P. Sollins and G. L. Swartzman MS in prep.). The old-growth forest ecosystem on which CONIFER is based is described by Grier and Logan (1977) and Sollins et al. (in press).

This report supersedes both undated internal report No. 158 of the Coniferous Forest Biome, Documentation for a Combined Carbon-water Flow Stand Level Coniferous Forest Model, by G. Swartzman and P. Sollins, and Coniferous Forest Biome Bulletin No. 8, CONIFER; A Model of Carbon and Water Flow Through a Coniferous Forest--Documentation, by the Coniferous Forest Biome Modeling Group.

## 1.1. *Format of the Report and Definitions*

The format of this report follows closely that of the FLEXFORM described by White and Overton (1974).

Model variables are restricted to six types: state variables, timing variables, driving variables, flow variables, intermediate variables, and output variables. In addition, there are special functions, two sets of parameters, and a set of initial conditions. Mnemonic variable names are not used. The abbreviation *(dim.)* indicates that the parameter or variable is dimensionless.

*Driving variables* (denoted $Z_i$) are those factors extrinsic to the system whose values influence the system but are not themselves influenced by it. Examples are average daily air temperature ($Z_3$) and daily amount of precipitation ($Z_1$). *State variables* (denoted $X_i$) consist of that set of variables whose values summarize the present state of the system and that are sufficient to predict the future state of the system when used as initial conditions in equations that describe the rate of change of each state variable. State variables in this model correspond primarily to storages in compartments, for example, amount of carbon in old foliage ($X_{11}$) or amount of water stored in the litter ($X_7$). *Flow variables* (denoted $F[i,j]$) correspond to the amount of a particular material transferred between two compartments during a time interval. This is calculated in a corresponding flow function, which in general may depend on state variables or driving variables or any parameters but not on other flow variables. In cases in which several flow functions have terms in common we create an *intermediate variable* (denoted $G_i$) and write both flows as functions of the intermediate variable.

The use of intermediate variables ($G$ functions) helps make clear the interactions between processes. For example, foliage resistance (stomatal) resistance plus mesophyll resistance) is used directly in the photosynthesis flow function and indirectly (after dividing by leaf area index to obtain a canopy resistance) in the transpiration flow function. The appearance of the same $G$ function in both a water and a carbon flow function makes clear a coupling--an important structural feature of both the model and the system.

It should be noted that in CONIFER for every flow function there is a corresponding $G$ function to which the $F$ function is equal. This is not a required feature of the paradigm but rather a practice we have found convenient.

*Output variables* (denoted $Y_i$) are created to display aspects of model behavior that cannot be seen by printing or plotting $X$ variables, $F$'s, or $G$'s. These variables do not appear in $F$, $G$, or $Z$ functions and do not influence system behavior. Examples include changing the units of, say, a $G$ function such as resistance to conductance for comparison with published values. In our model, for example, we have a $Y$ variable for net weekly assimilation ($Y_{16}$), which is the sum of old and new foliage net daytime photosynthesis less the sum of old and new foliage nighttime respiration.

Within many $G$ functions *temporary variables* are used to simplify calculations. These temporaries are denoted $T_1$, $T_2$, etc. in the code and are never used to transfer information from one $G$ function to another.

## 1.2. *Model Structure*

An overview of the model structure is necessary to avoid mistaking the forest for the trees. Three basic cycles are considered (Figure 1): water, carbon, and energy. The law of conservation of mass is used in the carbon and water modules in that all material entering the system either accumulates or flows out. In the energy module we have not maintained a conservation scheme, choosing instead to model only those processes we felt were important.

Unfortunately, flow diagrams as such provide no information about interactions among carbon, water, and energy flow processes, much less about interactions among processes within a module. Various attempts have been made to provide this information diagrammatically (e.g., Forrester 1971), but none is workable for a model as large and complex as CONIFER. We feel that some discussion of interactions is essential and have included in this section a list of those variables ($X$'s and $G$'s) that influence processes outside the module in which they are calculated (Table 1). Thus, for example, all cases in which a carbon variable affects water flow processes are listed. Other details of interactions between processes can be found in the detailed descriptions of each $G$ function.

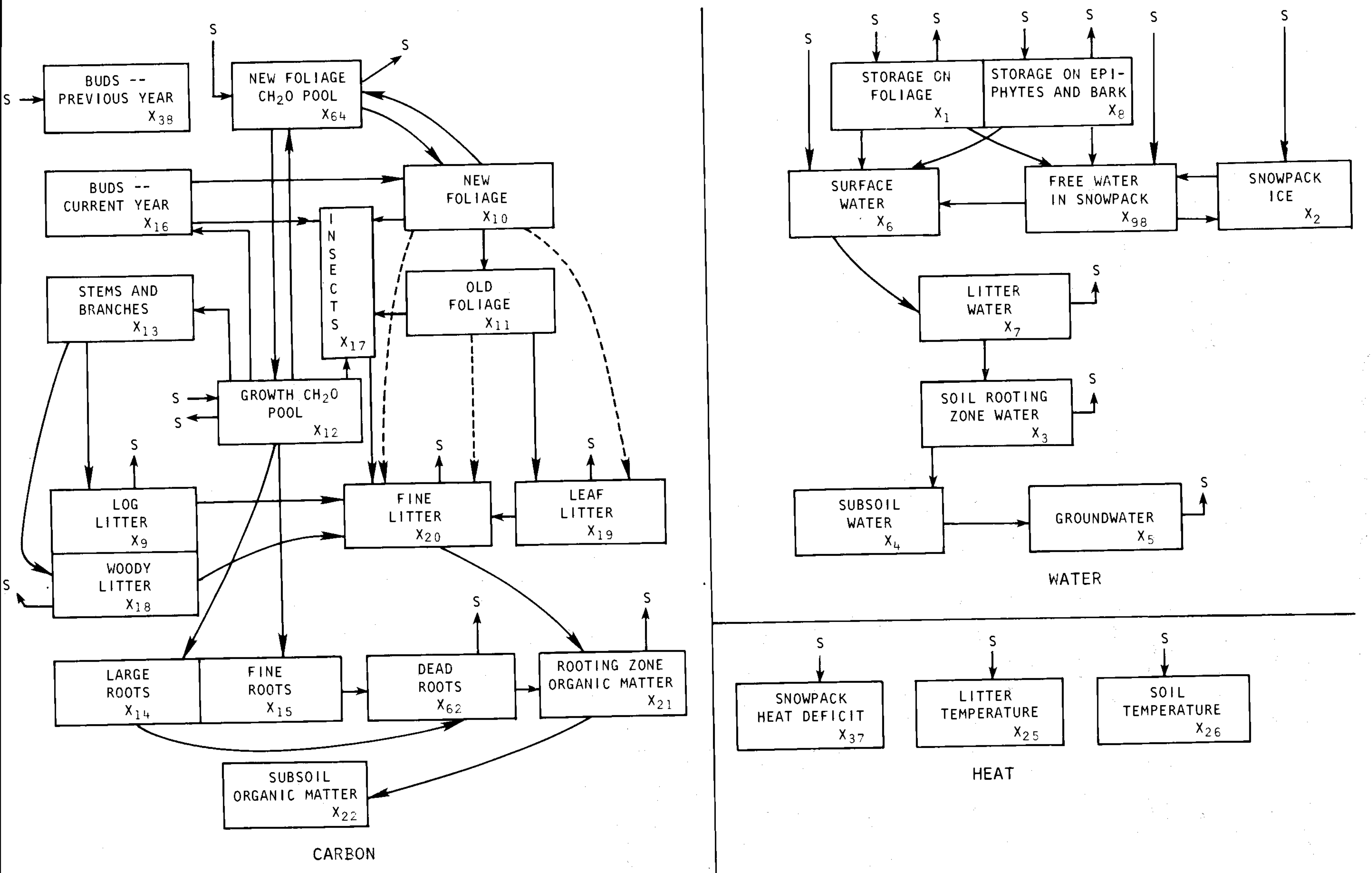


Figure 1. Compartments and flows of CONIFER. Dashed lines indicate transfers occurring only during perturbations.

Table 1. Interactions among modules of CONIFER.

| *Effect of carbon variables on water and energy flows* | *Comments* |
|---|---|
| A. *Foliage biomass affects:* | |
| 1. Transpiration | |
| 2. Fraction of rain incident to canopy that strikes foliage (and therefore also fraction striking nonfoliage) | 2. This and following two affect drip, litter, and soil moisture dynamics. There are also indirect effects through percent cover. |
| 3. Water retention capacity of canopy | |
| 4. Distribution of retention capacity between foliage and nonfoliage | |
| 5. Fraction of rainfall passing directly to forest floor | 5. Through percent cover |
| 6. Net longwave radiation input to canopy | 6. Through percent cover, which affects input and loss |
| B. *Stem biomass affects:* | |
| 1. Percent cover (and therefore numbers 2-6 above) | |
| C. *Fine, leaf and woody litter mass affects:* | |
| 1. Water retention capacity of litter | |
| *Effect of water variables on carbon and energy flows* | |
| A. *Soil moisture affects:* | |
| 1. New and old foliage photosynthesis | 1. Via stomatal resistance |
| 2. Fine root death | 2. Via plant moisture stress |
| 3. Dead root + soil organic matter decomposition processes | |
| B. *Litter moisture affects:* | |
| 1. Litter decomposition processes | |
| C. *Snowpack ice affects:* | |
| 1. Litter temperature | |
| D. *Snowfall affects:* | |
| 1. Heat loss from snowpack due to snowfall | |
| 2. Albedo of snowpack | |
| E. *Drip plus direct rainfall affect:* | |
| 1. Litter and soil temperature | |
| *Effect of energy variables on carbon and water flows* | |
| A. *Heat input to canopy affects:* | |
| 1. Potential evaporation from canopy | |
| 2. Transpiration | |
| B. *Litter temperature affects:* | |
| 1. Litter decomposition processes | |
| 2. Potential evaporation from litter | |
| C. *Soil temperature affects:* | |
| 1. Large and fine root respiration and growth | |
| D. *Net heat input to snowpack and heat deficit of snowpack affect:* | |
| 1. Net transfer between free water and ice in snowpack | |

### 1.3. *Model Implementation*

CONIFER was implemented on CDC CYBER at Oregon State University using a flow-oriented simulation processor similar to SIMCOMP (George Gustafson, Technical Report 138, Grasslands Biome, Natural Resource and Ecology Laboratory, Colorado State University, Fort Collins, Colorado). We provide below some details concerning the operation of our processor, although there should be no problem coding CONIFER again in a higher level language such as FORTRAN.

Our processor uses the following order of computation. It first reads in values for the driving variables (subroutine ZUP), and then calculates the values of each of the *G* functions in the proper order (subroutin GUP).

At the beginning of subroutine GUP, before any *G*'s are calculated, we set all *G*'s equal to a very large number. This ensures that, if a *G* variable is used before it is calculated, an overflow occurs and the program stops executing. This feature immediately brings attention to any circularities and sequencing errors, and we strongly recommend that it be programmed into any future version of the code.

Next, the processor updates the basic time variable (daily, zero origin) and converts it to weekly and monthly time (subroutine TIMER). It next calculates the *F* functions using current values of *Z*'s, *G*'s, and *X*'s, and then updates the *X's*.

$$X_i(t) = X_i(t-1) + \sum_{\substack{j=1 \\ j\neq i}}^{n} F_{ji} - \sum_{\substack{j=1 \\ j\neq i}}^{m} F_{ij}$$

Last, the processor updates *Y* variables.

The processor may be requested to print or plot in any combination or order *S*, *F*, or *Z* functions or *X* or *Y* variables. This occurs immediately after the *G* functions have been calculated but before the time variable is updated.

## 2. STATE VARIABLES

In this section we have listed the state variables (*X*'s) in numerical order. Following the description of each *X* is a list of the *G* functions in which that *X* is used. On the extreme right-hand side are two sets of initial conditions for each *X*. The first corresponds to day 1 in 1972, the second to day 131 in 1972. It should be noted that the first set is simpler in that the initial conditions for $X_{10}$ (new foliage) and $X_{38}$ (bud carbon--last year's) are both zero, while on day 131 these must have nonzero values. The meteorological station did not begin operation until day 131 (see Appendix III) so that for most purposes it is necessary to begin the model on day 131. There is, however, an advantage in starting during the summer in that both $X_1$ (water stored on foliar surfaces) and $X_8$ (storage on bark and epiphyte surfaces) can be assumed to be zero.

Two compartments, $X_6$ and $X_{64}$, are intended to be zero-valued throughout the simulation. The equations for flows in and out of these compartments are such that the compartment is empty at the end of each time step. These two variables (and $X_{22}$) are different from all other state variables in that they do not appear in any $G$ functions; they could be eliminated from the model but doing so would increase considerably the complexity of several of the $G$ functions.

| | | Day 1 | Day 131 |
|---|---|---|---|
| $X_1$ | water storage on foliage ($m^3$/ha) -- $G_5$, $G_7$, $G_{20}$, $Y_{20}$ | 19.1 | 0 |
| $X_2$ | snowpack ice ($m^3$/ha) -- $G_{22}$, $G_{60}$, $G_{67}$, $G_{118}$, $Y_4$, $Y_{20}$ | 2100 | 0 |
| $X_3$ | soil rooting zone water ($m^3$/ha) -- $G_{12}$, $G_{20}$, $G_{42}$, $G_{50}$, $G_{87}$, $Y_{20}$ | 3900 | 3980 |
| $X_4$ | subsoil water ($m^3$/ha) -- $G_{19}$, $Y_{20}$ | 9970 | 9970 |
| $X_5$ | groundwater storage ($m^3$/ha) -- $G_{18}$, $Y_{20}$ | 11900 | 11896 |
| $X_6$ | water storage on litter surface ($m^3$/ha) | 0 | 0 |
| $X_7$ | litter water ($m^3$/ha) -- $G_{15}$, $G_{22}$, $G_{69}$, $Y_{14}$, $Y_{20}$ | 0 | 129.5 |
| $X_8$ | water storage on epiphytes and bark surfaces ($m^3$/ha) -- $G_8$, $G_{56}$, $Y_{20}$ | 21.1 | 0 |
| $X_9$ | log litter carbon (t/ha) -- $G_{105}$ | 108 | 108 |
| $X_{10}$ | new foliage carbon (t/ha) -- $G_{24}$, $G_{25}$, $G_{34}$, $G_{38}$, $G_{46}$, $G_{61}$, $G_{101}$, $G_{135}$ | 0 | 0.30 |
| $X_{11}$ | old foliage carbon (t/ha) -- $G_{29}$, $G_{30}$, $G_{40}$, $G_{61}$, $G_{90}$, $G_{93}$, $G_{101}$ | 4.85 | 4.55 |
| $X_{12}$ | carbon in growth $CH_2O$ pool (t/ha) -- $G_{30}$, $G_{33}$, $G_{35}$, $G_{36}$, $G_{37}$, $G_{45}$, $G_{94}$, $G_{138}$, $G_{139}$, $G_{140}$ | 11.3 | 15.5 |
| $X_{13}$ | stem plus branch carbon (t/ha) -- $G_{13}$, $G_{16}$, $G_{23}$, $G_{56}$, $G_{57}$, $G_{62}$, $G_{92}$ | 350.0 | 350.0 |
| $X_{14}$ | large root carbon (t/ha) -- $G_{86}$ | 71.0 | 70.0 |
| $X_{15}$ | fine root carbon (t/ha) -- $G_{87}$, $G_{140}$ | 5.65 | 5.61 |
| $X_{16}$ | bud carbon -- current year (t/ha) -- $G_{44}$, $G_{79}$, $G_{95}$ | 0.0125 | $0.555 \times 10^{-16}$ |
| $X_{17}$ | canopy insect carbon (t/ha) -- $G_{82}$ | 0.07 | 0.01 |
| $X_{18}$ | woody litter carbon (t/ha) -- $G_{55}$, $G_{83}$ | 9.7 | 9.73 |
| $X_{19}$ | foliage litter carbon (t/ha) -- $G_{55}$, $G_{81}$, $Y_{14}$ | 7.25 | 7.17 |

| | | Day 1 | Day 131 |
|---|---|---|---|
| $X_{20}$ | fine litter carbon (t/ha) -- $G_{55}$, $G_{84}$, $Y_{14}$ | 8.7 | 8.7 |
| $X_{21}$ | carbon in soil rooting zone organic matter (t/ha) -- $G_{88}$ | 56.6 | 56.5 |
| $X_{22}$ | carbon in subsoil organic matter (t/ha) | 80.0 | 80.0 |
| $X_{25}$ | litter temperature (deg) -- $G_{14}$, $G_{15}$, $G_{41}$, $G_{67}$, $G_{68}$, $G_{121}$ | 7.5 | 7.5 |
| $X_{26}$ | soil rooting zone temperature (deg) -- $G_{51}$, $G_{68}$ | 4.1 | 4.1 |
| $X_{37}$ | snowpack heat deficit (ly) -- $G_{128}$, $G_{129}$, $G_{161}$ | 0 | 0 |
| $X_{38}$ | bud carbon (previous year; t/ha) -- $G_{44}$, $G_{46}$ | 0 | 0.00983 |
| $X_{62}$ | dead root carbon (t/ha) -- $G_{85}$ | 7.5 | 7.7 |
| $X_{64}$ | carbon in new foliage $CH_2O$ pool (t/ha) | 0 | 0 |
| $X_{98}$ | free water in snowpack ($m^3$/ha) -- $G_{10}$, $G_{128}$, $G_{161}$ | 0 | 0 |

## 3. TIMING VARIABLES

In this section we discuss the timing variables ($t_d$ and $t_w$) used in CONIFER. Definitions of these and lists of their occurrence follow.

---

$t_d$ = time in days

Comment: Various functions are set up such that $t_d$ must be day of the year, that is $t_d$ = 1 must be 1 January of some year. We typically begin simulations with $t_d$ = 131, which is the day in 1972 on which the meteorological station began operating. Here $t_d$ is used in special functions $S_3$, $S_5$, and $S_6$.

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$t_w$ = time in weeks (modulo 52)

Comment: This variable gives the week of the year (1-52) and is reset to 1 at the beginning of each year. Day 131 occurs during week 18. Here $t_w$ is used in the following intermediate functions: $G_{34}$, $G_{40}$, $G_{44}$, $G_{79}$, $G_{106}$.

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## 4. DRIVING VARIABLES

In this section we list the driving variables ($Z$'s) used in CONIFER. Immediately following the description of each $Z$, we list the functions

($G$'s, $S$'s, and $Y$'s) in which the $Z$ is used. All $Z$'s are averages or totals for a day. The data currently used in running CONIFER are shown in Appendix III. Methods used in obtaining this data set are described by Waring et al. (1978.)

### 4.1. *Cross Reference Listing of Driving Variables*

$Z_1$ total precipitation ($m^3 \cdot ha^{-1} \cdot day^{-1}$) -- $Z_8$, $G_{54}$, $G_{115}$

$Z_2$ average shortwave radiation (ly/min) -- $Z_{12}$, $Z_{16}$, $G_{109}$

$Z_3$ average 24-hr air temperature (deg) -- $Z_8$, $Z_{12}$, $G_6$, $G_{14}$, $G_{42}$, $G_{48}$, $G_{114}$, $G_{117}$, $G_{122}$, $G_{170}$

$Z_4$ day length (dim.) --$Z_{12}$, $Z_{16}$, $G_{20}$, $G_{110}$

$Z_5$ average 24-hr dew point temperature (deg) -- $Z_8$, $Z_{12}$, $G_2$, $G_6$, $G_{14}$

$Z_6$ average daytime air temperature (deg) -- $G_{20}$, $G_{43}$, $G_{54}$, $G_{107}$, $G_{115}$, $G_{118}$

$Z_7$ average nighttime termperature (deg) -- $G_{108}$

$Z_8$ incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$) -- $G_3$, $G_4$, $G_9$, $G_{54}$, $G_{115}$

$Z_9$ average daytime dew point temperature (deg) -- $G_{20}$, $G_{43}$

$Z_{12}$ daily longwave radiation from the sky (ly/day) -- $G_{120}$, $G_{168}$, $Y_{33}$

$Z_{13}$ potential solar radiation for horizontal surface (ly/day) -- $Z_{12}$

$Z_{14}$ average wind speed (m/sec) -- $G_{100}$

$Z_{15}$ slope factor for radiation calculations (dim.) -- $Z_{16}$, $G_{109}$

$Z_{16}$ actual shortwave radiation corrected for slope and aspect (ly/day) -- $G_{59}$

### 4.2. *Description of Driving Functions*

$Z_8$ = incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$Z_8 = \begin{cases} Z_1 & \text{if } T_1 \geq B_{19} \\ 0 & \text{if } T_1 < B_{19} \end{cases}$$

$T_1$ = calculated wet-bulb temperature (deg)

$$T_1 = Z_3 - (Z_3 - Z_5)(0.376 + 0.014\ Z_3)$$

$Z_1$ = total precipitation ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_3$ = average 24-hr air temperature (deg)
$Z_5$ = average 24-hr dew point temperature (deg)
$B_{19}$ = wet-bulb temperature above which all precipitation is snow (deg)

Comment: Function is from Anderson (1968)

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$Z_{12}$ = daily longwave radiation from sky (ly/day)

$$Z_{12} = S_4(Z_3) - (228.0 + 11.16[\sqrt{S_1(Z_3)} - \sqrt{S_1(Z_5)}])\ T_1$$

$T_1$ = correction for cloud cover

$$T_1 = (1440\ Z_2\ Z_4/Z_{13})^2$$

$Z_2$ = average shortwave radiation (ly/min)
$Z_3$ = average 24-hr air temperature (deg)
$Z_4$ = day length (dim.)
$Z_5$ = average 24-hr dew point temperature (deg)
$Z_{13}$ = potential solar radiation for horizontal surface (ly/day)
$S_1$ = saturation vapor pressure as function of temperature (mbar)
$S_4$ = longwave radiation from blackbody (ly/day)

Comment: Function is from Anderson and Baker (1967).

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$Z_{14}$ = wind speed (m/sec)

Comment: Wind speed is set equal to $B_{15}$ when datum is missing.

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$Z_{16}$ = actual shortwave radiation corrected for slope and aspect (ly/day)

$$Z_{16} = 1589\ Z_{15}Z_4Z_2$$

$Z_2$ = average shortwave radiation (ly/min)
$Z_4$ = day length (dim.)
$Z_{15}$ = slope factor (dim.)

Comment: The constant 1589 is min/day times $1/\cos\Theta$, where $\Theta$ is the average slope angle of WS-10. For discussion of this and the "slope factor" concept see EDFB Memo Report #73-10 by L. L. Swift and R. J. Luxmore (1973).

## 5. FLOW FUNCTIONS

In this section we list the flow functions ($F$'s) used in CONIFER. After each flow, we list the description of that flow, and, on the extreme left, the $G$ function to which the flow is equal. The $F$'s are listed in numerical order except that the index "99" is treated as a "0." This arrangement causes all inputs to the system to appear first.

The flow functions represent terms in the difference equations describing the daily change in each state variable. The abbreviation "$F(10,11)$" indicates transfer from $X_{10}$ to $X_{11}$; $F(99,10)$ indicates transfer into $X_{10}$ from outside the system, while $F(10,99)$ indicates transfer from $X_{10}$ to outside the system. The difference equation for $X_{10}$, for example, consists of the sum of all $F$'s containing "10" as the second index [$F(i,10)$] less the sum of all $F$'s containing "10" as the first index [$F(10,j)$]. All flows are calculated daily; however, the $G$ functions from which the carbon flows are calculated are set to zero except every seventh day, in keeping with the weekly time-step of that part of the model.

$F(99,1)$ rain input to foliar surfaces -- $G_3$

$F(99,2)$ snowfall reaching ground -- $G_{115}$

$F(99,6)$ rainfall passing directly to litter surface water -- $G_{70}$

$F(99,8)$ rain input to bark and epiphyte surfaces -- $G_4$

$F(99,12)$ input from old foliage photosynthesis to growth $CH_2O$ pool -- $G_{29}$

$F(99,20)$ input to fine litter from microparticulate matter and carbon dissolved in precipitation -- $G_{97}$

$F(99,25)$ change in litter temperature -- $G_{67}$

$F(99,26)$ change in soil temperature -- $G_{68}$

$F(99,37)$ net increase in heat deficit of snowpack -- $G_{128}$

$F(99,38)$ change in last year's bud carbon -- $G_{44}$

$F(99,64)$ input to new foliage $CH_2O$ pool due to net new foliage photosynthesis -- $G_{24}$

$F(99,98)$ rainfall passing directly into free water in snowpack -- $G_{74}$

$F(1,99)$ evaporation from foliage -- $G_7$

$F(1,6)$ drip from foliage to litter surface -- $G_{71}$

$F(1,98)$ drip from foliage to free water in snowpack -- $G_{75}$

$F(2,98)$ transfer from ice to free water in snowpack -- $G_{129}$

$F(3,99)$ transpiration rate -- $G_{20}$

$F(3,4)$ water transfer from soil rooting zone to subsoil -- $G_{12}$

$F(4,5)$ water transfer from subsoil to groundwater -- $G_{19}$

$F(5,99)$ outflow from groundwater -- $G_{18}$

$F(6,7)$ water flow from surface into litter layer -- $G_{11}$

$F(7,99)$ evaporation from litter -- $G_{22}$

$F(7,3)$ water transfer from litter to soil rooting zone -- $G_{15}$

$F(8,99)$ evaporation from epiphyte and bark surfaces -- $G_8$

$F(8,6)$ water drip from epiphyte and bark surfaces to storage on litter surface -- $G_{72}$

$F(8,98)$ drip from epiphyte and bark surfaces to free water in snowpack -- $G_{76}$

$F(9,99)$ carbon loss from logs due to respiration -- $G_{113}$

$F(9,20)$ carbon loss from logs due to fragmentation -- $G_{112}$

$F(10,11)$ maturation of new foliage -- $G_{34}$

$F(10,17)$ new foliage consumption by insects -- $G_{38}$

$F(10,19)$ carbon transfer from new foliage to leaf litter due to acute defoliation -- $G_{135}$

$F(10,20)$ carbon transfer from new foliage to fine litter due to acute defoliation -- $G_{135}$

$F(10,64)$ carbon transfer from new foliage to new foliage $CH_2O$ pool -- $G_{27}$

$F(11,17)$ old foliage consumption by insects -- $G_{90}$

$F(11,19)$ transfer from old foliage to leaf litter due to leaf fall and acute defoliation -- $G_{40}$

$F(11,20)$ transfer from old foliage to fine litter due to acute defoliation -- $G_{136}$

$F(12,99)$ total respiration loss from growth $CH_2O$ pool -- $G_{31}$

$F(12,13)$ carbon transfer to stems plus branches -- $G_{35}$

$F(12,14)$ carbon transfer to large roots -- $G_{36}$

$F(12,15)$ carbon transfer to fine roots -- $G_{37}$

$F(12,16)$ bud growth -- $G_{33}$

$F(12,17)$ consumption of growth $CH_2O$ pool by insects -- $G_{94}$

$F(12,64)$ transfer of carbon from growth $CH_2O$ pool to new foliage $CH_2O$ pool to meet foliar respiration and growth demands -- $G_{32}$

$F(13,9)$ carbon transfer from stems plus branches to log litter -- $G_{62}$

$F(13,18)$ carbon transfer from stems plus branches to woody litter -- $G_{92}$

$F(14,62)$ large root mortality -- $G_{86}$

$F(15,62)$ fine root mortality -- $G_{87}$

$F(16,10)$ carbon transfer from buds to new foliage -- $G_{79}$

$F(16,17)$ bud consumption by insects -- $G_{95}$

$F(17,20)$ insect frass input to fine litter -- $G_{82}$

$F(18,99)$ carbon loss from fine woody litter due to respiration -- $G_{111}$

$F(18,20)$ carbon loss from fine woody litter due to fragmentation -- $G_{104}$

$F(19,99)$ carbon loss from foliage litter due to respiration -- $G_{103}$

$F(19,20)$ carbon loss from foliage litter due to fragmentation -- $G_{98}$

$F(20,99)$ carbon loss from fine litter due to respiration -- $G_{125}$

$F(20,21)$ incorporation of fine litter into rooting zone organic matter -- $G_{116}$

$F(21,99)$ carbon loss from rooting zone due to respiration -- $G_{133}$

$F(21,22)$ carbon transfer from soil rooting zone to subsoil -- $G_{132}$

$F(62,99)$ carbon loss from dead roots due to respiration -- $G_{131}$

$F(62,21)$ carbon loss from dead roots due to fragmentation -- $G_{126}$

$F(64,99)$ new foliage nighttime respiration -- $G_{25}$

$F(64,10)$ transfer of carbon to new foliage from new foliage $CH_2O$ pool -- $G_{26}$

$F(64,12)$ transfer of surplus carbon from new foliage $CH_2O$ pool to growth $CH_2O$ pool -- $G_{28}$

$F(98,2)$ transfer from free water in snowpack to ice -- $G_{161}$

$F(98,6)$ water draining from snowpack to litter surface -- $G_{10}$

## 6. INTERMEDIATE VARIABLES AND FUNCTIONS

In this section we list the intermediate variables ($G$'s) and the corresponding functions used in CONIFER. The section contains three parts. The first is a cross-reference list designed to provide some minimum information about each $G$ quickly. It contains the description of each $G$ followed by a list of $G$ and $Y$ (output) functions in which the $G$ is used.

The second part provides algebraic and English language descriptions of each $G$. All variables and constants used in the $G$ function are defined. A "comment" paragraph may provide information helpful in understanding how the $G$ function behaves. Both lists are in numerical order, and not in order of computation.

In the third part, we show the scheme we used to divide the $G$'s into modules, the order in which the modules occur, and the sequence of computation within each module. The $G$ functions pertinent to computing water flow through the system are calculated each day. The $G$ functions used only in calculating carbon transfers are zero-valued except every seventh day. Variables that occur in modules 1 through 8 are calculated daily while those occurring in modules 9 through 18 are calculated weekly.

### 6.1. *Cross-Reference Listing of Intermediate Variables*

$G_1$ all-sided needle surface area index -- $G_{20}$

$G_2$ heat input to snowpack due to condensation -- $G_{127}$, $Y_{25}$

$G_3$ rain input to foliar surfaces -- $F(99,1)$, $G_5$, $G_7$, $G_{20}$

$G_4$ rain input to epiphyte and bark surfaces -- $F(99,8)$, $G_8$, $G_{56}$

$G_5$ drip from foliar surfaces -- $G_7$, $G_{20}$, $G_{71}$, $G_{75}$, $G_{134}$

$G_6$ potential evaporation from canopy -- $G_5$, $G_7$, $G_8$, $G_{56}$

$G_7$ evaporation from foliar surfaces -- $F(1,99)$, $G_{20}$, $Y_1$, $Y_{22}$

$G_8$ evaporation from epiphyte and bark surfaces -- $F(8,99)$, $Y_1$, $Y_{22}$

$G_9$ rainfall passing directly to snowpack or litter surface -- $G_{70}$, $G_{74}$, $G_{134}$

$G_{10}$ water transfer from snowpack to litter surface -- $F(98,6)$, $G_{11}$

$G_{11}$ water entering litter -- $F(6,7)$, $G_{15}$, $G_{22}$

$G_{12}$ water transfer from soil rooting zone to subsoil -- $F(3,4)$, $G_{19}$

$G_{13}$ fraction of rain incident to canopy which strikes foliage -- $G_3$, $G_4$

$G_{14}$ potential evaporation from litter -- $G_{15}$, $G_{22}$

$G_{15}$ water transfer from litter to soil rooting zone -- $F(7,3)$, $G_{12}$

$G_{16}$ water retention capacity of canopy -- $G_5$, $G_{56}$

$G_{18}$ outflow from groundwater -- $F(5,99)$ $-G_{17}$

$G_{19}$ water transfer from subsoil to groundwater -- $F(4,5)$

$G_{20}$ transpiration rate -- $F(3,99)$, $G_{12}$ $-G_{21}$

$G_{22}$ evaporation from litter -- $F(7,99)$, $Y_1$

$G_{23}$ percent cover by canopy -- $G_3$, $G_4$, $G_9$, $G_{54}$, $G_{91}$
$G_{119}$, $G_{120}$, $G_{124}$, $G_{168}$

$G_{24}$ net new foliage photosynthesis -- $F(99,64)$, $G_{47}$, $Y_{16}$

$G_{25}$ new foliage nighttime respiration -- $F(64,99)$, $G_{47}$, $Y_{16}$

$G_{26}$ transfer of carbon to new foliage from new foliage CH2O pool -- $F(64,10)$, $G_{34}$

$G_{27}$ transfer of carbon from new foliage to new foliage $CH_2O$ pool -- $F(10,64)$, $G_{34}$

$G_{28}$ transfer of surplus carbon from new foliage $CH_2O$ pool to growth $CH_2O$ pool -- $F(64,12)$

$G_{29}$ net old foliage photosynthesis -- $F(99,12)$, $Y_{16}$

$G_{30}$ old foliage nighttime respiration -- $G_{31}$, $Y_{16}$

$G_{31}$ total respiration loss from growth CH2O pool -- $F(12,99)$

$G_{32}$ transfer of carbon from growth CH2O pool to new foliage pool to meet foliar respiration and growth demands -- $F(12,64)$, $G_{87}$

$G_{33}$ bud growth -- $F(12,16)$, $G_{79}$

$G_{34}$ maturation of new foliage -- $F(10,11)$

$G_{35}$ carbon transfer to stems and branches -- $F(12,13)$, $Y_{23}$

$G_{36}$ carbon transfer to large roots -- $F(12,14)$, $Y_{23}$

$G_{37}$ carbon transfer to fine roots -- $F(12,15)$, $Y_{23}$

$G_{38}$ new foliage consumption by insects -- $F(10,17)$, $G_{34}$, $G_{44}$

$G_{39}$ temperature effect on growth processes -- $G_{33}$, $G_{35}$, $G_{38}$, $G_{46}$, $G_{90}$, $G_{94}$, $G_{95}$

$G_{40}$ leaf-fall rate -- $F(11,19)$, $Y_2$

$G_{41}$ litter temperature -- $G_{77}$

$G_{42}$ plant moisture stress (PMS) -- $G_{43}$

$G_{43}$ new foliage stomatal resistance -- $G_{49}$, $G_{52}$, $G_{101}$

$G_{44}$ change in last year's bud carbon -- $F(99,38)$, $G_{46}$

$G_{45}$ portion of growth CH2O pool available for foliar respiration and growth -- $G_{26}$, $G_{27}$, $G_{28}$, $G_{32}$

$G_{46}$ new foliage growth demand -- $G_{26}$, $G_{28}$, $G_{32}$

$G_{47}$ surplus or deficit of new foliage photosynthate after new foliage respiration is satisfied -- $G_{26}$, $G_{27}$, $G_{28}$, $G_{32}$

$G_{48}$ average weekly 24-hr air temperature -- $G_{39}$, $G_{67}$, $G_{138}$

$G_{49}$ average weekly stomatal resistance of new foliage -- $G_{24}$

$G_{50}$ effect of moisture and temperature on soil rooting zone processes -- $G_{85}$, $G_{88}$

$G_{51}$ weekly average soil temperature -- $G_{53}$, $G_{139}$, $G_{140}$

$G_{52}$ stomatal resistance of old foliage -- $G_{58}$, $G_{101}$

$G_{53}$ effect of soil temperature on soil processes -- $G_{36}$, $G_{37}$, $G_{50}$

$G_{54}$ snowfall which is initially intercepted but melts in the canopy -- $G_3$, $G_4$

$G_{55}$ water holding capacity of litter -- $G_{15}$, $G_{22}$, $G_{69}$

$G_{56}$ drip from epiphyte and bark surfaces -- $G_8$, $G_{72}$, $G_{76}$, $G_{134}$

$G_{57}$ fraction of water retention capacity of canopy due to foliage -- $G_5$, $G_7$, $G_8$, $G_{56}$

$G_{58}$ average weekly stomatal resistance of old foliage -- $G_{29}$

$G_{59}$ net shortwave radiation at top of canopy -- $G_6$, $G_{20}$, $G_{91}$, $Y_{17}$, $Y_{26}$

$G_{60}$ snowpack ice plus current day's snowfall -- $G_{10}$, $G_{70}$, $G_{71}$, $G_{72}$, $G_{74}$, $G_{75}$, $G_{76}$, $G_{128}$, $G_{129}$, $G_{130}$, $G_{161}$, $Y_{25}$, $Y_{26}$, $Y_{27}$, $Y_{28}$, $Y_{29}$, $Y_{30}$, $Y_{31}$, $Y_{32}$, $Y_{33}$, $Y_{34}$

$G_{61}$ total foliage carbon -- $G_1$, $G_{13}$, $G_{16}$, $G_{20}$, $G_{23}$, $G_{24}$, $G_{29}$, $G_{57}$, $G_{91}$, $G_{101}$

$G_{62}$ carbon transfer from stems plus branches to log litter -- $F(13,9)$, $Y_2$

$G_{67}$ change in litter temperature -- $F(99,25)$

$G_{68}$ change in soil temperature -- $F(99,26)$

$G_{69}$ effect of moisture and temperature on litter processes -- $G_{81}$, $G_{83}$, $G_{84}$

$G_{70}$ rainfall passing directly to litter surface water -- $F(99,6)$, $G_{11}$

$G_{71}$ drip from foliar surfaces to litter surface water -- $F(1,6)$, $G_{11}$, $Y_{21}$

$G_{72}$ drip from epiphyte and bark surfaces to litter surface water -- $F(8,6)$, $G_{11}$, $Y_{21}$

$G_{74}$ rainfall passing directly to free water in snowpack -- $F(99,98)$, $G_{10}$

$G_{75}$ drip from foliar surfaces to free water in snowpack -- $F(1,98)$, $G_{10}$, $Y_{21}$

$G_{76}$ drip from epiphyte and bark surfaces to free water in snowpack -- $F(8,98)$, $G_{10}$, $Y_{21}$

$G_{77}$ effect of temperature on litter processes -- $G_{69}$, $G_{105}$

$G_{79}$ carbon transfer from buds to new foliage -- $F(16,10)$

$G_{80}$ total weekly direct rainfall plus drip -- $G_{67}$

$G_{81}$ foliage litter decomposition rate -- $G_{98}$, $G_{103}$

$G_{82}$ insect frass input to fine litter -- $F(17,20)$

$G_{83}$ woody litter decomposition rate -- $G_{104}$, $G_{111}$

$G_{84}$ fine litter decomposition rate -- $G_{116}$, $G_{125}$

$G_{85}$ dead root decomposition rate -- $G_{126}$, $G_{131}$

$G_{86}$ large root mortality -- $F(14,62)$

$G_{87}$ fine root mortality -- $F(15,62)$

$G_{88}$ rooting-zone organic matter decomposition rate -- $G_{132}$, $G_{133}$

$G_{90}$ old foliage consumption by insects -- $F(11,17)$, $Y_2$

$G_{91}$ shortwave radiation incident to snowpack or litter -- $G_{119}$, $Y_{17}$, $Y_{27}$

$G_{92}$ carbon transfer from stems plus branches to woody litter -- $F(13,18)$, $Y_2$

$G_{93}$ acute old-foliage defoliation -- $G_{40}$, $G_{136}$

$G_{94}$ consumption of growth $CH_2O$ pool by insects -- $F(12,17)$

$G_{95}$ bud consumption by insects -- $F(16,17)$, $G_{79}$

$G_{97}$ input to fine litter from microparticulate matter and carbon dissolved in precipitation -- $F(99,20)$

$G_{98}$ carbon loss from foliage litter due to fragmentation -- $F(19,20)$

$-G_{99}$

$G_{100}$ aerodynamic resistance -- $G_6$, $G_{20}$

$G_{101}$ canopy resistance -- $G_{20}$

$G_{102}$ effect of temperature on photosynthesis -- $G_{24}$, $G_{29}$

$G_{103}$ carbon loss from foliage litter due to respiration -- $F(19,99)$ $Y_6$, $Y_{12}$

$G_{104}$ carbon loss from woody litter due to fragmentation -- $F(18,20)$

$G_{105}$ log litter decomposition rate -- $G_{112}$, $G_{113}$

$G_{106}$ phenology of tree growth -- $G_{33}$, $G_{35}$, $G_{44}$

$G_{107}$ average weekly daytime air temperature -- $G_{102}$

$G_{108}$ average weekly nighttime air temperature -- $G_{25}$, $G_{30}$

$G_{109}$ average weekly photosynthetically active radiation -- $G_{24}$, $G_{29}$

$G_{110}$ average weekly day length -- $G_{24}$, $G_{25}$, $G_{29}$, $G_{30}$

$G_{111}$ carbon loss from woody litter due to respiration -- $F(18,99)$, $Y_6$, $Y_{12}$

$G_{112}$ carbon loss from logs due to fragmentation -- $F(9,20)$

$G_{113}$ carbon loss from logs due to respiration -- $F(9,99)$, $Y_6$, $Y_{12}$

$G_{114}$ heat input to snowpack due to snowfall -- $G_{127}$, $Y_{28}$

$G_{115}$ snowfall reaching ground -- $F(99,2)$, $G_{60}$, $G_{114}$, $G_{118}$

$G_{116}$ incorporation of fine litter into rooting zone organic matter -- $F(20,21)$

$G_{117}$ heat input to snowpack due to rainfall -- $G_{127}$, $Y_{29}$

$G_{118}$ albedo of snowpack or litter -- $G_{119}$, $Y_{30}$

$G_{119}$ net heat transfer through canopy to snowpack or litter due to shortwave radiation -- $G_6$, $G_{20}$, $G_{127}$, $Y_{31}$

$G_{120}$ net heat input to snowpack or litter due to longwave radiation -- $G_{127}$, $Y_{32}$

$G_{121}$ heat loss from snowpack or litter due to longwave radiation -- $G_{120}$, $G_{124}$

$G_{122}$ longwave radiation from blackbody at air temperature -- $G_{124}$, $G_{168}$

$-G_{123}$

$G_{124}$ net heat transfer from canopy to snowpack or litter due to longwave radiation -- $G_6$, $G_{20}$, $G_{120}$

$G_{125}$ carbon loss from fine litter due to respiration -- $F(20,99)$, $Y_6$, $Y_{12}$

$G_{126}$ carbon loss from dead roots due to fragmentation -- $F(62,21)$

$G_{127}$ net heat input to snowpack -- $G_{128}$, $G_{129}$, $G_{161}$

$G_{128}$ net increase in heat deficit of snowpack -- $F(99,37)$

$G_{129}$ transfer from ice to free water in snowpack -- $F(2,98)$, $G_{10}$

$G_{130}$ free water holding capacity of snowpack -- $G_{10}$

$G_{131}$ carbon loss from dead roots due to respiration -- $F(62,99)$, $Y_7$, $Y_{12}$

$G_{132}$ carbon transfer from soil rooting zone to subsoil -- $F(21,22)$

$G_{133}$ carbon loss from rooting zone organic matter due to respiration -- $F(21,99)$, $Y_7$, $Y_{12}$

$G_{134}$ total water input to snowpack or litter -- $G_{80}$, $G_{117}$, $G_{128}$, $G_{161}$

$G_{135}$ transfer from new foliage to leaf litter due to acute defoliation -- $F(10,19)$, $F(10,20)$, $Y_2$

$G_{136}$ carbon transfer from old foliage to fine litter due to acute defoliation -- $F(11,20)$, $Y_2$

$G_{138}$ stem-plus-branch respiration -- $G_{31}$, $Y_{24}$

$G_{139}$ large root respiration -- $G_{31}$, $Y_7$, $Y_{12}$, $Y_{24}$

$G_{140}$ fine root respiration -- $G_{31}$, $Y_7$, $Y_{12}$, $Y_{24}$

$G_{160}$ snow surface temperature -- $G_2$, $G_{118}$, $G_{121}$, $G_{170}$

$G_{161}$ freezing of free water in snowpack -- $F(98,2)$, $G_{10}$

$G_{168}$ net heat transfer from sky to canopy due to longwave radiation -- $G_6$, $G_{20}$ $-G_{169}$

$G_{170}$ heat input to snowpack due to convection -- $G_{127}$, $Y_{34}$

## 6.2. *Descriptions of Intermediate Functions*

$G_1$ = all-sided needle surface area index (dimensionless)

$$G_1 = B_7 G_{61}$$

$G_{61}$ = total foliage carbon (t/ha)
$B_7$ = ratio of all-sided needle surface area to needle carbon mass (ha/t)

Comment: The estimate of the ratio of all-sided leaf area to biomass is from Gholz et al. (1976) for Douglas-fir. We are assuming this holds for minor species as well.

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$G_2$ = heat input to snowpack due to condensation (ly/day)

$$G_2 = \max\{0,\ 80B_{22}[S_1(Z_5) - S_1(G_{160})]\}$$

$G_{160}$ = snow surface temperature (deg)
$Z_5$ = average 24-hr dew point temperature (deg)
$S_1(Z_5)$ = vapor pressure of air (mbar)
$S_1(G_{160})$ = saturation vapor pressure of air at snow surface computed using Teten's equation (mbar)
$B_{22}$ = ratio of snowmelt due to condensation to vapor pressure deficit at snow surface ($g \cdot cm^{-2} \cdot day^{-1} \cdot mbar^{-1}$)

Comment: The factor 80 is the heat of fusion of water (cal/g). This relationship between condensation and dew point temperature is based on a four-year study at Willamette Basin Snow Laboratory (U.S. Army Corps of Engineers 1956). We are ignoring snow sublimation but it could be important in places where the sun shines in the winter. The term $S_1(Z_5)$ - $S_1(G_{160})$ is a measure of the vapor pressure gradient at the snowpack surface.

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$G_3$ = rain input to foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_3 = G_{13}(G_{23}Z_8 + G_{54})$$

$G_{13}$ = fraction of rain incident to canopy which strikes foliage (dim.)
$G_{23}$ = percent cover by canopy (dim.)
$G_{54}$ = snowfall which is initially intercepted but which melts in the canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_8$ = incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

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$G_4$ = rain input to epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_4 = (1 - G_{13})\ (G_{23}Z_8 + G_{54})$$

$G_{13}$ = fraction of rain incident to canopy which strikes foliage (dim.)
$G_{23}$ = percent cover by canopy (dim.)
$G_{54}$ = snowfall which is initially intercepted but which melts in the canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_8$ = incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

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$G_5$ = drip from foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_5 = \max\{0,\ T_1(X_1 - G_{16}G_{57}) + (G_3 - G_{57}G_6)(1 - T_1/B_{170})\}$$

$$T_1 = 1 - \exp(-B_{170})$$

$X_1$ = water storage on foliage ($m^3$/ha)
$G_3$ = rain input to foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_6$ = potential evaporation from canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{16}$ = water retention capacity of canopy ($m^3$/ha)
$G_{57}$ = fraction of water retention capacity of canopy due to foliage (dim.)
$B_{170}$ = rate constant for water drainage from canopy ($day^{-1}$)

Comment: This expression is based on the differential equation

$$(dX_1/dt) = G_3 - G_{57}G_6 - B_{170}(X_1 - G_{16}G_{57})$$

which assumes rain input at constant rate $G_3$, evaporation at constant rate $G_{57}G_6$, and drainage at a rate depending upon the amount of water $X_1$ in excess of storage capacity $G_{16}G_{57}$. It is a linear differential equation and may be solved analytically. The rate of water transfer out of $X_1$ is given by

$$G_5 = B_{170}\int_0^1 X_1\, dt - G_{16}G_{57}$$

This approach was necessary since storage capacity of the foliage $G_{16}G_{57}$ is often smaller than the daily rain input. A similar approach was used for water storage on epiphyte and bark surfaces, litter moisture, and soil moisture (see $G_{56}$, $G_{15}$, and $G_{12}$, respectively).

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$G_6$ = potential evaporation from canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_6 = \max\left\{\frac{B_{159}[T_4 B_{164} T_3 + (T_5/G_{100})]}{B_{157}(T_4 + B_{158})},\ 0\right\}$$

$T_3$ = heat input to canopy due to long- and shortwave radiation (ly/day)

$$T_3 = G_{59} - G_{119} + G_{168} - G_{124}$$

$T_4$ = rate of change of saturation vapor pressure with air temperature (mbar/deg)

$$T_4 = S_{10}(Z_3)$$

$T_5$ = vapor pressure deficit ($mbar \cdot joule \cdot m^{-3} \cdot deg^{-1}$)

$$T_5 = S_{12}(Z_3, Z_5)$$

$G_{59}$ = net shortwave radiation at top of canopy (ly/day)
$G_{100}$ = aerodynamic resistance (sec/m)
$G_{119}$ = net heat transfer from canopy to snowpack or litter due to shortwave radiation (ly/day)
$G_{124}$ = net heat transfer from canopy to snowpack or litter due to longwave radiation (ly/day)
$G_{168}$ = net heat transfer from sky to canopy due to longwave radiation (ly/day)
$Z_3$ = average 24-hr air temperature (deg)
$Z_5$ = average 24-hr dew point temperature (deg)
$S_{10}$ = function for rate of change of saturation vapor pressure with temperature (mbar/deg)
$S_{12}$ = function to calculate vapor deficit from air and dew-point temperature ($mbar \cdot joule \cdot m^{-1} deg^{-1}$)
$B_{157}$ = latent heat of vaporization of water (joule/kg)
$B_{158}$ = psychrometric constant (mbar/deg)
$B_{159}$ = factor to convert kg $m^{-2} \cdot sec^{-1}$ to $m^3 \cdot ha^{-1} \cdot day^{-1}$ ($sec \cdot m^5 \cdot day^{-1} \cdot kg^{-1} \cdot ha^{-1}$)
$B_{164}$ = factor to convert net radiation from ly/day to $joule \cdot m^{-2} \cdot sec^{-1}$ ($joule \cdot day \cdot m^{-2} \cdot sec^{-1} \cdot ly^{-1}$)

Comment: Evaporation is assumed to proceed throughout 24 hrs. Function is based on Penman's (1963) equation for evaporation as a function of temperature, dew point temperature, incoming short- and longwave radiation, and wind speed. Note that 1 $m^3$ of water weighs 1000 kg.

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$G_7$ = evaporation from foliage ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_7 = \begin{cases} G_6 G_{57} & \text{if } G_5 \leq X_1 + G_3 - G_6 G_{57} \\ X_1 + G_3 - G_5 & \text{if } G_5 > X_1 + G_3 - G_6 G_{57} \end{cases}$$

$X_1$ = water storage on foliage ($m^3$/ha)
$G_3$ = rain input to foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_5$ = drip from foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_6$ = potential evaporation from canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{57}$ = fraction of water retention capacity of canopy due to foliage (dim.)

Comment: If drip $G_5$ is larger than the amount of water stored on the foliage less potential evaporation then we reduce evaporation from the foliage so that both flows combined reduce the pool size to zero. Note that $G_{57}$, the fraction of retention capacity due to foliage, is used here to give the fraction of total evaporation from the canopy which is met from storage on foliar surfaces.

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$G_8$ = evaporation from epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_8 = \begin{cases} G_6(1 - G_{57}) & \text{if } G_{56} \leq X_8 + G_4 - G_6(1 - G_{57}) \\ X_8 + G_4 - G_{56} & \text{if } G_{56} > X_8 + G_4 - G_6(1 - G_{57}) \end{cases}$$

$X_8$ = water storage on epiphyte and bark surfaces ($m^3$/ha)
$G_4$ = rain input to epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_6$ = potential evaporation from canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{56}$ = drip from epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{57}$ = fraction of water retention capacity of canopy due to foliage (dim.)

Comment: See explanation of $G_7$ which is analogous.

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$G_9$ = rainfall passing directly to snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_9 = (1 - G_{23}) Z_8$$

$G_{23}$ = percent cover by canopy (dim.)
$Z_8$ = incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

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$G_{10}$ = water transfer from snowpack to litter surface ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{10} = \begin{cases} \max(T_1, 0) & \text{if } G_{60} \neq G_{129} \\ G_{130} + \max(T_1, 0) & \text{if } G_{60} = G_{129} \end{cases}$$

$$T_1 = G_{129} + X_{98} + G_{74} + G_{75} + G_{76} - G_{161} - G_{130}$$

$X_{98}$ = free water in snowpack ($m^3$/ha)
$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)

$G_{74}$ = rainfall passing directly to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{75}$ = drip from foliar surfaces to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{76}$ = drip from epiphyte and bark surfaces to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{129}$ = transfer from ice to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{130}$ = free-water holding capacity of snow ($m^3/ha$)
$G_{161}$ = freezing of free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

Comment: Here $T_1$ gives new value for free water in snow after melting, freezing, and rain input are accounted for. If this does not exceed holding capacity $G_{130}$, then water does not drain from the snowpack. If the holding capacity is exceeded then the excess free water drains to the litter surface. The second case ensures that, on a day on which all snow (existing plus incoming) melts, no free water remains in the snowpack.

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$G_{11}$ = water entering litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{11} = G_{10} + G_{70} + G_{71} + G_{72}$$

$G_{10}$ = transfer from snowpack to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{70}$ = rainfall passing directly to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{71}$ = drip from foliar surfaces to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{72}$ = drip from epiphyte and bark surfaces to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

Comment: When snowpack is present, only drainage from the pack ($G_{10}$) enters the litter. When the pack is absent, drip plus direct rainfall enter directly into the litter. The inclusion of $G_{10}$ pertains to the day immediately after the last snow melts, as discussed under $G_{10}$.

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$G_{12}$ = water transfer from rooting zone to subsoil ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{12} = \max\left(0,\ T_1\left[(G_{15} - G_{20})\left(\frac{1}{T_1} - \frac{1}{B_9}\right) + X_3 - B_{13}\right]\right)$$

$$T_1 = 1 - \exp(-B_9)$$

$X_3$ = soil rooting zone water ($m^3/ha$)
$G_{15}$ = water transfer from litter to soil rooting zone ($m^3/ha$)
$G_{20}$ = transpiration rate ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$B_9$ = rate constant for soil water drainage ($day^{-1}$)
$B_{13}$ = water retention capacity of soil ($m^3/ha$)

Comment: This expression is based on a differential equation for water flow through the soil in which water flows out at a rate depending upon soil moisture $X_3$.

$$\frac{dX_3}{dt} = G_{15} - B_9(X_3 - B_{13}) - G_{20}$$

See $G_5$ and $G_{15}$, which are analogous.

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$G_{13}$ = fraction of rain incident to canopy which strikes foliage (dim.)

$$G_{13} = \max\left(\frac{G_{61}}{G_{61} + B_{172}X_{13}}, 0\right)$$

$X_{13}$ = stem-plus-branch carbon (t/ha)
$G_{61}$ = total foliage carbon (t/ha)
$B_{172}$ = ratio of intercepting area to carbon mass for stems plus branches divided by same ratio for foliage (dim.)

Comment: We assume a constant ratio of intercepting area due to bark and epiphytes to stem-plus-branch carbon mass. We express this intercepting area ($B_{172}X_{13}$) in terms of an equivalent amount of foliage and add it to old plus new foliage when computing total intercepting area.

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$G_{14}$ = potential evaporation from litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{14} = \max\left(0, \frac{B_{163}T_1B_{159}}{B_{157}B_{158}}\right)$$

$T_1$ = vapor pressure deficit at litter surface ($mbar \cdot joule \cdot m^{-3} \cdot deg^{-1}$)

$$T_1 = S_{12}(X_{25}, T_2)$$

$T_2$ = dew point temperature at litter surface (deg)

$$T_2 = Z_5 - (Z_3 - X_{25})$$

$X_{25}$ = litter temperature (deg)
$Z_3$ = average 24-hr air temperature (deg)
$Z_5$ = average 24-hr dew point temperature (deg)
$S_{12}$ = function to calculate vapor pressure deficit from air and dew point temperature ($mbar \cdot joule\ m^{-3}\ deg^{-1}$)
$B_{157}$ = latent heat of vaporization of water (joule/kg)
$B_{158}$ = psychrometric constant (mbar/deg)
$B_{159}$ = factor to convert $kg \cdot m^{-2} \cdot sec^{-1}$ to $m^3 \cdot ha^{-1} \cdot day^{-1}$ ($sec \cdot m^5 \cdot deg^{-1} \cdot kg^{-1} \cdot ha^{-1}$)
$B_{163}$ = aerodynamic conductance at litter surface (m/sec)

Comment: This is the Penman equation for evaporation (Penman 1963) except that heat input to litter due to radiation was assumed to be negligible. To get litter dew point temperature we reduce air dew point temperature ($Z_5$) by the difference between air temperature and litter temperature.

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$G_{15}$ = water transfer from litter to soil rooting zone ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{15} = \begin{cases} \max\left[0, T_1(T_2 + X_7 - B_{20}G_{55})\right) & \text{if } X_7 > B_{20}G_{55} \\ 0 & \text{if } X_7 \le B_{20}G_{55} \text{ or } X_{25} < 0 \\ & \text{or } -T_2 > (X_7 - B_{20}G_{55}) \end{cases}$$

$$T_1 = 1 - \exp(-B_{165})$$

$$T_2 = (G_{11} - G_{14})(1/T_1 - 1/B_{165})$$

$X_7$ = litter water ($m^3$/ha)
$X_{25}$ = litter temperature (deg)
$G_{11}$ = water entering litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{14}$ = potential evaporation from litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{55}$ = water-holding capacity of litter ($m^3$/ha)
$B_{20}$ = fraction of litter water-holding capacity below which drainage ceases (dim.)
$B_{165}$ = rate constant for drainage from litter ($day^{-1}$)

Comment: When $X_7$ exceeds the retention capacity $B_{20}G_{55}$, and there are large inputs of water, outflow may be large compared with pool size and variation in pool size throughout the day must be considered. We set up a differential equation in which we assume water inflow ($G_{11}$) and evaporation ($G_{14}$) are constant but that drainage occurs at a rate proportional to water amount in excess of retention capacity

$$\frac{dX_7}{dt} = G_{11} - G_{14} - B_{165}(X_7 - B_{20}G_{55}) \qquad X_7 > B_{20}G_{55}$$

Solving this expression analytically for $X_7$ after one day, we get an expression which we can solve for $G_{15}$. Notice that if $X_7 \le B_{20}G_{55}$ we assume $G_{15} = 0$. It can happen also that with large water inflow $G_{11}$, $X_7$ may be greater than $G_{55}$ and some water input will flow out the same day. We neglect this possibility and let the water drain the next day.

---

$G_{16}$ = water retention capacity of canopy ($m^3$/ha)

$$G_{16} = B_3(G_{61} + B_{173}X_{13})$$

$X_{13}$ = stem-plus-branch carbon (t/ha)
$G_{61}$ = total foliage carbon (t/ha)
$B_3$ = ratio of water retention capacity to foliar carbon mass ($m^3$/t)
$B_{173}$ = ratio of storage capacity to carbon mass for stems plus branches divided by same ratio for foliage (dim.)

Comment: Storage capacity is assumed to increase with increasing canopy biomass. The storage capacity due to stems-plus-branches ($X_{13}$) is actually due to bark and epiphyte surfaces. The factor $B_{173}$ extrapolates stem-plus-branch carbon to bark and epiphyte surface area (which are not directly available in the model) and then converts this surface area to storage capacity. Storage capacity is expressed in terms of an equivalent amount of foliage (see also discussion of intercepting area -- $G_{13}$)

$-G_{17}$

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$G_{18}$ = outflow from groundwater ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{18} = \max \begin{cases} 0 \\ X_5 - B_{16} \end{cases}$$

$X_5$ = groundwater storage ($m^3$/ha)
$B_{16}$ = retention capacity of groundwater zone ($m^3$/ha)

Comment: Groundwater is assumed constant in CONIFER.

---

$G_{19}$ = water transfer from subsoil to groundwater ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{19} = \max \{0, T_1[G_{12}(\frac{1}{T_1} - \frac{1}{B_{10}}) + X_4 - B_{14})]\}$$

$$T_1 = 1 - \exp(-B_{10})$$

$X_4$ = subsoil water ($m^3$/ha)
$G_{12}$ = water transfer from soil rooting zone to subsoil ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$B_{10}$ = rate constant for subsoil water drainage ($day^{-1}$)
$B_{14}$ = water retention capacity of subsoil ($m^3$/ha)

Comment: This is based on the differential equation:

$$\frac{dX_4}{dt} = G_{12} - B_{10}(X_4 - B_{14})$$

See also $G_5$, $G_{15}$, and $G_{12}$.

---

$G_{20}$ = transpiration rate ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{20} = \begin{cases} \dfrac{B_{159}(T_2 T_3 B_{164} + T_1/G_{100})}{B_{157} \langle T_2 + B_{158} [1 + G_{101}/(G_1 G_{100})]\rangle} & \text{if } X_1 + G_3 - G_5 - G_7 < B_{171} \\ 0 & \text{if } X_1 + G_3 - G_5 - G_7 \geq B_{171} \\ & \text{or } X_3 \leq 0 \text{ or } G_{61} \leq 0 \end{cases}$$

$T_1$ = vapor pressure deficit during daytime ($mbar \cdot joule \cdot m^{-3} \cdot deg^{-1}$)

$$T_1 = S_{12}(Z_6, Z_9)$$

$T_2$ = rate of change of saturation vapor pressure deficit with daytime air temperature (mbar/deg)

$$T_2 = S_{10}(Z_6)$$

$T_3$ = heat input to canopy during daytime due to long- and shortwave radiation (ly/day)

$$T_3 = G_{59} - G_{119} + Z_4(G_{168} - G_{124})$$

$X_1$ = water storage on foliage ($m^3$/ha)
$X_3$ = soil rooting zone water ($m^3$/ha)
$G_1$ = all-sided needle surface area index (dim.)
$G_3$ = rain input to foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_5$ = drip from foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_7$ = evaporation from foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{59}$ = net shortwave radiation at top of canopy (ly/day)
$G_{61}$ = total foliage carbon (t/ha)
$G_{100}$ = aerodynamic resistance (sec/m)
$G_{101}$ = canopy resistance (sec/m)
$G_{119}$ = net heat transfer through canopy to snowpack or litter due to shortwave radiation (ly/day)

$G_{124}$ = net heat transfer from canopy to snowpack or litter due to longwave radiation (ly/day)
$G_{168}$ = net heat transfer from sky to canopy due to longwave radiation (ly/day)
$Z_4$ = day length (dim.)
$Z_6$ = average daytime air temperature (deg)
$Z_9$ = average daytime dew point temperature (deg)
$S_{10}$ = function for rate of change of saturation vapor pressure with temperature
$S_{12}$ = function to calculate vapor pressure deficit from air and dew point temperature
$B_{157}$ = latent heat of vaporization of water (joule/kg)
$B_{158}$ = psychrometric constant (mbar/deg)
$B_{159}$ = factor to convert $kg \cdot m^{-2} \cdot sec^{-1}$ to $m^3 \cdot ha^{-1} \cdot day^{-1}$ ($sec \cdot m^5 \cdot deg^{-1} \cdot kg^{-1} \cdot ha^{-1}$)
$B_{164}$ = factor to convert net radiation from ly/day to $joule \cdot m^{-2} \cdot sec^{-1}$ ($joule \cdot day \cdot m^{-2} \cdot sec^{-1} \cdot ly^{-1}$)
$B_{171}$ = water storage on foliage above which there is no transpiration ($m^3$/ha)

Comment: This is Penman's equation for evaporation as modified for transpiration to include leaf resistance (Montieth 1965). Division by two-sided NSAI converts $G_{101}$ from a unit leaf area to a unit ground area basis.

$-G_{21}$

$G_{22}$ = evaporation from litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{22} = \begin{cases} G_{14} & \text{if } X_7 > B_{11}G_{55} \\ \max\{0,\ (G_{11} + X_7 - B_{12}G_{55})[1 - \exp(-G_{14}/T_1)]\} & \text{if } B_{11}G_{55} \geq X_7 \geq B_{12}G_{55} \\ 0 & \text{if } X_7 < B_{12}G_{55} \text{ or } X_2 > 0 \end{cases}$$

$$T_1 = (B_{11} - B_{12})G_{55}$$

$X_2$ = snowpack ice ($m^3$/ha)
$X_7$ = litter water ($m^3$/ha)
$G_{11}$ = water entering litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{14}$ = potential evaporation from litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$B_{55}$ = water-holding capacity of litter ($m^3$/ha)
$B_{11}$ = fraction of litter water-holding capacity below which there is resistance to evaporation (dim.)
$B_{12}$ = fraction of litter water-holding capacity below which evaporation ceases (dim.)

Comment: The evaporation function $G_{22}$, as well as the flow rate of water out of litter $G_{15}$, are based on solutions to linear differential equations integrated over a day. This approach was used because of rapid turnover of $X_7$. The differential equation becomes important within the litter moisture range $B_{11}G_{55} \geq X_7 \geq B_{12}G_{55}$. Here

$$\frac{dX_7}{dt} = G_{11} - \frac{G_{14}(X_7 - B_{12}G_{55})}{(B_{11} - B_{12})G_{55}}$$

Note that the evaporation rate is reduced from potential evaporation in proportion to the litter water pool $X_7$.

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$G_{23}$ = percent cover by canopy (dim.)

$$G_{23} = 1 - \exp\,[-B_{174}(G_{61} + B_{172}X_{13})]$$

$X_{13}$ = stem-plus-branch carbon (t/ha)
$G_{61}$ = total foliage carbon
$B_{172}$ = ratio of intercepting area to carbon mass for stems plus branches divided by same ratio for foliage (dim.)
$B_{174}$ = coefficient for effect of foliar carbon mass on percent cover by canopy (ha/t)

---

$G_{24}$ = net new foliage photosynthesis ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{24} = \begin{cases} \dfrac{-B_{32}B_{33}G_{110}X_{10}T_1G_{102}}{B_{35}G_{49}G_{61}} & \text{if } G_{61} > 0 \\ 0 & \text{if } G_{61} \leq 0 \end{cases}$$

$T_1$ = logarithmic part of photosynthesis expression (dim.) (see below)
$X_{10}$ = new foliage carbon (t/ha)
$G_{49}$ = average weekly stomatal resistance of new foliage (sec/cm)
$G_{61}$ = total foliage carbon (t/ha)
$G_{102}$ = effect of temperature on photosynthesis (dim.)
$G_{110}$ = average weekly day length (dim.)
$B_{32}$ = ratio of net new foliage photosynthesis based on carbon budget to amount extrapolated from cuvette experiments (dim.)
$B_{33}$ = rate constant for new foliage photosynthesis ($sec \cdot cm^{-1} \cdot wk^{-1}$)
$B_{35}$ = coefficient for attenuation of shortwave radiation by foliage (ha/t)

Comment: New leaf photosynthesis is directly proportional to fraction of total foliage comprising new leaves. The minus sign occurs because $T_1$ is negative.

$T_1$ = logarithmic part of photosynthesis expression (dim.)

$$T_1 = \ln\left[\frac{B_{34} + G_{109}\exp\,(-B_{35}G_{61})}{B_{34} + G_{109}}\right]$$

$G_{61}$ = total foliage carbon (t/ha)
$G_{109}$ = average weekly photosynthetically active radiation (ly/min)
$B_{34}$ = light intensity at which new foliage photosynthesis is one-half maximum rate (ly/min)
$B_{35}$ = coefficient for attenuation of shortwave radiation by foliage (ha/t)

Comment: The shortwave radiation extinction coefficient assumes 5% light penetration through the canopy for average leaf area. The half maximum rate light intensity ($B_{34}$) was obtained from cuvette data (Salo 1974). The expression in the numerator is smaller than the denominator making $T_1$ negative.

---

$G_{25}$ = new foliage nighttime respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{25} = B_{26}(1 - G_{110})X_{10} \exp (B_{145}G_{108})$$

$X_{10}$ = new foliage carbon (t/ha)
$G_{108}$ = average weekly nighttime air temperature (deg
$G_{110}$ = average weekly day length (dim.)
$B_{26}$ = foliar respiration rate constant $(wk^{-1})$
$B_{145}$ = coefficient for temperature effect on foliar respiration $(deg^{-1})$

---

$G_{26}$ = transfer of carbon to new foliage from new foliage $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{26} = \begin{cases} T_1 & \text{if } 0 < T_1 < G_{46} \\ 0 & \text{if } T_1 \leq 0 \\ G_{46} & \text{if } T_1 \geq G_{46} \end{cases}$$

$T_1$ = surplus carbon available for new foliage growth

$$T_1 = G_{47} + G_{45}$$

$G_{45}$ = portion of growth $CH_2O$ pool available for foliar respiration and growth $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{46}$ = new foliage growth demand $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{47}$ = surplus or deficit of new foliage photosynthate after new foliage respiration is satisfied $(t \cdot ha^{-1} \cdot wk^{-1})$

Comment: If there is no surplus ($T_1 \leq 0$) there is no new foliage growth. If the surplus is less than the growth demand, the surplus is transferred to new foliage. If the surplus is greater than growth demand only the demand ($G_{46}$) goes to new foliage--the rest goes into the growth $CH_2O$ pool.

The new foliage $CH_2O$ pool ($X_{64}$) acts as a clearinghouse through which flows between the atmosphere, new foliage, and the growth $CH_2O$ pool ($X_{12}$) are channeled. $G_{26}$, $G_{27}$, $G_{28}$, and $G_{32}$ all represent flows into or out of $X_{64}$.

---

$G_{27}$ = transfer of carbon from new foliage to new foliage $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{27} = \begin{cases} -(G_{47} + G_{45}) & \text{if } G_{47} + G_{45} < 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{45}$ = portion of growth $CH_2O$ pool available for foliar respiration and growth $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{47}$ = surplus or deficit of new foliage photosynthate after new foliage respiration is satisfied $(t \cdot ha^{-1} \cdot wk^{-1})$

Comment: In this case $G_{47}$ is negative and the new foliage respiration demand cannot be met from new foliage photosynthesis or by transfer from the growth $CH_2O$ pool. New foliage tissue is utilized for respiration.

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$G_{28}$ = transfer of surplus carbon from new foliage $CH_2O$ pool to growth $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{28} = \begin{cases} 0 & \text{if } T_1 < 0 \\ G_{47} & \text{if } G_{47} < 0 \text{ and } T_1 \geq 0 \\ \max(0,\ G_{47} - G_{46}) & \text{if } G_{47} \geq 0 \end{cases}$$

$T_1$ = surplus carbon available for new foliage growth

$$T_1 = G_{47} + G_{45}$$

$G_{45}$ = portion of growth $CH_2O$ pool available for foliar respiration and growth $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{46}$ = new foliage growth demand $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{47}$ = surplus or deficit of new leaf photosynthate after new foliage respiration is satisfied $(t \cdot ha^{-1} \cdot wk^{-1})$

Comment: If respiration cannot be met by new foliage photosynthate ($G_{47} < 0$) but can be met from growth $CH_2O$ pool ($T_1 \geq 0$), the deficit ($G_{47}$) is transferred from growth $CH_2O$ pool to new foliage $CH_2O$ pool. If it cannot be met ($T_1 < 0$), then $G_{28}$ is zero. If there is a surplus after respiration, there will be transfer of $G_{47} - G_{46}$ to growth $CH_2O$ pool.

---

$G_{29}$ = net old foliage photosynthesis $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{29} = \begin{cases} \dfrac{B_{32} B_{41} G_{110} X_{11} T_1 G_{102}}{B_{35} G_{58} G_{61}} & \text{if } G_{61} > 0 \\ 0 & \text{if } G_{61} \leq 0 \end{cases}$$

$T_1$ = logarithmic part of photosynthesis expression (dim.)
$X_{11}$ = old foliage carbon (t/ha)
$G_{58}$ = average weekly stomatal resistance of old foliage (sec/cm)
$G_{61}$ = total foliage carbon (t/ha)
$G_{102}$ = temperature effect on photosynthesis (dim.)
$G_{110}$ = average weekly day length (dim.)
$B_{32}$ = ratio of net new foliage photosynthesis based on carbon budget to amount extrapolated from cuvette experiments (dim.)
$B_{35}$ = coefficient for attenuation of shortwave radiation by foliage (ha/t)
$B_{41}$ = rate constant for old foliage photosynthesis $(sec \cdot cm^{-1} \cdot wk^{-1})$

Comment: See curves for new foliage photosynthesis. Here $T_1$ is negative and is analogous to $T_1$ in the expression for new foliage photosynthesis

$T_1$ = logarithmic part of photosynthesis expression (dim.)

$$T_1 = \ln \left( \frac{B_{42} + G_{109} \exp(-B_{35} G_{61})}{B_{42} + G_{109}} \right)$$

$G_{61}$ = total foliage carbon (t/ha)
$G_{109}$ = average weekly photosynthetically active radiation (ly/min)
$B_{35}$ = coefficient for attenuation of shortwave radiation by foliage (ha/t)
$B_{42}$ = shortwave radiation value at which old foliage photosynthesis is one-half maximum (ly/min)

Comment: $T_1$ is negative and is analogous to $T_1$ in new foliage photosynthesis $G_{24}$.

---

$G_{30}$ = old foliage nighttime respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{30} = \frac{B_{27}B_{26}(1 - G_{110})X_{11}X_{12} \exp (B_{145}G_{108})}{B_{44} + X_{12}}$$

$X_{11}$ = old foliage carbon (t/ha)
$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{108}$ = average weekly nighttime air temperature (deg)
$G_{110}$ = average weekly day length (dim.)
$B_{26}$ = foliar respiration rate constant $(wk^{-1})$
$B_{27}$ = ratio of old foliage to new foliage respiration (dim.)
$B_{44}$ = value of growth pool at which old foliage respiration is one-half maximum (t/ha)
$B_{145}$ = coefficient for temperature effect on foliar respiration $(deg^{-1})$

Comment: Differs from new foliage respiration in that $G_{30}$ is affected directly by the size of the growth $CH_2O$ pool.

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$G_{31}$ = total respiratory loss from growth $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{31} = G_{30} + G_{138} + G_{139} + G_{140}$$

$G_{30}$ = old foliage nighttime respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{138}$ = stem plus branch respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{139}$ = large root respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{140}$ = fine root respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

---

$G_{32}$ = transfer of carbon from growth $CH_2O$ pool to new foliage $CH_2O$ pool to meet foliar respiration and growth demands $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{32} = \begin{cases} G_{45} & \text{if } T_1 \leq G_{46} \quad G_{47} \leq 0 \\ G_{46} & \text{if } T_1 > G_{46} \quad G_{47} \leq 0 \\ 0 & \text{if } T_2 \leq 0 \quad G_{47} > 0 \\ T_2 & \text{if } T_2 \leq G_{45} \quad G_{47} > 0 \\ G_{45} & \text{if } T_2 > G_{45} \quad G_{47} > 0 \end{cases}$$

$T_1$ = surplus carbon available for new foliage growth

$$T_1 = G_{47} + G_{45}$$

$T_2$ = portion of new foliage growth demand not satisfied by new foliage photosynthesis

$$T_2 = G_{46} - G_{47}$$

$G_{45}$ = portion of growth $CH_2O$ pool available for foliar respiration and growth $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{46}$ = new foliage growth demand $(t \cdot ha^{-1} \cdot wk^{-1})$

$G_{47}$ = surplus or deficit of new foliage photosynthate after new foliage respiration is satisfied $(t \cdot ha^{-1} \cdot wk^{-1})$

Comment: Cases I-II: New foliage respiration exceeds or equals new foliage photosynthesis ($G_{47} \leq 0$):

I. Available carbon is insufficient to meet entire growth demand. All available carbon is transferred.
II. Available carbon exceeds demand. Only demand is transferred.

Cases III-V: New foliage respiration is less than new foliage photosynthesis ($G_{47} > 0$):

III. Entire growth demand is met from new foliage photosynthesis. No carbon is transferred.
IV. Foliage growth demand which is not met by new foliage photosynthesis is less than what is available from growth pool. Only enough is transferred to meet demand.
V. Demand exceeds what is available. Only available is transferred.

---

$G_{33}$ = bud growth $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{33} = \begin{cases} B_{31}G_{39}X_{12}/(B_{83} + X_{12}) & \text{if } G_{106} \neq 0 \\ 0 & \text{otherwise} \end{cases}$$

$X_{12}$ = carbon in growth $CH_2O$ pool $(m^3/ha)$
$G_{39}$ = temperature effect on growth processes (dim.)
$G_{106}$ = phenology of tree growth (dim.)
$B_{31}$ = bud growth rate constant $(t \cdot ha^{-1} \cdot wk^{-1})$
$B_{83}$ = value of growth pool at which bud growth is one-half maximum (ton/ha)

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$G_{34}$ = maturation of new foliage $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{34} = \begin{cases} X_{10} + G_{26} - G_{27} - G_{38} & \text{if } t_w = M_4 \\ 0 & \text{otherwise} \end{cases}$$

$X_{10}$ = new foliage carbon (t/ha)
$G_{26}$ = transfer of carbon to new foliage from new foliage $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{27}$ = transfer of carbon from new foliage to new foliage $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{38}$ = new foliage consumption by insects $(t \cdot ha^{-1} \cdot wk^{-1})$
$M_4$ = week on which new foliage becomes old foliage
$t_w$ = time (wk modulo 52)

Comment: All new foliage is assumed to become old foliage at week 40. Growth minus losses for that week are also accounted for.

---

$G_{35}$ = carbon transfer to stems plus branches $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{35} = \begin{cases} \dfrac{B_{45}G_{39}X_{12}}{B_{46} + X_{12}} & \text{if } G_{106} > 0 \\ 0 & \text{if } G_{106} = 0 \end{cases}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{39}$ = temperature effect on growth processes (dim.)
$G_{106}$ = phenology of tree growth (dim.)
$B_{45}$ = maximum rate of carbon transfer from growth $CH_2O$ pool to stems plus branches ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{46}$ = value of growth pool at which respiration of and transfer to stems plus branches is one-half maximum (t/ha)

Comment: The coefficient called "maximum" rate is actually maximum rate at the optimum temperature.

---

$G_{36}$ = carbon transfer to large roots

$$G_{36} = \frac{B_{47}G_{53}X_{12}}{B_{48} + X_{12}}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{53}$ = effect of soil temperature on soil processes (dim.)
$B_{47}$ = maximum rate of carbon transfer from growth $CH_2O$ pool to large roots ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{48}$ = growth pool value at which respiration of and transfer to large roots is one-half maximum (t/ha)

Comment: See $G_{35}$.

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$G_{37}$ = carbon transfer to fine roots ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{37} = \frac{B_{49}G_{53}X_{12}}{B_{50} + X_{12}}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{53}$ = effect of soil temperature on soil processes (dim.)
$B_{49}$ = maximum rate of carbon transfer from growth $CH_2O$ pool to fine roots ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{50}$ = value of growth pool at which respiration of and transfer to fine fine roots is one-half maximum (t/ha)

Comment: The small value of $B_{50}$ implies that $G_{37}$ is usually unaffected by changes in $X_{12}$. It gives transfer to fine roots precedence over other transfers when growth $CH_2O$ pool is low, since all other transfers to live plant parts are also regulated by $CH_2O$ pool. See $G_{35}$.

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$G_{38}$ = insect consumption of new foliage ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{38} = B_{56}X_{10}G_{39}$$

$X_{10}$ = new foliage carbon (t/ha)
$G_{39}$ = temperature effect on growth processes (dim.)
$B_{56}$ = rate constant for new foliage consumption ($wk^{-1}$)

Comment: Amount of new foliage consumed by insects. This is a dummy function (depending on temperature function [$G_{39}$] and new foliage carbon only) designed solely to cause leaves to disappear in a reasonable seasonal pattern. There is no dependence on insect biomass.

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$G_{39}$ = temperature effect on growth processes (dim.)

$$G_{39} = B_{36}S_2(G_{48},\ 0,\ B_{76},\ 2.0,\ B_{77})$$

$G_{48}$ = average weekly 24-hour air temperature (deg)
$S_2$ = beta function
$B_{36}$ = factor such that $G_{39}$ averages 1.0 over the first year ($\mathrm{deg}^{-B_{77}}$)
$B_{76}$ = temperature above which growth processes cease (deg)
$B_{77}$ = coefficient determining shape of $G_{39}$ curve (dim.)

Comment: $G_{39}$ is also used to control timing of insect consumption.

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$G_{40}$ = leaf fall rate ($\mathrm{t \cdot ha^{-1} \cdot wk^{-1}}$)

$$G_{40} = (T_1 + B_{182})X_{11} + 0.5G_{93}$$

$$T_1 = \begin{cases} B_{43}S_2(t_w,\ M_5 - 52,\ M_5,\ B_{90},\ B_{91}) & \text{if } t_w \le M_5 \\ B_{43}S_2(t_w,\ M_5,\ M_5 + 52,\ B_{90},\ B_{91}) & \text{if } t_w > M_5 \end{cases}$$

$X_{11}$ = old foliage carbon (t/ha)
$G_{93}$ = acute old foliage defoliation ($\mathrm{t \cdot ha^{-1} \cdot wk^{-1}}$)
$S_2$ = beta function
$B_{43}$ = factor so that $G_{40}$ integrated over one year is 1.0 [$\mathrm{wk}^{-(B_{91}+1)}$]
$B_{90}$ = first coefficient for shape of leaf fall curve (dim.)
$B_{91}$ = second coefficient for shape of leaf fall curve (dim.)
$B_{182}$ = minimum leaf fall rate constant ($\mathrm{wk}^{-1}$)
$M_5$ = week on which leaf fall is minimum
$t_w$ = time (wk modulo 52)

Comment: Function describes pattern of leaf fall through the year; $B_{182}$ causes a constant leaf fall rate during the year to which a time-varying leaf fall rate ($T_1$) is added. The time-varying part ($T_1$) is constructed so that the area under the curve is 1.0 (all the leaves that are to fall in one year thus do so). The pattern repeats each year. Each year the start time is -17 (1 October of the previous year), and the finish time is 35 (1 October of the current year). The 0.5 in the defoliation part is because half of removed foliage goes to foliage litter ($X_{19}$) and half to fine litter ($X_{20}$) as frass. $B_{43}$ scales the function so that, in absence of defoliation, it integrates to measured annual leaf fall.

---

$G_{41}$ = weekly average litter temperature (deg)

$$G_{41} = X_{25}$$

$X_{25}$ = litter temperature (deg)

Comment: In this model litter temperature is calculated weekly. In other versions this has been changed to a daily calculation and $G_{41}$ is used to calculate average weekly temperature. We set $G_{41} = X_{25}$ simply for consistency between the various versions.

---

$G_{42}$ = plant moisture stress (PMS; atm)

$$G_{42} = \begin{cases} B_{84} - B_{85}X_3 & \text{if } X_3 \leq B_{82} \text{ and } Z_3 \geq B_{79} \\ B_{78} & \text{if } X_3 > B_{82} \text{ and } Z_3 \geq B_{79} \\ B_{87} & \text{if } Z_3 < B_{79} \end{cases}$$

$X_3$ = soil rooting zone water ($m^3$/ha)
$Z_3$ = average 24-hr air temperature (deg)
$B_{78}$ = minimum PMS (atm)
$B_{79}$ = air temperature above which PMS is unaffected by temperature (deg)
$B_{82}$ = soil moisture value above which PMS does not change ($m^3$/ha)
$B_{84}$ = PMS when $X_3$ is 0 (atm)
$B_{85}$ = rate of increase of PMS with increasing soil moisture content ($atm \cdot ha^{-1} \cdot m^{-3}$)
$B_{87}$ = PMS above which there is no increase in new foliage resistance (atm)

Comment: Here PMS refers to weekly average predawn plant moisture stress. As soil moisture drops below 66% holding capacity, PMS increases as a linear function of soil moisture (Running et at. 1975).

---

$G_{43}$ = new foliage stomatal resistance (sec/cm)

$$G_{43} = \begin{cases} \max \begin{cases} B_{88} \exp(B_{89}G_{42}) \\ B_{80} \end{cases} & \text{if } G_{42} \leq B_{87} \text{ or } T_1 \leq 1200\ B_{81} \\ B_{86} & \text{if } G_{42} > B_{87} \text{ or } T_1 > 1200\ B_{81} \end{cases}$$

$T_1$ = vapor pressure deficit during daytime ($mbar \cdot joule \cdot m^{-3} \cdot deg^{-1}$)

$$T_1 = S_{12}\ (Z_6,\ Z_9)$$

$G_{42}$ = plant moisture stress (atm)
$Z_6$ = average daytime air temperature (deg)
$Z_9$ = average daytime dew point temperature (deg)
$S_{12}$ = function to calculate vapor pressure deficit from air and dew point temperature
$B_{80}$ = minimum stomatal resistance (sec/cm)
$B_{81}$ = vapor pressure deficit above which stomata close (mbar)
$B_{86}$ = maximum new foliage stomatal resistance (sec/cm)
$B_{87}$ = PMS above which there is no increase in new foliage resistance (atm)
$B_{88}$ = new foliage stomatal resistance when PMS is 0.0 (sec/cm)
$B_{89}$ = coefficient for effect of PMS on new foliage stomatal resistance ($atm^{-1}$)

Comment: Based on model by Running et al. (1975). Resistance includes both stomatal and mesophyll resistances.

---

$G_{44}$ = change in last year's bud carbon (t/ha)

$$G_{44} = \begin{cases} -X_{38} & \text{if } G_{106} = 0 \\ X_{16}(1 - B_{167}) & \text{if } t_w = M_1 \\ -\min\ [\frac{G_{38}}{B_{37}} + S_6(B_{166},\ B_{169},\ B_{167}X_{38}),\ X_{38}] & \text{otherwise} \end{cases}$$

$X_{16}$ = bud carbon--current year (t/ha)
$X_{38}$ = bud carbon--previous year (t/ha)
$G_{38}$ = new foliage consumption by insects $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{106}$ = phenology of tree growth (dim.)
$S_6$ = delta function
$B_{37}$ = ratio of leaf carbon mass to bud carbon (dim.)
$B_{166}$ = first day on which new foliage is to be removed
$B_{167}$ = fraction by which foliage to be reduced during acute defoliation (dim.)
$B_{169}$ = second day on which new foliage is to be removed
$M_1$ = week on which budbreak occurs
$t_w$ = time (wk modulo 52)

Comment: Here $X_{38}$ keeps track of limit to growth of foliage in terms of buds decreased by any consumption by insects or other defoliation. On week $M_1$, actual bud biomass ($X_{16}$) becomes previous year bud biomass ($X_{38}$). During dormant season (while $G_{106} = 0$), $X_{38}$ remains empty. Note that both $X_{38}$ and $G_{44}$ give potential foliage in terms of bud weight. Here $B_{166}$, $B_{167}$, and $B_{169}$ are parameters used only for defoliation perturbations; $S_6 = B_{167}X_{38}$ when $t_d = B_{166}$ or $B_{169}$.

---

$G_{45}$ = portion of growth $CH_2O$ pool available for foliar respiration and growth $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{45} = \frac{B_{39}X_{12}}{B_{40} + X_{12}}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$B_{39}$ = maximum rate of carbon transfer from growth $CH_2O$ pool to new foliage $CH_2O$ pool $(t \cdot ha^{-1} \cdot wk^{-1})$
$B_{40}$ = value of growth $CH_2O$ pool at which transfer to new foliage pool is one-half maximum (t/ha)

---

$G_{46}$ = new foliage growth demand $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{46} = \max \{B_{38}B_{71}G_{39}[B_{37}(X_{38} + G_{44}) - X_{10}],\ 0\}$$

$X_{10}$ = new foliage carbon (t/ha)
$X_{38}$ = bud carbon--previous year (t/ha)
$G_{39}$ = temperature effect on growth processes (dim.)
$G_{44}$ = change in last year's bud carbon (t/ha)
$B_{37}$ = ratio of leaf carbon mass to bud carbon (dim.)
$B_{38}$ = rate constant for decrease in new foliage growth demand as new foliage carbon mass approaches the limiting value $(wk^{-1})$
$B_{71}$ = factor such that $B_{71}G_{39}$ averages 1.0 during the first-year growing season (dim.)

---

$G_{47}$ = surplus or deficit new foliage photosynthate after new foliage respiration is satisfied $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{47} = G_{24} - G_{25}$$

$G_{24}$ = net new foliage photosynthesis
$G_{25}$ = new foliage nighttime respiration

---

---

$G_{48}$ = average weekly 24-hr air temperature (deg)

$$G_{48} = S_3(6,\ Z_3)$$

$S_3$ = weekly averaging function
$Z_3$ = average 24-hr air temperature (deg)

---

$G_{49}$ = average weekly stomatal resistance of new foliage (sec/cm)

$$G_{49} = S_3(1,\ G_{43})$$

$G_{43}$ = new foliage stomatal resistance (sec/cm)
$S_3$ = weekly averaging function

---

$G_{50}$ = effect of moisture and temperature on soil rooting zone processes (dim.)

$$G_{50} = \frac{G_{53}X_3}{B_{67}}$$

$X_3$ = rooting zone water ($m^3$/ha)
$G_{53}$ = effect of soil temperature on soil processes (dim.)
$B_{67}$ = factor such that $G_{50}$ averages 1.0 during the first year ($m^3$/ha)

---

$G_{51}$ = soil temperature (deg)

$$G_{51} = X_{26}$$

$X_{26}$ = soil temperature (deg)

Comment: Soil temperature is updated weekly in this version of the model and daily in other versions. $G_{51}$ is weekly temperature in both versions. See $G_{41}$.

---

$G_{52}$ = old foliage stomatal resistance (sec/cm)

$$G_{52} = B_{60}G_{43}$$

$G_{43}$ = new foliage resistance (sec/cm)
$B_{60}$ = ratio of old to new foliage stomatal resistance (dim.)

Comment: Includes both stomatal and mesophyll resistance.

---

$G_{53}$ = effect of soil temperature on soil processes (dim.)

$$G_{53} = B_{54}S_2(G_{51},\ 0,\ B_{178},\ 2.0,\ B_{179})$$

$G_{51}$ = weekly average soil temperature (deg)

$S_2$ = beta function
$B_{54}$ = factor such that $G_{53}$ averages 1.0 during the first year (deg$^{-B_{179}}$)
$B_{178}$ = temperature above which soil rooting zone processes cease (deg)
$B_{179}$ = coefficient for temperature effect on soil rooting zone processes (dim.)

---

$G_{54}$ = snowfall which is initially intercepted but melts in the canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{54} = \begin{cases} G_{23}\ (Z_1 - Z_8) & \text{if } Z_6 > B_{17} \\ 0 & \text{if } Z_6 \leq B_{17} \end{cases}$$

$G_{23}$ = percent cover by canopy (dim.)
$Z_1$ = total precipitation ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_6$ = average daytime air temperature (deg)
$Z_8$ = incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$B_{17}$ = daytime air temperature above which all intercepted snow melts in the canopy (deg)

---

$G_{55}$ = water-holding capacity of litter ($m^3$/ha)

$$G_{55} = (B_{74}X_{18} + X_{19} + X_{20})B_{23}$$

$X_{18}$ = woody litter carbon (t/ha)
$X_{19}$ = leaf litter carbon (t/ha)
$X_{20}$ = fine litter carbon (t/ha)
$B_{23}$ = ratio of litter water-holding capacity to litter carbon mass ($m^3$/t)
$B_{74}$ = water-holding capacity per unit carbon mass for woody litter divided by same ratio for foliage plus fine litter (dim.)

Comment: We set $B_{74}$ to 0.25 since we assume woody litter holds less water than fine or foliage litter; the actual value is a guess.

---

$G_{56}$ = drip from epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{56} = \begin{cases} \max\left\{0,\ T_1[X_8 - G_{16}(1 - G_{57})] + [G_4 - (1 - G_{57})G_6]\ (1 - \dfrac{T_1}{B_{170}})\right\} & \text{if } X_{13} > 0 \\ 0 & \text{if } X_{13} \leq 0 \end{cases}$$

$$T_1 = 1 - \exp\ (-B_{170})$$

$X_8$ = water storage on epiphyte and bark surfaces ($m^3$/ha)
$X_{13}$ = stem-plus-branch carbon (t/ha)
$G_4$ = rain input to epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_6$ = potential evaporation from canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{16}$ = water retention capacity of canopy ($m^3$/ha)
$G_{57}$ = fraction of water retention capacity of canopy due to foliage (dim.)
$B_{170}$ = rate constant for water drainage from canopy (dim.)

Comment: See discussion of $G_5$, which is analogous.

---

$G_{57}$ = fraction of water retention capacity of canopy due to foliage (dim.)

$$G_{57} = \frac{G_{61}}{G_{61} + B_{173}X_{13}}$$

$X_{13}$ = stem carbon (t/ha)
$G_{61}$ = total foliage carbon (t/ha)
$B_{173}$ = ratio of storage capacity to carbon mass for stems plus branches divided by same ratio for foliage (dim.)

Comment: The fraction of canopy storage capacity due to bark and epiphyte surfaces is:

$$\frac{B_{173}X_{13}}{G_{61} + B_{173}X_{13}} = 1 - G_{57}$$

See also $G_{16}$.

---

$G_{58}$ = average weekly stomatal resistance of old foliage (sec/cm)

$$G_{58} = S_3(7, G_{52})$$

$G_{52}$ = stomatal resistance of old foliage (sec/cm)
$S_3$ = averaging function

---

$G_{59}$ = net shortwave radiation at top of canopy (ly/day)

$$G_{59} = (1 - B_{160})Z_{16}$$

$Z_{16}$ = actual shortwave radiation (ly/day)
$B_{160}$ = albedo of canopy (dim.)

---

$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)

$$G_{60} = X_2 + G_{115}$$

$X_2$ = snowpack ice ($m^3$/ha)
$G_{115}$ = snowfall reaching ground ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

---

$G_{61}$ = total foliage carbon (t/ha)

$$G_{61} = X_{10} + X_{11}$$

$X_{10}$ = new foliage carbon (t/ha)
$X_{11}$ = old foliage carbon (t/ha)

---

$G_{62}$ = carbon transfer from stems plus branches to log litter ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{62} = (1 - B_{150})B_{51}X_{13}$$

$X_{13}$ = stem-plus-branch carbon (t/ha)

$B_{51}$ = rate constant for stem-plus-branch mortality ($wk^{-1}$)
$B_{150}$ = fraction of stem-plus-branch mortality transferred to woody litter (dim.)

---

$G_{67}$ = change in litter temperature (deg/wk)

$$G_{67} = \begin{cases} \min(1, T_1)(G_{48} - X_{25}) & X_2 < 100 \\ 3.0 - X_{25} & X_2 \geq 100 \end{cases}$$

$T_1$ = lag effect of air temperature on litter temperature:

$$T_1 = B_{92}(1 + G_{80}/B_{93})$$

$X_2$ = snowpack ice ($m^3$/ha)
$X_{25}$ = litter temperature (deg)
$G_{48}$ = average weekly air temperature (deg)
$G_{80}$ = total weekly direct rainfall plus drip ($m^3 \cdot ha^{-1} \cdot wk^{-1}$)
$B_{92}$ = factor for effect of air temperature on litter temperature ($wk^{-1}$)
$B_{93}$ = weekly throughfall amount above which litter temperature equals air temperature ($m^3 \cdot ha^{-1} \cdot wk^{-1}$)

Comment: Changes in litter temperature reflect changes in air temperature with litter temperature changes lagging behind. To accomplish this a lag factor $T_1$ is incorporated and litter temperature is updated weekly. High rainfall will cause litter temperature to equilibrate to air temperature, since $(1 + G_{80}/B_{93})$ increases with increasing rain. This increases $T_1$ and thus increases the effect of $Z_3$ on $G_{41}$.

---

$G_{68}$ = change in soil temperature (deg/wk)

$$G_{68} = B_{95}\ (X_{25} - X_{26})$$

$X_{25}$ = litter temperature (deg)
$X_{26}$ = soil temperature (deg)
$B_{95}$ = lag coefficient for effect of litter temperature upon soil temperature ($wk^{-1}$)

---

$G_{69}$ = effect of moisture and temperature on litter processes (dim.)

$$G_{69} = \begin{cases} B_{94}X_7G_{77} & X_7 < G_{55} \\ B_{94}G_{55}G_{77} & X_7 \geq G_{55} \end{cases}$$

$X_7$ = litter water ($m^3$/ha)
$G_{55}$ = water holding capacity of litter ($m^3$/ha)
$G_{77}$ = effect of temperature on litter processes (dim.)
$B_{94}$ = constant such that $G_{69}$ averages 1.0 during the first year (ha/$m^3$)

Comment: Effect increases linearly with moisture until holding capacity is reached. Above holding capacity, effect does not change with litter moisture.

---

---

$G_{70}$ = rainfall passing directly to litter surface water $(m^3 \cdot ha^{-1} \cdot day^{-1})$

$$G_{70} = \begin{cases} 0 & \text{if } G_{60} > 0 \\ G_9 & \text{if } G_{60} \leq 0 \end{cases}$$

$G_9$ = rainfall passing directly to snowpack or litter surface $(m^3 \cdot ha^{-1} \cdot day^{-1})$
$G_{60}$ = snowpack ice plus current day's snowfall $(m^3/ha)$

---

$G_{71}$ = drip from foliar surfaces to litter surface water $(m^3 \cdot ha^{-1} \cdot day^{-1})$

$$G_{71} = \begin{cases} G_5 & \text{if } G_{60} \leq 0 \\ 0 & \text{if } G_{60} > 0 \end{cases}$$

$G_5$ = drip from foliar surfaces $(m^3 \cdot ha^{-1} \cdot day^{-1})$
$G_{60}$ = snowpack ice plus current day's snowfall $(m^3/ha)$

---

$G_{72}$ = drip from epiphyte and bark surfaces to litter surface water $(m^3 \cdot ha^{-1} \cdot day^{-1})$

$$G_{72} = \begin{cases} G_{56} & \text{if } G_{60} \leq 0 \\ 0 & \text{if } G_{60} > 0 \end{cases}$$

$G_{56}$ = drip from epiphyte and bark surfaces $(m^3 \cdot ha^{-1} \cdot day^{-1})$
$G_{60}$ = snowpack ice plus current day's snowfall $(m^3/ha)$

---

$G_{74}$ = rainfall passing directly to free water in snowpack $(m^3 \cdot ha^{-1} \cdot day^{-1})$

$$G_{74} = \begin{cases} G_9 & \text{if } G_{60} > 0 \\ 0 & \text{if } G_{60} \leq 0 \end{cases}$$

$G_9$ = rainfall passing directly to snowpack or litter surface $(m^3 \cdot ha^{-1} \cdot day^{-1})$
$G_{60}$ = snowpack ice plus current day's snowfall $(m^3/ha)$

---

$G_{75}$ = drip from foliar surfaces to free water in snowpack $(m^3 \cdot ha^{-1} \cdot day^{-1})$

$$G_{75} = \begin{cases} G_5 & \text{if } G_{60} > 0 \\ 0 & \text{if } G_{60} \leq 0 \end{cases}$$

$G_5$ = drip from foliar surfaces $(m^3 \cdot ha^{-1} \cdot day^{-1})$
$G_{60}$ = snowpack ice plus current day's snowfall $(m^3/ha)$

---

$G_{76}$ = drip from epiphyte and bark surfaces to free water in snowpack $(m^3 \cdot ha^{-1} \cdot day^{-1})$

$$G_{76} = \begin{cases} G_{56} & \text{if } G_{60} > 0 \\ 0 & \text{if } G_{60} \leq 0 \end{cases}$$

$G_{56}$ = drip from epiphyte and bark surfaces $(m^3 \cdot ha^{-1} \cdot day^{-1})$
$G_{60}$ = snowpack ice plus current day's snowfall $(m^3/ha)$

---

$G_{77}$ = effect of litter temperature on litter processes (dim.)

$$G_{77} = B_{24}S_2(G_{41},\ 0,\ B_{180},\ 2.0,\ B_{181})$$

$G_{41}$ = litter temperature (deg)
$S_2$ = beta function
$B_{24}$ = factor such that $G_{77}$ averages 1.0 during the first year ($deg^{-B_{181}}$)
$B_{180}$ = temperature above which litter decomposition ceases (deg)
$B_{181}$ = coefficient for temperature effect on litter decomposition (dim.)

—$G_{78}$

---

$G_{79}$ = carbon transfer from buds to new foliage ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{79} = \begin{cases} X_{16} - G_{95} + G_{33} & \text{if } t_w = M_1 \\ 0 & \text{otherwise} \end{cases}$$

$X_{16}$ = bud carbon--current year (t/ha)
$G_{33}$ = bud growth ($t \cdot ha^{-1} \cdot wk^{-1}$)
$G_{95}$ = bud consumption by insects ($t \cdot ha^{-1} \cdot wk^{-1}$)
$M_1$ = week on which bud break occurs
$t_w$ = time (wk modulo 52)

Comment: All bud carbon becomes new foliage at the start of the growing season. Bud growth and losses that week are taken into account.

---

$G_{80}$ = total weekly direct rainfall plus drip ($m^3 \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{80} = 7S_3(12,\ G_{134})$$

$G_{134}$ = total water input to snowpack or litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$S_3$ = averaging function

Comment: $S_3$ gives weekly average which we multiply by 7 to get weekly total.

---

$G_{81}$ = foliage litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{81} = B_{62}G_{69}X_{19}$$

$X_{19}$ = foliage litter carbon (t/ha)
$G_{69}$ = effect of moisture and temperature on litter processes (dim.)
$B_{62}$ = rate constant for foliage litter decomposition ($wk^{-1}$)

---

$G_{82}$ = insect frass input to fine litter ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{82} = B_{75}X_{17}$$

$X_{17}$ = canopy insect carbon (t/ha)
$B_{75}$ = rate constant for frass fall ($wk^{-1}$)

Comment: Here $B_{75}$ is based on an estimate by Strand (1974).

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$G_{83}$ = fine woody litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{83} = B_{61}G_{69}X_{18}$$

$X_{18}$ = fine woody litter carbon (t/ha)
$G_{69}$ = effect of moisture and temperature on litter processes (dim.)
$B_{61}$ = rate constant for fine woody litter decomposition ($wk^{-1}$)

---

$G_{84}$ = fine litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{84} = B_{63}G_{69}X_{20}$$

$X_{20}$ = fine litter carbon (t/ha)
$G_{69}$ = effect of moisture and temperature on litter processes (dim.)
$B_{63}$ = rate constant for fine litter decomposition ($wk^{-1}$)

---

$G_{85}$ = dead root decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{85} = B_{68}G_{50}X_{62}$$

$X_{62}$ = dead root carbon (t/ha)
$G_{50}$ = effect of moisture and temperature on soil rooting zone processes (dim.)
$B_{68}$ = rate constant for dead root decomposition ($wk^{-1}$)

---

$G_{86}$ = large root mortality ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{86} = B_{52}X_{14}$$

$X_{14}$ = large root carbon (t/ha)
$B_{52}$ = rate constant for large root mortality ($wk^{-1}$)

Comment: Since large root biomass varies little during the year, large root mortality is nearly constant.

---

$G_{87}$ = fine root mortality ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{87} = B_{53}X_{15}T_1(B_5G_{32} + 1.0)$$

$$T_1 = 1.0 + B_{72} \max(0, B_{82} - X_3)$$

$X_3$ = soil rooting zone water ($m^3/ha$)
$X_{15}$ = fine root carbon (t/ha)
$G_{32}$ = transfer of carbon from growth $CH_2O$ pool to new foliage pool ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_5$ = coefficient relating fine root mortality to carbohydrate demand ($ha \cdot wk \cdot t^{-1}$)
$B_{53}$ = rate constant for fine root mortality ($wk^{-1}$)
$B_{72}$ = coefficient relating fine root mortality to soil moisture ($ha/m^3$)
$B_{82}$ = soil moisture value above which PMS does not change ($m^3/ha$)

Comment: Mortality rate increases with decreasing soil moisture and with increasing utilization of growth $CH_2O$ pool for foliar growth and respiration.

---

$G_{88}$ = rooting zone carbon decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{88} = B_{65}G_{50}X_{21}$$

$X_{21}$ = rooting zone carbon (t/ha)
$G_{50}$ = effect of moisture and temperature on soil rooting zone processes (dim.)
$B_{65}$ = rate constant for decomposition of soil rooting zone carbon ($wk^{-1}$)

---

$G_{90}$ = old foliage consumption by insects ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{90} = B_{57}X_{11}G_{39}$$

$X_{11}$ = old foliage carbon (t/ha)
$G_{39}$ = temperature effect on growth processes (dim.)
$B_{57}$ = rate constant for old foliage consumption ($wk^{-1}$)

---

$G_{91}$ = shortwave radiation exiting the canopy (ly/day)

$$G_{91} = G_{59}[1 - G_{23} + G_{23}\ (1 - B_8)\ T_1 + B_8G_{23}T_1T_2]$$

$T_1$ = fraction of incident light transmitted through understory

$$T_1 = \exp\ [-B_1G_{61}(1 - B_4)]$$

$T_2$ = fraction of incident light transmitted through overstory

$$T_2 = \exp\ (-B_2G_{61}B_4)$$

$G_{23}$ = percent cover by overstory (see comment below; dim.)
$G_{59}$ = net shortwave radiation at top of canopy (ly/day)
$G_{61}$ = total foliage carbon (t/ha)
$B_1$ = coefficient for attenuation of shortwave radiation by understory (ha/t)
$B_2$ = coefficient for attenuation of shortwave radiation by overstory (ha/t)
$B_4$ = fraction of total foliage occurring in the overstory (dim.)
$B_8$ = ratio of understory cover to total canopy cover (dim.)

Comment: Originally we lumped overstory and understory together and calculated attenuation according to Beer's law; however, since understory is largely broad-leaved, it has attenuation characteristics different from those of the overstory. Also, a fraction of the shortwave radiation incident to the canopy $(1 - G_{23})$, passes unattenuated to the understory.

---

This results in radiation incident to the forest floor depending upon both the total foliage biomass $X_{10} + X_{11}$ (both directly and via $G_{59}$, which also depends indirectly upon $X_{10} + X_{11}$) and upon the fraction of the total foliage in the overstory.

---

$G_{92}$ = carbon transfer from stems plus branches to woody litter $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{92} = B_{150} B_{51} X_{13}$$

$X_{13}$ = stem-plus-branch carbon (t/ha)
$B_{51}$ = rate constant for stem-plus-branch mortality $(wk^{-1})$
$B_{150}$ = fraction of stem-plus-branch mortality transferred to woody litter (dim.)

---

$G_{93}$ = acute old foliage defoliation $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{93} = S_6(B_{185}, B_{186}, B_{184} X_{11})$$

$X_{11}$ = old foliage carbon (t/ha)
$S_6$ = delta function
$B_{184}$ = fraction by which old foliage is reduced during acute defoliation perturbation (dim.)
$B_{185}$ = first day on which old foliage is removed
$B_{186}$ = second day on which old foliage is removed

Comment: See comments for $G_{40}$, $G_{44}$.

---

$G_{94}$ = consumption of growth $CH_2O$ pool by insects $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{94} = B_{58} X_{12} G_{39}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{39}$ = temperature effect on growth processes (dim.)
$B_{58}$ = rate constant for consumption of growth $CH_2O$ pool by insects $(wk^{-1})$

Comment: Temperature effect makes consumption vary seasonally.

---

$G_{95}$ = bud consumption by insects $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{95} = B_{59} X_{16} G_{39}$$

$X_{16}$ = bud carbon--current year (t/ha)
$G_{39}$ = temperature effect on growth processes (dim.)
$B_{59}$ = rate constant for bud consumption $(wk^{-1})$

---

$G_{97}$ = input to fine litter from microparticulate matter and carbon dissolved in precipitation $(t \cdot ha^{-1} \cdot wk^{-1})$

$$G_{97} = B_{152}$$

$B_{152}$ = rate of input of carbon to fine litter in microparticulate matter and carbon dissolved in precipitation ($t \cdot ha^{-1} \cdot wk^{-1}$)

---

$G_{98}$ = carbon loss from foliage litter due to fragmentation ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{98} = B_{149} G_{81}$$

$G_{81}$ = foliage litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{149}$ = fraction of carbon loss from foliage litter due to fragmentation (dim.)

Comment: Ratio of fragmentation loss to respiration loss is assumed constant.

$-G_{99}$

---

$G_{100}$ = aerodynamic resistance (sec/m)

$$G_{100} = \begin{cases} (Z_{14} B_{156}{}^2)^{-1} & \text{if } Z_{14} \neq 0 \\ 10^6 & \text{if } Z_{14} = 0 \end{cases}$$

$Z_{14}$ = wind speed (m/sec)
$B_{156}$ = wind profile drag coefficient (dim.)

Comment: The wind profile drag coefficient is a composite coefficient dependent upon von Karman's constant, the height at which wind speed is measured, and the average height of the vegetation (see Rutter et al. 1971). Note that, if $Z_{14} = 0$, $G_{100}$ is set equal to a large, arbitrary number.

---

$G_{101}$ = canopy resistance (sec/m)

$$G_{101} = \begin{cases} \dfrac{(G_{43} X_{10} + G_{52} X_{11})\ 100}{G_{61}} & \text{if } G_{61} > 0 \\ 0 & \text{if } G_{61} \leq 0 \end{cases}$$

$X_{10}$ = new foliage carbon (t/ha)
$X_{11}$ = old foliage carbon (t/ha)
$G_{43}$ = new foliage stomatal resistance (sec/cm)
$G_{52}$ = old foliage stomatal resistance (sec/cm)
$G_{61}$ = total foliage carbon (t/ha)

Comment: Canopy resistance is weighted average of old and new foliage resistances. The 100 converts sec/cm to sec/m as needed for Penman's equation.

---

$G_{102}$ = effect of temperature on photosynthesis (dim.)

$$G_{102} = \max\{0, B_{70}[B_{176} + B_{177} G_{107}(B_{168} - G_{107})]\}$$

$G_{107}$ = average weekly daytime air temperature (deg)
$B_{70}$ = factor such that $G_{102}$ averages 1.0 over the first year (dim.)

$B_{168}$ = coefficient determining shape of $G_{102}$ (deg)
$B_{176}$ = coefficient determining shape of $G_{102}$ (dim.)
$B_{177}$ = coefficient determining shape of $G_{102}$ ($\text{deg}^{-2}$)

---

$G_{103}$ = carbon loss from foliage litter due to respiration ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$$G_{103} = (1 - B_{149})G_{81}$$

$G_{81}$ = foliage litter decomposition rate ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$B_{149}$ = fraction of carbon loss from foliage litter due to fragmentation (dim.)

---

$G_{104}$ = carbon loss from fine woody litter due to fragmentation ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$$G_{104} = B_{148}G_{83}$$

$G_{83}$ = fine woody litter decomposition rate ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$B_{148}$ = fraction of carbon loss from fine woody litter due to fragmentation (dim.)

---

$G_{105}$ = log litter decomposition rate ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$$G_{105} = B_{146}X_9G_{77}$$

$X_9$ = log litter carbon (t/ha)
$G_{77}$ = effect of temperature on litter processes (dim.)
$B_{146}$ = rate constant for log litter decomposition ($\text{wk}^{-1}$)

---

$G_{106}$ = phenology of tree growth

$$G_{106} = \begin{cases} 0 & \text{if } t_w < M_2 \text{ or } t_w \geq M_3 \\ 1 & \text{otherwise} \end{cases}$$

$M_2$ = week on which growing season starts
$M_3$ = week on which growing season ends
$t_w$ = time (wk modulo 52)

Comment: $G_{106}$ is 1 during the growing season, zero otherwise.

---

$G_{107}$ = average weekly daytime air temperature (deg)

$$G_{107} = S_3(4,\ Z_6)$$

$Z_6$ = average daytime air temperature (deg)
$S_3$ = weekly averaging function

---

$G_{108}$ = average weekly nighttime air temperature (deg)

$$G_{108} = S_3(5,\ Z_7)$$

$Z_7$ = average nighttime temperature (deg)
$S_3$ = weekly averaging function

---

$G_{109}$ = average weekly photosynthetically active radiation (ly/min)

$$G_{109} = B_{183}S_3(2,\ 1.1\ Z_2Z_{15})$$

$Z_2$ = average shortwave radiation (ly/min)
$Z_{15}$ = slope factor for radiation calculations (dim.)
$S_3$ = weekly averaging function
$B_{183}$ = ratio of photosynthetically active radiation to total shortwave radiation (dim.)

<u>Comment</u>: Constant 1.1 corrects for inclination of slope. See $Z_{12}$ for discussion of this and "slope factor."

---

$G_{110}$ = average weekly day length (dim.)

$$G_{110} = S_3(3,\ Z_4)$$

$Z_4$ = day length (dim.)
$S_3$ = weekly averaging function

---

$G_{111}$ = carbon loss from fine woody litter due to respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{111} = (1 - B_{148})G_{83}$$

$G_{83}$ = fine woody litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{148}$ = fraction of carbon loss from woody litter due to fragmentation (dim.)

---

$G_{112}$ = carbon loss from log litter due to fragmentation ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{112} = B_{147}G_{105}$$

$G_{105}$ = log litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{147}$ = fraction of carbon loss from log litter due to fragmentation (dim.)

---

$G_{113}$ = carbon loss from log litter due to respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{113} = (1 - B_{147})G_{105}$$

$G_{105}$ = log litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{147}$ = fraction of carbon loss from log litter due to fragmentation (dim.)

---

$G_{114}$ = heat input to snowpack due to snowfall (ly/day)

$$G_{114} = \min\ (0,\ 0.005Z_3G_{115})$$

$G_{115}$ = snowfall reaching ground ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_3$ = average 24-hr air temperature (deg)

<u>Comment:</u> The specific heat of ice = 0.5 $cal \cdot cm^{-3} \cdot deg^{-1}$ = 0.5 x $10^6$ $cal \cdot m^{-3} \cdot deg^{-1}$. We then multiply by $10^{-8}$ $ha/cm^2$ to get 0.005 $ly \cdot ha \cdot m^{-3} \cdot deg^{-1}$. Snowfall may occur when air temperature is above zero but we assume falling snow will be at 0°C.

---

$G_{115}$ = snowfall reaching ground ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{115} = T_1 + (Z_1 - Z_8)(1 - G_{23})$$

$T_1$ = snow initially intercepted but which falls without melting ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$T_1 = \begin{cases} G_{23}\,(Z_1 - Z_8) & \text{if } Z_6 \le B_{17} \\ 0 & \text{if } Z_6 > B_{17} \end{cases}$$

$G_{23}$ = percent cover by canopy (dim.)
$Z_1$ = total precipitation ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_6$ = average daytime air temperature (deg)
$Z_8$ = incident rainfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$B_{17}$ = daytime temperature about which all intercepted snow melts in the canopy (deg)

---

$G_{116}$ = incorporation of fine litter into rooting zone organic matter

$$G_{116} = B_{64} G_{84}$$

$G_{84}$ = fine litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{64}$ = fraction of carbon loss from fine litter due to incorporation into soil rooting zone organic matter (dim.)

---

$G_{117}$ = heat input to snowpack due to rainfall (ly/day)

$$G_{117} = 0.01 Z_3 G_{134}$$

$G_{134}$ = total water input to snowpack or litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$Z_3$ = average 24-hr air temperature (deg)

<u>Comment:</u> Specific heat of water = 1 $cal \cdot cm^{-3} \cdot deg^{-1}$ which is converted to 0.01 $ly \cdot ha \cdot m^{-3} \cdot deg^{-1}$ as with $G_{114}$.

---

$G_{118}$ = albedo of snowpack or litter (dim.)

$$G_{118} = S_5$$

$$S_5 = \begin{cases} T_1(t_d - T_2) & \text{if } G_{115} = 0 \text{ and } t_d - T_2 \le 40 \\ 0.4 & \text{if } t_d - T_2 > 40 \text{ and } G_{115} = 0 \\ 0.8 & \text{if } Z_6 \le B_6 \text{ and } G_{115} > 0 \\ 0.91 & \text{if } G_{160} < 0 \text{ and } G_{115} > 0 \\ 0.81 & \text{if } G_{160} \ge 0 \text{ and } G_{115} > 0 \\ 0.1 & \text{if } X_2 \le 10 \end{cases}$$

$T_1$ = table look-up function for albedo as function of time since last snow, range is 0.8 to 0.4 (dim.)
$T_2$ = time of most recent snowfall (day)

$X_2$ = snowpack ice ($m^3$/ha)
$G_{115}$ = snowfall reaching ground ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{160}$ = snow surface temperature (deg)
$Z_6$ = average daytime air temperature (deg)
$B_6$ = temperature threshold below which albedo of snowpack is set equal to 0.8 (deg)
$t_d$ = time (day)

Comment: $T_2$ is called INT in code. See Leaf and Brink (1973). Albedo of the snowpack depends upon the time since the last snowfall ($t_d - T_2$) and whether the snowpack is accumulating or melting. This is determined by looking at air temperature and snow temperature. If daytime air temperature is below $B_6$ (3°C), or snow temperature is less than zero, or it is snowing, then we assume an accumulating phase; otherwise we assume a melting phase and albedo drops with increasing time since the last snow. When there is no snow on the ground, litter albedo is used.

---

$G_{119}$ = net heat transfer through canopy to snowpack or litter due to shortwave radiation (ly/day)

$$G_{119} = (1 - G_{118})G_{91}/(1 - G_{118}G_{23}B_{160})$$

$G_{23}$ = percent cover by canopy (dim.)
$G_{91}$ = shortwave radiation incident to litter layer or snowpack (ly/day)
$G_{118}$ = albedo of snowpack or litter (dim.)
$B_{160}$ = albedo of canopy (dim.)

Comment: Includes shortwave light penetrating directly through gaps in canopy. Multiple reflections between litter or snowpack and canopy are also taken into account (see Bohren and Thorud 1973, eq. 2).

---

$G_{120}$ = net heat input to snowpack or litter due to longwave radiation (ly/day)

$$G_{120} = G_{124} + (1 - G_{23})(Z_{12} - G_{121})$$

$G_{23}$ = percent cover by canopy (dim.)
$G_{121}$ = heat loss from snowpack or litter due to longwave radiation (ly/day)
$G_{124}$ = net heat transfer from canopy to snowpack or litter due to longwave radiation (ly/day)
$Z_{12}$ = daily longwave radiation from the sky (ly/day)

---

$G_{121}$ = heat loss from snowpack or litter due to longwave radiation (ly/day)

$$G_{121} = \begin{cases} S_4(G_{160}) & \text{if } G_{60} > 0 \\ S_4(X_{25}) & \text{if } G_{60} \le 0 \end{cases}$$

$X_{25}$ = litter temperature (deg)
$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{160}$ = snow surface temperature (deg)
$S_4$ = longwave radiation from blackbody (ly/day)

Comment: If there is snow on the ground it is assumed to radiate as a blackbody at its surface temperature $G_{160}$. If there is no snow ($X_2 < 10$) the forest floor emits at litter temperature $X_{25}$.

---

$G_{122}$ = longwave radiation from blackbody at air temperature (ly/day)

$$G_{122} = S_4(Z_3)$$

$Z_3$ = average 24-hr temperature (deg)
$S_4$ = longwave radiation from blackbody (ly/day)

---

$-G_{123}$

$G_{124}$ = net heat transfer from canopy to snowpack or litter due to longwave radiation (ly/day)

$$G_{124} = G_{23}(G_{122} - G_{121})$$

$G_{23}$ = percent cover by canopy (dim.)
$G_{121}$ = heat loss from snowpack or litter due to longwave radiation (ly/day)
$G_{122}$ = longwave radiation from blackbody at air temperature (ly/day)

Comment: We assume the canopy radiates as a blackbody at air temperature.

---

$G_{125}$ = carbon loss from fine litter due to respiration

$$G_{125} = (1 - B_{64})G_{84}$$

$G_{84}$ = fine litter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{64}$ = fraction of carbon loss from fine litter due to incorporation into soil rooting zone organic matter (dim.)

---

$G_{126}$ = carbon loss from dead roots due to fragmentation

$$G_{126} = B_{69}G_{85}$$

$G_{85}$ = dead root decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{69}$ = fraction of carbon loss from dead roots due to fragmentation (dim.)

---

$G_{127}$ = net heat input to snowpack (ly/day)

$$G_{127} = G_{114} + G_{117} + G_{119} + G_{120} + G_2 + G_{170}$$

$G_2$ = heat input to snow due to condensation (ly/day)
$G_{114}$ = heat input to snowpack due to snowfall (ly/day)
$G_{117}$ = heat input to snowpack due to rainfall (ly/day)
$G_{119}$ = net heat transfer through canopy to snowpack or litter due to shortwave radiation (ly/day)
$G_{120}$ = net heat input to snowpack or litter due to longwave radiation (ly/day)
$G_{170}$ = heat input to snowpack due to convection (ly/day)

---

---

$G_{128}$ = net increase in heat deficit of snowpack (ly/day)

$$G_{128} = \begin{cases} T_1 & \text{if } G_{60} > 0 \\ \min(0, T_2) & \text{if } G_{60} \le 0 \end{cases}$$

$$T_1 = \max(-X_{37}, -T_2)$$

$$T_2 = G_{127} + 0.8(G_{134} + X_{98})$$

$X_{37}$ = snowpack heat deficit (ly)
$X_{98}$ = free water in snowpack ($m^3$/ha)
$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{127}$ = net heat input to snowpack (ly/day)
$G_{134}$ = total water input to snowpack or litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

Comment: This seemingly simple expression masks a complex situation. Initial heat deficit $X_{37}$ (which may be zero) is compared with net heat input to snowpack $G_{127}$ plus potential heat gain ($0.8[G_{134} + X_{98}]$) if all free water in snowpack were to freeze. The smaller of these is the resultant change in heat deficit (the min becomes a max because change in heat deficit is the negative of the heat gain). The 0.8 is the heat of fusion of water ($ly \cdot ha \cdot m^{-3}$).

---

$G_{129}$ = transfer from ice to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{129} = \min \begin{cases} G_{60} \\ \max \begin{cases} 0 \\ \dfrac{G_{127} - X_{37}}{0.8} \end{cases} \end{cases}$$

$X_{37}$ = snowpack heat deficit (ly)
$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{127}$ = net heat input to snowpack (ly/day)

Comment: There is no snowmelt unless there is a daily heat gain greater than the initial heat deficit. There must of course be snow to melt. If $G_{127} > X_{37}$ then the quantity $(G_{127} - X_{37})/0.8$ (net heat input to snowpack minus initial heat deficit converted to water equivalent) is compared with the total snow ice available to melt and the smaller of these melts. The 0.8 is the heat of fusion of water ($ly \cdot ha \cdot m^{-3}$).

---

$G_{130}$ = free water holding capacity of snowpack ($m^3$/ha)

$$G_{130} = B_{154} G_{60}$$

$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$B_{154}$ = ratio of free water holding capacity to snow ice (dim.)

Comment: Ratio of free water holding capacity to snow ice is from U.S. Army Corps of Engineers (1956, p. 301-304)

---

$G_{131}$ = carbon loss from dead roots due to respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{131} = (1 - B_{69}) G_{85}$$

$G_{85}$ = dead root decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{69}$ = fraction of carbon loss from dead roots due to fragmentation (dim.)

---

$G_{132}$ = carbon transfer from soil rooting zone to subsoil ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{132} = B_{66} G_{88}$$

$G_{88}$ = rooting zone organic matter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{66}$ = fraction of carbon loss from soil rooting zone due to incorporation into subsoil organic matter (dim.)

---

$G_{133}$ = carbon loss from rooting zone due to respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{133} = (1 - B_{66}) G_{88}$$

$G_{88}$ = rooting zone organic matter decomposition rate ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{66}$ = fraction of carbon loss from soil rooting zone due to incorporation into subsoil organic matter (dim.)

---

$G_{134}$ = total water input to snowpack or litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{134} = G_9 + G_5 + G_{56}$$

$G_5$ = drip from foliar surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_9$ = rainfall passing directly to snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{56}$ = drip from epiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

---

$G_{135}$ = transfer from new foliage to leaf litter due to acute defoliation ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{135} = 0.5 S_6 (B_{166}, B_{169}, B_{167} X_{10})$$

$X_{10}$ = new foliage carbon (t/ha)
$S_6$ = delta function
$B_{166}$ = first day on which new foliage is to be removed
$B_{167}$ = fraction by which new foliage is to be reduced during acute defoliation perturbation
$B_{169}$ = second day on which new foliage is to be removed

Comment: See $G_{40}$, $G_{44}$. We assume this is equal to transfer to fine litter, i.e., one-half is transferred to each. This function is zero-valued unless we desire to see the effect of acute defoliation.

---

$G_{136}$ = carbon transfer from old foliage to fine litter due to acute defoliation ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{136} = 0.5 G_{93}$$

$G_{93}$ = acute old foliage defoliation ($t \cdot ha^{-1} \cdot wk^{-1}$)

---

$G_{138}$ = stem-plus-branch respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{138} = \frac{B_{28} \exp (B_{141}G_{48})X_{12}}{X_{12} + B_{46}}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{48}$ = average weekly 24-hr air temperature (deg)
$B_{28}$ = maximum respiration rate of stems plus branches ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{46}$ = value of growth pool at which respiration of and transfer to stems plus branches is one-half maximum (t/ha)
$B_{141}$ = coefficient for effect of temperature on plant nonfoliar respiration ($deg^{-1}$)

Comment: The assumption in $G_{138}$, $G_{139}$, and $G_{140}$ is that temperature has the same effect ($Q_{10}$ = 2) on both above- and belowground plant respiration, although the rates at any given time are not the same since air and soil temperatures are not equal. Also note that stem-plus-branch carbon and large root carbon do not enter into the respiration functions. As the trees grow, the growth $CH_2O$ pool will also increase, resulting in increased respiration.

---

$G_{139}$ = large root respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{139} = \frac{B_{29} \exp (B_{141}G_{51})X_{12}}{X_{12} + B_{48}}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$G_{51}$ = average weekly soil temperature (deg)
$B_{29}$ = maximum respiration rate of large roots ($t \cdot ha^{-1} \cdot wk^{-1}$)
$B_{48}$ = value of growth pool at which respiration of and transfer to large roots is one-half maximum (t/ha)
$B_{141}$ = coefficient for effect of temperature on plant nonfoliar respiration ($deg^{-1}$)

Comment: See $G_{138}$.

---

$G_{140}$ = fine root respiration ($t \cdot ha^{-1} \cdot wk^{-1}$)

$$G_{140} = \frac{B_{30} \exp (B_{141}G_{51})X_{15}X_{12}}{X_{12} + B_{50}}$$

$X_{12}$ = carbon in growth $CH_2O$ pool (t/ha)
$X_{15}$ = fine root carbon (t/ha)
$G_{51}$ = average weekly soil temperature (deg)
$B_{30}$ = rate constant for fine root respiration ($wk^{-1}$)
$B_{50}$ = value of growth pool at which respiration of and transfer to fine roots in one-half maximum (t/ha)
$B_{141}$ = coefficient for effect of temperature on plant nonfoliar respiration ($deg^{-1}$)

Comment: See $G_{138}$.

---

$G_{160}$ = snow surface temperature (deg)

$$G_{160} = 0$$

Comment: We assume snowpack surface temperature is always 0°C but realize that for many other study areas $G_{106}$ would have to be computed.

---

$G_{161}$ = freezing of free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$G_{161} = \begin{cases} \min \begin{cases} X_{98} + G_{134} \\ \max \begin{cases} 0 \\ \dfrac{X_{37} - G_{127}}{0.8} \end{cases} \end{cases} & \text{if } G_{60} > 0 \\ 0 & \text{if } G_{60} \leq 0 \end{cases}$$

$X_{37}$ = heat deficit in snowpack (ly)
$X_{98}$ = free water in snowpack ($m^3$/ha)
$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{127}$ = net heat input to snowpack (ly/day)
$G_{134}$ = total water input to snowpack or litter ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

Comment: No snow freezes unless the heat deficit at the end of the day ($X_{37} - G_{127}$) is greater than zero and there is free water available to freeze. In this case the smaller of what could potentially freeze [($X_{37}$ - $G_{127}$)/0.8] and what is available ($X_{98} + G_{134}$) actually freezes. The 0.8 is the heat of fusion of water ($ly \cdot ha \cdot m^{-3}$).

---

$G_{168}$ = net heat transfer from sky to canopy due to longwave radiation (ly/day)

$$G_{168} = (Z_{12} - G_{122})G_{23}$$

$G_{23}$ = percent cover by canopy (dim.)
$G_{122}$ = longwave radiation from blackbody at air temperature (ly/day)
$Z_{12}$ = daily longwave radiation from sky (ly/day)

---

$-G_{169}$

$G_{170}$ = heat input to snowpack due to convection (ly/day)

$$G_{170} = \max\,[0,\ 80B_{21}(Z_3 - G_{160})]$$

$G_{160}$ = snow surface temperature (deg)
$Z_3$ = average 24-hr air temperature (deg)
$B_{21}$ = ratio of snowmelt due to convection to difference between air and snow temperature ($g \cdot cm^{-2} \cdot day^{-1} \cdot deg^{-1}$)

Comment: The relationship in $G_{170}$ is from a regression of temperature difference on snowmelt due to convection based on a four-year study at Willamette Basin Snow Laboratory (U.S. Army Corps of Engineers 1956). Note that 80 is heat of fusion of water (cal/g). Conversion to ly/day was necessary to calculate snowpack heat deficit ($X_{37}$). The term $Z_3$ - $G_{160}$ is a measure of the temperature gradient at the pack surface.

---

## 6.3. *Tree Diagrams*

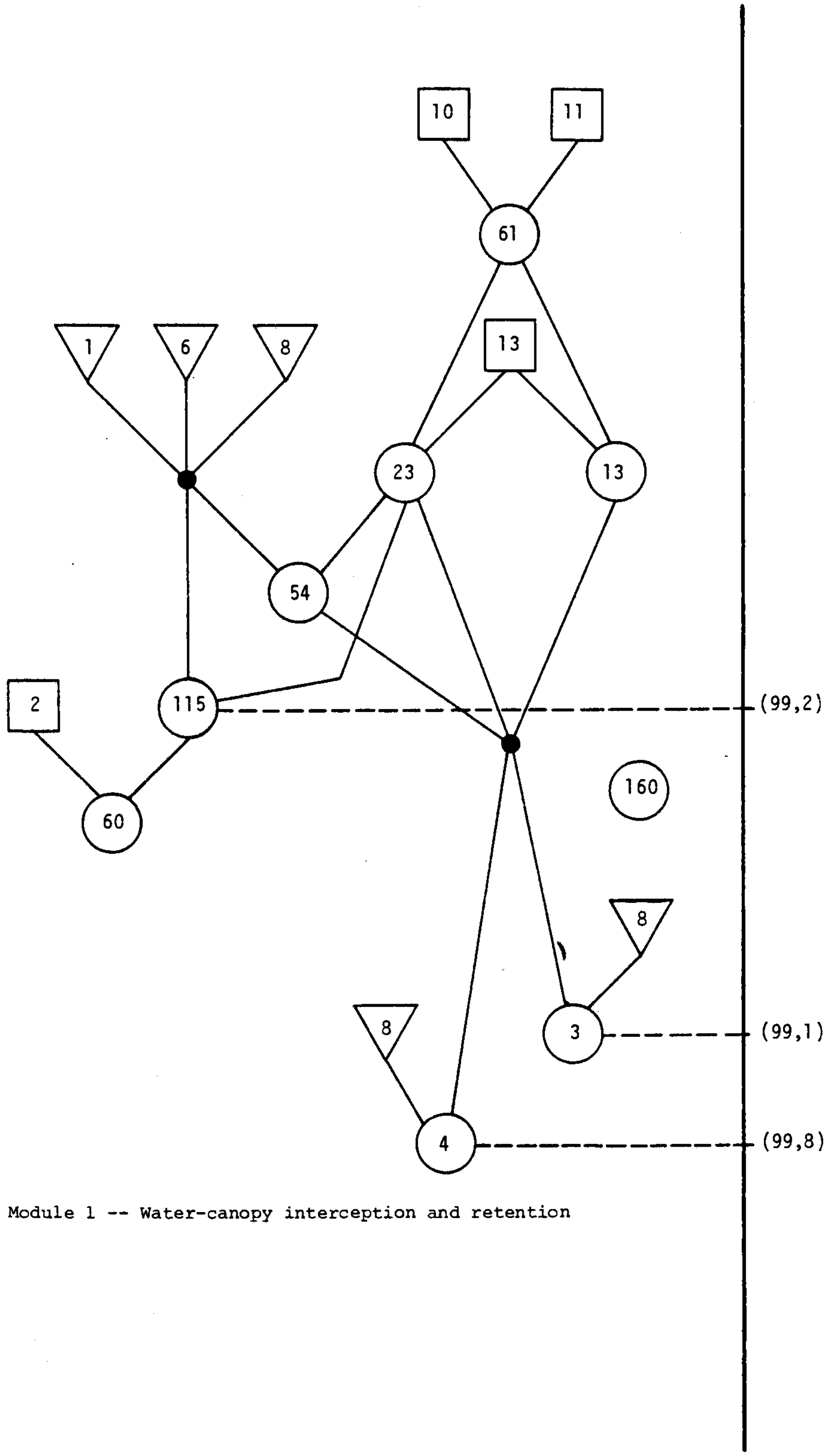
In this section we present a sequence of tree diagrams detailing the interrelationships between all variables in the model. The calculation of *G*'s in the code is segmented into 18 modules. The *G*'s in modules 1-8 are calculated daily; those in the remaining modules are calculated weekly. Each page of the tree diagrams refers to a module in the code.

In general, a dashed line indicates flow of information into or out of a module while a solid line indicates information flow within the module. Information flow (calculation) proceeds generally from top to bottom. (Module 5 contains two instances in which complex topology of the tree forced us to draw two lines that lead downward, but bend upward at the bottom.) A solid circle (●) indicates a junction; all variables from which lines lead downward to the junction are used in calculating all variables to which lines lead downward from the junction.

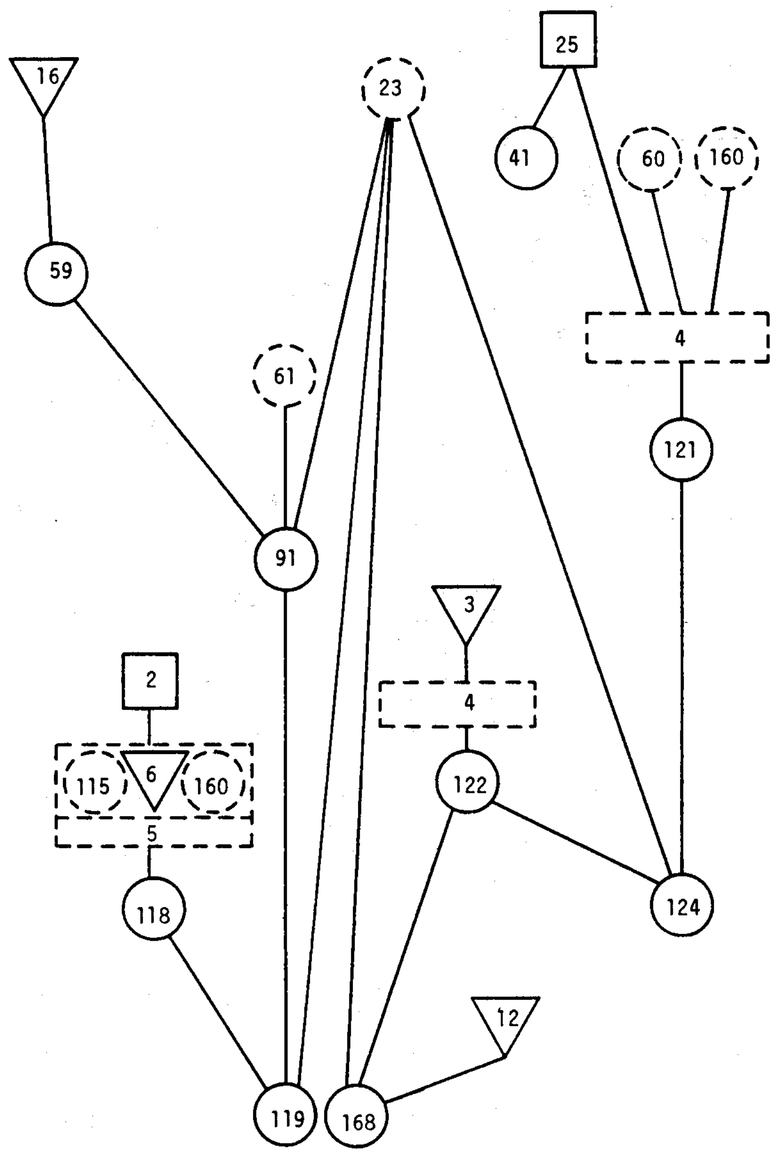
The *G*'s can depend on values of state variables (*X*'s), driving variables (*Z*'s), and other *G* variables, as well as referring to special (*S*) functions, and we have used a pictorial system of distinguishing among the variable types. The *G*'s are indicated by circles with the index written inside. A dashed-line circle indicates that the *G* was calculated in an earlier module. The *Z*'s are indicated by solid-line triangles and *X*'s by solid-line squares. When *S* functions are used in calculating a *G*, the *S* is indicated by a dashed-line rectangle with the arguments of the function shown leading into it from above. Each time a *G* corresponding to a flow is calculated, we show it with a dashed line leading to the right. At the extreme right-hand margin, at the end of these dashed lines, we have written the corresponding flow term.

The diagrammatic conventions used in the tree diagrams are summarized below:

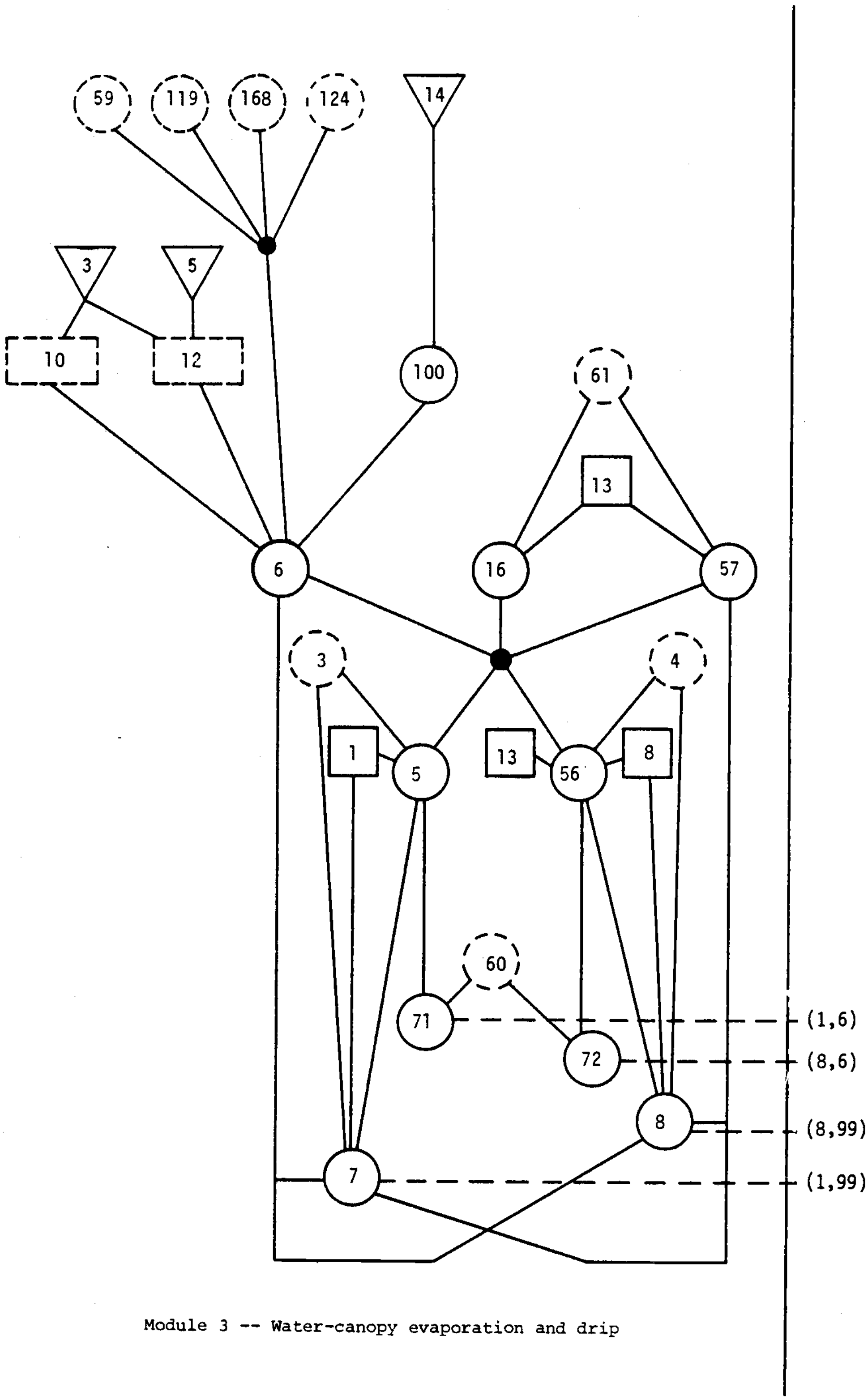
- □ state variable (*X*)
- ▽ driving variable (*Z*)
- ○ intermediate variable (*G*) calculated in the module
- ◌ intermediate variable (*G*) calculated in previous module
- ⬚ special function (*S*)
- ● junction



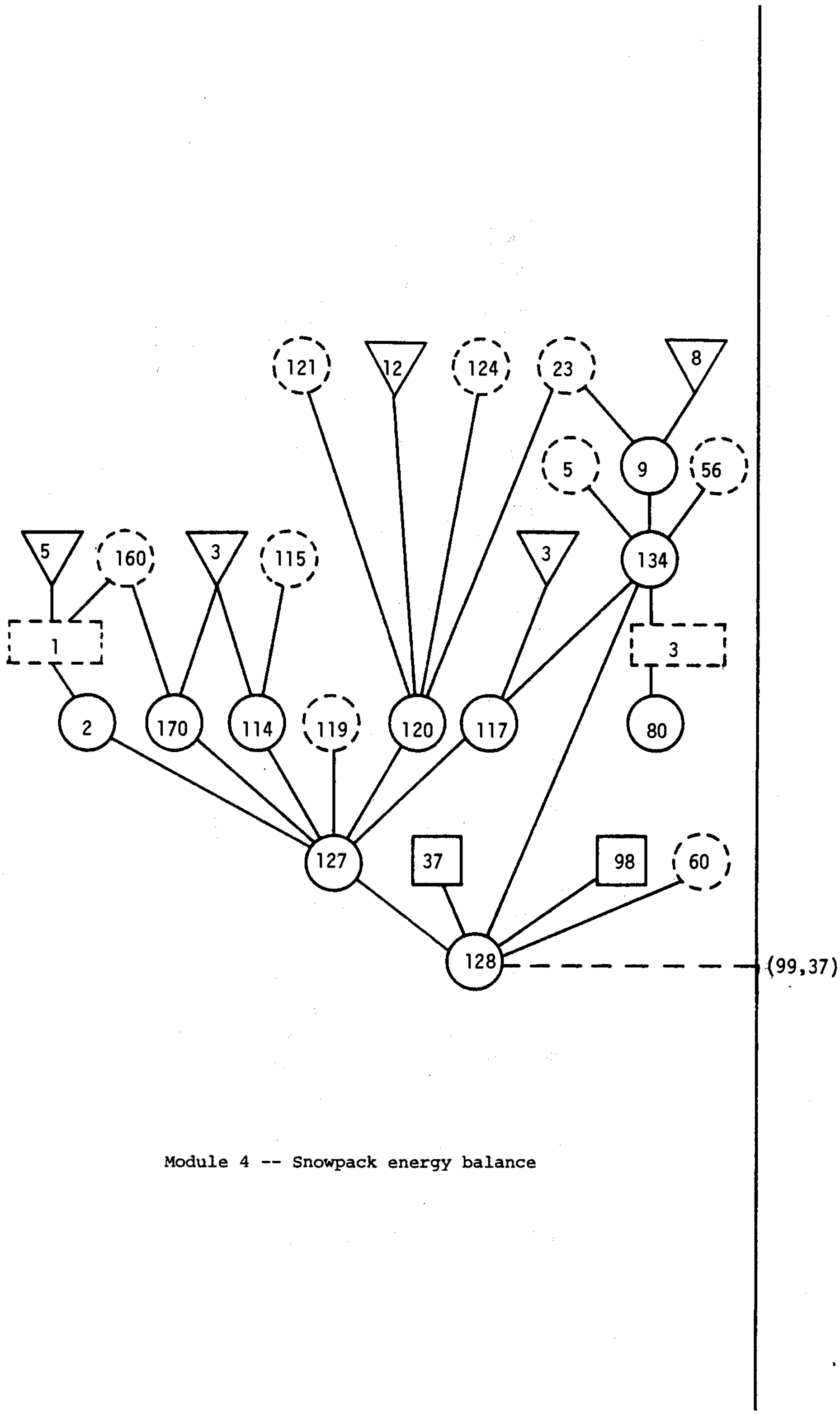

Module 1 -- Water-canopy interception and retention



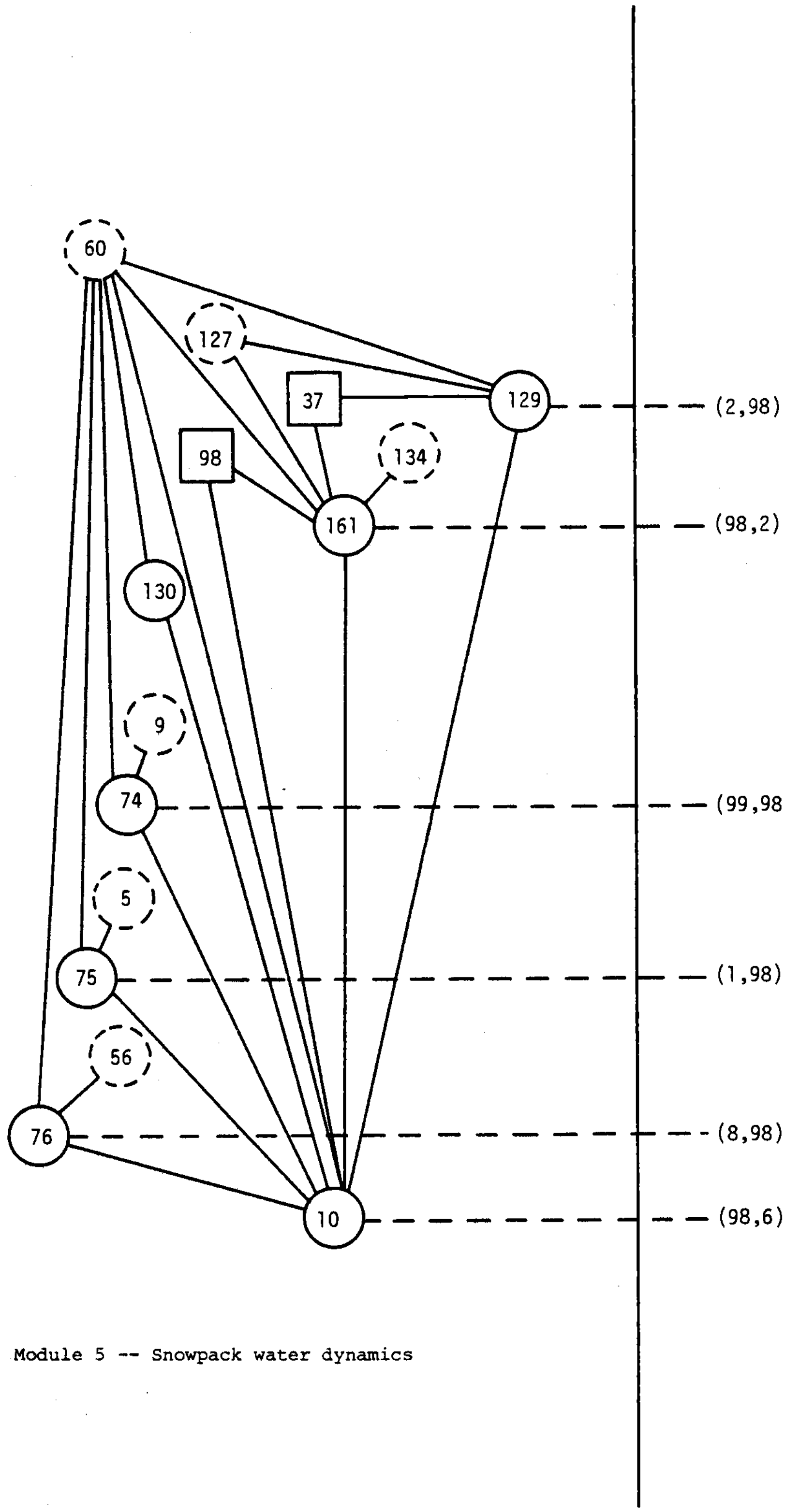

Module 2 -- Canopy energy balance



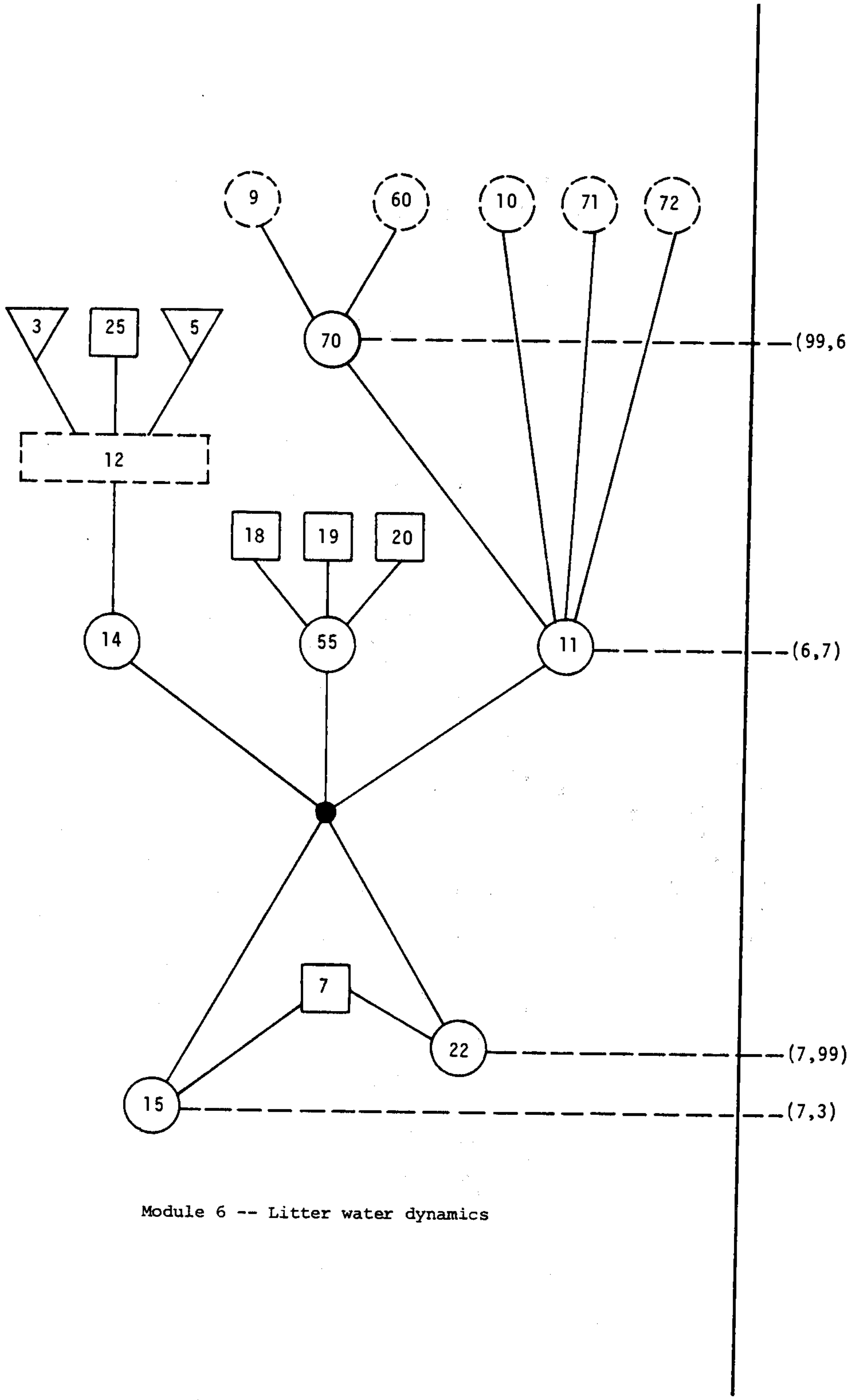

Module 3 -- Water-canopy evaporation and drip



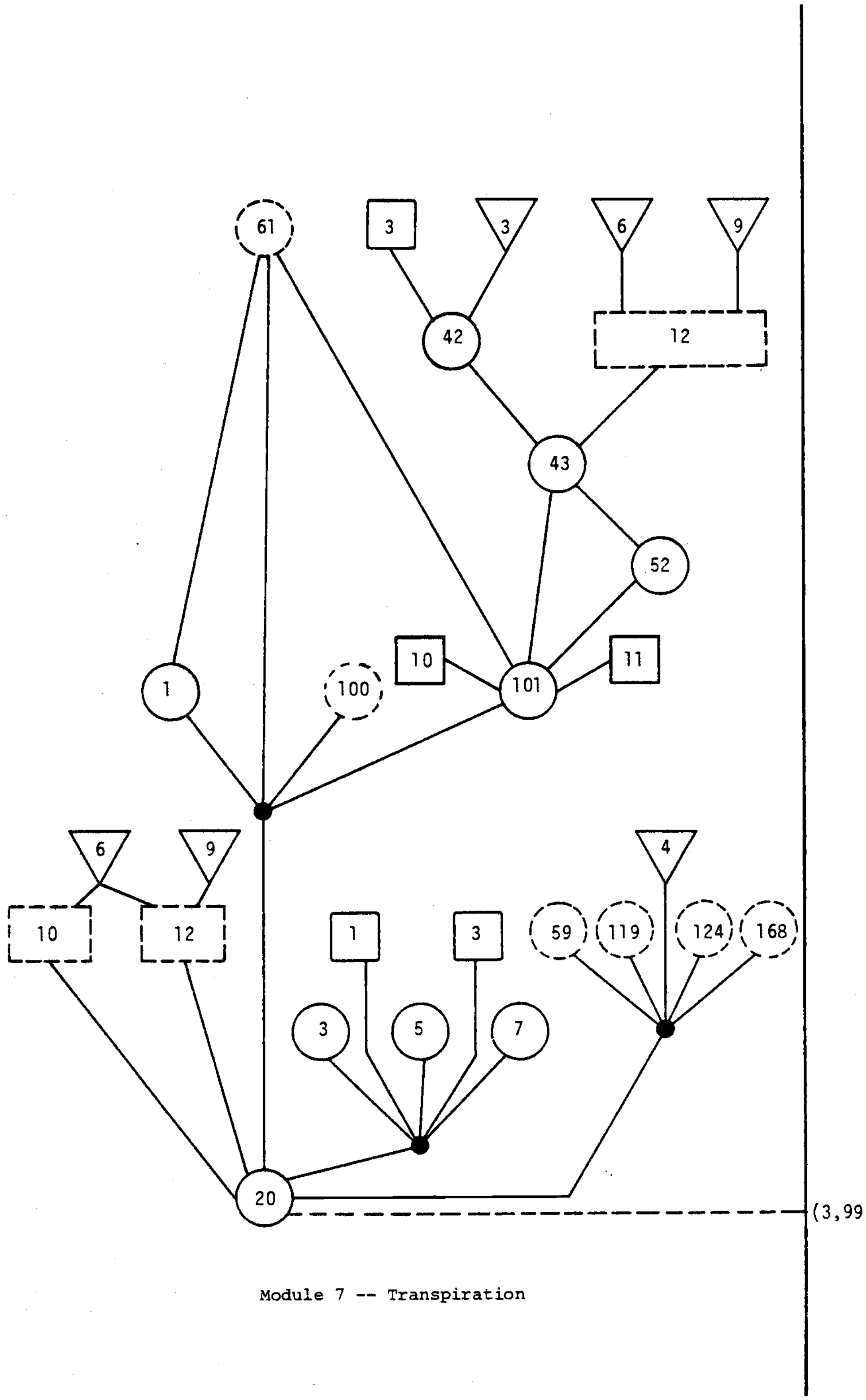

Module 4 -- Snowpack energy balance



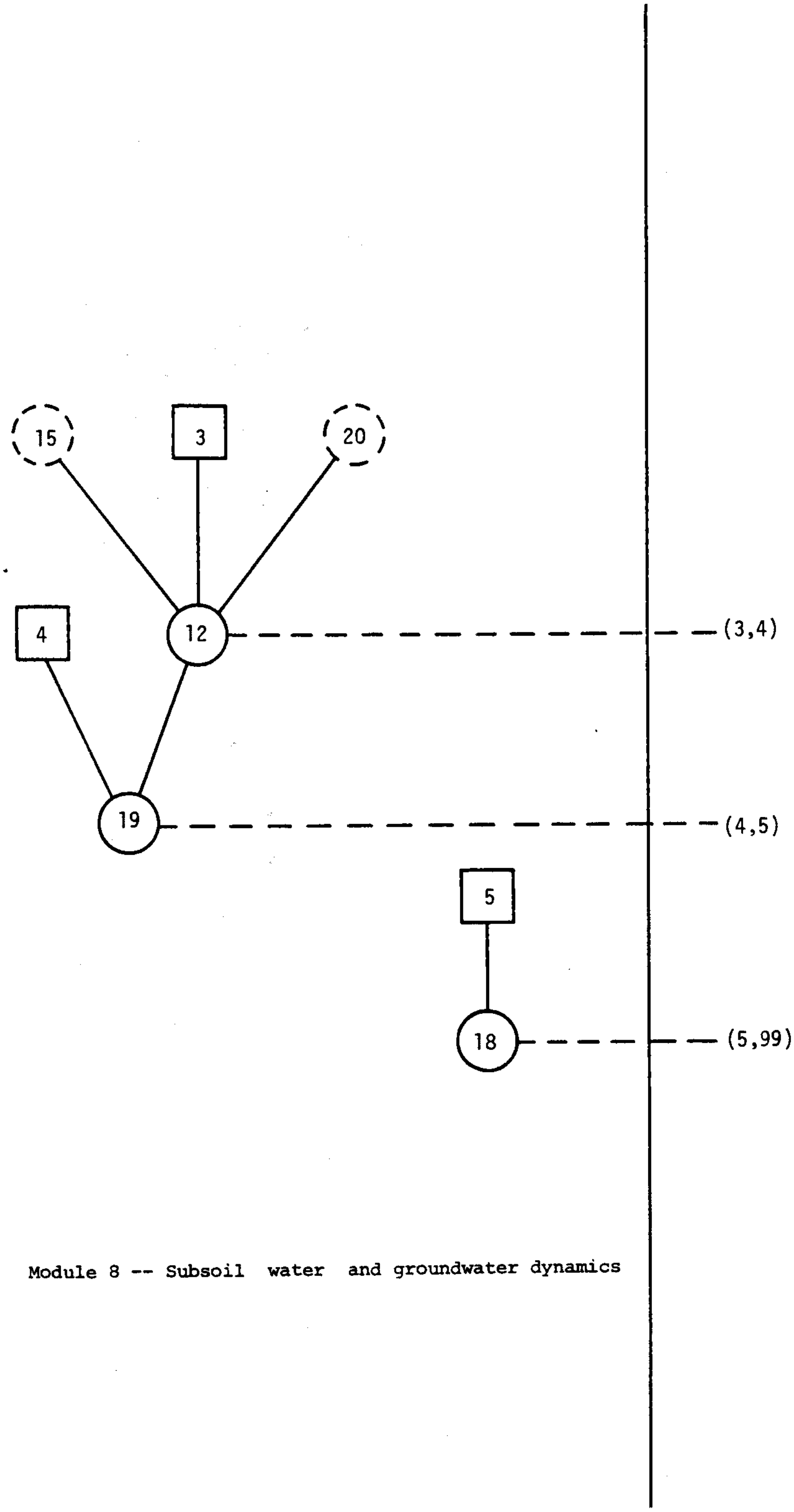

Module 5 -- Snowpack water dynamics



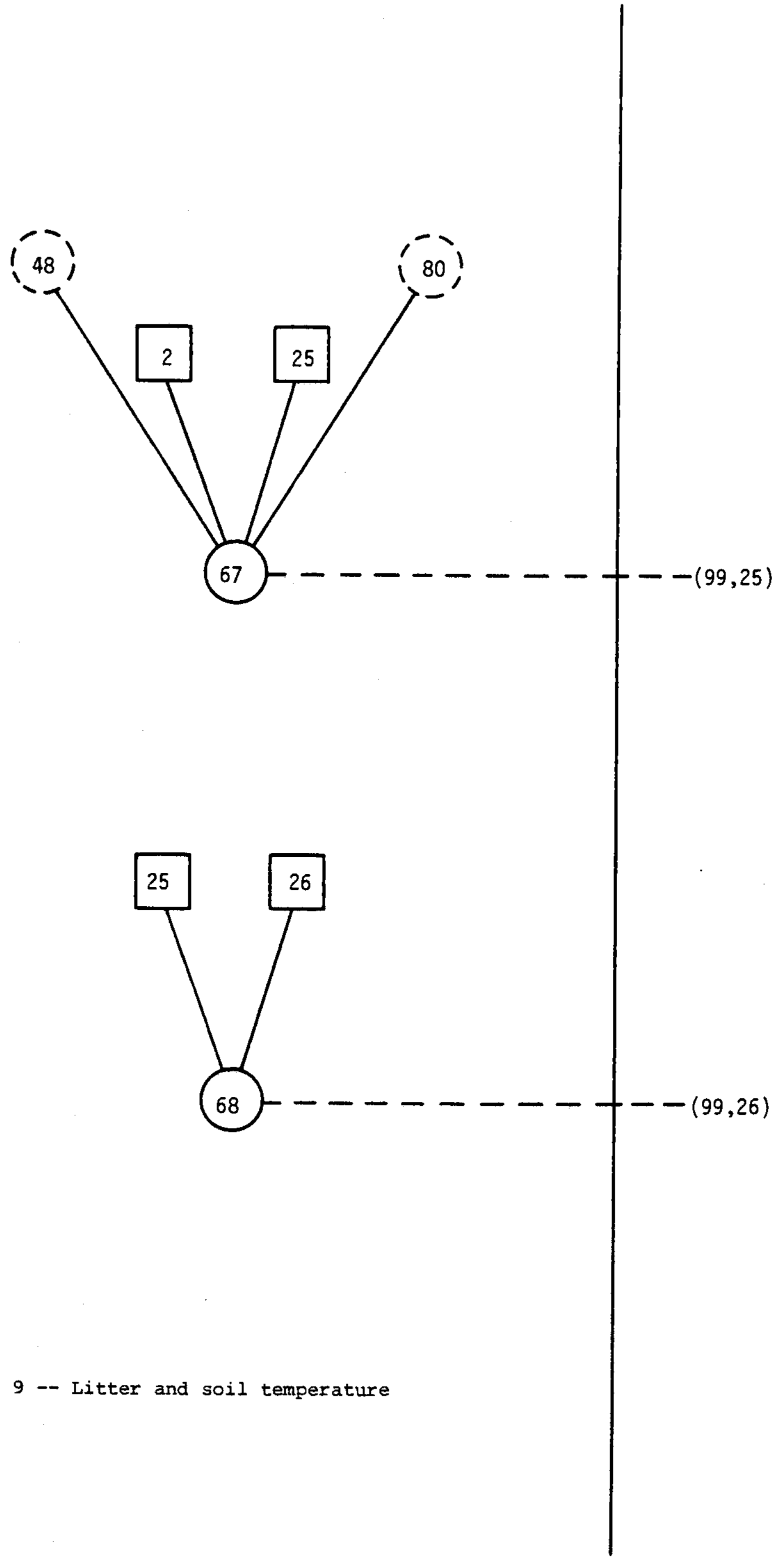

Module 6 -- Litter water dynamics



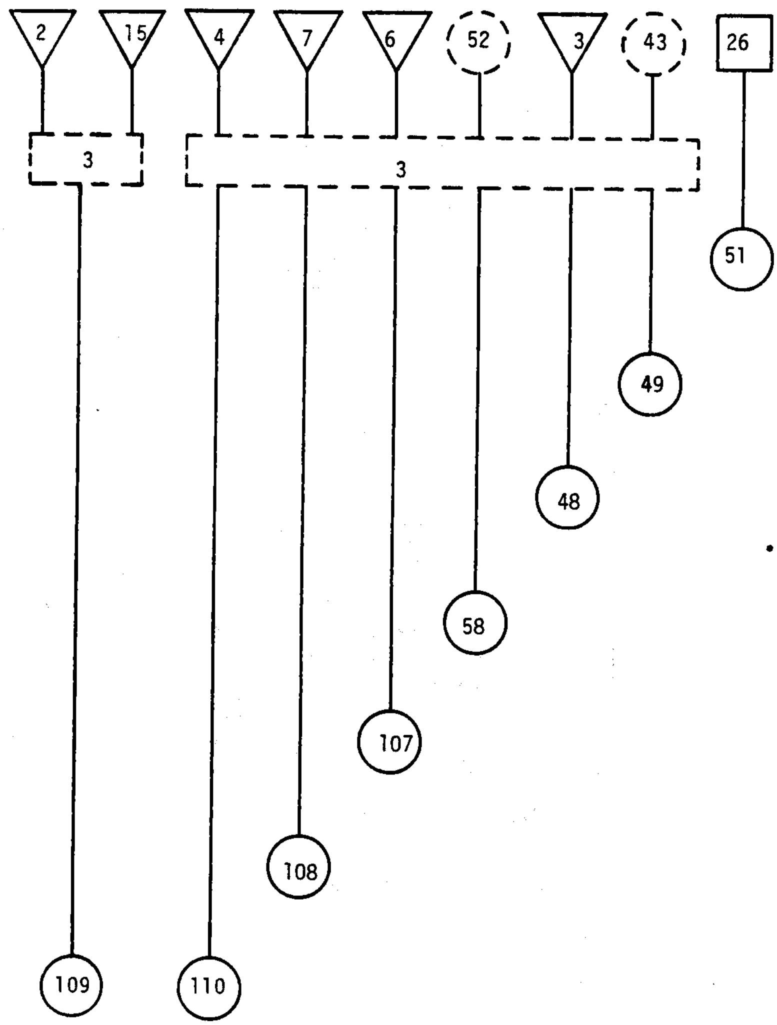

Module 7 -- Transpiration



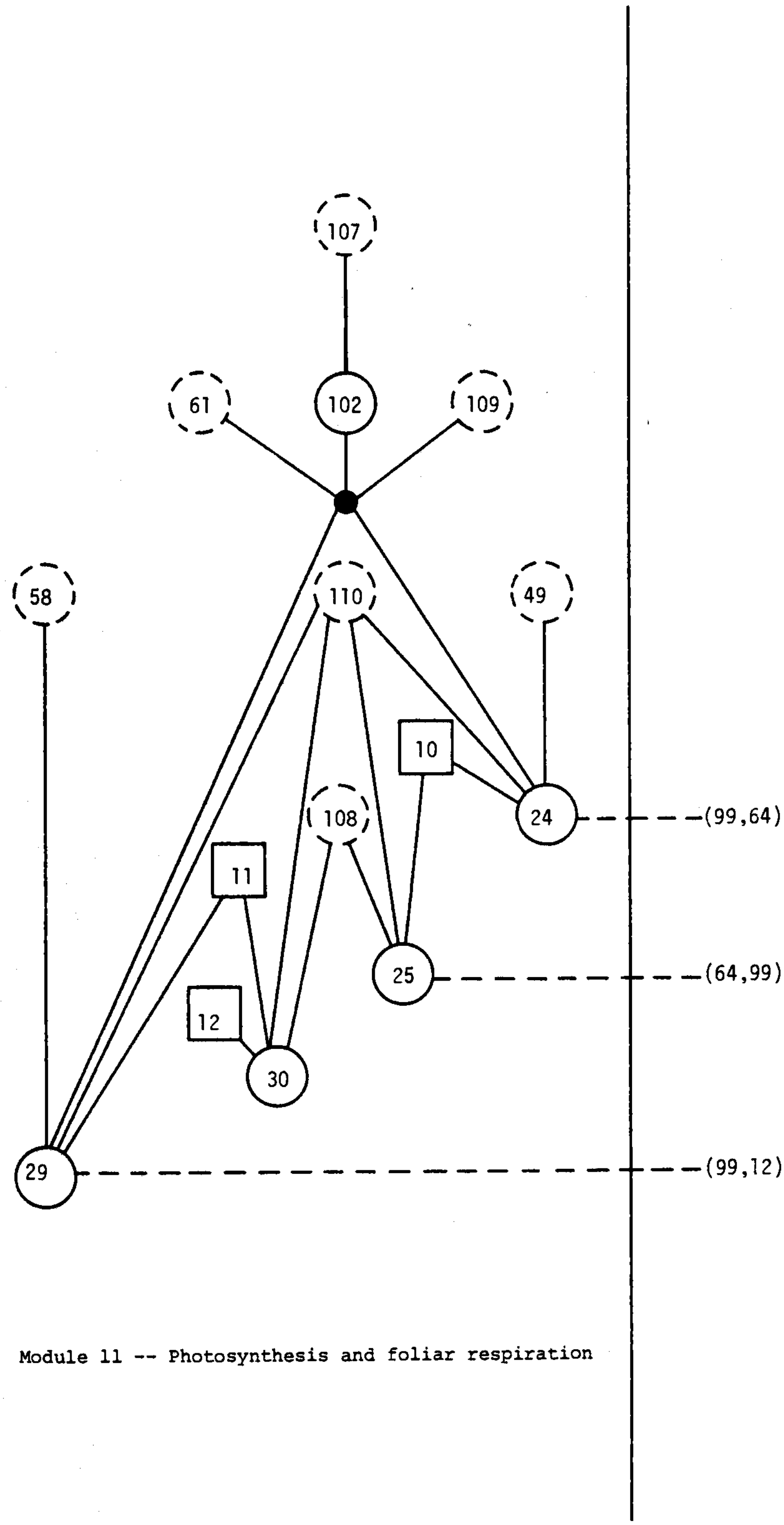

Module 8 -- Subsoil water and groundwater dynamics



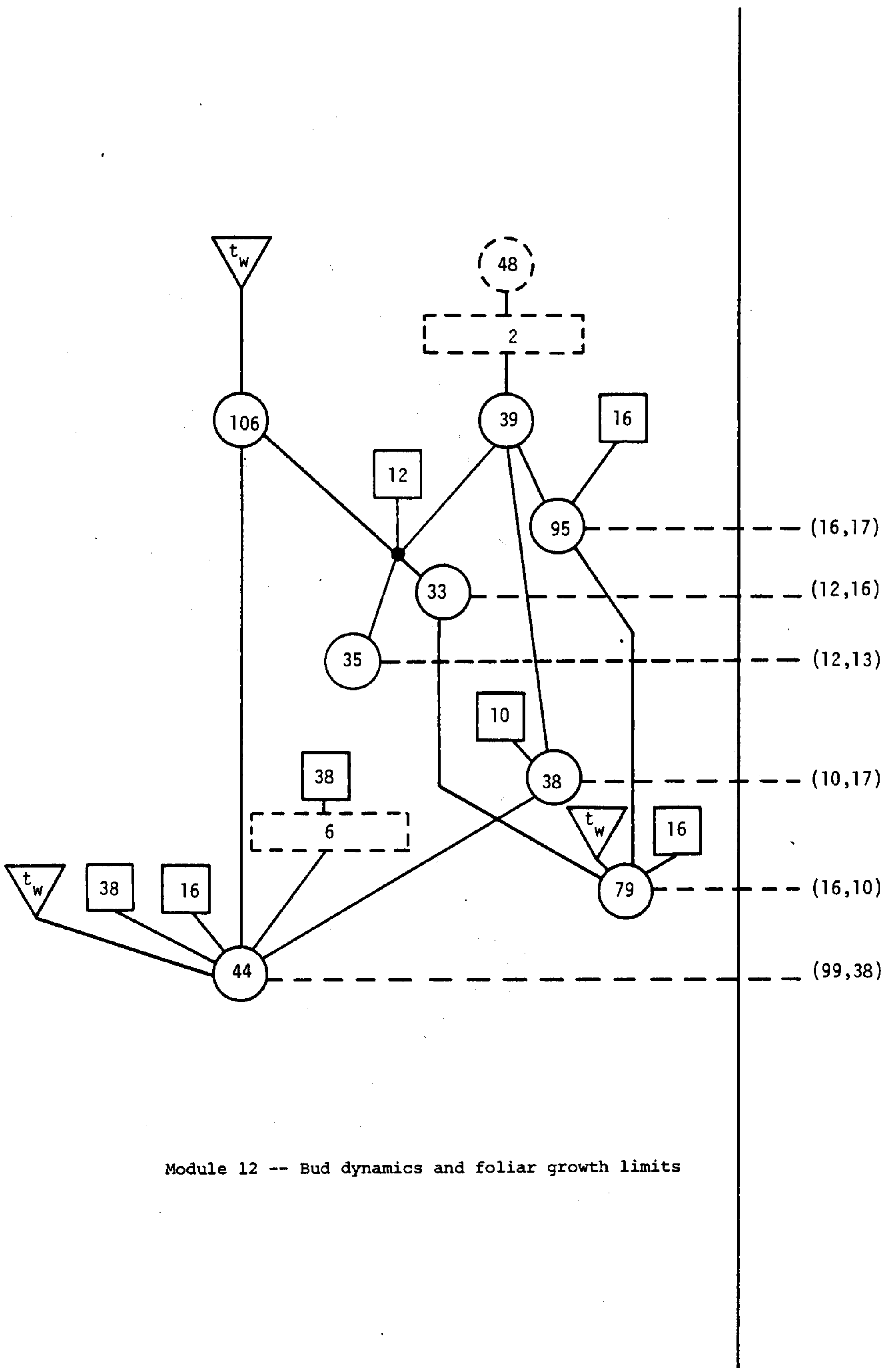

Module 9 -- Litter and soil temperature



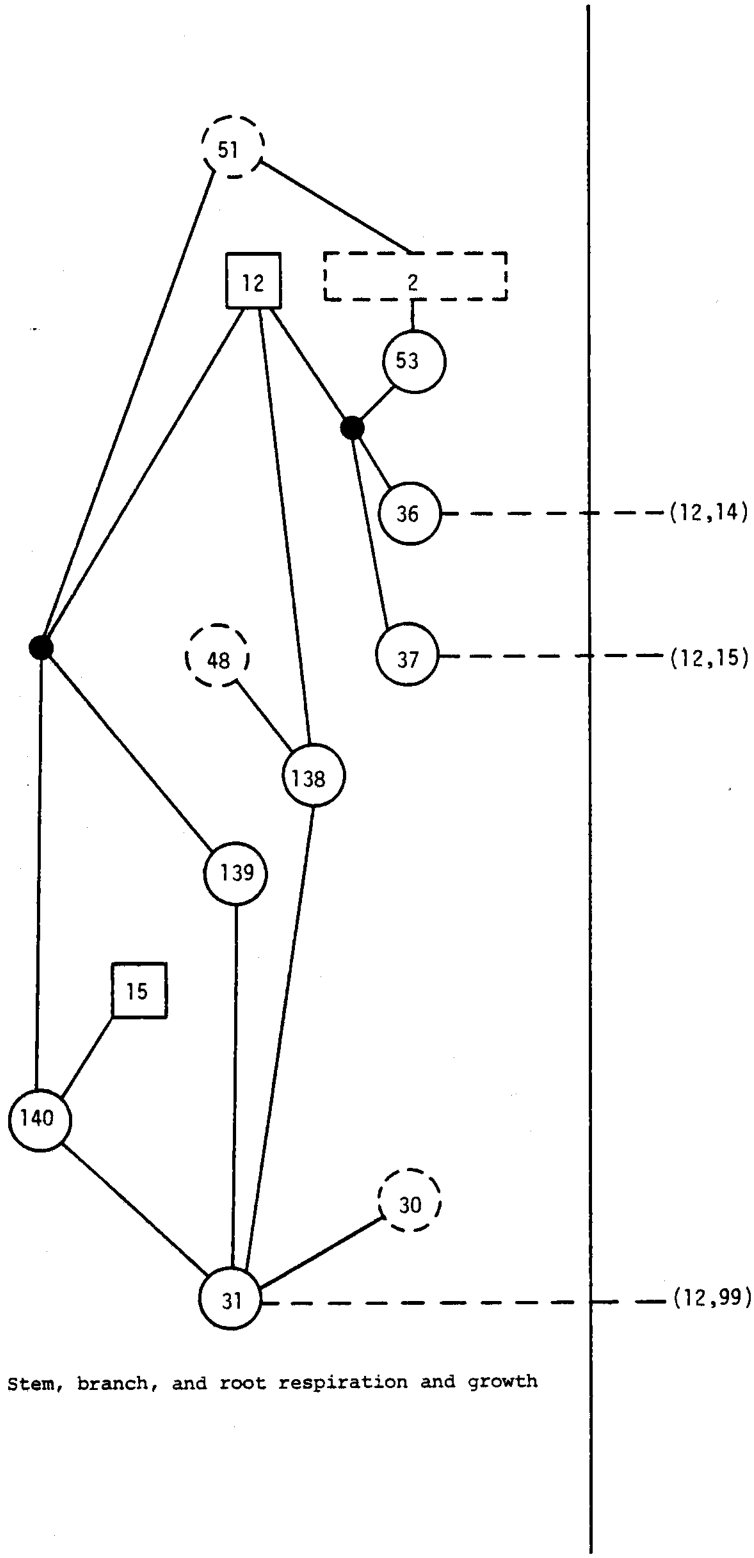

Module 10 -- Weekly averages



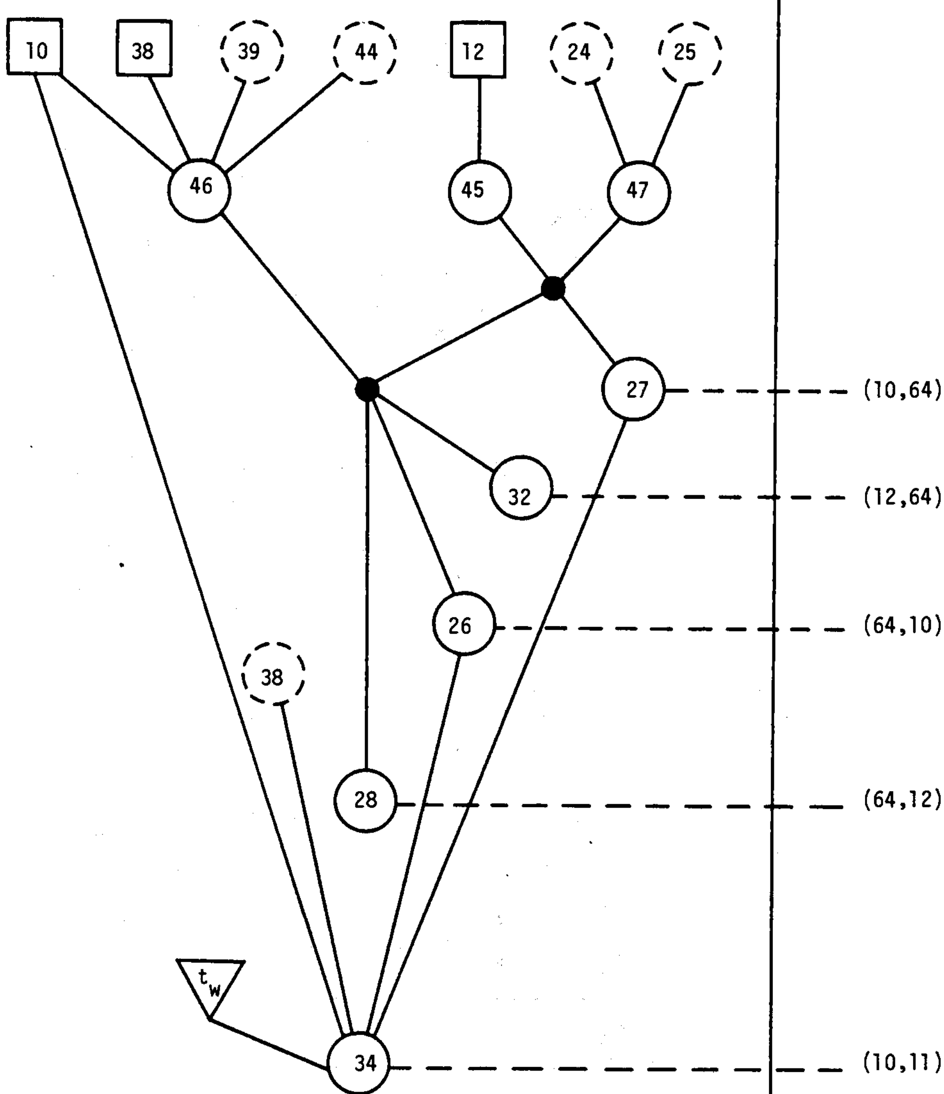

Module 11 -- Photosynthesis and foliar respiration



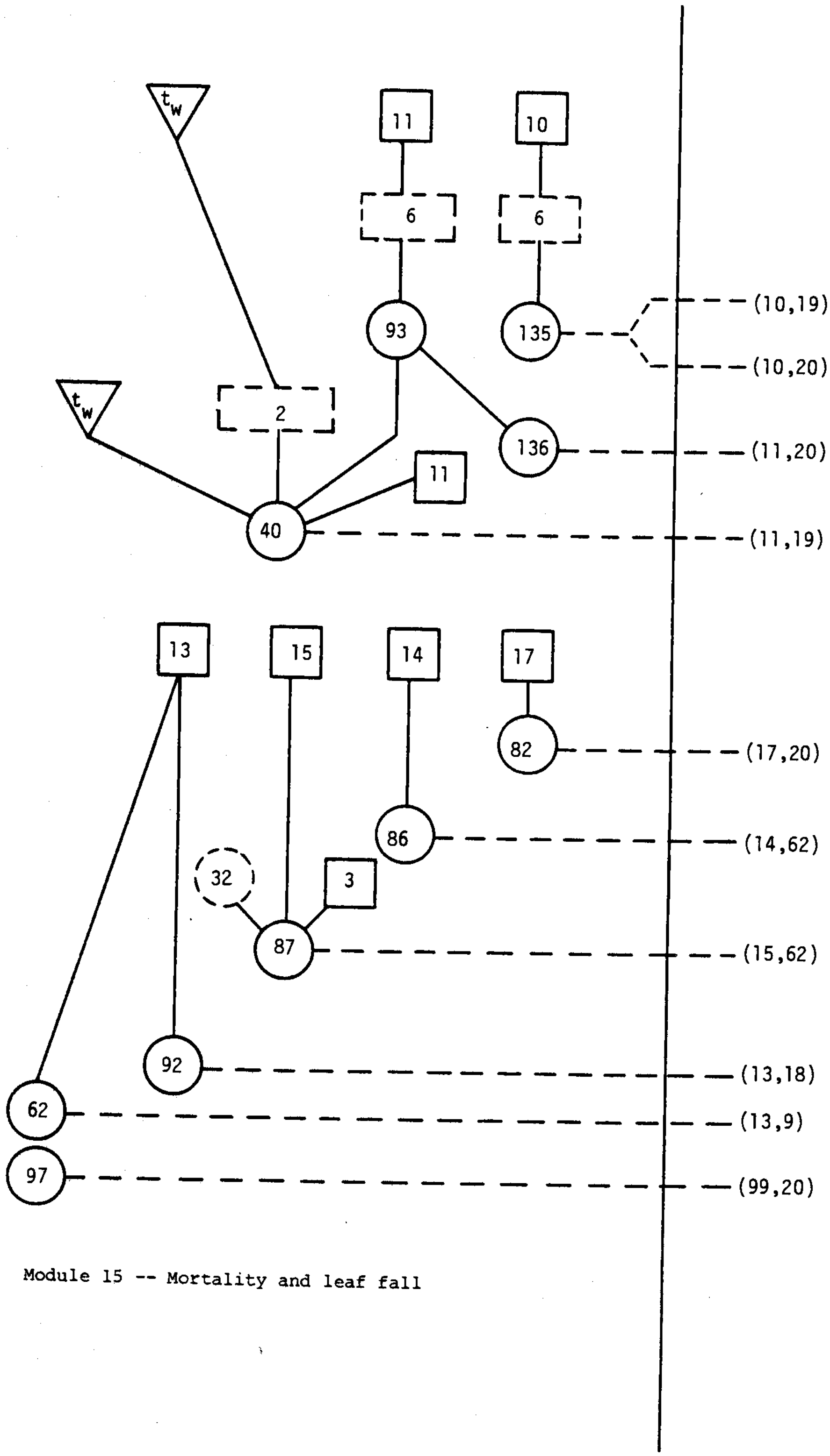

Module 12 -- Bud dynamics and foliar growth limits



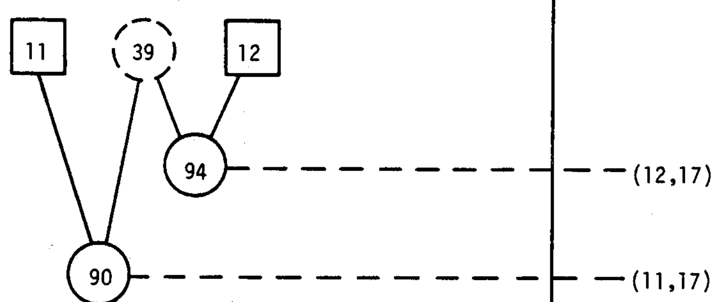

Module 13 -- Stem, branch, and root respiration and growth



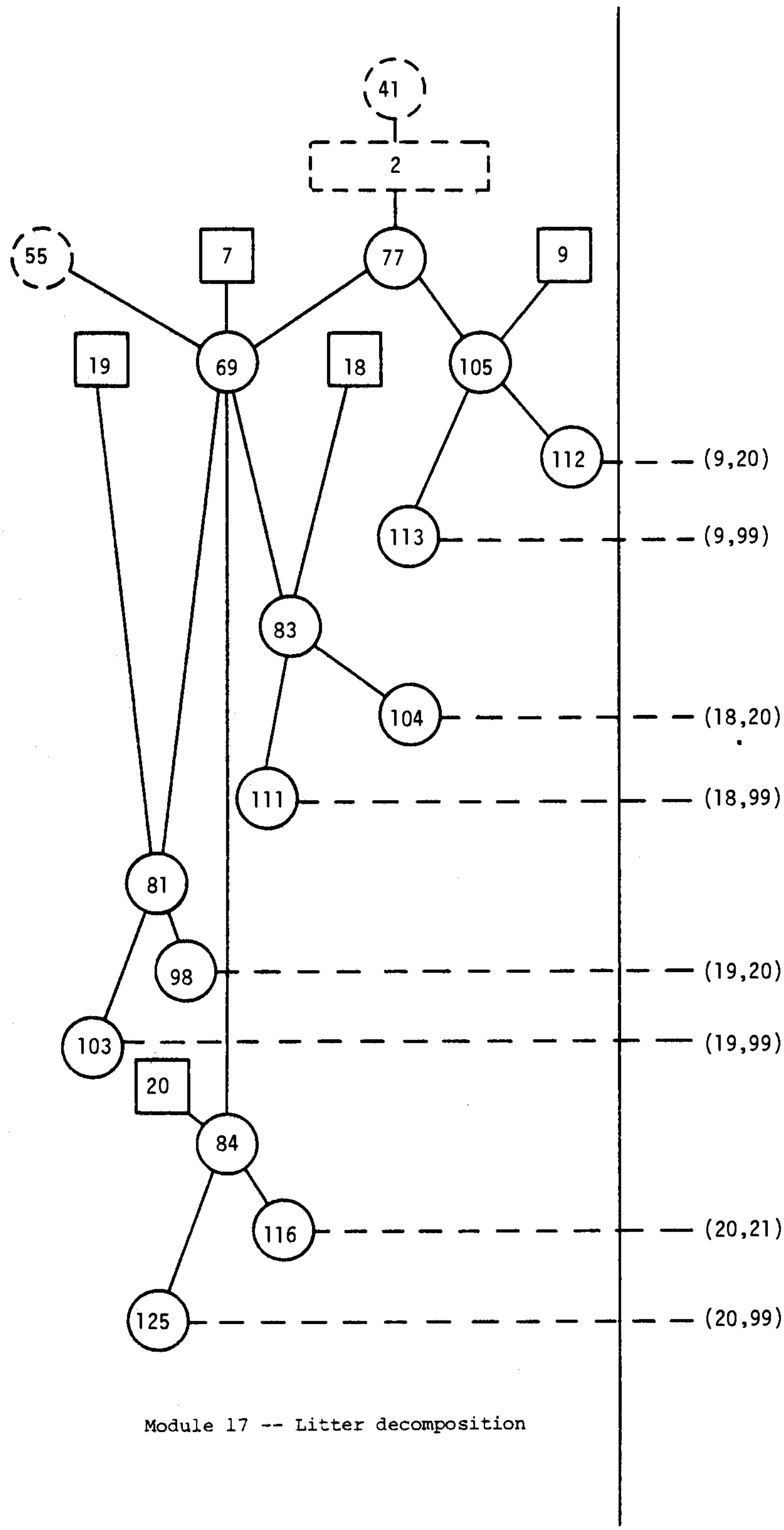

Module 14 -- Foliar growth and $CH_2O$ pool dynamics



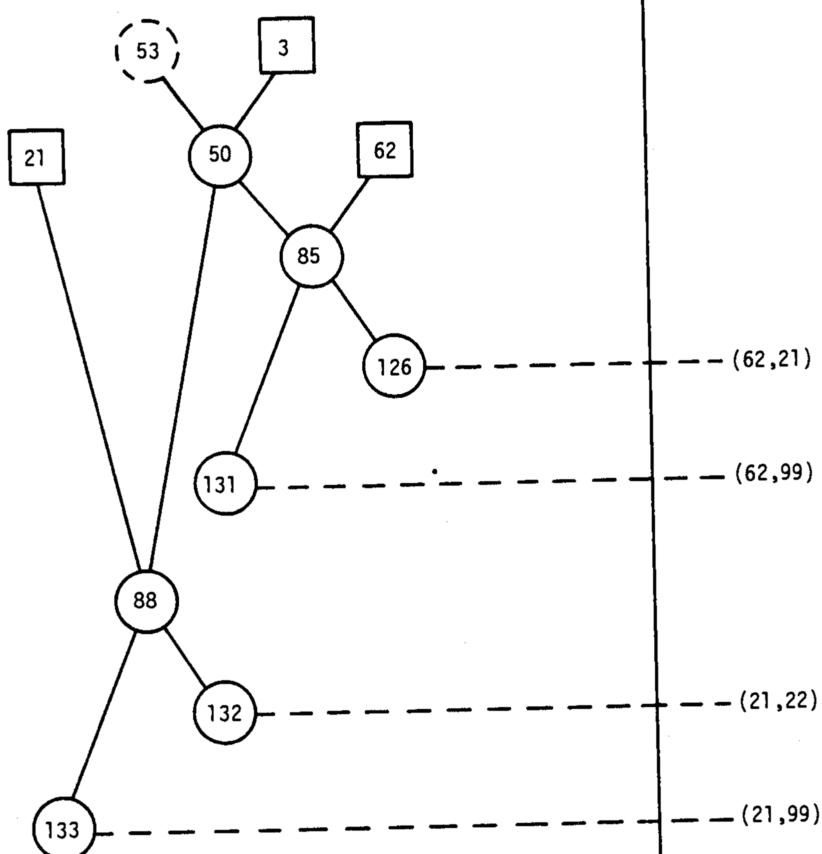

Module 15 -- Mortality and leaf fall




Module 16 -- Old foliage consumption




Module 17 -- Litter decomposition




Module 18 -- Soil and subsoil decomposition

# 7. SPECIAL FUNCTIONS

In this section we list the special functions ($S$ functions) used in CONIFER. The section consists of two parts. The first is a cross-reference list of $S$ functions indicating the $G$ and $Y$ functions in which each $S$ is used. In the second part we define the $S$ functions algebraically.

## 7.1. *Cross-Reference Listing of Special Functions*

$S_1$ saturation vapor pressure as function of temperature -- $Z_{12}$, $G_2$, $S_{10}$, $S_{12}$

$S_2$ beta function -- $G_{39}$, $G_{40}$, $G_{53}$, $G_{77}$

$S_3$ convert functions from daily to weekly -- $G_{48}$, $G_{49}$, $G_{58}$, $G_{80}$, $G_{107}$, $G_{108}$, $G_{109}$, $G_{110}$, $Y_{14}$, $Y_{17}$

$S_4$ longwave radiation from blackbody -- $Z_{12}$, $G_{121}$, $G_{122}$

$S_5$ table look-up function for albedo of snowpack -- $G_{118}$

$S_6$ delta function -- $G_{44}$, $G_{93}$, $G_{135}$

$S_{10}$ function for rate of change of saturation vapor pressure with temperature temperature -- $G_6$, $G_{20}$

$S_{12}$ function to calculate vapor pressure deficit from air and dew-point temperature -- $G_6$, $G_{14}$, $G_{20}$, $G_{43}$

## 7.2 *Descriptions of S Functions*

$S_1$ = saturation vapor pressure as function of temperature (mbar)

$$S_1(T_1) = 6.11 \exp\left(\frac{17.27\ T_1}{T_1 + 237.3}\right)$$

$T_1$ = arbitrary temperature (deg)

Comment: $S_1$ is Teten's equation for saturation vapor pressure as a function of temperature (Murray 1967).

---

$S_2$ = beta function

$$S_2(T_1, T_2, T_3, T_4, T_5) = \begin{cases} (T_1 - T_2)^{T_4-1}\ (T_3 - T_1)^{T_5-1} & \text{if } T_2 \geq T_1 \leq T_3 \\ 0 & \text{otherwise} \end{cases}$$

$T_1$, $T_2$, $T_3$, and $T_4$ = arbitrary parameters

---

$S_3$ = weekly averaging function

$$S_3(i, T_1) = \begin{cases} \text{weekly average of } T_1 & \text{if } t_d \text{ modulo } 7 = 1 \\ T_1 & \text{if } t_d = 1 \\ 0 & \text{otherwise} \end{cases}$$

$T_1$ = arbitrary parameter
$t_d$ = time (days)

$i$ = index for keeping separate each instance in which $S_3$ is used

Comment: Function is designed to compute weekly average value of variables that are computed daily. $T_1$ may be a $G$, a $Z$, or a $Y$. A sum must be accumulated for seven days in order to compute the average and it is necessary to have a separate sum for each instance in which the function is used. This vector of sums is called DAILY in the code. The allocation of elements of DAILY is shown below.

| $i$ | variable |
|---|---|
| 1 | $G_{49}$ |
| 2 | $G_{109}$ |
| 3 | $G_{110}$ |
| 4 | $G_{107}$ |
| 5 | $G_{108}$ |
| 6 | $G_{48}$ |
| 7 | $G_{58}$ |
| 12 | $G_{80}$ |
| 15 | $Y_{17}$ |
| 16 | $Y_{14}$ |

---

$S_4$ = longwave radiation from blackbody (ly/day)

$$S_4(T_1) = 1.17 \times 10^{-7}(T_1 + 273.16)^4$$

$T_1$ = arbitrary temperature

Comment: We assume emissivity of 1.0 in all calculations.

---

$S_5$ = table look-up function for albedo of snowpack (see $G_{118}$)

---

$S_6(T_1, T_2, T_3)$ = delta function

$$S_6(T_1, T_2, T_3) = \begin{cases} T_3 & \text{if } t_d = T_1 \text{ or } t_d = T_2 \\ 0 & \text{otherwise} \end{cases}$$

$T_1$, $T_2$, and $T_3$ = arbitrary parameters
$t_d$ = time in days

---

$S_{10}$ = function for rate of change of saturation vapor pressure with temperature (mbar/deg)

$$S_{10}(T_1) = \frac{4098.2\ S_1(T_1)}{(T_1 + 237.3)^2}$$

$T_1$ = arbitrary temperature (deg)
$S_1$ = saturation vapor pressure as function of temperature

---

$S_{12}$ = function to calculate vapor pressure deficit from air and dew point temperature ($\text{mbar}\cdot\text{joule}\cdot\text{m}^{-3}\cdot\text{deg}^{-1}$)

$$S_{12}(T_1, T_2) = 1.2 \times 10^3 \; [S_1(T_1) - S_1(T_2)]$$

$T_1$ = air temperature (deg)
$T_2$ = dew point temperature (deg)
$S_1$ = saturation vapor pressure as function of temperature

Comment: The constant is the density of saturated air times the specific heat of saturated air ($\text{joule}\cdot\text{m}^{-3}\cdot\text{deg}^{-1}$)

---

## 8. OUTPUT VARIABLES

In this section we list the output variables and functions ($Y$'s) that we have included in CONIFER. These functions are not necessary for the operation of CONIFER; they are simply the functions that, in the course of working with the model over some three years, we have found useful and convenient.

$Y_1$ = weekly evaporation from litter and canopy ($\text{m}^3\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$$Y_1 = G_7 + G_8 + G_{22}$$

$G_7$ = evaporation from foliar surfaces ($\text{m}^3\cdot\text{ha}^{-1}\cdot\text{day}^{-1}$)
$G_8$ = evaporation from epiphyte and bark surfaces ($\text{m}^3\cdot\text{ha}^{-1}\cdot\text{day}^{-1}$)
$G_{22}$ = evaporation from litter ($\text{m}^3\cdot\text{ha}^{-1}\cdot\text{day}^{-1}$)

---

$Y_2$ = litterfall ($\text{ton}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$$Y_2 = G_{40} + G_{62} + G_{90} + G_{92} + 2G_{135} + G_{136}$$

$G_{40}$ = leaf-fall rate ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$G_{62}$ = carbon transfer from stems-plus-branches to log litter ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$G_{90}$ = old-foliage consumption by insects ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$G_{92}$ = carbon transfer from stems-plus-branches to woody litter ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$G_{135}$ = transfer from new foliage to leaf litter due to acute defoliation ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$G_{136}$ = transfer from old foliage to fine litter due to acute defoliation ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

---

$Y_4$ = length of time snowpack present (dim.)

$$Y_4 = \begin{cases} 1 & \text{if } X_2 > 0 \\ 0 & \text{if } X_2 \le 0 \end{cases}$$

$X_2$ = snowpack ice ($\text{m}^3$/ha)

---

$-Y_5$

$Y_6$ = total litter respiration ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$$Y_6 = G_{103} + G_{111} + G_{113} + G_{125}$$

$G_{103}$ = carbon loss from foliage litter due to respiration ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)
$G_{111}$ = carbon loss from woody litter due to respiration ($\text{t}\cdot\text{ha}^{-1}\cdot\text{wk}^{-1}$)

$G_{113}$ = carbon loss from logs due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{125}$ = carbon loss from fine litter due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

---

$Y_7$ = total soil respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

$$Y_7 = G_{131} + G_{133} + G_{139} + G_{140}$$

$G_{131}$ = carbon loss from dead roots due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{133}$ = carbon loss from rooting zone organic matter due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{139}$ = large root respiration $(t \cdot ha^{-1} \cdot wk^{-1})$ $-Y_9$
$G_{140}$ = fine root respiration $(t \cdot ha^{-1} \cdot wk^{-1})$ $-Y_{10}$

$-Y_{11}$

---

$Y_{12}$ = total forest floor respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

$$Y_{12} = G_{103} + G_{111} + G_{113} + G_{125} + G_{131} + G_{133} + G_{139} + G_{140}$$

$G_{103}$ = carbon loss from foliage litter due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{111}$ = carbon loss from woody litter due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{113}$ = carbon loss from logs due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{125}$ = carbon loss from fine litter due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{131}$ = carbon loss from dead roots due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{133}$ = carbon loss from rooting zone organic matter due to respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{139}$ = large root respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{140}$ = fine root respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

---

$Y_{14}$ = weekly average percent litter moisture on dry weight basis (dim.)

$$Y_{14} = \begin{cases} S_3[16,\ 50\ X_7/T_1] & \text{if } X_{19} + X_{20} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$T_1 = X_{19} + X_{20}$$

$X_7$ = litter water $(m^3/ha)$
$X_{19}$ = foliage litter carbon (t/ha)
$X_{20}$ = fine litter carbon (t/ha)
$S_3$ = weekly averaging function

Comment: Here 50 is 0.5 carbon-to-dry-weight ratio times 100 percent.

---

$Y_{16}$ = net assimilation $(t \cdot ha^{-1} \cdot wk^{-1})$

$$Y_{16} = G_{24} - G_{25} + G_{29} - G_{30}$$

$G_{24}$ = net new foliage photosynthesis $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{25}$ = new foliage nighttime respiration $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{29}$ = net old foliage photosynthesis $(t \cdot ha^{-1} \cdot wk^{-1})$
$G_{30}$ = old foliage nighttime respiration $(t \cdot ha^{-1} \cdot wk^{-1})$

---

---

$Y_{17}$ = weekly average of percent shortwave radiation intercepted by canopy (dim.)

$$Y_{17} = S_3(15, T_1)$$

$T_1$ = percent of shortwave radiation intercepted by canopy (dim.)

$$T_1 = 100(1 - G_{91}/G_{59})$$

$G_{59}$ = net shortwave radiation at top of canopy (ly/day)
$G_{91}$ = shortwave radiation exiting from canopy (ly/day)
$S_3$ = weekly averaging function

---

$Y_{20}$ = total water stored in system ($m^3$/ha)

$$Y_{20} = X_1 + X_2 + X_3 + X_4 + X_5 + X_7 + X_8$$

$X_1$ = water storage on foliage ($m^3$/ha)
$X_2$ = snowpack ice ($m^3$/ha)
$X_3$ = soil rooting zone water ($m^3$/ha)
$X_4$ = subsoil water ($m^3$/ha)
$X_5$ = groundwater storage ($m^3$/ha)
$X_7$ = litter water ($m^3$/ha)
$X_8$ = water storage on epiphytes and bark surfaces ($m^3$/ha)

---

$Y_{21}$ = throughfall ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$Y_{21} = G_{70} + G_{71} + G_{72} + G_{74} + G_{75} + G_{76}$$

$G_{70}$ = rainfall passing directlv to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{71}$ = drip from foliar surfaces to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{72}$ = drip from epiphyte and bark surfaces to litter surface water ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{74}$ = rainfall passing directly to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{75}$ = drip from foliar surfaces to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_{76}$ drip from epiphyte and bark surfaces to free water in snowpack ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

---

$Y_{22}$ = daily evaporation from canopy ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

$$Y_{22} = G_7 + G_8$$

$G_7$ = evaporation from foliage ($m^3 \cdot ha^{-1} \cdot day^{-1}$)
$G_8$ = evaporation from ephiphyte and bark surfaces ($m^3 \cdot ha^{-1} \cdot day^{-1}$)

---

$Y_{23}$ = nonfoliar growth ($ton \cdot ha^{-1} \cdot wk^{-1}$)

$$Y_{23} = G_{35} + G_{36} + G_{37}$$

$G_{35}$ = carbon transfer to stems plus branches ($t \cdot ha^{-1} \cdot wk^{-1}$)
$G_{36}$ = carbon transfer to large roots ($t \cdot ha^{-1} \cdot wk^{-1}$)
$G_{37}$ = carbon transfer to fine roots ($t \cdot ha^{-1} \cdot wk^{-1}$)

---

---

$Y_{24}$ = nonfoliar respiration (ton•ha$^{-1}$•wk$^{-1}$)

$$Y_{24} = G_{138} + G_{139} + G_{140}$$

$G_{138}$ = stem-plus-branch respiration (t•ha$^{-1}$•wk$^{-1}$)
$G_{139}$ = large-root respiration (t•ha$^{-1}$•wk$^{-1}$)
$G_{140}$ = fine-root respiration (t•ha$^{-1}$•wk$^{-1}$)

---

$Y_{25}$ = heat input to snow via condensation (ly/day)

$$Y_{25} = \begin{cases} G_2 & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_2$ = heat input to snowpack due to condensation (ly/day)
$G_{60}$ = snowpack ice plus current day's snowfall (m$^3$/ha)

---

$Y_{26}$ = shortwave radiation incident to canopy when snow is present (ly/day)

$$Y_{26} = \begin{cases} G_{59} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{59}$ = net shortwave radiation at top of canopy (ly/day)
$G_{60}$ = snowpack ice plus current day's snowfall (m$^3$/ha)

---

$Y_{27}$ = shortwave radiation incident to snowpack (ly/day)

$$Y_{27} = \begin{cases} G_{91} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall (m$^3$/ha)
$G_{91}$ = shortwave radiation incident to litter or snowpack (ly/day)

---

$Y_{28}$ = heat input to snowpack due to snowfall (ly/day)

$$Y_{28} = \begin{cases} G_{114} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall (m$^3$/ha)
$G_{114}$ = heat input to snowpack due to snowfall (ly/day)

---

$Y_{29}$ = heat input to snowpack due to rainfall (ly/day)

$$Y_{29} = \begin{cases} G_{117} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall (m$^3$/ha)
$G_{117}$ = heat input to snowpack due to rainfall (ly/day)

---

$Y_{30}$ = albedo of snowpack (dim.)

$$Y_{30} = \begin{cases} G_{118} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall (m$^3$/ha)
$G_{118}$ = albedo of snowpack or litter (dim.)

---

$Y_{31}$ = net heat input to snowpack due to shortwave radiation (ly/day)

$$Y_{31} = \begin{cases} G_{119} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{119}$ = net heat transfer through canopy to snowpack or litter due to shortwave radiation (ly/day)

---

$Y_{32}$ = net heat input to snowpack due to longwave radiation (ly/day)

$$Y_{32} = \begin{cases} G_{120} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{120}$ = net heat input to snowpack or litter due to longwave radiation (ly/day)

---

$Y_{33}$ = longwave radiation incident to stand when snowpack present (ly/day)

$$Y_{33} = \begin{cases} Z_{12} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$Z_{12}$ = daily longwave radiation from the sky (ly/day)

---

$Y_{34}$ = heat input to snowpack due to convection (ly/day)

$$Y_{34} = \begin{cases} G_{170} & \text{if } G_{60} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$G_{60}$ = snowpack ice plus current day's snowfall ($m^3$/ha)
$G_{170}$ = heat input to snowpack due to convection (ly/day)

---

## 9. PARAMETERS AND PARAMETER VALUES

In this section we have listed all parameters used in CONIFER. Parameters in CONIFER are of two types: integer (*M* parameters ) and decimal (*B* parameters). The *M* parameters are used exclusively to specify the timing of processes. Immediately following the description of each parameter, we have listed the functions (*G*'s, *S*'s, and *Y*'s) in which the parameter is used. On the right-hand side are shown the numerical value of each parameter and (for *B* parameters) the units. The abbreviation "(dim.)" indicates that the parameter is dimensionless.

| | | |
|---|---|---|
| $B_1$ | coefficient for attenuation of shortwave radiation by understory -- $G_{91}$ | 1.5 ha/t |
| $B_2$ | coefficient for attenuation of shortwave radiation by overstory -- $G_{91}$ | 1.0 ha/t |
| $B_3$ | ratio of canopy water retention capacity to foliar carbon mass -- $G_{16}$ | 2.0 $m^3$/t |
| $B_4$ | fraction of total foliage occurring in overstory -- $G_{91}$ | 0.7 (dim.) |

| | | |
|---|---|---|
| $B_5$ | coefficient relating fine root mortality to carbohydrate demand -- $G_{87}$ | 73.71 ha·wk·$t^{-1}$ |
| $B_6$ | temperature threshold below which albedo of snowpack is set equal to 0.8 -- $G_{118}$ | 3 deg |
| $B_7$ | ratio of all-sided needle surface area to needle carbon mass -- $G_1$ | 3.48 ha/t |
| $B_8$ | ratio of understory cover to total canopy cover -- $G_{91}$ | 0.7 (dim.) |
| $B_9$ | rate constant for soil water drainage -- $G_{12}$ | 2.16 $day^{-1}$ |
| $B_{10}$ | rate constant for subsoil water drainage -- $G_{19}$ | 1.08 $day^{-1}$ |
| $B_{11}$ | fraction of litter water-holding capacity below which there is resistance to evaporation -- $G_{22}$ | 0.36 (dim.) |
| $B_{12}$ | fraction of litter water-holding capacity below which evaporation ceases -- $G_{22}$ | 0.10 (dim.) |
| $B_{13}$ | water retention capacity of soil -- $G_{12}$ | 3900 $m^3$/ha |
| $B_{14}$ | water retention capacity of subsoil -- $G_{19}$ | 9970 $m^3$/ha |
| $B_{15}$ | default windspeed when data are missing -- $Z_{14}$ | 0.2 m/sec |
| $B_{16}$ | retention capacity of groundwater zone -- $G_{18}$ | 11.9 x $10^3$ $m^3$/ha |
| $B_{17}$ | daytime temperature above which all intercepted snow melts in the canopy -- $G_{54}$, $G_{115}$ | -2.5 deg -$B_{18}$ |
| $B_{19}$ | wet bulb temperature below which all precipitation is snow -- $Z_8$ | 0.0 deg |
| $B_{20}$ | fraction of litter water-holding capacity below which drainage ceases -- $G_{15}$ | 0.7 (dim.) |
| $B_{21}$ | ratio of snowmelt due to convection to the difference between air and snow temperature -- $G_{170}$ | 0.187 $g\cdot cm^{-2}\cdot day^{-1}\cdot deg^{-1}$ |
| $B_{22}$ | ratio of snowmelt due to condensation to vapor pressure deficit at snow surface -- $G_2$ | 0.28 $g\cdot cm^{-2}\cdot day^{-1}\cdot mbar^{-1}$ |
| $B_{23}$ | ratio of litter water-holding capacity to litter carbon mass -- $G_{55}$ | 4.6 $m^3$/t |
| $B_{24}$ | factor such that $G_{77}$ averages 1.0 during first year -- $G_{77}$ | 0.0356 $deg^{-B_{181}}$ |
| $B_{26}$ | foliar respiration rate constant -- $G_{25}$, $G_{30}$ | 0.0219 $wk^{-1}$ |
| $B_{27}$ | ratio of old foliage to new foliage respiration -- $G_{30}$ | 1.11 (dim.) |
| $B_{28}$ | maximum respiration rate of stems plus branches -- $G_{138}$ | 0.091 $t\cdot ha^{-1}\cdot wk^{-1}$ |

| | | |
|---|---|---|
| $B_{29}$ | maximum respiration rate of large roots -- $G_{139}$ | $0.107\ t \cdot ha^{-1} \cdot wk^{-1}$ |
| $B_{30}$ | rate constant for fine root respiration -- $G_{140}$ | $3.10 \times 10^{-3}\ wk^{-1}$ |
| $B_{31}$ | bud growth rate constant -- $G_{33}$ | $2.53 \times 10^{-4}\ t \cdot ha^{-1} \cdot wk^{-1}$ |
| $B_{32}$ | ratio of net new foliage photosynthesis based on carbon budget to amount extrapolated from cuvette experiments -- $G_{24}$, $G_{29}$ | 36.4 (dim.) |
| $B_{33}$ | rate constant for new foliage photosynthesis -- $G_{24}$ | $0.346\ sec \cdot cm^{-1} \cdot wk^{-1}$ |
| $B_{34}$ | light intensity at which new foliage photosynthesis is one-half maximum rate -- $G_{24}$ | 0.1 ly/min |
| $B_{35}$ | coefficient for attenuation of shortwave radiation by foliage -- $G_{24}$, $G_{29}$ | 0.52 ha/t |
| $B_{36}$ | factor such that $G_{39}$ averages 1.0 over the first year -- $G_{39}$ | $0.0367\ deg^{-B_{77}}$ |
| $B_{37}$ | ratio of leaf carbon mass to bud carbon -- $G_{44}$, $G_{46}$ | 120 (dim.) |
| $B_{38}$ | rate constant for decrease in new foliage growth demand as new foliage carbon mass approaches limiting value -- $G_{46}$ | $0.3\ wk^{-1}$ |
| $B_{39}$ | maximum rate of carbon transfer from growth $CH_2O$ pool to new foliage $CH_2O$ pool -- $G_{45}$ | $0.38\ t \cdot ha^{-1} \cdot wk^{-1}$ |
| $B_{40}$ | value of growth $CH_2O$ pool at which transfer to new foliage pool is one-half maximum -- $G_{45}$ | 0.1 t/ha |
| $B_{41}$ | rate constant for old foliage photosynthesis -- $G_{29}$ | $0.346\ sec \cdot cm^{-1} \cdot wk^{-1}$ |
| $B_{42}$ | shortwave radiation value at which old foliage photosynthesis is one-half maximum -- $G_{29}$ | 0.1 ly/min |
| $B_{43}$ | factor such that $G_{40}$ integrated over one year is 1.0 assuming no defoliation -- $G_{40}$ | $1.838 \times 10^{-39} wk^{-(B_{91}+1)}$ |
| $B_{44}$ | value of growth pool at which old foliage respiration is one-half maximum -- $G_{30}$ | 0.1 t/ha |
| $B_{45}$ | maximum rate of carbon transfer from growth $CH_2O$ pool to stems plus branches -- $G_{35}$ | $0.079\ t \cdot ha^{-1} \cdot wk^{-1}$ |
| $B_{46}$ | value of growth pool at which respiration of and transfer to stems plus branches is one-half maximum -- $G_{35}$, $G_{138}$ | 6.0 t/ha |
| $B_{47}$ | maximum rate of carbon transfer from growth $CH_2O$ pool to large roots -- $G_{36}$ | $0.00931\ t \cdot ha^{-1} \cdot wk^{-1}$ |
| $B_{48}$ | value of growth pool at which respiration of and transfer to large roots is one-half maximum -- $G_{36}$, $G_{139}$ | 6.0 t/ha |

| | | |
|---|---|---|
| $B_{49}$ | maximum rate of carbon transfer from growth $CH_2O$ pool to fine roots -- $G_{37}$ | $0.022\ t \cdot ha^{-1} \cdot wk^{-1}$ |
| $B_{50}$ | value of growth pool at which respiration of and transfer to fine roots is one-half maximum -- $G_{37}$, $G_{140}$ | 0.07 t/ha |
| $B_{51}$ | rate constant for stem-plus-branch mortality -- $G_{62}$, $G_{92}$ | $2.221 \times 10^{-4}\ wk^{-1}$ |
| $B_{52}$ | rate constant for large root mortality -- $G_{86}$ | $1.91 \times 10^{-4}\ wk^{-1}$ |
| $B_{53}$ | rate constant for fine root mortality -- $G_{87}$ | $1.46 \times 10^{-3}\ wk^{-1}$ |
| $B_{54}$ | factor such that $G_{53}$ averages 1.0 during the first year -- $G_{53}$ | $0.0344\ deg^{-B_{179}}$ |
| $B_{56}$ | rate constant for new foliage consumption -- $G_{38}$ | $6.06 \times 10^{-4}\ wk^{-1}$ |
| $B_{57}$ | rate constant for old foliage consumption -- $G_{90}$ | $1.0 \times 10^{-5}\ wk^{-1}$ |
| $B_{58}$ | rate constant for consumption of growth $CH_2O$ pool -- $G_{94}$ | $0.0001\ wk^{-1}$ |
| $B_{59}$ | rate constant for bud consumption -- $G_{95}$ | $0.0001\ wk^{-1}$ |
| $B_{60}$ | ratio of old to new foliage stomatal resistance -- $G_{52}$ | 1.20 (dim.) |
| $B_{61}$ | rate constant for woody litter decomposition -- $G_{83}$ | $1.05 \times 10^{-3}\ wk^{-1}$ |
| $B_{62}$ | rate constant for foliage litter decomposition -- $G_{81}$ | $3.10 \times 10^{-3}\ wk^{-1}$ |
| $B_{63}$ | rate constant for fine litter decomposition -- $G_{84}$ | $3.9 \times 10^{-3}\ wk^{-1}$ |
| $B_{64}$ | fraction of carbon loss from fine litter due to incorporation into soil rooting zone organic matter -- $G_{116}$, $G_{125}$ | 0.0 (dim.) |
| $B_{65}$ | rate constant for decomposition of soil rooting zone organic matter -- $G_{88}$ | $2.56 \times 10^{-5}\ wk^{-1}$ |
| $B_{66}$ | fraction of carbon loss from soil rooting zone due to incorporation into subsoil organic matter -- $G_{132}$, $G_{133}$ | 0.0 (dim.) |
| $B_{67}$ | factor such that soil moisture--temperature effect averages 1.0 over first year -- $G_{50}$ | $3288\ m^3/ha$ |
| $B_{68}$ | rate constant for dead root decomposition -- $G_{85}$ | $0.005\ wk^{-1}$ |
| $B_{69}$ | fraction of carbon loss from dead roots due to fragmentation -- $G_{126}$, $G_{131}$ | 0.5 (dim.) |

| | | |
|---|---|---|
| $B_{70}$ | factor such that $G_{102}$ averages 1.0 over the first year -- $G_{102}$ | 0.929 (dim.) |
| $B_{71}$ | factor such that $B_{71}G_{39}$ averages 1.0 during the first-year growing season -- $G_{46}$ | 0.564 (dim.) |
| $B_{72}$ | coefficient relating fine root mortality to soil moisture -- $G_{87}$ | 0.01 ha·m$^{-3}$ |
| | | $-B_{73}$ |
| $B_{74}$ | water-holding capacity per unit carbon mass for woody litter divided by the same ratio for foliage plus fine litter -- $G_{55}$ | 0.25 (dim.) |
| $B_{75}$ | rate constant for frass fall -- $G_{82}$ | 0.05 wk$^{-1}$ |
| $B_{76}$ | temperature above which growth processes cease -- $G_{39}$ | 45 deg |
| $B_{77}$ | coefficient determining shape of $G_{39}$ curve -- $G_{39}$ | 1.35 (dim.) |
| $B_{78}$ | minimum plant moisture stress (PMS) -- $G_{42}$ | 6.0 atm |
| $B_{79}$ | air temperature above which PMS is unaffected by temperature -- $G_{42}$ | -2.0 deg |
| $B_{80}$ | minimum stomatal resistance -- $G_{43}$ | 5.0 sec/cm |
| $B_{81}$ | vapor pressure deficit above which stomata close -- $G_{43}$ | 5.0 mbar |
| $B_{82}$ | soil moisture value above which PMS does not change -- $G_{42}$, $G_{87}$ | 2600 m$^3$/ha |
| $B_{83}$ | value of growth $CH_2O$ pool at which bud growth is one-half maximum -- $G_{33}$ | 0.01 ton/ha |
| $B_{84}$ | PMS when $X_3$ is 0 -- $G_{42}$ | 248.6 atm |
| $B_{85}$ | rate of increase of PMS with increasing soil moisture content -- $G_{42}$ | 0.0933 atm·ha$^{-1}$·m$^{-3}$ |
| $B_{86}$ | maximum new foliage stomatal resistance -- $G_{43}$ | 300 sec/cm |
| $B_{87}$ | PMS above which there is no increase in new foliage resistance -- $G_{43}$ | 19 atm |
| $B_{88}$ | new foliage stomatal resistance when PMS is 0.0 -- $G_{43}$ | 0.755 sec/cm |
| $B_{89}$ | coefficient for effect of PMS on new foliage stomatal resistance -- $G_{43}$ | 0.315 atm$^{-1}$ |
| $B_{90}$ | first coefficient for shape of leaf-fall curve -- $G_{40}$ | 16.0 (dim.) |
| $B_{91}$ | second coefficient for shape of leaf-fall curve -- $G_{40}$ | 12.0 (dim.) |

| | | | |
|---|---|---|---|
| $B_{92}$ | factor for effect of air temperature on litter temperature -- $G_{67}$ | 0.5 $wk^{-1}$ | |
| $B_{93}$ | weekly throughfall amount above which litter temperature equals air temperature -- $G_{67}$ | 3000 $m^3 \cdot ha^{-1} \cdot wk^{-1}$ | |
| $B_{94}$ | factor such that $G_{69}$ averages 1.0 during the first year -- $G_{69}$ | 0.030 $ha/m^3$ | |
| $B_{95}$ | lag coefficient for effect of litter temperature upon soil temperature -- $G_{68}$ | 0.1 $wk^{-1}$ | |
| $B_{141}$ | coefficient for effect of temperature on plant nonfoliar respiration -- $G_{138}$, $G_{139}$, $G_{140}$ | 0.069 $deg^{-1}$ | |
| $B_{145}$ | coefficient for temperature effect on foliar respiration -- $G_{25}$, $G_{30}$ | 0.073 $deg^{-1}$ | |
| $B_{146}$ | rate constant for log litter decomposition -- $G_{105}$ | $1.74 \times 10^{-4}$ $wk^{-1}$ | |
| $B_{147}$ | fraction of carbon loss from log litter due to fragmentation -- $G_{112}$, $G_{113}$ | 0.8 (dim.) | |
| $B_{148}$ | fraction of carbon loss from woody litter due to fragmentation -- $G_{104}$, $G_{111}$ | 0.614 (dim.) | |
| $B_{149}$ | fraction of carbon loss from foliage litter due to fragmentation -- $G_{98}$, $G_{103}$ | 0.4 (dim.) | |
| $B_{150}$ | fraction of stem-plus-branch mortality transferred to woody litter -- $G_{62}$, $G_{92}$ | 0.136 (dim.) | |
| $B_{152}$ | rate of input of carbon to fine litter in microparticulate litterfall and carbon dissolved in throughfall -- $G_{97}$ | $3.846 \times 10^{-3}$ $t \cdot ha^{-1} \cdot wk^{-1}$ | |
| $B_{154}$ | ratio of free water holding capacity to snow ice -- $G_{130}$ | 0.04 (dim.) | $-B_{153}$ |
| $B_{156}$ | wind profile drag coefficient -- $G_{100}$ | 0.67 (dim.) | $-B_{155}$ |
| $B_{157}$ | latent heat of vaporization of water -- $G_6$, $G_{14}$, $G_{20}$ | $2.5 \times 10^6$ joule/kg | |
| $B_{158}$ | psychrometric constant -- $G_6$, $G_{14}$, $G_{20}$ | 0.66 mbar/deg | |
| $B_{159}$ | factor to convert $kg \cdot m^{-2} \cdot sec^{-1}$ to $m^3 \cdot ha^{-1} \cdot day^{-1}$ -- $G_6$, $G_{14}$, $G_{20}$ | $8.64 \times 10^5$ $sec \cdot m^5 \cdot day^{-1}$ $kg^{-1} \cdot ha^{-1}$ | |
| $B_{160}$ | albedo of canopy -- $G_{59}$, $G_{119}$ | 0.1 (dim.) | |
| $B_{163}$ | aerodynamic conductance at litter surface -- $G_{14}$ | 0.001 m/sec | |
| $B_{164}$ | factor to convert net radiation from ly/day to $joule \cdot m^{-2} \cdot sec^{-1}$ -- $G_6$, $G_{20}$ | 0.48 joule $day \cdot m^{-2} \cdot sec^{-1} \cdot ly^{-1}$ | |
| $B_{165}$ | rate constant for drainage from litter -- $G_{15}$ | 10 $day^{-1}$ | |
| $B_{166}$ | first day on which new foliage is to be removed (defoliation perturbation only) -- $G_{44}$, $G_{135}$ | 0 | |

| | | |
|---|---|---|
| $B_{167}$ | fraction by which new foliage is to be reduced during acute defoliation perturbation -- $G_{44}$, $G_{135}$ | 0 (dim.) |
| $B_{168}$ | coefficient determining shape of $G_{102}$ -- $G_{102}$ | 30.0 deg |
| $B_{169}$ | second day on which new foliage is to be removed (defoliation perturbation only) -- $G_{44}$, $G_{135}$ | 0 |
| $B_{170}$ | rate constant for water drainage from canopy -- $G_5$, $G_{56}$ | 6.0 $day^{-1}$ |
| $B_{171}$ | water storage on foliage above which there is no transpiration -- $G_{20}$ | 100.0 $m^3$/ha |
| $B_{172}$ | ratio of intercepting area to carbon mass for stems plus branches divided by same ratio for foliage -- $G_{13}$, $G_{23}$ | 0.01 (dim.) |
| $B_{173}$ | ratio of storage capacity to carbon mass for stems plus branches divided by same ratio for foliage -- $G_{16}$, $G_{57}$ | 0.015 (dim.) |
| $B_{174}$ | coefficient for effect of foliar carbon mass on intercepting area -- $G_{23}$ | 0.32 ha/t |
| $B_{176}$ | coefficient determining shape of $G_{102}$ -- $G_{102}$ | 0.71 (dim.) |
| $B_{177}$ | coefficient determining shape of $G_{102}$ -- $G_{102}$ | 0.00274 ($deg^{-2}$) |
| $B_{178}$ | temperature above which soil rooting zone processes cease -- $G_{53}$ | 45 deg |
| $B_{179}$ | coefficient for temperature effect on soil rooting zone processes -- $G_{53}$ | 1.35 (dim.) |
| $B_{180}$ | temperature above which litter decomposition ceases -- $G_{77}$ | 45 deg |
| $B_{181}$ | coefficient for temperature effect on litter decomposition -- $G_{77}$ | 1.35 (dim.) |
| $B_{182}$ | minimum leaf-fall rate constant -- $G_{40}$ | $1.06 \times 10^{-3}$ $wk^{-1}$ |
| $B_{183}$ | ratio of photosynthetically active radiation to total shortwave radiation -- $G_{109}$ | 0.4 (dim.) |
| $B_{184}$ | fraction by which old foliage is reduced during acute defoliation perturbation -- $G_{93}$ | 0 (dim.) |
| $B_{185}$ | first day on which old foliage is removed (defoliation perturbation only) -- $G_{93}$ | 0 |
| $B_{186}$ | second day on which old foliage is removed (defoliation perturbation only) -- $G_{93}$ | 0 |

| | | |
|---|---|---|
| $M_1$ | week on which budbreak occurs -- $G_{44}$, $G_{79}$ | 18 |
| $M_2$ | week on which growing season begins -- $G_{106}$ | 18 |
| $M_3$ | week on which growing season ends -- $G_{106}$ | 40 |
| $M_4$ | week on which new foliage becomes old foliage -- $G_{34}$ | 40 |
| $M_5$ | week on which leaf-fall is minimum -- $G_{40}$ | 12 |

# 10. ACKNOWLEDGMENTS

CONIFER is a product of six years of research by various people employed by and associated with the Coniferous Forest Biome, Ecosystem Analysis Studies, U.S./International Biological Program. The project was initially supervised by W. S. Overton of Oregon State University (OSU) who developed the notational scheme and much of the methodology. By summer 1973 Overton and co-workers (C. E. White and J. Colby) had implemented a model of water flow based on earlier versions by J. P. Riley and G. B. Shih of Utah State University. In the spring of 1973 P. Sollins joined the project at the University of Washington (UW) and brought with him a carbon flow model which he had developed at Oak Ridge National Laboratory. With C. E. White (OSU) and K. L. Reed (then of UW), he reorganized and substantially improved the Oak Ridge version. In the fall 1973, G. L. Swartzman joined the project (at UW) and proceeded to combine Overton's hydrology model with Sollins' model of production and decomposition. At this time Swartzman added the litter and soil temperature component and Sollins added equations for predicting stomatal resistance based on the work of R. H. Waring and S. W. Running (both of OSU). Some initial problems with the coupled carbon-water model were traced to inadequate representation of snowmelt and, with the help of J. Rogers (USDA Forest Service), Swartzman incorporated the snowmelt model of Leaf and Brink (1973) into CONIFER.

During spring 1974 Swartzman, working with P. G. Jarvis (on leave from the University of Edinburgh), incorporated mechanistic equations for transpiration and evaporation from the canopy. Swartzman, working with R. Fogel and K. Cromack (both of OSU), also developed preliminary equations for drainage and evaporation from litter. Later that spring Sollins constructed a new model of canopy interception and storage and with Swartzman wrote improved equations for drainage from canopy, litter, and soil water pools.

Over the next year various improvements and refinements were made with the help of various programmers at UW including, E. Hamerly and M. Gaponoff. The basic documentation system was developed jointly by Swartzman and Sollins; however, implementation would have been impossible without the conscientious assistance of staff and students including M. Roscoe, D. Dodson, K. Nicholson, E. Small, and R. Harr. In 1975 S. Clark joined the UW project as a programmer and totally reorganized the code for CONIFER. Clark developed the module system and, with E. Small, developed the tree diagrams used here. Most aspects of the code showing systematic organization reflect the single-handed efforts of S. Clark. Preparation of the first bulletin (No. 8) was supervised by P. Sollins and M. Ellis (UW).

In spring 1976, P. Sollins moved to OSU and with the help of A. T. Brown (OSU) began comparing model behavior with actual data for the old-growth Douglas-fir-dominated forest. Many functions were modified, including those for transpiration, evaporation, and the energy budget of the canopy, snowpack, and forest floor. A. T. Brown wrote the processor we have used on the CDC Cyber at OSU. R. D. Harr and R. L. Fredriksen (USDA Forest Service) supplied streamflow data to help test the model.

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# APPENDIX I. Listing of Code

The code listing of Appendix I is reproduced directly from computer output.

```
*MODCW  - REV: 10 APR 79
      SUBROUTINE GUP
      COMMON /MODPASS/ MODEL(4)
      COMMON /ZVAR/ Z(100)
      COMMON /BVAR/ B(500)
      COMMON /XVAR/ X(300)
      COMMON /GVAR/ G(500)
      COMMON /SYS/ A(80),TIME
      COMMON /KVAR/ K,KSTART,KSTEP,KSTOP,PRINT,KMO,KWK,
     1 KT,KTIM(11),KT1,KTW
      COMMON /MVAR/ M(100)
      DATA (MODEL(1)=10HGUP-CW     )
C
C                    THIS SUBROUTINE UPDATES ALL INTERMEDIATE (G) FUNCTIONS
C
C
C
C------------------------------------------------------------------------
C     WATER - CANOPY INTERCEPTION AND RETENTION
C------------------------------------------------------------------------
C
C
C
C---G(61)---------- TOTAL FOLIAGE CARBON
C
      G(61) = X(10) + X(11)
C
C
C---G(23)---------- PERCENT COVER BY CANOPY (ALSO PERCENT COVER BY
C                   OVERSTORY)
C
      T1 = -B(174) * ( G(61) + B(172) * X(13) )
      G(23) = 1.0 - EXP ( T1 )
C
C
C---G(13)---------- FRACTION OF RAIN INCIDENT TO CANOPY WHICH STRIKES
C                   FOLIAGE
C
      G(13) = 0.0
      IF ( G(61) .LE. 0.0 )  GO TO 1310
      G(13) = G(61) / ( G(61) + B(172) * X(13) )
 1310 CONTINUE
C
C
C---G(54)---------- PRECIPITATION AS RAINFALL
C
      G(54) = 0.
      IF ( Z(5) .GT. B(17) )  G(54) = G(23) * ( Z(1) - Z(8) )
C
C
C---G(115)--------- SNOWFALL REACHING GROUND
C
      T1 = 0.0
        IF ( Z(6) .LE. B(17) )  T1 = G(23) * ( Z(1) - Z(8) )
      G(115) = T1 + ( Z(1) - Z(8) ) * ( 1.0 - G(23) )
C
C
C---G(60)---------- SNOWPACK ICE PLUS CURRENT DAYS SNOWFALL
```

```
C
      G(60) = X(2) + G(115)
C
C
C---G(160)--------- SNOW SURFACE TEMPERATURE
C
      G(160) = 0.0
C
C
C---G(3)---------- RAIN INPUT TO FOLIAR SURFACES
C
      G(3) = G(13) * ( G(23) * Z(8) + G(54) )
C
C
C---G(4)---------- RAIN INPUT TO EPIPHYTE AND BARK SURFACES
C
      G(4) = ( 1.0 - G(13) ) * ( G(23) * Z(8) + G(54) )
C
C
C
C
C-----------------------------------------------------------------------
C     SHORT-WAVE RADIATION TO CANOPY AND LONG-WAVE ENERGY BALANCE
C-----------------------------------------------------------------------
C
C
C
C---G(41)---------- LITTER TEMPERATURE
C
      G(41) = X(25)
C
C
C---G(121)--------- HEAT LOSS FROM SNOWPACK OR LITTER DUE TO LONGWAVE
C                   RADIATION
C
      T1 = G(160)
      IF ( G(50) .LE. 0.0 )
     >   T1 = X(25)
      G(121) = S4 ( T1 )
C
C
C---G(122)--------- LONGWAVE RADIATION FROM BLACK BODY AT AIR TEMP.
C
      G(122) = S4 ( Z(3) )
C
C
C---G(124)--------- NET HEAT TRANSFER FROM CANOPY TO SNOWPACK OR LITTER
C                   DUE TO LONGWAVE RADIATION
C
      G(124) = G(23) * ( G(122) - G(121) )
C
C
C---G(168)--------- NET HEAT TRANSFER FROM SKY TO CANOPY DUE TO LONG-
C                   WAVE RADIATION
C
      G(168) = G(23) * ( Z(12) - G(122) )
C
C
```

```
C---G(59)---------- NET SHORTWAVE RADIATION AT TOP OF CANOPY
C
      G(59) = ( 1. - B(160) ) * Z(16)
C
C
C---G(91)---------- SHORTWAVE RADIATION INCIDENT TO SNOWPACK OR LITTER
C
C                T1 = ATTENUATION BY UNDERSTORY
C
      T1 = EXP ( -B(1) * G(61) * ( 1.0 - B(4) ) )
C
C                T2 = ATTENUATION BY OVERSTORY
C
      T2 = EXP ( - B(2) * G(61) * B(4) )
C
      G(91) = G(59) * ( 1.0 - G(23) + G(23) * ( 1.0 - B(8) ) * T1 +
     1          B(8) * G(23) * T1 * T2 )
C
C
C---G(118)--------- ALBEDO OF SNOW OR LITTER
C
      T1 = 0.3
      IF ( X(2) .LE. 10.0 )
     >   T1 = 1.0
      G(118) = S5 ( T1 )
C
C
C---G(119)--------- NET HEAT TRANSFER FROM CANOPY TO SNOWPACK OR LITTER
C                   DUE TO SHORTWAVE RADIATION
C
      G(119) = G(91) * ( 1.0 - G(118) ) / ( 1.0 - G(118) * G(23) *
     1  B(160) )
C
C
C
C----------------------------------------------------------------------
C----------------------------------------------------------------------
C     WATER - CANOPY EVAPORATION AND DRIP
C----------------------------------------------------------------------
C
C
C
C---G(100)--------- AERODYNAMIC RESISTANCE
C
      G(100) = 1.E6
      IF ( Z(14) .NE. 0.0 )
     >   G(100) = 1.0 / ( Z(14) * B(156)**2 )
C
C---G(6)---------- POTENTIAL EVAPORATION FROM CANOPY
C
      T3 = G(59) - G(119) + G(168) - G(124)
      T4 = S10 ( Z(3) )
      T5 = S12 ( Z(3) , Z(5) )
      T1 = B(159) * ( T4 * T3 * B(164) + T5 / G(100) )
      T2 = B(157) * ( T4 + B(158) )
      G(6) = AMAX1 ( 0.0 , T1 / T2 )
C
C
```

```
C---G(16)---------- WATER RETENTION CAPACITY OF CANOPY
C
      G(16) = B(3) * ( G(61) + B(173) * X(13) )
C
C
C---G(57)---------- FRACTION OF RETENTION CAPACITY DUE TO FOLIAGE
C
      G(57) = 0.0
      IF ( G(51) .LE. 0.0 )  GO TO 5710
      G(57) = G(61) / ( G(61) + B(173) * X(13) )
 5710 CONTINUE
C
C
C---G(5)---------- DRIP FROM FOLIAR SURFACES
C
      T1 = 1.0 - EXP ( -B(170) )
      T2 = X(1) - G(16) * G(57)
      T3 = G(3) - G(57) * G(6)
      T4 = 1.0 - T1 / B(170)
      G(5) = AMAX1 (   0.0   ,   T1 * T2 + T3 * T4   )
C
C
C---G(7)---------- EVAPORATION FROM FOLIAR SURFACES
C
      G(7) = G(6) * G(57)
      IF ( G(5) .GT. X(1) + G(3) - G(7) )
     >   G(7) = X(1) + G(3) - G(5)
C
C
C---G(71)---------- DRIP FROM FOLIAR SURFACES TO LITTER SURFACES WATER
C
      G(71) = G(5)
      IF ( G(60) .GT. 0.0 )
     >   G(71) = 0.0
C
C
C---G(56)---------- DRIP FROM EPIPHYTE AND BARK SURFACES
C
      G(56) = 0.0
      IF ( X(13) .LE. 0.0 )  GO TO 5610
      T1 = 1.0 - EXP ( -B(170) )
      T2 = 1.0 - G(57)
      T3 = ( G(4) - G(6) * T2 )  *  ( 1.0 - T1 / B(170) )
      G(56) = AMAX1 (   0.0 , T3  +  T1 * ( X(8) - G(16) * T2 )   )
 5610 CONTINUE
C
C
C---G(8)---------- EVAPORATION FROM EPIPHYTE AND BARK SURFACES
C
      G(8) = G(6) * ( 1.0 - G(57) )
      IF ( G(56) .GT. X(8) + G(4) - G(8) )
     >   G(8) = X(8) + G(4) - G(56)
C
C
C---G(72)---------- DRIP FROM EPIPHYTE AND BARK SURFACES TO LITTER
C                   SURFACE WATER
C
      G(72) = G(56)
```

```
      IF ( G(60) .GT. 0.0 )
     >   G(72) = 0.0
C
C
C
C
C-----------------------------------------------------------------------
C     ENERGY INPUT TO SNOW
C-----------------------------------------------------------------------
C
C
C
C---G(9)---------- RAINFALL PASSING DIRECTLY TO SNOWPACK OR LITTER
C                  SURFACES
C
      G(9) = ( 1.0 - G(23) ) * Z(8)
C
C
C---G(134)--------- TOTAL WATER INPUT TO SNOWPACK OR LITTER
C
      G(134) = G(9) + G(5) + G(56)
C
C
C---G(80)---------- TOTAL WEEKLY RAINFALL PLUS DRIP
C
      G(80) = 7.0 * S3 ( 12 , G(134) )
C
C
C---G(2)---------- HEAT INPUT TO SNOWPACK DURING CONDENSATION
C
      G(2) = AMAX1 ( 0.0 , 80. * B(22) * ( S1 (Z(5)) - S1 (G(160)) ) )
C
C
C---G(170)--------- HEAT INPUT TO SNOWPACK DUE TO CONVECTION
C
      G(170) = AMAX1 (  0.0  ,  80.0 * B(21) * ( Z(3) - G(160) )  )
C
C
C---G(114)--------- HEAT LOSS FROM SNOWPACK DUE TO SNOWFALL
C
      G(114) = AMIN1 ( 0.0 , 0.005 * Z(3) * G(115) )
C
C
C---G(120)--------- NET HEAT TRANSFER FROM CANOPY TO SNOWPACK OR LITTER
C                   DUE TO LONGWAVE RADIATION
C
      G(120) = G(124) + ( 1.0 - G(23) ) * ( Z(12) - G(121) )
C
C
C---G(117)--------- HEAT INPUT TO SNOWPACK DUE TO RAINFALL
C
      G(117) = 0.01 * Z(3) * G(134)
C
C
C---G(127)--------- NET HEAT INPUT TO SNOWPACK
C
      G(127) = G(114) + G(117) + G(119) + G(120) + G(2) + G(170)
C
```

```
C
C---G(128)--------- NET INCREASE IN HEAT DEFICIT OF SNOWPACK
C
      T1 = G(127) + 0.8 * ( G(134) + X(98) )
      T2 = AMAX1 ( -X(37) , -T1 )
      G(128) = T2
      IF ( G(50) .LE. 1.0 )
     >   G(128) = AMIN1 ( 0.0 , T2 )
C
C
C
C
C----------------------------------------------------------------------
C     WATER - SNOW INPUT, FREEZE, AND MELT
C----------------------------------------------------------------------
C
C
C
C---G(129)--------- TRANSFER FROM ICE TO FREE WATER IN SNOWPACK
C
      T1 = AMAX1 (  0.0  ,  ( G(127) - X(37) ) / 0.8  )
      G(129) = AMIN1 ( T1 , G(60) )
C
C
C---G(161)--------- NET DAILY FREEZING OF FREE WATER IN SNOWPACK
C
      G(161) = 0.0
      IF ( G(60) .LE. 0.0 )
     >   GO TO 16110
C     ELSE
         T1 = AMAX1 (  0.0  ,  ( X(37) - G(127) ) / 0.8  )
         G(161) = AMIN1 (  T1  ,  X(98) + G(134)  )
16110 CONTINUE
C
C
C---G(130)--------- FREE WATER HOLDING CAPACITY OF SNOWPACK
C
      G(130) = B(154) * G(60)
C
C
C---G(74)---------- RAINFALL PASSING DIRECTLY TO FREE WATER IN SNOWPACK
C
      G(74) = G(9)
      IF ( G(50) .LE. 0.0 )
     >   G(74) = 0.0
C
C
C---G(75)---------- DRIP FROM FOLIAR SURFACES TO FREE WATER IN SNOWPACK
C                   IN SNOWPACK
C
      G(75) = G(5)
      IF ( G(50) .LE. 0.0 )
     >   G(75) = 0.0
C
C
C---G(76)---------- DRIP FROM EPIPHYTE AND BARK SURFACES TO FREE WATER
C                   IN SNOWPACK
C
```

```
      G(76) = G(56)
      IF ( G(50) .LE. 0.0 )
     >   G(76) = 0.0
C
C
C---G(10)---------- WATER TRANSFER FROM SNOWPACK TO LITTER SURFACE
C
      T1 = G(74) + G(75) + G(76) + G(129) + X(98) - G(161) - G(130)
      G(10) = AMAX1 ( 0.0 , T1 )
      IF ( G(129) .EQ. G(60) )
     >   G(10) = G(10) + G(130)
C
C
C
C
C-----------------------------------------------------------------------
C     WATER - LITTER MOISTURE DYNAMICS
C-----------------------------------------------------------------------
C
C
C
C---G(70)---------- RAINFALL PASSING DIRECTLY TO LITTER SURFACE WATER
C
      G(70) = G(9)
      IF ( G(60) .GT. 0.0 )
     >   G(70) = 0.0
C
C
C---G(14)---------- POTENTIAL EVAPORATION FROM LITTER
C
      T2 = Z(5) - ( Z(3) - X(25) )
      T1 = S12 ( X(25) , T2 )
      T3 = B(163) * B(159) / ( B(157) * B(158) )
      G(14) = AMAX1 ( 0.0 , T1 * T3 )
C
C
C---G(55)---------- WATER HOLDING CAPACITY OF LITTER
C
      G(55) = B(23) * ( B(74) * X(18) + X(19) + X(20) )
C
C
C---G(11)---------- WATER ENTERING LITTER
C
      G(11) = G(10) + G(70) + G(71) + G(72)
C
C
C---G(15)---------- WATER TRANSFER FROM LITTER TO SOIL ROOTING ZONE
C
      G(15) = 0.0
      T1 = 1.0 - EXP ( -B(165) )
      T2 = ( G(11) - G(14) ) * ( 1.0 / T1 - 1.0 / B(165) )
      IF ( X(7) .GT. B(20) * G(55) )
     >   G(15) = AMAX1 ( 0.0 , T1 * ( T2 + X(7) - B(20) * G(55) ) )
        IF ( X(7) .LE. B(20) * G(55) .OR.
     >     -T2 .GT. X(7) - B(20) * G(55) )
     >                   G(15) = 0.0
C
C
```

```
C---G(22)---------- EVAPORATION FROM LITTER
C
      G(22) = 0.0
      IF ( X(7) .LT. B(12) * G(55) .OR. X(2) .GT. 0.0 )
     >     GO TO 2210
      T1 = ( 3(11) - B(12) ) * G(55)
      IF ( X(7) .GT. B(11) * G(55) )  G(22) = G(14)
      IF ( X(7) .LE. B(11) * G(55) .AND. X(7) .GE. B(12) * G(55) )
     >     G(22) = AMAX1 ( 0.0 , ( G(11) + X(7) - B(12) * G(55) ) *
     >                   ( 1.0 - EXP ( -G(14) / T1 ) ) )
C
 2210 CONTINUE
C
C
C
C
C-----------------------------------------------------------------------
C     WATER - SOIL ROOTING ZONE INPUT AND TRANSPIRATION
C-----------------------------------------------------------------------
C
C
C
C---G(42)---------- PLANT MOISTURE STRESS (PMS)
C
      G(42) = B(87)
      IF (  Z(3) .LT. B(79))
     >   GO TO 4210
C     ELSE
         G(42) = B(78)
         IF ( X(3) .LE. B(82) )
     >      G(42) = 3(84) - B(85) * X(3)
 4210 CONTINUE
C
C
C---G(43)---------- NEW FOLIAGE STOMATAL RESISTANCE
C
      T1 = S12 ( Z(6) , Z(9) )
      T2 = B(31) * 1200.
      T3 = B(88) * EXP ( B(89) * G(42) )
        IF ( G(42) .GT. B(87) )  T3 = 3(86)
      T4 = B(30)
        IF ( T1 .GT. T2 )  T4 = B(86)
      G(43) = AMAX1 ( T3 , T4 )
C
C
C---G(52)---------- STOMATAL RESISTANCE OF OLD FOLIAGE
C
      G(52) = 3(60) * G(43)
C
C
C---G(1)---------- TWO-SIDED NEEDLE SURFACE AREA INDEX
C
      G(1) = 3(7) * G(61)
C
C
C---G(101)--------- CANOPY RESISTANCE
C
      G(101) = 0.0
```

```
      IF ( G(51) .LE. 0.0 )  GO TO 10110
      T1 = G(43) * X(10) + G(52) * X(11)
      G(101) = 100.0 * T1 / G(61)
10110 CONTINUE
C
C---G(20)---------- TRANSPIRATION RATE
C
      G(20) = 0.0
      IF ( G(61) .LE. 0.0 .OR. X(3) .LT. 0.0 .OR.
     > X(1) + G(3) - G(5) - G(7) .GE. B(171) ) GO TO 2010
C
      T1 = S12 ( Z(6) , Z(9) )
      T2 = S10 ( Z(6) )
      T3 = G(53) - G(119) + Z(4) * (G(168) - G(124))
      T4 = B(159) * ( T2 * T3 * B(164) + T1 / G(100) )
      T5 = T2 + B(158) * ( 1.0 + G(101) / ( G(1) * G(100) ) )
      G(20) = T4  / ( B(157) * T5 )
      G(20) = AMAX1 ( G(20) , 0.0 )
 2010 CONTINUE
C
C
C
C
C------------------------------------------------------------------------
C     SUBSOIL AND GROUND WATER
C------------------------------------------------------------------------
C
C
C
C---G(18)---------- OUTFLOW FROM GROUND WATER
C
      G(18) = AMAX1 ( 0.0 , X(5) - B(16) )
C
C
C---G(12)---------- WATER TRANSFER FROM SOIL ROOTING ZONE TO SUBSOIL
C
      T1 = 1.0 - EXP ( -B(9) )
      T2 = ( G(15) - G(20) ) * ( 1.0 / T1 - 1.0 / B(9) )
      G(12) = AMAX1 (   0.0   ,   T1 * ( T2 + X(3) - B(13) )   )
C
C
C---G(19)---------- WATER TRANSFER FROM SUBSOIL TO GROUNDWATER
C
      T1 = 1.0 - EXP ( -B(10) )
      T2 = G(12) * ( 1.0 / T1 - 1.0 / B(10) )
      G(19) = AMAX1 (   0.0   ,   T1 * ( T2 + X(4) - B(14) )   )
C
C
C
C
C------------------------------------------------------------------------
C     WEEKLY AVERAGES FROM OTHER MODULES ( CALCULATED DAILY )
C------------------------------------------------------------------------
C
C
C
C---G(51)---------- WEEKLY AVERAGE SOIL TEMPERATURE
C
```

```
      G(51) = X(26)
C
C
C---G(49)---------- AVERAGE WEEKLY STOMATAL RESISTANCE OF NEW FOLIAGE
C
      G(49) = S3 ( 1 , G(43) )
C
C
C---G(48)---------- AVERAGE WEEKLY 24-HOUR AIR TEMPERATURE
C
      G(48) = S3 ( 6 , Z(3) )
C
C
C---G(58)---------- AVERAGE WEEKLY STOMATAL RESISTANCE OF OLD FOLIAGE
C
      G(58) = S3 ( 7 , G(52) )
C
C
C---G(107)--------- AVERAGE WEEKLY DAYTIME AIR TEMPERATURE
C
      G(107) = S3 ( 4 , Z(6) )
C
C
C---G(108)--------- AVERAGE WEEKLY NIGHTTIME AIR TEMPERATURE
C
      G(108) = S3 ( 5 , Z(7) )
C
C
C---G(109)--------- AVERAGE WEEKLY PHOTOSYNTHETICALLY ACTIVE RADIATION
C
      G(109) = B(183) * S3 ( 2 , 1.1 * Z(2) * Z(15) )
C
C
C---G(110)--------- AVERAGE WEEKLY DAYLENGTH
C
      G(110) = S3 ( 3 , Z(4) )
C
C
C
C
C-----------------------------------------------------------------------
C     PRIMARY PRODUCTION - PHOTOSYNTHESIS ( CALCULATED WEEKLY )
C-----------------------------------------------------------------------
C
C        *       ZERO ALL G-S IF THIS IS DURING WEEK.
C
      IF ( KT .EQ. 0 )
     >   GO TO 91200
C
      G(24)  = 0.0
      G(25)  = 0.0
      G(29)  = 0.0
      G(30)  = 0.0
      G(102) = 0.0
C
      GO TO 91210
C
91200 CONTINUE
```

```
C
C
C---G(102)--------- EFFECT OF TEMPERATURE ON PHOTOSYNTHESIS
C
      G(102) = B(70) * ( B(176) + B(177) * G(107) * (  B(168)
     >       - G(107) ) )
      G(102) = AMAX1 ( G(102), 0.0 )

C
C
C---G(24)---------- NET NEW FOLIAGE PHOTOSYNTHESIS
C
      G(24) = 0.0
      IF ( G(61) .LE. 0.0 )  GO TO 2410
      T1 = B(35) * G(61)
      T2 = B(34) + G(109) * EXP ( -T1 )
      T3 = ALOG (  T2 / ( B(34) + G(109) )  )
      G(24) = -B(32) * B(33) * G(110) * G(102) * X(10) * T3 /
     >         ( T1 *  G(49) )
 2410 CONTINUE
C
C
C---G(25)---------- NEW FOLIAGE NIGHTTIME RESPIRATION
C
      T1 = EXP ( B(145) * G(108) )
      G(25) = B(26) * X(10) * T1 * ( 1.0 - G(110) )
C
C
C---G(30)---------- OLD FOLIAGE NIGHTTIME RESPIRATION
C
      T1 = EXP ( B(145) * G(108) )
      G(30) = B(27) * B(26) * X(11) * X(12) * T1 * ( 1.0 - G(110) ) /
     >         ( B(44) + X(12) )
C
C
C---G(29)---------- NET OLD FOLIAGE PHOTOSYNTHESIS
C
      G(29) = 0.0
      IF ( G(61) .LE. 0.0 ) GO TO 2910
      T1 = B(35) * G(61)
      T2 = (  B(42) + G(109) * EXP ( -T1 )   )  /
     >     (  B(42) + G(109)   )
      G(29) = -B(32) * B(41) * G(110) * G(102) * X(11) * ALOG ( T2 ) /
     >         ( T1 *  G(58) )
 2910 CONTINUE
C
C
31210 CONTINUE
C
C
C
C-----------------------------------------------------------------------
C     FOLIAGE GROWTH AND CONSUMPTION BY INSECTS ( CALCULATED WEEKLY )
C-----------------------------------------------------------------------
C
C                 ZERO ALL G-S IF THIS IS DURING WEEK
C
      IF ( KT .EQ. 0 )
```

```
     >   GO TO 91300
C
      G(33) = 0.0
      G(35) = 0.0
      G(38) = 0.0
      G(39) = 0.0
      G(44) = 0.0
      G(79) = 0.0
      G(95) = 0.0
      G(106)= 0.0
C
      GO TO 91310
C
91300 CONTINUE
C
C
C---G(106)--------- PHENOLOGY OF TREE GROWTH
C
      G(106) = 1.0
      IF ( KTW .LT. M(2) .OR. KTW .GE. M(3) )
     >   G(105) = 0.0
C
C
C---G(39)---------- TEMPERATURE EFFECT ON GROWTH PROCESSES
C
      G(39) = 3(36) * S2 ( G(48) , 0.0 , B(76) , 2.0 , B(77) )
C
C
C---G(95)---------- BUD CONSUMPTION BY INSECTS
C
      G(95) = 3(59) * X(16) * G(39)
C
C
C---G(33)---------- BUD GROWTH
C
      G(33) = 3(31) * G(39) * X(12) / ( B(83) + X(12) )
      IF ( G(106) .EQ. 0.0 )
     >   G(33) = 0.0
C
C
C---G(35)--------- CARBON TRANSFER TO STEMS AND BRANCHES
C
      G(35) = 0.0
      IF ( G(106) .GT. 0.0 )
     >   G(35) = B(45) * G(39) * X(12) / ( X(12) + 3(46) )
C
C
C---G(38)---------- NEW FOLIAGE CONSUMPTION BY INSECTS
C
      G(38) = 3(56) * X(10) * G(39)
C
C
C---G(79)---------- CARBON TRANSFER FROM BUDS TO NEW FOLIAGE
C
      G(79) = 0.0
      IF ( KTW .EQ. M(1) )
     >   G(79) = X(16) + G(33) - G(95)
C
```

```
C
C---G(44)---------- CHANGE IN LAST YEAR+S BUD CARBON
C
       G(44) = - AMIN1 ( X(38) , G(38) / B(37) +
      >                    S6 ( B(166), B(169), B(167) * X(38) ) )
       IF ( KTW .EQ. M(1) )
      >   G(44) = X(16) * ( 1.0 - B(167) )
       IF ( G(106) .EQ. 0.0 )
      >   G(44) = -X(38)
C
C
91310 CONTINUE
C
C
C
C----------------------------------------------------------------------
C      STEM, BRANCH, AND ROOT RESPIRATION ( CALCULATED WEEKLY )
C----------------------------------------------------------------------
C                ZERO ALL G-S IF THIS IS DURING WEEK
C
       IF ( KT .EQ. 0 )
      >   GO TO 91400
C
       G(31)  = 0.0
       G(36)  = 0.0
       G(37)  = 0.0
       G(53)  = 0.0
       G(138) = 0.0
       G(139) = 0.0
       G(140) = 0.0
C
       GO TO 91410
C
91400 CONTINUE
C
C
C---G(53)---------- EFFECT OF SOIL TEMPERATURE ON SOIL PROCESSES
C
       G(53) = B(54) * S2 ( G(51) , 0.0 , B(178) , 2.0 , B(179) )
C
C
C---G(36)---------- CARBON TRANSFER TO LARGE ROOTS
C
       G(36) = B(47) * G(53) * X(12) / ( X(12) + B(48) )
C
C
C---G(37)---------- CARBON TRANSFER TO FINE ROOTS
C
       G(37) = B(49) * G(53) * X(12) / ( X(12) + B(50) )
C
C
C---G(138)--------- STEM AND BRANCH RESPIRATION
C
       G(138) = B(28) * X(12) * EXP ( B(141) * G(48) ) /
      >         ( X(12) + B(46) )
C
C
C---G(139)--------- LARGE ROOT RESPIRATION
```

```
C
      G(139) = B(29) * X(12) * EXP ( B(141) * G(51) ) /
     >          ( X(12) + B(48) )
C
C
C---G(140)--------- FINE ROOT RESPIRATION
C
      G(140) = B(30) * X(12) * X(15) * EXP ( B(141) * G(51) ) /
     >          ( X(12) + B(50) )
C
C
C---G(31)---------- TOTAL RESPIRATION LOSS FROM GROWTH CARBOHYDRATE
C                   POOL
C
      G(31) = G(139) + G(138) + G(140) + G(30)
C
C
91410 CONTINUE
C
C
C
C-----------------------------------------------------------------------
C     NEW FOLIAGE GROWTH DEMANDS ( CALCULATED WEEKLY )
C-----------------------------------------------------------------------
C
C               ZERO ALL G-S IF THIS IS DURING WEEK.
C
      IF ( KT .EQ. 0 )
     >   GO TO 91500
C
      G(26) = 0.0
      G(27) = 0.0
      G(28) = 0.0
      G(32) = 0.0
      G(34) = 0.0
      G(45) = 0.0
      G(46) = 0.0
      G(47) = 0.0
C
      GO TO 91510
C
91500 CONTINUE
C
C
C---G(46)---------- NEW FOLIAGE GROWTH DEMAND
C
      T1 = B(37) * ( X(38) + G(44) ) - X(10)
      G(46) = B(71) * G(39) * AMAX1 ( 0.0 , B(38) * T1 )
C
C
C---G(45)---------- PORTION OF GROWTH CARBOHYDRATE POOL AVAILABLE FOR
C                   FOLIAR RESPIRATION AND GROWTH
C
      G(45) = B(39) * X(12) / ( B(40) + X(12) )
C
C
C---G(47)---------- SURPLUS OR DEFICIT OF NEW FOLIAGE PHOTOSYNTHATE
C                   AFTER NEW FOLIAGE RESPIRATION IS SATISFIED
```

```
C
      G(47) = G(24) - G(25)
C
C
C---G(27)---------- TRANSFER OF CARBON FROM NEW FOLIAGE TO NEW FOLIAGE
C                   CARBOHYDRATE POOL
C
      G(27) = 0.0
      T1 = G(45) + G(47)
      IF ( T1 .LT. 0.0 )
     >   G(27) = -T1
C
C
C---G(32)---------- TRANSFER OF CARBON FROM GROWTH CARBOHYDRATE POOL
C                   TO NEW FOLIAGE POOL TO MEET FOLIAR RESPIRATION AND
C                   GROWTH DEMANDS
C
      IF ( G(47) .GT. 0.0 )
     >   GO TO 3210
C     ELSE
         G(32) = G(46)
         T1 = G(45) + G(47)
         IF ( T1 .LE. G(46) )
     >      G(32) = G(45)
         GO TO 3220
 3210 CONTINUE
         G(32) = G(45)
         T2 = G(46) - G(47)
         IF ( T2 .LE. G(45) )
     >      G(32) = T2
         IF ( T2 .LE. 0.0 )
     >      G(32) = 0.0
 3220 CONTINUE
C
C
C---G(26)---------- TRANSFER OF CARBON TO NEW FOLIAGE FROM NEW FOLIAGE
C                   CARBOHYDRATE POOL
C
      G(26) = G(46)
      T1 = G(45) + G(47)
      IF ( T1 .LT. G(46) )
     >   G(26) = T1
      IF ( T1 .LE. 0.0 )
     >   G(26) = 0.0
C
C
C---G(28)---------- TRANSFER OF SURPLUS CARBON FROM NEW FOLIAGE
C                   CARBOHYDRATE POOL TO GROWTH CARBOHYDRATE POOL
C
      G(28) = 0.0
      IF ( G(47) + G(45) .GE. 0.0 )
     >   G(28) = G(47)
      IF ( G(47) .GE. 0.0 )
     >   G(28) = AMAX1 (  0.0 , G(47) - G(46)   )
C
C
C---G(34)---------- MATURATION OF NEW FOLIAGE
C
```

```
      G(34) = 0.0
      IF ( KTW .EQ. M(4) )
     >   G(34) = X(10) + G(26) - G(27) - G(38)
C
C
91510 CONTINUE
C
C
C
C---------------------------------------------------------------------
C     MORTALITY ( CALCULATED WEEKLY )
C---------------------------------------------------------------------
C
C                 ZERO ALL G-S IF THIS IS DURING WEEK
C
      IF ( KT .EQ. 0 )
     >   GO TO 91600
C
      G(40)  = 0.0
      G(62)  = 0.0
      G(82)  = 0.0
      G(86)  = 0.0
      G(87)  = 0.0
      G(92)  = 0.0
      G(93)  = 0.0
      G(97)  = 0.0
      G(135) = 0.0
      G(136) = 0.0
C
      GO TO 91610
C
91600 CONTINUE
C
C
C---G(93)---------- ACUTE OLD FOLIAGE DEFOLIATION
C
      G(93) = S6 ( B(185) , B(186) , B(184) * X(11) )
C
C
C---G(135)--------- NEW FOLIAGE DEFOLIATION TO LEAF LITTER
C
      G(135) = 0.5 * S6 ( B(166) , B(169) , B(167) * X(10) )
C
C
C---G(136)--------- CARBON TRANSFER FROM OLD FOLIAGE TO FINE LITTER DUE
C                   TO ACUTE DEFOLIATION
C
      G(136) = 0.5 * G(93)
C
C
C---G(40)---------- LEAF FALL RATE
C
      T2 = KTW
      T3 = FLOAT ( M(5) )
      IF ( KTW .GT. M(5) )
     >   GO TO 4010
C     ELSE
         T1 = B(43) * S2 ( T2 , T3-52.0 , T3 , B(90) , B(91) )
```

```
          GO TO 4020
 4010 CONTINUE
          T1 = B(43) * S2 ( T2 , T3 , T3+52.0 , B(90) , B(91) )
C
 4020 G(40) = 0.5 * G(93) + X(11) * ( B(182) + T1 )
C
C
C---G(82)---------- INSECT FRASS INPUT TO FINE LITTER
C
      G(82) = B(75) * X(17)
C
C
C---G(86)---------- LARGE ROOT MORTALITY
C
      G(86) = B(52) * X(14)
C
C
C---G(87)---------- FINE ROOT MORTALITY
C
      T1 = B(72) * AMAX1 ( 0., B(82) - X(3) ) + 1.0
      G(87) = B(53) * X(15) * T1 * ( B(5) * G(32) + 1.0 )
C
C
C---G(92)---------- CARBON TRANSFER FROM STEMS PLUS BRANCHES TO WOODY
C                   LITTER
C
      G(92) = B(150) * B(51) * X(13)
C
C
C---G(62)---------- CARBON TRANSFER FROM STEMS PLUS BRANCHES TO
C                   LOG LITTER
C
      G(62) = B(51) * X(13) * ( 1.0 - B(150) )
C
C
C---G(97)---------- INPUT TO FINE LITTER FROM MICROPARTICULATE MATTER
C                   AND CARBON DISSOLVED IN PRECIPITATION
C
      G(97) = B(152)
C
C
91610 CONTINUE
C
C
C
C------------------------------------------------------------------------
C     OLD FOLIAGE CONSUMPTION ( CALCULATED WEEKLY )
C------------------------------------------------------------------------
C
C                ZERO ALL G-S IF THIS IS DURING WEEK.
C
      IF ( KT .EQ. 0 )
     > GO TO 91700
C
      G(90) = 0.0
      G(94) = 0.0
C
      GO TO 91710
```

```
C
91700 CONTINUE
C
C
C---G(94)---------- CONSUMPTION OF GROWTH CH2O POOL BY INSECTS
C
      G(94) = B(58) * X(12) * G(39)
C
C
C---G(90)---------- OLD FOLIAGE CONSUMPTION BY INSECTS
C
      G(90) = B(57) * X(11) * G(39)
C
C
91710 CONTINUE
C
C
C
C---------------------------------------------------------------------
C     LITTER RESPIRATION AND DECOMPOSITION ( CALCULATED WEEKLY )
C---------------------------------------------------------------------
C
C                ZERO ALL G-S IF THIS IS DURING WEEK.
C
      IF ( KT .EQ. 0 )
     >   GO TO 91800
C
      G(69)  = 0.0
      G(77)  = 0.0
      G(81)  = 0.0
      G(83)  = 0.0
      G(84)  = 0.0
      G(98)  = 0.0
      G(103) = 0.0
      G(104) = 0.0
      G(105) = 0.0
      G(111) = 0.0
      G(112) = 0.0
      G(113) = 0.0
      G(116) = 0.0
      G(125) = 0.0
C
      GO TO 91810
C
91800 CONTINUE
C
C
C---G(77)---------- EFFECT OF TEMPERATURE ON LITTER PROCESSES
C
      G(77) = B(24) * S2 ( G(41) , 0.0 , B(180) , 2.0 , B(181) )
C
C
C---G(69)---------- EFFECT OF TEMPRATURE AND MOISTURE ON LITTER
C                   PROCESSES
C
      G(69) = B(94) * X(7) * G(77)
      IF ( X(7) .GE. G(55) )
     >   G(69) = B(94) * G(55) * G(77)
```

```
C
C
C---G(105)--------- LOG LITTER DECOMPOSITION RATE
C
      G(105) = B(146) * X(9) * G(77)
C
C
C---G(112)--------- CARBON LOSS FROM LOGS DUE TO FRAGMENTATION
C
      G(112) = G(105) * B(147)
C
C
C---G(113)--------- CARBON LOSS FROM LOGS DUE TO RESPIRATION
C
      G(113) = G(105) * ( 1.0 - B(147) )
C
C
C---G(83)---------- WOODY LITTER DECOMPOSITION RATE
C
      G(83) = B(61) * G(69) * X(18)
C
C
C---G(104)--------- CARBON LOSS FROM WOODY LITTER DUE TO FRAGMENTATION
C
      G(104) = B(148) * G(83)
C
C
C---G(111)--------- CARBON LOSS FROM WOODY LITTER DUE TO RESPIRATION
C
      G(111) = G(83) * ( 1.0 - B(148) )
C
C
C---G(81)---------- FOLIAGE LITTER DECOMPOSTION RATE
C
      G(81) = B(62) * G(69) * X(19)
C
C
C---G(98)---------- CARBON LOSS FROM FOLIAGE LITTER DUE TO FRAGMENTATION
C
      G(98) = B(149) * G(81)
C
C
C---G(103)--------- CARBON LOSS FROM FOLIAGE LITTER DUE TO RESPIRATION
C
      G(103) = G(81) * ( 1.0 - B(149) )
C
C
C---G(84)---------- FINE LITTER DECOMPOSITION RATE
C
      G(84) = B(63) * G(69) * X(20)
C
C
C---G(116)--------- INCORPORATION OF FINE LITTER INTO ROOTING ZONE
C                   ORGANIC MATTER
C
      G(116) = G(84) * B(64)
C
C
```

```
C---G(125)--------- CARBON LOSS FROM FINE LITTER DUE TO RESPIRATION
C
      G(125) = G(84) * ( 1.0 - B(64) )
C
C
91810 CONTINUE
C
C
C
C-----------------------------------------------------------------------
C     ROOTING ZONE AND SUBSOIL ORGANIC MATTER DECOMPOSITION
C             AND RESPIRATION ( CALCULATED WEEKLY )
C-----------------------------------------------------------------------
C
C                ZERO ALL G-S IF THIS IS DURING WEEK.
C
      IF ( KT .EQ. 0 )
     >   GO TO 91900
C
      G(50)  = 0.0
      G(85)  = 0.0
      G(88)  = 0.0
      G(126) = 0.0
      G(131) = 0.0
      G(132) = 0.0
      G(133) = 0.0
C
      GO TO 91910
C
91900 CONTINUE
C
C
C---G(50)---------- EFFECT OF MOISTURE AND TEMPERATURE ON ROOTING ZONE
C                   PROCESS
C
      G(50) = X(3) * G(53) / B(67)
C
C
C---G(85)---------- DEAD ROOT DECOMPOSITION RATE
C
      G(85) = B(68) * G(50) * X(62)
C
C
C---G(126)--------- CARBON LOSS FROM DEAD ROOTS DUE TO FRAGMENTATION
C
      G(126) = G(85) * B(69)
C
C
C---G(131)--------- CARBON LOSS FROM DEAD ROOTS DUE TO RESPIRATION
C
      G(131) = G(85) * ( 1.0 - B(69) )
C
C
C---G(88)---------- ROOT ZONE ORGANIC MATTER DCOMPOSITION RATE
C
      G(88) = B(65) * G(50) * X(21)
C
C
```

```
C---G(132)--------- CARBON TRANSFER FROM SOIL ROOTING ZONE TO SUBSOIL
C
      G(132) = G(88) * B(66)
C
C
C---G(133)--------- CARBON LOSS FROM ROOTING ZONE DUE TO RESPIRATION
C
      G(133) = G(88) * ( 1.0 - B(66) )
C
C
91910 CONTINUE
C
C
C
C
C-----------------------------------------------------------------------
C     LITTER AND SOIL TEMPERATURES
C-----------------------------------------------------------------------
C
C                 ZERO ALL G-S IF THIS IS DURING WEEK.
C
      IF ( KT .EQ. 0 )
     >   GO TO 90100
C
      G(67) = 0.0
      G(68) = 0.0
C
      GO TO 90110
C
90100 CONTINUE
C
C
C---G(67)---------- CHANGE IN LITTER TEMPERATURE
C
      T1 = B(92) * ( 1.0 + G(80) / B(93) )
      T2 = AMIN1 ( 1.0 , T1 )
      G(67) = T2 * ( G(48) - X(25) )
      IF ( X(2) .GT. 100.0 )
     >   G(67) = 3.0 - X(25)
C
C
C---G(68)---------- CHANGE IN SOIL TEMPERATURE
C
      G(68) = ( X(25) - X(26) ) * B(95)
C
C
90110 CONTINUE
C
C
      RETURN
      END
```

```
      SUBROUTINE XUP
C
C-----------------------------------------------------------------------
C
C            SUBROUTINE XUP HAS TWO PURPOSES:
C            1. CALCULATION OF FLOWS
C               FROM THE APPROPRIATE G FUNCTIONS;
C            2. UPDATING THE STATE VARIABLES WITH THE FLOWS JUST OBTAINED.
C
C            COMPARTMENT 00 IS A DUMMY COMPARTMENT SUPPLYING FLOWS
C              (WATER,CARBON,ETC.), OR ACTING AS A SINK.
C
C-----------------------------------------------------------------------
C
      COMMON /MODPASS/ MODEL(4)
      COMMON /XVAR/ X(300)
      COMMON /GVAR/ G(500)
      COMMON /BVAR/ B(500)
      COMMON /ZVAR/ Z(100)
      DATA (MODEL(2)=10HXUP-CM     )
C
C                              RAIN INPUT TO FOLIAR SURFACES
      F0001 = G(  3)
C                              PRECIPITATION AS SNOW
      F0002 = G(115)
C                              RAINFALL PASSING DIRECTLY TO LITTER SURFACE
C                              WATER
      F0006 = G( 70)
C                              RAIN INPUT TO EPIPHYTE AND BARK SURFACES
      F0008 = G(  4)
C                              NET OLD FOLIAGE PHOTOSYNTHESIS
      F0012 = G( 29)
C                              INPUT TO FINE LITTER FROM MICROPARTICULATE
C                              MATTER AND CARBON DISSOLVED IN PRECIPITATION
      F0020 = G( 97)
C                              CHANGE IN LITTER TEMPERATURE
      F0025 = G( 67)
C                              CHANGE IN SOIL TEMPERATURE
      F0026 = G( 68)
C                              CHANGE IN CALORIE DEFICIT OF SNOW
      F0037 = G(128)
C                              ACUTE OLD FOLIAGE DEFOLIATION
      F0038 = G( 44)
C                              NET NEW FOLIAGE PHOTOSYNTHESIS
      F0064 = G( 24)
C                              RAINFALL PASSING DIRECTLY TO FREE WATER IN SNOW
C                              PACK
      F0098 = G( 74)
C                              EVAPORATION FROM FOLIAR SURFACES
      F0100 = G(  7)
C                              DRIP FROM FOLIAR SURFACES TO LITTER SURFACE
C                              WATER
      F0106 = G( 71)
C                              DRIP FROM FOLIAR SURFACES TO FREE WATER IN SNOW
C                              PACK
      F0198 = G( 75)
C                              TRANSFER FROM ICE TO FREE WATER IN SNOWPACK
      F0298 = G(129)
```

```
C                            TRANSPIRATION FROM SOIL ROOTING ZONE
      F0300 = G( 20)
C                            WATER TRANSFER FROM SOIL ROOTING ZONE TO SUBSOIL
      F0304 = G( 12)
C                            WATER TRANSFER FROM SUBSOIL TO GROUNDWATER
      F0405 = G( 19)
C                            OUTFLOW FROM GROUNDWATER
      F0500 = G( 18)
C                            WATER ENTERING LITTER
      F0607 = G( 11)
C                            EVAPORATION FROM LITTER
      F0700 = G( 22)
C                            WATER TRANSFER FROM LITTER TO SOIL ROOTING ZONE
      F0703 = G( 15)
C                            EVAPORATION FROM EPIPHYTE AND BARK SURFACES
      F0800 = G(  8)
C                            DRIP FROM EPIPHYTE AND BARK SURFACES TO LITTER
C                            SURFACE WATER
      F0806 = G( 72)
C                            DRIP FROM EPIPHYTE AND BARK SURFACES TO FREE
C                            WATER IN SNOWPACK
      F0898 = G( 76)
C                            CARBON LOSS FROM LOGS DUE TO RESPIRATION
      F0900 = G(113)
C                            CARBON LOSS FROM LOGS DUE TO FRAGMENTATION
      F0920 = G(112)
C                            MATURATION OF NEW FOLIAGE
      F1011 = G( 34)
C                            INSECT CONSUMPTION OF NEW LEAVES
      F1017 = G( 38)
C                            NEW FOLIAGE DEFOLIATION TO LEAF LITTER
      F1019 = G(135)
C                            NEW FOLIAGE DEFOLIATION TO FINE LITTER
      F1020 = G(135)
C                            TRANSFER OF CARBON FROM NEW FOLIAGE TO NEW
C                            FOLIAGE CARBOHYDRATE POOL
      F1064 = G( 27)
C                            OLD FOLIAGE CONSUMPTION BY INSECTS
      F1117 = G( 90)
C                            LEAF FALL RATE
      F1119 = G( 40)
C                            CARBON TRANSFER FROM OLD FOLIAGE TO FINE LITTER
C                            DUE TO ACUTE DEFOLIATION
      F1120 = G(136)
C                            TOTAL CARBOHYDRATE POOL RESPIRATION LOSS
      F1200 = G( 31)
C                            CARBON TRANSFER TO STEMS AND BRANCHES
      F1213 = G( 35)
C                            CARBON TRANSFER TO LARGE ROOTS
      F1214 = G( 36)
C                            CARBON TRANSFER TO FINE ROOTS
      F1215 = G( 37)
C                            BUD GROWTH
      F1216 = G( 33)
C                            CONSUMPTION OF GROWTH CH2O POOL BY INSECTS
      F1217 = G( 94)
C                            TRANSFER OF CARBON FROM GROWTH CARBOHYDRATE POOL
C                            TO NEW FOLIAGE POOL TO MEET FOLIAR RESPIRATION
```

```
C                               AND GROWTH DEMANDS
      F1264 = G( 32)
C                               BOLE FALL
      F1309 = G( 62)
C                               CARBON TRANSFER FROM STEMS AND BRANCHES
C                               TO WOODY LITTER
      F1318 = G( 92)
C                               LARGE ROOT MORTALITY
      F1462 = G( 86)
C                               FINE ROOT MORTALITY
      F1562 = G( 87)
C                               TRANSFER OF CARBON FROM BUDS TO NEW FOLIAGE
      F1610 = G( 79)
C                               BUD CONSUMPTION BY INSECTS
      F1617 = G( 95)
C                               INSECT FRASS INPUT TO FINE LITTER
      F1720 = G( 82)
C                               CARBON LOSS FROM WOODY LITTER DUE TO
C                               RESPIRATION
      F1800 = G(111)
C                               CARBON LOSS FROM WOODY LITTER DUE TO
C                               FRAGMENTATION
      F1820 = G(104)
C                               CARBON LOSS FROM FOLIAGE LITTER DUE TO
C                               RESPIRATION
      F1900 = G(103)
C                               CARBON LOSS FROM FOLIAGE LITTER DUE TO FRAG-
C                               MENTATION
      F1920 = G( 98)
C                               CARBON LOSS FROM FINE LITTER DUE TO RESPIRATION
      F2000 = G(125)
C                               INCORPORATION OF FINE LITTER INTO ROOTING ZONE
C                               ORGANIC MATTER
      F2021 = G(116)
C                               CARBON LOSS FROM ROOTING ZONE DUE TO RESPIRATION
      F2100 = G(133)
C                               CARBON TRANSFER FROM SOIL ROCTING ZONE TO
C                               SUBSOIL
      F2122 = G(132)
C                               CARBON LOSS FROM DEAD ROOTS DUE TO RESPIRATION
      F6200 = G(131)
C                               CARBON LOSS FROM DEAD ROOTS DUE TO FRAGMENTATION
      F6221 = G(126)
C                               NEW FOLIAGE NIGHTTIME RESPIRATION
      F6400 = G( 25)
C                               TRANSFER OF CARBON TO NEW FOLIAGE FROM NEW
C                               FOLIAGE CARBOHYDRATE POOL
      F6410 = G( 26)
C                               TRANSFER OF SURPLUS CARBON FROM NEW FOLIAGE
C                               CARBOHYDRATE POOL TO GROWTH CARBOHYDRATE POOL
      F6412 = G( 28)
C                               NET DAILY FREEZING OF FREE WATER IN SNOWPACK
      F9802 = G(161)
C                               WATER TRANSFER FROM SNOWPACK TO LITTER SURFACE
      F9806 = G( 10)
C
C
C---------------------------------------------------------------------
```

```
C
      X( 1) = X( 1)+F0001-F0106-F0198-F0100
      X( 2) = X( 2)+F9802+F0002-F0298
      X( 3) = X( 3)+F0703-F0304-F0300
      X( 4) = X( 4)+F0304-F0405
      X( 5) = X( 5)+F0405-F0500
      X( 6) = X( 6)+F0106+F0806+F9806+F0006-F0607
      X( 7) = X( 7)+F0607-F0703-F0700
      X( 8) = X( 8)+F0008-F0806-F0898-F0800
      X( 9) = X( 9)+F1309-F0920-F0900
      X(10) = X(10)+F1610+F6410-F1011-F1017-F1019-F1020-F1064
      X(11) = X(11)+F1011-F1117-F1119-F1120
      X(12) = X(12)+F6412+F0812-F1213-F1214-F1215-F1216-F1217-F1264-
     *              F1200
      X(13) = X(13)+F1213-F1309-F1318
      X(14) = X(14)+F1214-F1462
      X(15) = X(15)+F1215-F1562
      X(16) = X(16)+F1216-F1610-F1617
      X(17) = X(17)+F1017+F1117+F1217+F1617-F1720
      X(18) = X(18)+F1318-F1820-F1800
      X(19) = X(19)+F1019+F1119-F1920-F1900
      X(20) = X(20)+F0920+F1020+F1120+F1720+F1820+F1920+F0020-F2021-
     *              F2000
      X(21) = X(21)+F2021+F6221-F2122-F2100
      X(22) = X(22)+F2122
      X(25) = X(25)+F0025
      X(26) = X(26)+F0026
      X(37) = X(37)+F0037
      X(38) = X(38)+F0038
      X(62) = X(62)+F1462+F1562-F6221-F6200
      X(64) = X(64)+F1064+F1264+F0064-F6410-F6412-F6400
      X(98) = X(98)+F0198+F0298+F0898+F0098-F9802-F9806
      RETURN
      END
```

```
      SUBROUTINE YUP
C
C     *     THIS ROUTINE PRODUCES ALL OUTPUT VARIABLES NOT SPECIFICALLY
C           CALCULATED AS INTERMEDIATE, STATE, OR DRIVING VARIABLES
C
      COMMON /MODPASS/ MODEL(4)
      COMMON /GVAR/ G(500)
      COMMON /ZVAR/ Z(100)
      COMMON /BVAR/ B(500)
      COMMON /XVAR/ X(300)
      COMMON /YVAR/ Y(200)
      DATA (MODEL(3)=10HYUP-CW     )
C
C     *     TOTAL EVAPORATION
C
      Y(1) = G(7) + G(8) + G(22)
C
C     *     LITTERFALL
C
      Y(2) = G(40) + G(62) + G(90) + G(92) + 2 * G(135) + G(136)
C
C     *     VAPOR PRESSURE DEFICIT
C
      Y( 3) = S12 ( Z(6) , Z(9) )
C
C     *     LENGTH OF TIME SNOWPACK IS PRESENT
C
      Y(4) = 0.0
      IF ( X(2) .GT. 0.0)  Y(4) = 1.0
C
C     *     TOTAL LITTER RESPIRATION
C
      Y (6) = G(103) + G(111) + G(113) + G(125)
C
C     *     TOTAL SOIL RESPIRATION
C
      Y (7) = G(131) + G(133) + G(139) + G(140)
C
C     *     TOTAL FOREST FLOOR RESPIRATION
C
      Y(12) = G(103) + G(111) + G(113) + G(125)+
     >        G(131) + G(133) + G(139) + G(140)
C
C     *     AVERAGE WEEKLY LITTER H2O AS PERCENT HOLDING CAP.
C
      Y(14) = 0.
        IF (X(19) + X(20) .EQ. 0.) GC TO 1400
      Y(14) = S3 ( 16 , 50.0 * X(7) / (X(19) + X(20)))
C
 1400 CONTINUE
C
C     *     NET FOLIAR ASSIMILATION
C
      Y(16) = G(24) - G(25) + G(29) - G(30)
C
C     *     AVERAGE WEEKLY PERCENT SOLAR RADIATION INTERCEPTED
C
      Y(17) = 0.
```

```
      IF (G(59) .EQ. 0.) GO TO 1700
      Y(17) = S3 ( 15 , 100.0 * (1.0 - G(91) / G(59) ) )
C
 1700 CONTINUE
C
C     *    TOTAL WATER IN SYSTEM
C
      Y(20) = X(1) + X(3) + X(4) + X(5) + X(7) + X(8) + X(2)
C
C     *    THROUGHFALL
C
      Y(21) = G(71) + G(72) + G(75) + G(76) + G(78) + G(74)
C
C     *    EVAPORATION FROM CANOPY
C
      Y(22) = G(7) + G(8)
C
C     *    NON-FOLIAR GROWTH
C
      Y(23) = G(35) + G(36) + G(37)
C
C     *    NON-FOLIAR RESPIRATION
C
      Y(24) = G(138) + G(139) + G(140)
C
C     *    HEAT TO SNOW DURING CONDENSATION (WHEN SNOWPACK PRESENT)
C
      Y(25) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(25) = G(2)
C
C     *    SW RAD (TOP OF CANOPY) (WHEN SNOWPACK PRESENT)
C
      Y(26) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(26) = G(59)
C
C     *    SW RAD (INC. TO SNOW WHEN SNOWPACK PRESENT)
C
      Y(27) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(27) = G(91)
C
C     *    HEAT FROM SNOW DUE TO SNOWFALL (WHEN SNOWPACK PRESENT)
C
      Y(28) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(28) = G(114)
C
C     *    HEAT TO SNOW BY RAINFALL (WHEN SNOWPACK PRESENT)
C
      Y(29) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(29) = G(117)
C
C     *    ALBEDO OF SNOW/LITTER (WHEN SNOWPACK PRESENT)
C
      Y(30) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(30) = G(118)
C
C     *    HEAT FROM CANOPY TO SNOW (WHEN SNOWPACK PRESENT) - SW
C
      Y(31) = 0.0
```

```
      IF ( G(60) .GT. 0.0 )  Y(31) = G(119)
C
C     *   HEAT FROM CANOPY TO SNOW (WHEN SNOWPACK PRESENT) - LW
C
      Y(32) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(32) = G(120)
C
C     *   LONGWAVE RADIATION FROM SKY (WHEN SNOWPACK PRESENT)
C
      Y(33) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(33) = Z(12)
C
C     *   HEAT TO SNOW DUE TO CONVECTION (WHEN SNOWPACK PRESENT)
C
      Y(34) = 0.0
        IF ( G(60) .GT. 0.0 )  Y(34) = G(170)
C
      RETURN
      END
```

```
      SUBROUTINE ZUP
      COMMON /MODPASS/ MODEL(4)
      COMMON /ZVAR/ Z(100)
      COMMON /BVAR/ B(500)
      COMMON /SYS/ A(80),TIME
      COMMON /FORMAT/ DUMMY(7),FORM(7)
      DATA (MODEL(4)=10HZUP-CW     )
C
C---------------------------------------------------
C       THIS ROUTINE UPDATES ALL DRIVING VARIABLES
C---------------------------------------------------
C
C            Z        DESCRIPTION
C            1        TOTAL PRECIPITATION (IN)
C            2        AVERAGE RADIATION (LY/MIN)
C            3        AIR TEMPERATURE (DEG C) - AVE. 24 HOUR
C            4        DAYLENGTH (FRACTION OF DAY)
C            5        DEW POINT TEMPERATURE - AVE. 24 HOUR
C            6        DAYTIME AIR TEMPERATURE
C            7        NIGHTTIME AIR TEMPERATURE
C            8        INCIDENT RAINFALL
C            9        DAYTIME DEW TEMPERATURE
C           12        LONGWAVE RADIATION FROM SKY
C           13        HORIZONTAL POTENTIAL RADIATION (LANG/DAY)
C           14        WIND SPEED (M/SEC)
C           15        SLOPE FACTOR
C           16        EFFECTIVE RADIATION AT THE SLOPE CORRECTED FOR
C                       MAP AREA (DIVIDED BY COSINE OF INCLINATION)
C
C
C
C-----------------READ THE DRIVING VARIABLES FOR THE DAY
C
      READ (5,FORM) Z(3),Z(5),Z(6),Z(9),Z(7),Z(4),Z(2),Z(1),Z(14),
     >  Z(13),Z(15)
      IF (EOF(5).NE.0.0) GO TO 99
C
C
C     *  CONVERT DAILY PRECIPITATION TO TONS/HA
C
      Z(1)=254.0 * Z(1)
C
C
C     *  ELIMINATE NEGATIVE VAPOR PRESSURE DEFICITS CAUSED BY
C        BAD DATA.  SET DEW POINT TEMPERATURE TO AVERAGE NIGHTTIME
C        TEMPERATURE Z(7).
C
      IF (Z(5).GT.Z(3)) Z(5)=Z(7)
      IF (Z(7).GT.Z(3) .AND. Z(5).GT.Z(3)) Z(5)=Z(3)
C
      IF ( Z(3) .GT. Z(6) )  Z(9) = Z(6)
C
C
C---Z(8)-----------INCIDENT RAINFALL
C
      Z(8) = 0.0
      T1 = Z(3) - ( Z(3) - Z(5) ) * ( 0.376 + 0.014 * Z(3) )
      IF ( T1 .GE. B(19) )  Z(8) = Z(1)
```

```
C
C
C---Z(16)----------CORRECTED SHORTWAVE RADIATION
C
      Z(16) = Z(2) * Z(15) * Z(4) * 1589.
C
C
C---Z(12)----------INCIDENT LONGWAVE RADIATION
C
      Z(12) = S4 ( Z(3) ) - ( 228. + 11.16 *
     > ( SQRT (S1 ( Z(3) ) ) - SQRT ( S1 ( Z(5) ) ) ) ) *
     > ( Z(2) * Z(4) * 1440. / Z(13) ) ** 2
C
C
C---Z(14)----------WIND SPEED
C
      IF ( Z(14) .EQ. 99.0 )  Z(14) = B(15)
C
      RETURN
   99 STOP ≠EOF(5) - ZUP≠
      END
```

```
C-----------------------------------------------------------------------
      FUNCTION S1 ( T1 )
C
C     *         COMPUTES E(S) AND E(A) FROM TETENS EQUATION
C
      COMMON /BVAR/ B(500)
      S1 = 6.11 * EXP ( 17.27 * T1 / ( T1 + 237.3 ) )
      RETURN
      END


C
C-----------------------------------------------------------------------
C
      FUNCTION S2 (T1 , T2 , T3 , T4 , T5)
C
C     *       GENERALIZED BETA FUNCTION
C
      S2 = 0.0
      IF ( T1 .LT. T2 .OR. T1 .GT. T3 )  GO TO 10
      S2 = ( T1 - T2 ) ** ( T4 - 1.0 ) * ( T3 - T1 ) ** ( T5 - 1.0 )
   10 RETURN
      END


C
C-----------------------------------------------------------------------
C
      FUNCTION S3 ( I , T1 )
C
C     *         MAINTAINS WEEKLY SUMMATION OF T1 FOR A PARTICULAR I
C             AND RETURNS WEEKLY AVERAGE IN FUNCTIONNAME EVERY
C             SEVENTH CALL.
C
      COMMON /KVAR/ K,KSTART,KSTEP,KSTOP,KPRINT,KMO,KWK,KT,
     1 KTIM(11),KT1,KTW
      DIMENSION DAILY ( 100 )
C
C     *         INITIALIZE SUMMER FOR THE ITH FUNCTION
C
      IF ( K .NE. KSTART ) GO TO 10
      DAILY (I) = 0.0
      S3 = T1
      RETURN
C
C     *         ADD TODAYS VALUE TO SUMMER, RETURN IF NOT TIME TO
C             COMPUTE AVERAGE.
C
   10 DAILY (I) = DAILY (I) + T1
      IF ( KT .EQ. 0 ) GO TO 50
      S3 = 0.0
      RETURN
C
C     *         RETURN WEEKLY AVERAGE AND ZERO SUMMER.
C
   50 S3 = DAILY (I) / 7.0
      DAILY (I) = 0.0
      RETURN
      END
```

```
C
C---------------------------------------------------------------------
C
      FUNCTION S4 ( T1 )
C
C     *           COMPUTES LONGWAVE RADIATION FROM A BLACK BODY
C
      S4 = 1.17E-7 * ( T1 + 273.16 )**4
      RETURN
      END
C
C---------------------------------------------------------------------
C
      FUNCTION S5 ( DUM )
C
C     *           COMPUTES ALBEDO OF SNOWPACK OR LITTER
C
      COMMON /GVAR/ G(500)
      COMMON /ZVAR/ Z(100)
      COMMON /BVAR/ B(500)
      COMMON /KVAR/ K,KSTART,KSTEP,KSTOP,KPRINT,KMO,KWK,KT,
     1 KTIM(11),KT1,KTW
      DIMENSION FACUM(15), FMELT(15)
      DATA FACUM/.80,.77,.75,.72,.70,.69,.68,.67,.66,.65,
     *           .64,.63,.62,.61,.60/
      DATA FMELT/.72,.65,.60,.58,.56,.54,.52,.50,.48,.46,
     *           .44,.43,.42,.41,.40/
      IF ( DUM .EQ. 1.0 ) GO TO 40
      IF ( K .NE. KSTART ) GO TO 10
      LASTUSD = 0.0
      INT = 0
   10 IF ( G(115) .LE. 0.0 .OR. Z(6) .LE. B(6) ) GO TO 20
      INT = 0
      S5 = 0.31
      LASTUSD = 1
      IF ( G(150) .LT. 0.0 ) S5 = 0.91
      IF ( G(150) .LT. 0.0 ) LASTUSD = 0
      RETURN
C
C     *           LASTUSD IS A SWITCH FOR WHETHER FMELT OR FACUM IS TO BE
C               USED.  LASTUSD = 1 IMPLIES FMELT TO BE USED (IT IS A
C               MELTING PHASE).
C
   20 INT = INT + 1
      S5 = FACUM (INT)
      IF ( LASTUSD .EQ. 1 .AND. INT .LE. 15 ) S5 = FMELT(INT)
      IF ( LASTUSD .EQ. 0 .AND. INT .GE. 15 ) GO TO 30
      IF ( LASTUSD .EQ. 1 .AND. INT .GE. 15 ) S5 = FMELT(5)
      RETURN
   30 INT = 4
      LASTUSD = 1
      RETURN
C
C     *           SET LITTER ALBEDO EQUAL TO .1
C
   40 S5 = .1
      RETURN
      END
```

```
C
C-----------------------------------------------------------------------
C
      FUNCTION S6 ( T1 , T2 , T3 )
C
C     *            THIS FUNCTION IS USED FOR ACUTE PERTURBATIONS
C
      COMMON /SYS/ A(80),TIME
      S6 = 0.0
      IF ( TIME .EQ. T1 .OR. TIME .EQ. T2 ) S6 = T3
      RETURN
      END

C
C-----------------------------------------------------------------------
C
C                RATE OF CHANGE OF SATURATION VAPOR PRESSURE WITH
C                  TEMPERATURE
C
      FUNCTION S10 ( T1 )
      S10 = 4098.2 * S1 ( T1 ) / ( ( T1 + 237.3 ) ** 2 )
      RETURN
      END

C-----------------------------------------------------------------------
C
C                VAPOR PRESSURE DEFICIT FROM AIR AND DEW TEMPERATURE
C
      FUNCTION S12 ( T1 , T2 )
      S12 = 1200. * ( S1 ( T1 ) - S1 ( T2 ) )
      RETURN
      END
```

# APPENDIX II. Listing of Input File

The input file listing of Appendix II is reproduced directly from computer output.

```
COMMENT.  THIS HEADER IS - CARBON/WATER.
COMMENT.  THIS HEADER LAST VERIFIED: 22 JULY 77
 $IVAR IB=200, IG=200, IM=10, IX=100, IY=50, IZ=25$
 $MVAR M(1)=18, M(2)=18, M(3)=40, M(4)=40, M(5)=12$
 $BVAR B(1)=1.5, B(2)=1.0, B(3)=2.0, B(4)=0.7, B(5)=73.71,
 B(6)=3.0, B(7)=3.48, B(8)=0.7, B(9)=2.16, B(10)=1.08,
 B(11)=0.36, B(12)=0.1, B(13)=3900., B(14)=9970., B(15)=0.2,
 B(16)=11896., B(17)=-2.5, B(18)=3., B(19)=0.0, B(20)=.7,
 B(21)=.167, B(22)=.28, B(23)=4.5, B(24)=.0356,
 B(26)=.0219, B(27)=1.11, B(28)=0.091, B(29)=.107, B(30)=.0031,
 B(31)=2.53E-4, B(32)=36.4, B(33)=0.346, B(34)=.1,
 B(35)=.52, B(36)=.0367, B(37)=120., B(38)=.3, B(39)=.38,
 B(40)=.1, B(41)=0.346, B(42)=.1, B(43)=1.838E-39, B(44)=.1,
 B(45)=0.079, B(46)=6., B(47)=9.31E-3, B(48)=6., B(49)=.022,
 B(50)=.07, B(51)=2.221E-4, B(52)=1.91E-4, B(53)=14.6E-4, B(54)=.0344,
 B(56)=6.06E-4, B(57)=1.0E-5, B(58)=1.0E-4, B(59)=1.0E-4,
 B(60)=1.2, B(61)=1.05E-3, B(62)=3.1E-3, B(63)=3.9E-3, B(64)=0.0,
 B(65)=2.56E-4, B(66)=0.0, B(67)=3288., B(68)=5.0E-3, B(69)=.5,
 B(70)=0.929, B(71)=.564, B(72)=0.01,  B(74)=.25,
 B(75)=.05, B(76)=45., B(77)=1.35, B(78)=6.0, B(79)=-2.,
 B(80)=5.0, B(81)=5.0,
 B(82)=2600., B(83)=.01, B(84)=248.59, B(85)=.0933,
 B(86)=300., B(87)=19., B(88)=.755, B(89)=.315, B(90)=16., B(91)=12.,
 B(92)=.5, B(93)=3000., B(94)=.03, B(95)=.1,
 B(141)=.069, B(145)=.073, B(146)=1.74E-4, B(147)=.8, B(148)=.614,
 B(149)=.4, B(150)=.136, B(152)=3.846E-3,
 B(154)=.04, B(156)=.67, B(157)=2.5E6, B(158)=.66,
 B(159)=.864E6, B(160)=.1, B(163)=.001, B(164)=.48, B(165)=10.,
 B(168)=30., B(170)=6.0, B(171)=100., B(172)=.01, B(173)=.015, B(174)=.32,
 B(176)=0.71, B(177)=0.00274, B(178)=45., B(179)=1.35, B(180)=45.,
 B(181)=1.35, B(182)=1.06E-3, B(183)=.4, B(184)=0., B(185)=0.,
 B(186)=0.$
 $XVAR X(3)=3980., X(4)=9970., X(5)=11896., X(6)=1., X(7)=129.5,
 X(9)=108., X(10)=.3, X(11)=4.55, X(12)=15.5, X(13)=350.,
 X(14)=70., X(15)=5.61, X(16)=5.55E-17, X(17)=.01,
 X(18)=9.73, X(19)=7.17, X(20)=8.7, X(21)=56.5, X(22)=80.,
 X(25)=7.5, X(26)=4.1, X(38)=9.83E-3, X(62)=7.7, X(64)=1.$
 $KVAR K=72, KSTART=131, KSTEP=1, KSTOP=1225, KPRINT=91, KTPRINT=364,
  KTHETA=1$
$FORMIS1=(4X,2I3)
$FORMDAT=(10X,5F5.1,2F5.3,2F6.2,F5.0,F6.3)
*INIT
*PRINTX
*DUMP
*TITLE=C123491 - 23APR 79 - C/W -
*INPUT
*GO
*STOP
```

# APPENDIX III. Listing of Driving Variable Data

The driving variable listing in Appendix III is reproduced directly from computer output.

| Date | $z_1$ | $z_6$ | $z_7$ | $z_3$ | $z_5$ | $z_2$ | $z_{14}$ | $z_4$ | $z_{13}$ | $z_{15}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 72131 | 0.00 | 14.800 | 3.800 | 10.600 | 3.700 | .665 | 0.0000 | .614 | 924.0 | 1.014 |
| 72132 | 0.00 | 16.400 | 6.900 | 12.700 | 5.700 | .664 | 0.0000 | .615 | 928.0 | 1.012 |
| 72133 | 0.00 | 22.200 | 8.300 | 16.900 | 8.000 | .628 | 0.0000 | .617 | 931.0 | 1.010 |
| 72134 | 0.00 | 22.200 | 9.900 | 17.500 | 8.700 | .620 | 0.0000 | .618 | 935.0 | 1.007 |
| 72135 | 0.00 | 19.900 | 9.800 | 16.100 | 8.800 | .578 | 0.0000 | .620 | 938.0 | 1.005 |
| 72136 | .20 | 13.000 | 7.700 | 11.000 | 7.800 | .263 | 0.0000 | .621 | 942.0 | 1.003 |
| 72137 | .70 | 11.500 | 8.100 | 10.200 | 9.800 | .134 | 0.0000 | .623 | 945.0 | 1.001 |
| 72138 | .46 | 7.300 | 5.500 | 6.600 | 5.600 | .300 | 0.0000 | .624 | 948.0 | .999 |
| 72139 | .38 | 8.100 | 3.900 | 6.500 | 4.600 | .553 | 0.0000 | .625 | 951.0 | .997 |
| 72140 | .02 | 17.000 | 7.400 | 13.400 | 6.300 | .605 | 0.0000 | .627 | 954.0 | .995 |
| 72141 | .82 | 14.100 | 9.300 | 12.300 | 9.200 | .365 | 0.0000 | .628 | 957.0 | .993 |
| 72142 | .51 | 8.300 | 7.900 | 8.200 | 8.000 | .113 | 0.0000 | .629 | 960.0 | .991 |
| 72143 | .12 | 11.000 | 8.000 | 9.900 | 9.000 | .258 | 0.0000 | .630 | 963.0 | .989 |
| 72144 | 0.00 | 9.800 | 5.400 | 8.200 | 4.700 | .442 | 0.0000 | .631 | 966.0 | .987 |
| 72145 | 0.00 | 13.300 | 3.500 | 9.700 | 4.300 | .666 | 0.0000 | .632 | 968.0 | .986 |
| 72146 | 0.00 | 17.300 | 6.000 | 13.200 | 6.800 | .612 | 0.0000 | .633 | 971.0 | .984 |
| 72147 | 0.00 | 23.000 | 9.200 | 18.000 | 8.500 | .637 | 0.0000 | .634 | 973.0 | .983 |
| 72148 | 0.00 | 25.800 | 11.100 | 20.400 | 10.200 | .610 | 0.0000 | .635 | 975.0 | .981 |
| 72149 | 0.00 | 27.500 | 14.500 | 22.800 | 12.300 | .642 | 0.0000 | .636 | 978.0 | .980 |
| 72150 | 0.00 | 21.800 | 13.200 | 18.700 | 9.300 | .621 | 0.0000 | .637 | 980.0 | .978 |
| 72151 | 0.00 | 21.200 | 11.300 | 17.600 | 9.600 | .660 | 0.0000 | .638 | 982.0 | .977 |
| 72152 | 0.00 | 17.200 | 10.100 | 14.600 | 8.400 | .698 | 0.0000 | .639 | 984.0 | .976 |
| 72153 | 0.00 | 18.500 | 8.900 | 15.000 | 8.400 | .717 | 0.0000 | .639 | 985.0 | .974 |
| 72154 | .04 | 20.400 | 11.100 | 17.100 | 10.000 | .677 | 0.0000 | .640 | 987.0 | .973 |
| 72155 | .02 | 16.200 | 11.400 | 14.500 | 9.600 | .696 | 0.0000 | .641 | 989.0 | .972 |
| 72156 | 0.00 | 19.700 | 9.700 | 16.100 | 10.100 | .670 | 0.0000 | .641 | 990.0 | .971 |
| 72157 | 0.00 | 22.100 | 12.100 | 18.500 | 12.100 | .675 | 0.0000 | .642 | 992.0 | .970 |
| 72158 | 0.00 | 21.200 | 13.100 | 18.300 | 13.600 | .505 | 0.0000 | .643 | 993.0 | .969 |
| 72159 | .03 | 19.700 | 14.700 | 17.900 | 14.500 | .408 | 0.0000 | .643 | 994.0 | .968 |
| 72160 | .12 | 18.800 | 12.200 | 16.400 | 14.000 | .576 | 0.0000 | .644 | 995.0 | .968 |
| 72161 | .35 | 12.300 | 8.300 | 10.900 | 9.600 | .343 | 0.0000 | .644 | 997.0 | .967 |
| 72162 | .25 | 8.500 | 5.100 | 7.300 | 6.200 | .498 | 0.0000 | .644 | 997.0 | .966 |
| 72163 | .04 | 12.400 | 6.000 | 10.100 | 6.900 | .633 | 0.0000 | .645 | 998.0 | .966 |
| 72164 | 0.00 | 15.900 | 6.500 | 12.600 | 7.400 | .704 | 0.0000 | .645 | 999.0 | .965 |
| 72165 | 0.00 | 19.400 | 9.500 | 15.900 | 9.700 | .698 | 0.0000 | .645 | 1000.0 | .965 |
| 72166 | 0.00 | 19.200 | 11.500 | 16.500 | 11.200 | .691 | 0.0000 | .645 | 1000.0 | .964 |
| 72167 | 0.00 | 13.400 | 11.500 | 12.700 | 10.200 | .310 | 0.0000 | .646 | 1001.0 | .964 |
| 72168 | 0.00 | 13.800 | 8.100 | 11.800 | 8.400 | .374 | 0.0000 | .646 | 1001.0 | .963 |
| 72169 | 0.00 | 17.800 | 7.200 | 14.000 | 7.100 | .729 | 0.0000 | .646 | 1001.0 | .963 |
| 72170 | 0.00 | 18.500 | 6.900 | 14.400 | 9.100 | .722 | 0.0000 | .646 | 1002.0 | .963 |
| 72171 | 0.00 | 20.700 | 9.700 | 16.800 | 9.600 | .709 | 0.0000 | .646 | 1002.0 | .963 |
| 72172 | 0.00 | 18.700 | 9.700 | 15.500 | 8.800 | .742 | 0.0000 | .646 | 1002.0 | .963 |
| 72173 | 0.00 | 17.700 | 9.500 | 14.800 | 8.600 | .761 | 0.0000 | .646 | 1002.0 | .963 |
| 72174 | 0.00 | 17.200 | 9.000 | 14.300 | 6.800 | .735 | 0.0000 | .646 | 1001.0 | .963 |
| 72175 | 0.00 | 12.000 | 9.300 | 11.000 | 6.900 | .401 | 0.0000 | .645 | 1001.0 | .963 |
| 72176 | .07 | 10.600 | 8.600 | 9.900 | 7.400 | .233 | 0.0000 | .645 | 1001.0 | .963 |
| 72177 | 0.00 | 13.300 | 7.900 | 11.400 | 8.500 | .491 | 0.0000 | .645 | 1000.0 | .963 |
| 72178 | 0.00 | 15.300 | 8.600 | 12.900 | 9.400 | .517 | 0.0000 | .645 | 1000.0 | .964 |
| 72179 | 0.00 | 21.800 | 9.800 | 17.500 | 10.100 | .718 | 0.0000 | .644 | 999.0 | .964 |
| 72180 | 0.00 | 23.800 | 10.700 | 19.100 | 9.900 | .705 | 0.0000 | .644 | 998.0 | .964 |
| 72181 | 0.00 | 23.900 | 11.400 | 19.400 | 11.000 | .713 | 0.0000 | .643 | 997.0 | .965 |
| 72182 | 0.00 | 22.300 | 12.600 | 18.800 | 11.000 | .687 | 0.0000 | .643 | 996.0 | .965 |
| 72183 | 0.00 | 23.200 | 11.800 | 19.100 | 10.400 | .701 | 0.0000 | .642 | 995.0 | .966 |
| 72184 | 0.00 | 24.800 | 13.800 | 20.900 | 4.100 | .694 | 0.0000 | .642 | 994.0 | .967 |
| 72185 | 0.00 | 27.300 | 14.600 | 22.700 | 7.000 | .644 | 0.0000 | .641 | 993.0 | .967 |
| 72186 | 0.00 | 27.400 | 15.500 | 23.100 | 10.400 | .631 | 0.0000 | .641 | 991.0 | .968 |
| 72187 | 0.00 | 26.100 | 15.700 | 22.400 | 12.700 | .632 | 0.0000 | .640 | 990.0 | .969 |
| 72188 | 0.00 | 20.100 | 11.700 | 17.100 | 10.600 | .659 | 0.0000 | .639 | 988.0 | .970 |
| 72189 | 0.00 | 20.300 | 10.300 | 16.700 | 8.000 | .692 | 0.0000 | .638 | 987.0 | .971 |
| 72190 | 0.00 | 13.100 | 9.700 | 11.900 | 7.800 | .602 | 0.0000 | .637 | 985.0 | .972 |
| 72191 | 0.00 | 16.900 | 8.100 | 13.700 | 7.200 | .726 | 0.0000 | .637 | 983.0 | .973 |
| 72192 | 0.00 | 19.300 | 10.000 | 15.900 | 7.300 | .655 | 0.0000 | .636 | 981.0 | .974 |
| 72193 | 0.00 | 22.700 | 15.400 | 20.000 | 12.000 | .577 | 0.0000 | .635 | 979.0 | .975 |
| 72194 | 0.00 | 25.000 | 15.100 | 21.400 | 11.100 | .651 | 0.0000 | .634 | 977.0 | .976 |
| 72195 | 0.00 | 25.300 | 18.400 | 22.800 | 13.600 | .599 | 0.0000 | .633 | 975.0 | .978 |
| 72196 | 0.00 | 25.000 | 15.100 | 21.400 | 12.900 | .633 | 0.0000 | .632 | 973.0 | .979 |
| 72197 | 0.00 | 27.000 | 15.100 | 23.000 | 13.600 | .647 | 0.0000 | .631 | 970.0 | .981 |
| 72198 | 0.00 | 28.300 | 16.500 | 23.900 | 12.700 | .635 | 0.0000 | .630 | 968.0 | .982 |
| 72199 | 0.00 | 28.500 | 16.900 | 24.200 | 12.700 | .644 | 0.0000 | .628 | 965.0 | .984 |
| 72200 | 0.00 | 22.600 | 13.500 | 19.200 | 8.700 | .691 | 0.0000 | .627 | 963.0 | .985 |
| 72201 | 0.00 | 22.000 | 11.900 | 18.200 | 5.400 | .692 | 0.0000 | .626 | 960.0 | .987 |
| 72202 | 0.00 | 19.200 | 9.500 | 15.600 | 6.300 | .493 | 0.0000 | .625 | 957.0 | .989 |
| 72203 | 0.00 | 21.100 | 10.800 | 17.200 | 7.200 | .354 | 0.0000 | .623 | 954.0 | .990 |
| 72204 | 0.00 | 23.900 | 12.300 | 19.500 | 7.900 | .643 | 0.0000 | .622 | 951.0 | .992 |
| 72205 | 0.00 | 22.700 | 14.700 | 19.700 | 8.800 | .631 | 0.0000 | .621 | 948.0 | .994 |
| 72206 | 0.00 | 22.600 | 13.300 | 19.100 | 9.800 | .653 | 0.0000 | .619 | 945.0 | .996 |
| 72207 | 0.00 | 21.500 | 11.500 | 17.700 | 9.700 | .647 | 0.0000 | .618 | 941.0 | .998 |
| 72208 | 0.00 | 20.500 | 11.200 | 16.900 | 9.300 | .710 | 0.0000 | .616 | 938.0 | 1.000 |
| 72209 | 0.00 | 23.400 | 11.500 | 18.600 | 9.000 | .678 | 0.0000 | .615 | 935.0 | 1.002 |
| 72210 | 0.00 | 25.400 | 13.900 | 20.900 | 11.400 | .673 | 0.0000 | .613 | 931.0 | 1.004 |
| 72211 | 0.00 | 25.600 | 15.200 | 21.600 | 11.700 | .648 | 0.0000 | .611 | 927.0 | 1.007 |
| 72212 | 0.00 | 27.400 | 15.400 | 22.700 | 11.100 | .663 | 0.0000 | .610 | 924.0 | 1.009 |
| 72213 | 0.00 | 22.700 | 14.200 | 19.400 | 10.700 | .658 | 0.0000 | .608 | 920.0 | 1.011 |
| 72214 | 0.00 | 21.500 | 11.900 | 17.700 | 9.800 | .708 | 0.0000 | .606 | 916.0 | 1.014 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 72215 | 0.00 | 20.600 | 10.100 | 16.400 | 8.600 | .716 | 0.0000 | .605 | 912.0 | 1.016 |
| 72216 | 0.00 | 25.500 | 12.700 | 20.400 | 9.400 | .663 | 0.0000 | .603 | 908.0 | 1.019 |
| 72217 | 0.00 | 26.000 | 14.300 | 21.300 | 10.600 | .679 | 0.0000 | .601 | 904.0 | 1.021 |
| 72218 | 0.00 | 28.200 | 16.200 | 23.400 | 12.300 | .654 | 0.0000 | .599 | 900.0 | 1.024 |
| 72219 | 0.00 | 29.800 | 17.800 | 25.000 | 13.200 | .642 | 0.0000 | .597 | 896.0 | 1.026 |
| 72220 | 0.00 | 30.500 | 18.400 | 25.600 | 12.900 | .629 | 0.0000 | .596 | 891.0 | 1.029 |
| 72221 | 0.00 | 28.000 | 18.100 | 24.000 | 12.400 | .519 | 0.0000 | .594 | 887.0 | 1.032 |
| 72222 | 0.00 | 26.800 | 15.800 | 22.700 | 11.700 | .648 | 0.0000 | .592 | 882.0 | 1.035 |
| 72223 | 0.00 | 25.200 | 14.200 | 20.700 | 10.200 | .678 | 0.0000 | .590 | 878.0 | 1.038 |
| 72224 | 0.00 | 21.300 | 11.800 | 17.400 | 8.300 | .666 | 0.0000 | .588 | 873.0 | 1.041 |
| 72225 | 0.00 | 18.100 | 9.400 | 14.500 | 7.000 | .711 | 0.0000 | .586 | 869.0 | 1.044 |
| 72226 | 0.00 | 18.300 | 9.700 | 14.700 | 5.700 | .685 | 0.0000 | .584 | 864.0 | 1.047 |
| 72227 | 0.00 | 16.800 | 10.400 | 14.100 | 7.000 | .530 | 0.0000 | .582 | 859.0 | 1.050 |
| 72228 | .15 | 13.500 | 10.300 | 12.200 | 8.300 | .352 | 0.0000 | .580 | 854.0 | 1.053 |
| 72229 | .84 | 13.900 | 9.200 | 11.900 | 9.600 | .397 | 0.0000 | .577 | 849.0 | 1.056 |
| 72230 | .06 | 15.100 | 9.200 | 12.600 | 9.700 | .630 | 0.0000 | .575 | 844.0 | 1.060 |
| 72231 | 0.00 | 17.500 | 8.600 | 13.700 | 9.300 | .509 | 0.0000 | .573 | 839.0 | 1.063 |
| 72232 | 0.00 | 20.900 | 12.400 | 17.300 | 11.200 | .686 | 0.0000 | .571 | 834.0 | 1.066 |
| 72233 | 0.00 | 18.600 | 12.800 | 16.100 | 10.700 | .491 | 0.0000 | .569 | 828.0 | 1.070 |
| 72234 | 0.00 | 20.100 | 12.100 | 16.600 | 11.300 | .574 | 0.0000 | .566 | 823.0 | 1.073 |
| 72235 | 0.00 | 19.400 | 12.200 | 16.300 | 9.900 | .613 | 0.0000 | .564 | 818.0 | 1.077 |
| 72236 | 0.00 | 21.800 | 10.500 | 16.900 | 9.400 | .652 | 0.0000 | .562 | 812.0 | 1.081 |
| 72237 | 0.00 | 21.600 | 12.600 | 17.600 | 11.500 | .588 | 0.0000 | .560 | 807.0 | 1.084 |
| 72238 | 0.00 | 24.700 | 13.800 | 19.900 | 12.000 | .598 | 0.0000 | .557 | 801.0 | 1.088 |
| 72239 | 0.00 | 26.500 | 15.300 | 21.500 | 11.900 | .586 | 0.0000 | .555 | 796.0 | 1.092 |
| 72240 | 0.00 | 29.000 | 16.300 | 23.300 | 11.900 | .542 | 0.0000 | .553 | 790.0 | 1.096 |
| 72241 | 0.00 | 28.000 | 16.800 | 23.000 | 13.200 | .538 | 0.0000 | .550 | 784.0 | 1.100 |
| 72242 | 0.00 | 25.500 | 15.200 | 20.800 | 10.700 | .555 | 0.0000 | .548 | 779.0 | 1.104 |
| 72243 | 0.00 | 22.800 | 12.800 | 18.300 | 8.800 | .580 | 0.0000 | .546 | 773.0 | 1.108 |
| 72244 | 0.00 | 24.300 | 11.400 | 18.400 | 4.200 | .576 | 0.0000 | .543 | 767.0 | 1.112 |
| 72245 | 0.00 | 25.900 | 12.800 | 19.900 | 4.100 | .547 | 0.0000 | .541 | 761.0 | 1.116 |
| 72246 | 0.00 | 27.000 | 14.000 | 21.000 | 6.900 | .542 | 0.0000 | .538 | 755.0 | 1.120 |
| 72247 | 0.00 | 25.600 | 13.000 | 19.800 | 6.000 | .575 | 0.0000 | .536 | 749.0 | 1.125 |
| 72248 | 0.00 | 22.700 | 13.800 | 18.500 | 7.900 | .523 | 0.0000 | .534 | 743.0 | 1.129 |
| 72249 | .03 | 16.500 | 13.900 | 15.300 | 9.600 | .424 | 0.0000 | .531 | 737.0 | 1.133 |
| 72250 | 0.00 | 15.900 | 9.800 | 13.000 | 6.600 | .457 | 0.0000 | .529 | 731.0 | 1.138 |
| 72251 | 0.00 | 19.300 | 8.300 | 14.100 | 6.200 | .578 | 0.0000 | .526 | 725.0 | 1.142 |
| 72252 | 0.00 | 17.200 | 9.800 | 13.700 | 7.000 | .596 | 0.0000 | .524 | 719.0 | 1.147 |
| 72253 | .06 | 11.600 | 7.800 | 9.800 | 7.200 | .440 | 0.0000 | .521 | 712.0 | 1.152 |
| 72254 | .20 | 13.300 | 6.200 | 9.900 | 5.500 | .642 | 0.0000 | .519 | 706.0 | 1.156 |
| 72255 | 0.00 | 14.600 | 6.500 | 10.700 | 5.100 | .589 | 0.0000 | .516 | 700.0 | 1.161 |
| 72256 | 0.00 | 15.700 | 8.600 | 12.200 | 5.200 | .576 | 0.0000 | .514 | 694.0 | 1.166 |
| 72257 | 0.00 | 20.800 | 6.900 | 14.000 | 5.200 | .579 | 0.0000 | .511 | 687.0 | 1.171 |
| 72258 | 0.00 | 22.400 | 9.600 | 16.100 | 6.100 | .557 | 0.0000 | .509 | 681.0 | 1.176 |
| 72259 | 0.00 | 22.600 | 8.900 | 15.800 | 8.300 | .527 | 0.0000 | .506 | 675.0 | 1.181 |
| 72260 | 0.00 | 21.000 | 9.800 | 15.400 | 7.000 | .513 | 0.0000 | .504 | 668.0 | 1.186 |
| 72261 | 0.00 | 20.800 | 12.400 | 16.600 | 9.000 | .549 | 0.0000 | .501 | 662.0 | 1.191 |
| 72262 | .18 | 14.100 | 10.800 | 12.400 | 6.800 | .276 | 0.0000 | .499 | 655.0 | 1.197 |
| 72263 | .91 | 7.600 | 7.700 | 7.700 | 4.900 | .344 | 0.0000 | .496 | 649.0 | 1.202 |
| 72264 | .09 | 10.300 | 10.700 | 10.500 | 6.200 | .329 | 0.0000 | .494 | 642.0 | 1.207 |
| 72265 | .77 | 10.900 | 10.100 | 10.500 | 9.100 | .127 | 0.0000 | .491 | 636.0 | 1.213 |
| 72266 | .48 | 7.900 | 8.900 | 8.400 | 7.400 | .383 | 0.0000 | .489 | 630.0 | 1.218 |
| 72267 | .76 | 5.300 | 5.900 | 5.600 | 3.500 | .180 | 0.0000 | .486 | 623.0 | 1.224 |
| 72268 | .78 | 5.100 | 5.300 | 5.200 | 3.000 | .336 | 0.0000 | .484 | 617.0 | 1.230 |
| 72269 | 0.00 | 9.200 | 3.800 | 6.400 | 3.400 | .528 | 0.0000 | .481 | 610.0 | 1.236 |
| 72270 | 0.00 | 9.000 | 1.400 | 5.000 | 1.200 | .522 | 0.0000 | .479 | 604.0 | 1.241 |
| 72271 | 0.00 | 9.900 | 1.600 | 5.600 | 2.800 | .578 | 0.0000 | .476 | 597.0 | 1.247 |
| 72272 | 0.00 | 10.200 | 3.800 | 6.800 | 4.500 | .352 | 0.0000 | .474 | 591.0 | 1.253 |
| 72273 | 0.00 | 14.000 | 6.500 | 10.000 | 7.700 | .548 | 0.0000 | .471 | 584.0 | 1.259 |
| 72274 | 0.00 | 15.300 | 7.100 | 10.900 | 8.400 | .542 | 0.0000 | .469 | 578.0 | 1.265 |
| 72275 | 0.00 | 15.500 | 7.400 | 11.200 | 8.500 | .528 | 0.0000 | .466 | 572.0 | 1.272 |
| 72276 | 0.00 | 15.800 | 7.700 | 11.500 | 9.000 | .521 | 0.0000 | .464 | 565.0 | 1.278 |
| 72277 | 0.00 | 15.300 | 8.100 | 11.400 | 9.200 | .442 | 0.0000 | .462 | 559.0 | 1.284 |
| 72278 | 0.00 | 16.000 | 6.500 | 10.900 | 4.600 | .536 | 0.0000 | .459 | 553.0 | 1.291 |
| 72279 | 0.00 | 13.400 | 1.900 | 7.200 | 1.600 | .538 | 0.0000 | .457 | 546.0 | 1.297 |
| 72280 | 0.00 | 15.800 | 4.700 | 9.700 | -.400 | .523 | 0.0000 | .454 | 540.0 | 1.304 |
| 72281 | 0.00 | 16.400 | 5.200 | 10.300 | 1.500 | .498 | 0.0000 | .452 | 534.0 | 1.310 |
| 72282 | 0.00 | 14.200 | 7.500 | 10.500 | 1.900 | .500 | 0.0000 | .450 | 527.0 | 1.317 |
| 72283 | .04 | 10.000 | 7.900 | 8.800 | 2.800 | .130 | 0.0000 | .447 | 521.0 | 1.324 |
| 72284 | .58 | 7.000 | 6.500 | 6.700 | 1.600 | .150 | 0.0000 | .445 | 515.0 | 1.330 |
| 72285 | .03 | 7.100 | 4.400 | 5.600 | .600 | .404 | 0.0000 | .443 | 509.0 | 1.337 |
| 72286 | 0.00 | 11.600 | 7.300 | 9.200 | 2.900 | .407 | 0.0000 | .440 | 503.0 | 1.344 |
| 72287 | .45 | 11.200 | 7.700 | 9.200 | 8.600 | .257 | 0.0000 | .438 | 497.0 | 1.351 |
| 72288 | .04 | 12.200 | 5.400 | 8.400 | 5.600 | .487 | 0.0000 | .436 | 491.0 | 1.358 |
| 72289 | 0.00 | 10.900 | 4.100 | 7.000 | 4.500 | .490 | 0.0000 | .434 | 485.0 | 1.365 |
| 72290 | 0.00 | 10.600 | 4.400 | 7.100 | 4.600 | .396 | 0.0000 | .431 | 479.0 | 1.373 |
| 72291 | 0.00 | 10.200 | 4.400 | 6.900 | 4.600 | .369 | 0.0000 | .429 | 473.0 | 1.380 |
| 72292 | 0.00 | 13.000 | 5.700 | 8.800 | 6.300 | .439 | 0.0000 | .427 | 467.0 | 1.387 |
| 72293 | 0.00 | 10.600 | 3.200 | 6.300 | 3.500 | .441 | 0.0000 | .425 | 462.0 | 1.395 |
| 72294 | 0.00 | 9.300 | 3.100 | 5.700 | 3.500 | .374 | 0.0000 | .423 | 456.0 | 1.402 |
| 72295 | .06 | 10.300 | 7.100 | 8.400 | 7.500 | .258 | 0.0000 | .420 | 450.0 | 1.410 |
| 72296 | 0.00 | 10.300 | 7.500 | 8.700 | 8.100 | .239 | 0.0000 | .418 | 445.0 | 1.417 |
| 72297 | 0.00 | 8.800 | 3.600 | 5.800 | 4.100 | .441 | 0.0000 | .416 | 439.0 | 1.425 |
| 72298 | 0.00 | 8.800 | 1.400 | 4.500 | 1.600 | .393 | 0.0000 | .414 | 434.0 | 1.433 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 72299 | .07 | 8.900 | 2.200 | 5.000 | 3.400 | .415 | 0.0000 | .412 | 428.0 | 1.440 |
| 72300 | .13 | 5.900 | 3.100 | 4.200 | 3.500 | .315 | 0.0000 | .410 | 423.0 | 1.448 |
| 72301 | .29 | 5.300 | 2.300 | 3.500 | 2.500 | .337 | 0.0000 | .408 | 418.0 | 1.456 |
| 72302 | 1.12 | -.200 | .100 | 0.000 | -.100 | .144 | 0.0000 | .406 | 412.0 | 1.464 |
| 72303 | 0.00 | 2.300 | -1.300 | .100 | -1.200 | .382 | 0.0000 | .404 | 407.0 | 1.472 |
| 72304 | 0.00 | .700 | -3.000 | -1.500 | -2.700 | .362 | 0.0000 | .403 | 402.0 | 1.479 |
| 72305 | 0.00 | 4.400 | .300 | 1.900 | .200 | .301 | 0.0000 | .401 | 397.0 | 1.487 |
| 72306 | 1.14 | 4.800 | 4.000 | 4.300 | 4.300 | .104 | 0.0000 | .399 | 392.0 | 1.495 |
| 72307 | .06 | 8.900 | 5.500 | 6.900 | 6.500 | .304 | 0.0000 | .397 | 388.0 | 1.503 |
| 72308 | .90 | 8.100 | 6.400 | 7.100 | 5.500 | .105 | 0.0000 | .395 | 383.0 | 1.511 |
| 72309 | .88 | 8.000 | 5.900 | 6.700 | 5.400 | .148 | 0.0000 | .394 | 379.0 | 1.519 |
| 72310 | .23 | 6.000 | 3.400 | 4.400 | 2.900 | .351 | 0.0000 | .392 | 374.0 | 1.527 |
| 72311 | .16 | 5.100 | 3.300 | 4.000 | 2.800 | .096 | 0.0000 | .390 | 369.0 | 1.535 |
| 72312 | .39 | 6.600 | 4.600 | 5.400 | 4.400 | .204 | 0.0000 | .389 | 365.0 | 1.543 |
| 72313 | .07 | 5.000 | 2.700 | 3.600 | 3.200 | .366 | 0.0000 | .387 | 360.0 | 1.551 |
| 72314 | .50 | 5.400 | 4.100 | 4.600 | 4.600 | .119 | 0.0000 | .385 | 356.0 | 1.559 |
| 72315 | .25 | 6.500 | 3.600 | 4.700 | 4.500 | .250 | 0.0000 | .384 | 352.0 | 1.567 |
| 72316 | 0.00 | 4.400 | .400 | 1.900 | 1.300 | .360 | 0.0000 | .382 | 348.0 | 1.575 |
| 72317 | 0.00 | 5.100 | 1.300 | 2.700 | 2.200 | .317 | 0.0000 | .381 | 344.0 | 1.583 |
| 72318 | 0.00 | 5.800 | 3.400 | 4.300 | 3.700 | .187 | 0.0000 | .379 | 340.0 | 1.591 |
| 72319 | .12 | 5.200 | 2.900 | 3.800 | 3.300 | .331 | 0.0000 | .378 | 337.0 | 1.599 |
| 72320 | 0.00 | 4.100 | 1.700 | 2.600 | 2.100 | .276 | 0.0000 | .377 | 333.0 | 1.606 |
| 72321 | 0.00 | 6.400 | 3.500 | 4.600 | 4.000 | .167 | 0.0000 | .375 | 329.0 | 1.614 |
| 72322 | .51 | 7.400 | 3.500 | 5.000 | 4.400 | .256 | 0.0000 | .374 | 326.0 | 1.621 |
| 72323 | .08 | 4.500 | 3.400 | 3.800 | 3.600 | .190 | 0.0000 | .373 | 322.0 | 1.629 |
| 72324 | .01 | 5.400 | 3.800 | 4.400 | 3.900 | .202 | 0.0000 | .372 | 319.0 | 1.636 |
| 72325 | 0.00 | 4.900 | 1.800 | 2.900 | 2.500 | .225 | 0.0000 | .370 | 316.0 | 1.644 |
| 72326 | .16 | 3.100 | 2.100 | 2.500 | 2.400 | .237 | 0.0000 | .369 | 313.0 | 1.651 |
| 72327 | .02 | 2.800 | 1.800 | 2.200 | 1.800 | .170 | 0.0000 | .368 | 310.0 | 1.658 |
| 72328 | 0.00 | 3.600 | 2.900 | 3.200 | 2.900 | .261 | 0.0000 | .367 | 307.0 | 1.665 |
| 72329 | .04 | 4.000 | 3.300 | 3.600 | 3.200 | .148 | 0.0000 | .366 | 304.0 | 1.671 |
| 72330 | .61 | 4.300 | 5.800 | 5.300 | 5.000 | .068 | 0.0000 | .365 | 301.0 | 1.678 |
| 72331 | .32 | 7.400 | 4.600 | 5.600 | 5.000 | .149 | 0.0000 | .364 | 299.0 | 1.684 |
| 72332 | 0.00 | .500 | .400 | .400 | .300 | .230 | 0.0000 | .363 | 296.0 | 1.691 |
| 72333 | .23 | 3.300 | 2.800 | 3.000 | 2.900 | .161 | 0.0000 | .363 | 294.0 | 1.697 |
| 72334 | 0.00 | 5.100 | 4.300 | 4.600 | 4.100 | .161 | 0.0000 | .362 | 292.0 | 1.703 |
| 72335 | 0.00 | 1.000 | .400 | .600 | .300 | .265 | 0.0000 | .361 | 290.0 | 1.709 |
| 72336 | 0.00 | .700 | -.900 | -.300 | -.600 | .208 | 0.0000 | .360 | 287.0 | 1.714 |
| 72337 | .74 | 5.500 | 2.300 | 3.500 | 2.200 | .070 | 0.0000 | .359 | 286.0 | 1.719 |
| 72338 | .12 | .600 | -1.900 | -1.000 | -1.200 | .186 | 0.0000 | .359 | 284.0 | 1.724 |
| 72339 | 0.00 | -6.500 | -7.000 | -6.800 | -7.000 | .233 | 0.0000 | .358 | 282.0 | 1.729 |
| 72340 | .64 | -6.400 | -7.000 | -6.800 | -7.000 | .093 | 0.0000 | .358 | 280.0 | 1.734 |
| 72341 | .12 | -7.900 | -7.800 | -7.800 | -7.900 | .097 | 0.0000 | .357 | 279.0 | 1.738 |
| 72342 | .05 | -11.900 | -14.900 | -13.800 | -15.000 | .195 | 0.0000 | .357 | 277.0 | 1.742 |
| 72343 | 0.00 | -14.900 | -15.900 | -15.500 | -16.000 | .234 | 0.0000 | .356 | 276.0 | 1.746 |
| 72344 | 0.00 | -8.600 | -12.900 | -11.400 | -13.000 | .195 | 0.0000 | .356 | 275.0 | 1.750 |
| 72345 | 0.00 | -9.100 | -9.900 | -9.600 | -10.000 | .117 | 0.0000 | .355 | 274.0 | 1.753 |
| 72346 | .10 | -7.800 | -7.600 | -7.700 | -7.800 | .117 | 0.0000 | .355 | 273.0 | 1.756 |
| 72347 | .79 | -2.800 | -3.900 | -3.500 | -3.500 | .098 | 0.0000 | .355 | 272.0 | 1.759 |
| 72348 | 0.00 | -3.300 | -4.200 | -3.300 | -4.000 | .117 | 0.0000 | .355 | 271.0 | 1.761 |
| 72349 | .01 | -7.500 | -6.300 | -6.700 | -7.000 | .196 | 0.0000 | .354 | 270.0 | 1.763 |
| 72350 | .02 | -3.200 | -4.100 | -3.800 | -3.900 | .137 | 0.0000 | .354 | 270.0 | 1.765 |
| 72351 | 1.94 | -1.100 | -1.400 | -1.300 | -1.300 | .078 | 0.0000 | .354 | 269.0 | 1.767 |
| 72352 | 1.97 | -.100 | -.800 | -.600 | -.600 | .078 | 0.0000 | .354 | 269.0 | 1.768 |
| 72353 | .57 | -.100 | -.200 | -.200 | -.300 | .078 | 0.0000 | .354 | 268.0 | 1.769 |
| 72354 | 1.61 | 1.000 | .800 | .900 | .800 | .078 | 0.0000 | .354 | 268.0 | 1.769 |
| 72355 | 1.47 | 1.800 | 2.500 | 2.300 | 2.200 | .078 | 0.0000 | .354 | 268.0 | 1.770 |
| 72356 | 1.00 | 6.300 | 4.100 | 4.900 | 4.800 | .118 | 0.0000 | .354 | 268.0 | 1.769 |
| 72357 | 1.46 | 5.100 | 4.500 | 4.700 | 4.600 | .098 | 0.0000 | .355 | 268.0 | 1.769 |
| 72358 | 1.40 | 3.400 | 3.700 | 3.600 | 3.500 | .117 | 0.0000 | .355 | 269.0 | 1.768 |
| 72359 | .96 | .800 | 1.500 | 1.300 | 1.200 | .078 | 0.0000 | .355 | 269.0 | 1.767 |
| 72360 | 0.00 | 2.700 | -.100 | .800 | .600 | .129 | 0.0000 | .355 | 270.0 | 1.766 |
| 72361 | .36 | 2.900 | 1.500 | 2.000 | 2.000 | .140 | 0.0000 | .356 | 270.0 | 1.764 |
| 72362 | 1.23 | 3.500 | 2.700 | 3.000 | 3.000 | .117 | 0.0000 | .356 | 271.0 | 1.762 |
| 72363 | .29 | 2.300 | .700 | 1.300 | 1.200 | .211 | 0.0000 | .356 | 272.0 | 1.760 |
| 72364 | 0.00 | 1.000 | -.200 | .200 | -.200 | .198 | 0.0000 | .357 | 273.0 | 1.758 |
| 72365 | .39 | 1.300 | .600 | .900 | .400 | .175 | 0.0000 | .357 | 274.0 | 1.755 |
| 72366 | 0.00 | 2.500 | .700 | 1.300 | 1.200 | .209 | 0.0000 | .358 | 274.0 | 1.755 |
| 73001 | .23 | .400 | .300 | .300 | .200 | .233 | 0.0000 | .358 | 275.0 | 1.751 |
| 73002 | .47 | 0.000 | 0.000 | 0.000 | -.100 | .162 | 0.0000 | .359 | 276.0 | 1.747 |
| 73003 | .56 | -.200 | -2.300 | -1.500 | -1.600 | .077 | 0.0000 | .359 | 278.0 | 1.744 |
| 73004 | 0.00 | -5.900 | -6.800 | -6.500 | -6.900 | .154 | 0.0000 | .360 | 279.0 | 1.740 |
| 73005 | .31 | -3.600 | -4.100 | -3.900 | -4.000 | .096 | 0.0000 | .361 | 281.0 | 1.735 |
| 73006 | .08 | -4.200 | -5.400 | -5.000 | -5.000 | .115 | 0.0000 | .361 | 283.0 | 1.731 |
| 73007 | 0.00 | -7.700 | -9.100 | -8.600 | -9.100 | .153 | 0.0000 | .362 | 284.0 | 1.726 |
| 73008 | .04 | -7.000 | -8.800 | -8.100 | -8.100 | .191 | 0.0000 | .363 | 286.0 | 1.721 |
| 73009 | .04 | -3.800 | -5.400 | -4.800 | -5.000 | .153 | 0.0000 | .364 | 288.0 | 1.716 |
| 73010 | .73 | -1.800 | -2.600 | -2.300 | -2.400 | .076 | 0.0000 | .365 | 290.0 | 1.710 |
| 73011 | .38 | -.200 | -.900 | -.600 | -.600 | .057 | 0.0000 | .366 | 293.0 | 1.705 |
| 73012 | 2.09 | 1.000 | .800 | .900 | .800 | .057 | 0.0000 | .367 | 295.0 | 1.699 |
| 73013 | 1.13 | 3.000 | 1.500 | 2.100 | 2.000 | .159 | 0.0000 | .368 | 297.0 | 1.693 |
| 73014 | 0.00 | 3.300 | 1.500 | 2.200 | 2.000 | .260 | 0.0000 | .369 | 300.0 | 1.686 |
| 73015 | .50 | 3.400 | 1.600 | 2.300 | 2.000 | .124 | 0.0000 | .370 | 303.0 | 1.680 |
| 73016 | .98 | 3.800 | 1.900 | 2.600 | 2.500 | .213 | 0.0000 | .371 | 305.0 | 1.673 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 73017 | .30 | 3.300 | 1.500 | 2.200 | 2.000 | .258 | 0.0000 | .372 | 308.0 | 1.667 |
| 73018 | .60 | 3.300 | .100 | 1.300 | 1.200 | .112 | 0.0000 | .373 | 311.0 | 1.660 |
| 73019 | .27 | -.300 | -1.100 | -.800 | -.800 | .078 | 0.0000 | .375 | 314.0 | 1.653 |
| 73020 | .45 | 1.400 | -.300 | .300 | .100 | .055 | 0.0000 | .376 | 317.0 | 1.646 |
| 73021 | 0.00 | 1.700 | -.700 | .100 | -.500 | .088 | 0.0000 | .377 | 321.0 | 1.638 |
| 73022 | 0.00 | -.200 | -2.000 | -1.300 | -1.700 | .165 | 0.0000 | .379 | 324.0 | 1.631 |
| 73023 | 0.00 | -.900 | -2.500 | -1.900 | -2.400 | .208 | 0.0000 | .380 | 327.0 | 1.624 |
| 73024 | .60 | -.100 | -1.000 | -.700 | -.800 | .055 | 0.0000 | .382 | 331.0 | 1.616 |
| 73025 | .10 | -.200 | -2.000 | -1.300 | -1.300 | .207 | 0.0000 | .383 | 335.0 | 1.609 |
| 73026 | 0.00 | -2.400 | -4.600 | -3.800 | -4.400 | .271 | 0.0000 | .385 | 338.0 | 1.601 |
| 73027 | 0.00 | -1.300 | -2.800 | -2.200 | -2.500 | .281 | 0.0000 | .386 | 342.0 | 1.593 |
| 73028 | 0.00 | .300 | -2.300 | -1.300 | -1.800 | .311 | 0.0000 | .388 | 346.0 | 1.585 |
| 73029 | .42 | -1.300 | -2.000 | -1.700 | -1.700 | .086 | 0.0000 | .389 | 350.0 | 1.578 |
| 73030 | .67 | .100 | -1.000 | -.500 | -.600 | .085 | 0.0000 | .391 | 354.0 | 1.570 |
| 73031 | .12 | .600 | -1.800 | -.800 | -1.500 | .254 | 0.0000 | .393 | 358.0 | 1.562 |
| 73032 | 0.00 | .300 | -2.400 | -1.300 | -2.200 | .264 | 0.0000 | .394 | 363.0 | 1.554 |
| 73033 | 0.00 | 2.100 | -.800 | .300 | -.500 | .295 | 0.0000 | .396 | 367.0 | 1.546 |
| 73034 | .06 | 2.700 | 0.000 | 1.000 | 1.000 | .230 | 0.0000 | .398 | 372.0 | 1.538 |
| 73035 | .59 | 3.900 | 2.100 | 2.800 | 2.700 | .260 | 0.0000 | .400 | 376.0 | 1.530 |
| 73036 | .24 | 5.900 | 2.900 | 4.100 | 4.000 | .238 | 0.0000 | .402 | 381.0 | 1.522 |
| 73037 | 0.00 | 2.200 | -.600 | .500 | -.400 | .258 | 0.0000 | .404 | 386.0 | 1.514 |
| 73038 | 0.00 | 3.600 | -1.100 | .700 | -.600 | .206 | 0.0000 | .405 | 390.0 | 1.506 |
| 73039 | 0.00 | 5.200 | .300 | 2.300 | 1.000 | .307 | 0.0000 | .407 | 395.0 | 1.498 |
| 73040 | .12 | 6.100 | 1.300 | 3.300 | 3.200 | .275 | 0.0000 | .409 | 400.0 | 1.490 |
| 73041 | .71 | 4.900 | 1.100 | 2.700 | 2.700 | .314 | 0.0000 | .411 | 405.0 | 1.482 |
| 73042 | .02 | 3.900 | -.600 | 1.200 | -.400 | .373 | 0.0000 | .413 | 411.0 | 1.474 |
| 73043 | .23 | 3.300 | -.300 | 1.100 | 1.000 | .351 | 0.0000 | .415 | 416.0 | 1.466 |
| 73044 | 0.00 | 5.700 | -.500 | 2.000 | -.300 | .380 | 0.0000 | .417 | 421.0 | 1.458 |
| 73045 | .08 | 4.400 | 1.100 | 2.500 | 1.800 | .199 | 0.0000 | .419 | 426.0 | 1.450 |
| 73046 | .05 | 5.800 | 2.500 | 3.900 | 3.000 | .326 | 0.0000 | .422 | 432.0 | 1.443 |
| 73047 | .08 | 7.000 | 3.100 | 4.800 | 3.900 | .314 | 0.0000 | .424 | 437.0 | 1.435 |
| 73048 | .35 | 2.400 | 3.000 | 2.700 | 2.500 | .254 | 0.0000 | .426 | 443.0 | 1.427 |
| 73049 | 0.00 | 3.900 | -.400 | 1.400 | -.600 | .389 | 0.0000 | .428 | 449.0 | 1.420 |
| 73050 | 0.00 | 5.100 | -1.900 | 1.100 | -2.000 | .426 | 0.0000 | .430 | 454.0 | 1.412 |
| 73051 | 0.00 | 7.100 | -1.500 | 2.200 | -1.700 | .424 | 0.0000 | .432 | 460.0 | 1.404 |
| 73052 | 0.00 | 10.400 | -1.100 | 3.800 | -1.100 | .421 | 0.0000 | .435 | 466.0 | 1.397 |
| 73053 | 0.00 | 5.900 | -.500 | 2.200 | -.800 | .353 | 0.0000 | .437 | 472.0 | 1.390 |
| 73054 | 0.00 | 6.100 | -.300 | 2.500 | -.200 | .399 | 0.0000 | .439 | 478.0 | 1.382 |
| 73055 | .15 | 9.600 | 3.900 | 6.400 | 5.300 | .198 | 0.0000 | .441 | 484.0 | 1.375 |
| 73056 | .20 | 9.000 | 5.300 | 6.900 | 6.900 | .300 | 0.0000 | .444 | 490.0 | 1.368 |
| 73057 | .37 | 6.200 | 4.900 | 5.500 | 5.400 | .121 | 0.0000 | .446 | 496.0 | 1.360 |
| 73058 | .08 | 7.800 | 5.400 | 6.500 | 6.000 | .363 | 0.0000 | .448 | 502.0 | 1.353 |
| 73059 | .80 | 6.300 | 4.800 | 5.500 | 5.300 | .129 | 0.0000 | .451 | 508.0 | 1.346 |
| 73060 | .77 | 2.700 | 1.900 | 2.300 | 2.200 | .212 | 0.0000 | .453 | 514.0 | 1.339 |
| 73061 | .02 | 5.100 | 1.200 | 3.000 | 2.000 | .475 | 0.0000 | .456 | 520.0 | 1.332 |
| 73062 | .24 | 3.400 | 1.500 | 2.400 | 2.200 | .218 | 0.0000 | .458 | 527.0 | 1.326 |
| 73063 | .19 | 3.900 | 1.800 | 2.800 | 2.700 | .426 | 0.0000 | .460 | 533.0 | 1.319 |
| 73064 | .07 | 5.100 | 3.100 | 4.000 | 4.000 | .423 | 0.0000 | .463 | 539.0 | 1.312 |
| 73065 | .19 | 6.000 | 3.300 | 4.600 | 4.000 | .323 | 0.0000 | .465 | 546.0 | 1.306 |
| 73066 | 0.00 | 7.500 | 3.200 | 5.200 | 4.000 | .454 | 0.0000 | .468 | 552.0 | 1.299 |
| 73067 | 0.00 | 8.100 | 3.900 | 5.900 | 3.900 | .514 | 0.0000 | .470 | 559.0 | 1.292 |
| 73068 | .13 | 5.800 | 4.800 | 5.300 | 5.300 | .255 | 0.0000 | .473 | 565.0 | 1.286 |
| 73069 | 1.29 | 4.100 | 1.800 | 2.900 | 2.700 | .368 | 0.0000 | .475 | 572.0 | 1.280 |
| 73070 | .03 | 3.500 | -.400 | 1.400 | .200 | .550 | 0.0000 | .477 | 578.0 | 1.273 |
| 73071 | .40 | 1.800 | -.200 | .700 | .600 | .243 | 0.0000 | .480 | 585.0 | 1.267 |
| 73072 | .36 | 1.800 | -.600 | .500 | .100 | .389 | 0.0000 | .482 | 591.0 | 1.261 |
| 73073 | 0.00 | 3.500 | -.100 | 1.600 | .400 | .464 | 0.0000 | .485 | 598.0 | 1.255 |
| 73074 | 0.00 | 7.700 | .100 | 3.800 | .500 | .522 | 0.0000 | .487 | 604.0 | 1.249 |
| 73075 | .44 | 2.300 | -.600 | .800 | .600 | .145 | 0.0000 | .490 | 611.0 | 1.243 |
| 73076 | .19 | 1.000 | -1.100 | 0.000 | -.100 | .474 | 0.0000 | .492 | 617.0 | 1.237 |
| 73077 | .29 | 3.400 | 1.000 | 2.200 | 2.000 | .412 | 0.0000 | .495 | 624.0 | 1.231 |
| 73078 | .46 | .100 | .300 | .200 | .200 | .126 | 0.0000 | .497 | 630.0 | 1.226 |
| 73079 | .11 | 2.000 | .900 | 1.500 | 1.000 | .133 | 0.0000 | .500 | 637.0 | 1.220 |
| 73080 | .06 | 3.800 | 1.600 | 2.700 | 1.700 | .389 | 0.0000 | .503 | 644.0 | 1.215 |
| 73081 | .07 | 5.300 | .400 | 2.900 | .200 | .536 | 0.0000 | .505 | 650.0 | 1.209 |
| 73082 | 0.00 | 8.000 | -.900 | 3.600 | -.500 | .591 | 0.0000 | .508 | 657.0 | 1.204 |
| 73083 | 0.00 | 9.900 | 2.200 | 6.100 | 2.500 | .547 | 0.0000 | .510 | 663.0 | 1.198 |
| 73084 | 0.00 | 7.900 | 1.900 | 5.000 | 2.500 | .414 | 0.0000 | .513 | 670.0 | 1.193 |
| 73085 | 0.00 | 4.200 | .500 | 2.400 | -.800 | .599 | 0.0000 | .515 | 676.0 | 1.188 |
| 73086 | .23 | 2.200 | .400 | 1.300 | 1.200 | .338 | 0.0000 | .518 | 683.0 | 1.183 |
| 73087 | .09 | 3.300 | -.500 | 1.400 | 1.300 | .481 | 0.0000 | .520 | 689.0 | 1.178 |
| 73088 | .12 | 4.200 | .500 | 2.400 | 1.100 | .414 | 0.0000 | .523 | 695.0 | 1.172 |
| 73089 | .81 | 4.000 | 1.800 | 3.000 | 3.000 | .238 | 0.0000 | .525 | 702.0 | 1.168 |
| 73090 | .19 | 2.800 | .400 | 1.700 | 1.700 | .419 | 0.0000 | .527 | 708.0 | 1.163 |
| 73091 | .09 | 3.500 | .200 | 1.900 | 1.700 | .558 | 0.0000 | .530 | 715.0 | 1.158 |
| 73092 | .02 | 7.500 | .500 | 4.200 | 2.000 | .634 | 0.0000 | .532 | 721.0 | 1.153 |
| 73093 | .04 | 10.500 | .800 | 6.000 | 2.000 | .639 | 0.0000 | .535 | 727.0 | 1.148 |
| 73094 | 0.00 | 12.200 | 2.800 | 7.900 | 3.700 | .628 | 0.0000 | .537 | 733.0 | 1.144 |
| 73095 | 0.00 | 12.100 | 3.000 | 7.900 | 3.700 | .532 | 0.0000 | .540 | 740.0 | 1.139 |
| 73096 | 0.00 | 8.600 | 1.200 | 5.200 | .900 | .623 | 0.0000 | .542 | 746.0 | 1.135 |
| 73097 | 0.00 | 12.300 | .500 | 6.900 | -2.300 | .659 | 0.0000 | .544 | 752.0 | 1.130 |
| 73098 | 0.00 | 13.800 | 3.400 | 9.100 | 1.300 | .571 | 0.0000 | .547 | 758.0 | 1.126 |
| 73099 | 0.00 | 13.500 | 4.500 | 9.400 | 2.700 | .539 | 0.0000 | .549 | 764.0 | 1.122 |
| 73100 | 0.00 | 14.600 | 4.700 | 10.200 | 4.100 | .574 | 0.0000 | .552 | 770.0 | 1.117 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 73101 | 0.00 | 14.400 | 4.100 | 9.800 | 4.100 | .587 | 0.0000 | .554 | 776.0 | 1.113 |
| 73102 | .41 | 9.500 | 4.700 | 7.400 | 6.300 | .390 | 0.0000 | .556 | 782.0 | 1.109 |
| 73103 | .03 | 8.300 | 5.700 | 7.200 | 7.100 | .335 | 0.0000 | .559 | 788.0 | 1.105 |
| 73104 | 0.00 | 8.600 | 5.300 | 7.200 | 5.500 | .564 | 0.0000 | .561 | 793.0 | 1.101 |
| 73105 | 0.00 | 10.200 | 5.300 | 8.100 | 4.400 | .577 | 0.0000 | .563 | 799.0 | 1.097 |
| 73106 | 1.23 | 6.500 | 4.200 | 5.500 | 5.500 | .170 | 0.0000 | .565 | 805.0 | 1.093 |
| 73107 | .71 | 2.000 | 1.000 | 1.600 | 1.600 | .513 | 0.0000 | .568 | 810.0 | 1.089 |
| 73108 | 1.22 | .500 | -1.000 | -.100 | -.200 | .278 | 0.0000 | .570 | 816.0 | 1.085 |
| 73109 | .20 | 3.500 | .600 | 2.300 | 2.200 | .597 | 0.0000 | .572 | 821.0 | 1.082 |
| 73110 | .02 | 6.800 | 1.000 | 4.300 | 2.400 | .661 | 0.0000 | .574 | 827.0 | 1.078 |
| 73111 | 0.00 | 10.000 | 2.100 | 6.700 | 3.900 | .709 | 0.0000 | .576 | 832.0 | 1.074 |
| 73112 | 0.00 | 10.100 | 5.500 | 8.200 | 6.400 | .440 | 0.0000 | .578 | 837.0 | 1.071 |
| 73113 | .01 | 8.000 | 2.900 | 5.900 | 2.900 | .394 | 0.0000 | .581 | 843.0 | 1.067 |
| 73114 | 0.00 | 12.000 | 3.500 | 8.500 | 3.300 | .658 | 0.0000 | .583 | 848.0 | 1.064 |
| 73115 | 0.00 | 15.300 | 6.000 | 11.400 | 5.800 | .641 | 0.0000 | .585 | 853.0 | 1.061 |
| 73116 | 0.00 | 16.200 | 5.800 | 12.300 | 6.700 | .639 | 0.0000 | .587 | 858.0 | 1.057 |
| 73117 | 0.00 | 10.800 | 4.500 | 8.200 | 2.300 | .580 | 0.0000 | .589 | 863.0 | 1.054 |
| 73118 | 0.00 | 7.600 | 0.000 | 4.500 | -.500 | .592 | 0.0000 | .591 | 868.0 | 1.051 |
| 73119 | 0.00 | 8.500 | .500 | 5.200 | -.600 | .583 | 0.0000 | .593 | 872.0 | 1.048 |
| 73120 | 0.00 | 12.100 | 1.800 | 7.900 | .300 | .595 | 0.0000 | .595 | 877.0 | 1.045 |
| 73121 | 0.00 | 15.800 | 6.000 | 11.800 | 6.000 | .594 | 0.0000 | .596 | 882.0 | 1.042 |
| 73122 | 0.00 | 13.700 | 8.000 | 11.400 | 8.000 | .390 | 0.0000 | .598 | 886.0 | 1.039 |
| 73123 | .13 | 10.400 | 6.100 | 8.700 | 7.100 | .444 | 0.0000 | .600 | 891.0 | 1.036 |
| 73124 | .03 | 6.700 | 6.700 | 6.700 | 6.600 | .284 | 0.0000 | .602 | 895.0 | 1.033 |
| 73125 | 0.00 | 11.600 | 9.000 | 10.600 | 9.000 | .614 | 0.0000 | .604 | 900.0 | 1.030 |
| 73126 | 0.00 | 9.800 | 8.600 | 9.300 | 8.800 | .557 | 0.0000 | .606 | 904.0 | 1.027 |
| 73127 | .05 | 9.200 | 7.700 | 8.600 | 8.500 | .357 | 0.0000 | .607 | 908.0 | 1.025 |
| 73128 | .53 | 10.700 | 7.300 | 9.400 | 8.300 | .458 | 0.0000 | .609 | 912.0 | 1.022 |
| 73129 | .08 | 9.600 | 5.200 | 7.900 | 6.300 | .525 | 0.0000 | .611 | 916.0 | 1.019 |
| 73130 | .07 | 11.700 | 3.900 | 8.700 | 4.500 | .624 | 0.0000 | .612 | 920.0 | 1.017 |
| 73131 | 0.00 | 16.000 | 12.000 | 14.500 | 12.000 | .735 | 0.0000 | .614 | 924.0 | 1.014 |
| 73132 | 0.00 | 19.000 | 14.000 | 17.100 | 14.000 | .734 | 0.0000 | .615 | 928.0 | 1.012 |
| 73133 | 0.00 | 22.000 | 17.000 | 20.100 | 17.000 | .754 | 0.0000 | .617 | 931.0 | 1.010 |
| 73134 | 0.00 | 27.000 | 17.000 | 23.200 | 13.100 | .445 | 0.0000 | .618 | 935.0 | 1.007 |
| 73135 | 0.00 | 23.500 | 13.600 | 19.700 | 13.600 | .585 | 0.0000 | .620 | 938.0 | 1.005 |
| 73136 | 0.00 | 23.800 | 13.000 | 19.700 | 13.300 | .604 | 0.0000 | .621 | 942.0 | 1.003 |
| 73137 | 0.00 | 23.900 | 12.500 | 19.600 | 11.900 | .642 | 0.0000 | .623 | 945.0 | 1.001 |
| 73138 | 0.00 | 21.000 | 10.700 | 17.100 | 10.500 | .648 | 0.0000 | .624 | 948.0 | .999 |
| 73139 | 0.00 | 16.200 | 8.900 | 13.500 | 8.000 | .613 | 0.0000 | .625 | 951.0 | .997 |
| 73140 | 0.00 | 11.400 | 5.300 | 9.100 | 2.600 | .598 | 0.0000 | .627 | 954.0 | .995 |
| 73141 | 0.00 | 16.000 | 4.200 | 11.600 | 5.300 | .756 | 0.0000 | .628 | 957.0 | .993 |
| 73142 | 0.00 | 16.200 | 6.700 | 12.700 | 7.500 | .735 | .3500 | .629 | 960.0 | .991 |
| 73143 | .51 | 13.900 | 10.100 | 12.500 | 12.500 | .324 | .1700 | .630 | 963.0 | .989 |
| 73144 | .90 | 7.500 | 7.300 | 7.400 | 7.400 | .198 | .2200 | .631 | 966.0 | .987 |
| 73145 | .01 | 7.600 | 2.000 | 5.500 | 4.400 | .719 | .2100 | .632 | 968.0 | .986 |
| 73146 | 0.00 | 11.900 | 2.000 | 8.300 | 3.200 | .777 | .3600 | .633 | 971.0 | .984 |
| 73147 | 0.00 | 12.400 | 4.200 | 9.400 | 8.300 | .407 | .2600 | .634 | 973.0 | .983 |
| 73148 | 0.00 | 20.200 | 6.500 | 15.200 | 9.500 | .761 | .3300 | .635 | 975.0 | .981 |
| 73149 | 0.00 | 24.500 | 9.100 | 18.900 | 11.500 | .727 | .3200 | .636 | 978.0 | .980 |
| 73150 | 0.00 | 17.500 | 9.500 | 14.600 | 11.100 | .576 | .3500 | .637 | 980.0 | .978 |
| 73151 | 0.00 | 13.600 | 4.500 | 10.300 | 5.500 | .836 | .4300 | .638 | 982.0 | .977 |
| 73152 | 0.00 | 13.200 | 4.800 | 10.200 | 5.300 | .802 | .4000 | .639 | 984.0 | .976 |
| 73153 | 0.00 | 14.000 | 7.400 | 11.600 | 6.500 | .756 | .1500 | .639 | 985.0 | .974 |
| 73154 | 0.00 | 15.900 | 7.100 | 12.700 | 8.600 | .664 | .3500 | .640 | 987.0 | .973 |
| 73155 | 0.00 | 18.800 | 7.600 | 14.800 | 8.600 | .787 | .3900 | .641 | 989.0 | .972 |
| 73156 | 0.00 | 22.200 | 10.500 | 18.000 | 9.700 | .767 | .4000 | .641 | 990.0 | .971 |
| 73157 | 0.00 | 21.500 | 14.200 | 18.900 | 10.300 | .746 | .4700 | .642 | 992.0 | .970 |
| 73158 | 0.00 | 19.800 | 12.800 | 17.300 | 9.300 | .713 | .4300 | .643 | 993.0 | .969 |
| 73159 | 0.00 | 19.600 | 10.000 | 16.200 | 11.400 | .732 | .3800 | .643 | 994.0 | .968 |
| 73160 | 0.00 | 13.900 | 8.100 | 11.800 | 6.400 | .699 | .4200 | .644 | 995.0 | .968 |
| 73161 | 0.00 | 16.100 | 5.600 | 12.400 | 5.900 | .848 | .3400 | .644 | 997.0 | .967 |
| 73162 | 0.00 | 18.900 | 10.400 | 15.900 | 7.900 | .718 | .3300 | .644 | 997.0 | .966 |
| 73163 | .11 | 12.000 | 3.100 | 11.000 | 11.000 | .258 | .2000 | .645 | 998.0 | .966 |
| 73164 | 0.00 | 12.500 | 8.400 | 11.000 | 8.200 | .769 | .3400 | .645 | 999.0 | .965 |
| 73165 | .16 | 9.600 | 6.600 | 8.500 | 7.400 | .594 | .3100 | .645 | 1000.0 | .965 |
| 73166 | .25 | 11.400 | 7.900 | 10.200 | 8.300 | .627 | .2500 | .645 | 1000.0 | .964 |
| 73167 | .97 | 7.800 | 5.900 | 7.100 | 7.000 | .232 | .2700 | .646 | 1001.0 | .964 |
| 73168 | 1.03 | 6.200 | 4.400 | 5.600 | 5.400 | .477 | .2700 | .646 | 1001.0 | .963 |
| 73169 | 0.00 | 13.500 | 6.700 | 11.100 | 7.000 | .671 | .2300 | .646 | 1001.0 | .963 |
| 73170 | 0.00 | 20.200 | 7.500 | 15.700 | 10.300 | .690 | .4700 | .646 | 1002.0 | .963 |
| 73171 | 0.00 | 24.100 | 11.600 | 19.700 | 13.200 | .639 | .3400 | .646 | 1002.0 | .963 |
| 73172 | 0.00 | 24.300 | 14.800 | 20.900 | 16.000 | .516 | .2700 | .646 | 1002.0 | .963 |
| 73173 | 0.00 | 16.900 | 12.300 | 15.300 | 12.900 | .284 | .3700 | .646 | 1002.0 | .963 |
| 73174 | 0.00 | 15.900 | 11.800 | 14.400 | 11.500 | .381 | .3200 | .646 | 1001.0 | .963 |
| 73175 | .02 | 19.100 | 13.300 | 17.000 | 11.800 | .439 | 0.0000 | .645 | 1001.0 | .963 |
| 73176 | .83 | 22.000 | 18.000 | 20.600 | 18.000 | .534 | 0.0000 | .645 | 1001.0 | .963 |
| 73177 | .05 | 22.300 | 16.800 | 20.300 | 17.700 | .581 | .3100 | .645 | 1000.0 | .963 |
| 73178 | 0.00 | 22.800 | 15.100 | 20.100 | 16.500 | .581 | .3600 | .645 | 1000.0 | .964 |
| 73179 | 0.00 | 19.300 | 11.900 | 16.700 | 13.600 | .615 | .3300 | .644 | 999.0 | .964 |
| 73180 | 0.00 | 13.500 | 8.500 | 11.700 | 9.700 | .647 | .3800 | .644 | 998.0 | .964 |
| 73181 | 0.00 | 12.800 | 7.500 | 10.900 | 6.600 | .544 | .2800 | .643 | 997.0 | .965 |
| 73182 | 0.00 | 16.600 | 9.600 | 14.100 | 8.000 | .609 | .3400 | .643 | 996.0 | .965 |
| 73183 | 0.00 | 19.700 | 10.800 | 16.500 | 9.700 | .591 | .3500 | .642 | 995.0 | .966 |
| 73184 | 0.00 | 20.300 | 11.800 | 17.300 | 10.800 | .591 | .4000 | .642 | 994.0 | .967 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 73185 | 0.00 | 20.700 | 13.800 | 18.200 | 12.700 | .572 | .3600 | .641 | 993.0 | .967 |
| 73186 | 0.00 | 17.000 | 14.300 | 16.000 | 11.400 | .566 | .5100 | .641 | 991.0 | .968 |
| 73187 | 0.00 | 16.200 | 11.300 | 14.400 | 9.300 | .501 | .3900 | .640 | 990.0 | .969 |
| 73188 | 0.00 | 18.600 | 10.300 | 15.600 | 8.400 | .561 | .2800 | .639 | 988.0 | .970 |
| 73189 | 0.00 | 19.100 | 11.600 | 16.400 | 10.500 | .568 | .3100 | .638 | 987.0 | .971 |
| 73190 | 0.00 | 21.300 | 12.800 | 18.200 | 12.300 | .569 | .3600 | .637 | 985.0 | .972 |
| 73191 | 0.00 | 19.800 | 11.700 | 16.900 | 12.200 | .556 | .3100 | .637 | 983.0 | .973 |
| 73192 | 0.00 | 17.600 | 10.600 | 15.100 | 10.700 | .583 | .3900 | .636 | 981.0 | .974 |
| 73193 | 0.00 | 19.900 | 12.000 | 17.000 | 11.500 | .782 | .3600 | .635 | 979.0 | .975 |
| 73194 | 0.00 | 20.000 | 8.000 | 15.600 | 7.900 | .727 | .3600 | .634 | 977.0 | .976 |
| 73195 | 0.00 | 24.000 | 20.000 | 22.500 | 8.200 | .738 | .3100 | .633 | 975.0 | .978 |
| 73196 | 0.00 | 24.000 | 19.000 | 22.200 | 19.000 | .633 | 0.0000 | .632 | 973.0 | .979 |
| 73197 | 0.00 | 24.000 | 18.000 | 21.800 | 18.000 | .647 | 0.0000 | .631 | 970.0 | .981 |
| 73198 | 0.00 | 24.000 | 19.000 | 22.100 | 19.000 | .635 | 0.0000 | .630 | 968.0 | .982 |
| 73199 | 0.00 | 24.000 | 21.000 | 22.900 | 21.000 | .644 | 0.0000 | .628 | 965.0 | .984 |
| 73200 | .01 | 20.000 | 17.000 | 18.900 | 17.000 | .691 | 0.0000 | .627 | 963.0 | .985 |
| 73201 | 0.00 | 19.000 | 15.000 | 17.500 | 16.800 | .558 | .5000 | .626 | 960.0 | .987 |
| 73202 | 0.00 | 17.800 | 13.000 | 16.000 | 14.100 | .587 | .2800 | .625 | 957.0 | .989 |
| 73203 | 0.00 | 18.400 | 11.500 | 15.800 | 12.100 | .579 | .3100 | .623 | 954.0 | .990 |
| 73204 | 0.00 | 19.800 | 8.700 | 15.600 | 11.000 | .703 | .3100 | .622 | 951.0 | .992 |
| 73205 | 0.00 | 25.000 | 11.000 | 19.700 | 11.600 | .694 | .3000 | .621 | 948.0 | .994 |
| 73206 | 0.00 | 26.700 | 12.300 | 21.200 | 14.100 | .639 | .2800 | .619 | 945.0 | .996 |
| 73207 | 0.00 | 30.000 | 14.800 | 24.200 | 16.000 | .641 | .2700 | .618 | 941.0 | .998 |
| 73208 | 0.00 | 30.400 | 15.500 | 24.700 | 17.200 | .625 | .3000 | .616 | 938.0 | 1.000 |
| 73209 | 0.00 | 31.600 | 16.200 | 25.700 | 16.700 | .615 | .2700 | .615 | 935.0 | 1.002 |
| 73210 | 0.00 | 30.500 | 15.000 | 24.500 | 16.800 | .617 | .3000 | .613 | 931.0 | 1.004 |
| 73211 | 0.00 | 29.700 | 13.500 | 23.400 | 12.200 | .619 | .3000 | .611 | 927.0 | 1.007 |
| 73212 | 0.00 | 30.200 | 13.800 | 23.800 | 14.200 | .631 | .2900 | .610 | 924.0 | 1.009 |
| 73213 | 0.00 | 29.600 | 14.500 | 23.700 | 9.300 | .622 | .2700 | .608 | 920.0 | 1.011 |
| 73214 | 0.00 | 27.100 | 12.900 | 21.500 | 9.000 | .635 | .2700 | .606 | 916.0 | 1.014 |
| 73215 | 0.00 | 27.700 | 13.200 | 22.000 | 9.100 | .626 | .3000 | .605 | 912.0 | 1.016 |
| 73216 | 0.00 | 27.600 | 13.600 | 22.000 | 15.000 | .638 | .2700 | .603 | 908.0 | 1.019 |
| 73217 | 0.00 | 26.500 | 15.400 | 22.100 | 15.800 | .580 | .2500 | .601 | 904.0 | 1.021 |
| 73218 | 0.00 | 24.700 | 14.300 | 20.500 | 15.200 | .661 | .3600 | .599 | 900.0 | 1.024 |
| 73219 | 0.00 | 26.700 | 12.800 | 21.100 | 11.100 | .614 | .3000 | .597 | 896.0 | 1.026 |
| 73220 | 0.00 | 23.000 | 18.000 | 21.000 | 9.800 | .699 | 0.0000 | .596 | 891.0 | 1.029 |
| 73221 | 0.00 | 19.000 | 18.000 | 18.600 | 9.800 | .713 | 0.0000 | .594 | 887.0 | 1.032 |
| 73222 | 0.00 | 21.000 | 17.000 | 19.400 | 9.100 | .680 | 0.0000 | .592 | 882.0 | 1.035 |
| 73223 | 0.00 | 22.000 | 19.000 | 20.800 | 10.300 | .730 | 0.0000 | .590 | 878.0 | 1.038 |
| 73224 | 0.00 | 23.000 | 20.000 | 21.800 | 10.800 | .738 | 0.0000 | .588 | 873.0 | 1.041 |
| 73225 | 0.00 | 31.000 | 20.000 | 26.400 | 6.800 | .545 | 0.0000 | .586 | 869.0 | 1.044 |
| 73226 | 0.00 | 27.300 | 15.800 | 22.500 | 14.900 | .608 | .2900 | .584 | 864.0 | 1.047 |
| 73227 | 0.00 | 24.800 | 12.100 | 19.500 | 9.900 | .630 | .3000 | .582 | 859.0 | 1.050 |
| 73228 | 0.00 | 16.400 | 10.100 | 13.800 | 4.400 | .693 | .3000 | .580 | 854.0 | 1.053 |
| 73229 | 0.00 | 18.200 | 9.400 | 14.500 | 8.100 | .615 | .3000 | .577 | 849.0 | 1.056 |
| 73230 | 0.00 | 18.400 | 8.200 | 14.100 | 4.100 | .669 | .3000 | .575 | 844.0 | 1.060 |
| 73231 | 0.00 | 22.000 | 9.200 | 16.500 | 7.200 | .547 | .3000 | .573 | 839.0 | 1.063 |
| 73232 | 0.00 | 20.600 | 8.200 | 15.300 | 3.700 | .715 | .3000 | .571 | 834.0 | 1.066 |
| 73233 | 0.00 | 19.200 | 7.500 | 14.200 | 3.700 | .665 | .3000 | .569 | 828.0 | 1.070 |
| 73234 | 0.00 | 17.400 | 5.500 | 12.200 | 1.300 | .659 | .3000 | .566 | 823.0 | 1.073 |
| 73235 | .12 | 15.300 | 6.800 | 11.600 | 1.800 | .619 | .2200 | .564 | 818.0 | 1.077 |
| 73236 | .65 | 12.000 | 9.500 | 10.900 | 10.800 | .305 | .0900 | .562 | 812.0 | 1.081 |
| 73237 | .02 | 16.900 | 9.700 | 13.700 | 5.800 | .582 | .1600 | .560 | 807.0 | 1.084 |
| 73238 | 0.00 | 18.900 | 8.300 | 14.200 | 5.800 | .552 | .2400 | .557 | 801.0 | 1.088 |
| 73239 | 0.00 | 16.200 | 7.100 | 12.200 | 4.000 | .576 | .2400 | .555 | 796.0 | 1.092 |
| 73240 | 0.00 | 20.600 | 9.100 | 15.500 | 5.600 | .589 | .2300 | .553 | 790.0 | 1.096 |
| 73241 | 0.00 | 21.400 | 10.100 | 16.300 | 7.400 | .581 | .2900 | .550 | 784.0 | 1.100 |
| 73242 | 0.00 | 15.500 | 10.500 | 13.200 | 5.000 | .356 | .2200 | .548 | 779.0 | 1.104 |
| 73243 | 0.00 | 14.200 | 6.800 | 10.800 | .200 | .563 | .2800 | .546 | 773.0 | 1.108 |
| 73244 | 0.00 | 17.000 | 3.900 | 11.000 | 4.000 | .709 | .2100 | .543 | 767.0 | 1.112 |
| 73245 | 0.00 | 21.200 | 6.200 | 14.300 | 3.900 | .624 | .1700 | .541 | 761.0 | 1.116 |
| 73246 | 0.00 | 22.500 | 9.000 | 16.300 | 8.500 | .616 | .2100 | .538 | 755.0 | 1.120 |
| 73247 | 0.00 | 28.600 | 11.300 | 20.600 | 7.900 | .479 | .2300 | .536 | 749.0 | 1.125 |
| 73248 | 0.00 | 23.300 | 12.200 | 18.100 | 10.900 | .562 | .3700 | .534 | 743.0 | 1.129 |
| 73249 | .28 | 17.200 | 14.000 | 15.700 | 13.500 | .263 | 0.0000 | .531 | 737.0 | 1.133 |
| 73250 | .21 | 14.000 | 8.000 | 11.200 | 11.100 | .543 | 0.0000 | .529 | 731.0 | 1.138 |
| 73251 | 0.00 | 18.100 | 9.000 | 13.800 | 13.600 | .642 | .2200 | .526 | 725.0 | 1.142 |
| 73252 | 0.00 | 22.800 | 9.800 | 16.600 | 10.300 | .620 | .2200 | .524 | 719.0 | 1.147 |
| 73253 | 0.00 | 25.100 | 12.200 | 18.900 | 12.100 | .540 | .1400 | .521 | 712.0 | 1.152 |
| 73254 | 0.00 | 23.200 | 12.000 | 17.800 | 13.600 | .510 | .2200 | .519 | 706.0 | 1.156 |
| 73255 | 0.00 | 22.600 | 10.300 | 16.700 | 11.100 | .545 | .2100 | .516 | 700.0 | 1.161 |
| 73256 | 0.00 | 18.900 | 8.900 | 14.000 | 9.000 | .547 | .3200 | .514 | 694.0 | 1.166 |
| 73257 | 0.00 | 17.700 | 9.900 | 13.900 | 8.300 | .477 | .1500 | .511 | 687.0 | 1.171 |
| 73258 | 0.00 | 19.100 | 7.100 | 13.200 | 6.000 | .540 | .2000 | .509 | 681.0 | 1.176 |
| 73259 | 0.00 | 18.000 | 8.200 | 13.200 | 6.000 | .543 | .2000 | .506 | 675.0 | 1.181 |
| 73260 | .17 | 17.100 | 9.800 | 13.500 | 10.300 | .335 | .1400 | .504 | 668.0 | 1.186 |
| 73261 | .15 | 14.700 | 11.700 | 13.200 | 13.200 | .324 | .1100 | .501 | 662.0 | 1.191 |
| 73262 | .93 | 12.700 | 10.800 | 11.700 | 11.600 | .163 | .0500 | .499 | 655.0 | 1.197 |
| 73263 | .97 | 12.500 | 10.100 | 11.300 | 11.300 | .340 | 0.0000 | .496 | 649.0 | 1.202 |
| 73264 | .27 | 15.800 | 12.100 | 13.900 | 13.800 | .354 | 0.0000 | .494 | 642.0 | 1.207 |
| 73265 | 1.11 | 13.300 | 11.500 | 12.400 | 12.100 | .293 | .0400 | .491 | 636.0 | 1.213 |
| 73266 | 1.03 | 12.000 | 10.500 | 11.200 | 11.100 | .256 | .1300 | .489 | 630.0 | 1.218 |
| 73267 | 1.69 | 10.600 | 10.200 | 10.400 | 10.300 | .116 | .2300 | .486 | 623.0 | 1.224 |
| 73268 | .02 | 12.000 | 9.000 | 10.500 | 10.000 | .413 | .0700 | .484 | 617.0 | 1.230 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 73269 | 0.00 | 15.000 | 7.000 | 10.800 | 10.300 | .494 | .0800 | .481 | 610.0 | 1.236 |
| 73270 | 0.00 | 19.000 | 9.000 | 13.800 | 13.800 | .470 | .1000 | .479 | 604.0 | 1.241 |
| 73271 | 0.00 | 25.000 | 10.000 | 17.100 | 13.800 | .394 | .1000 | .476 | 597.0 | 1.247 |
| 73272 | 0.00 | 20.000 | 11.000 | 15.300 | 12.800 | .396 | .2100 | .474 | 591.0 | 1.253 |
| 73273 | 0.00 | 13.000 | 8.000 | 10.400 | 7.000 | .279 | .2000 | .471 | 584.0 | 1.259 |
| 73274 | 0.00 | 10.900 | 4.500 | 7.500 | 2.400 | .413 | .1400 | .469 | 578.0 | 1.265 |
| 73275 | 0.00 | 8.800 | 2.300 | 5.300 | 2.500 | .581 | .2100 | .466 | 572.0 | 1.272 |
| 73276 | 0.00 | 10.600 | 3.100 | 6.600 | 4.000 | .567 | .2100 | .464 | 565.0 | 1.278 |
| 73277 | 0.00 | 11.900 | 4.600 | 8.000 | 4.800 | .537 | .1200 | .462 | 559.0 | 1.284 |
| 73278 | 0.00 | 8.600 | 7.200 | 7.800 | 5.600 | .472 | .1300 | .459 | 553.0 | 1.291 |
| 73279 | .28 | 10.600 | 7.800 | 9.100 | 9.100 | .085 | .1600 | .457 | 546.0 | 1.297 |
| 73280 | .07 | 6.000 | 5.600 | 5.800 | 5.800 | .341 | .0500 | .454 | 540.0 | 1.304 |
| 73281 | 0.00 | 7.400 | 3.300 | 5.200 | 3.500 | .462 | .0700 | .452 | 534.0 | 1.310 |
| 73282 | 0.00 | 10.600 | 1.200 | 5.400 | 5.400 | .517 | .1900 | .450 | 527.0 | 1.317 |
| 73283 | 0.00 | 11.600 | 4.400 | 7.600 | 7.500 | .451 | .1200 | .447 | 521.0 | 1.324 |
| 73284 | .11 | 12.400 | 8.400 | 10.200 | 8.100 | .348 | .0700 | .445 | 515.0 | 1.330 |
| 73285 | .01 | 12.700 | 10.000 | 11.200 | 11.100 | .367 | .0900 | .443 | 509.0 | 1.337 |
| 73286 | 0.00 | 14.700 | 8.700 | 11.300 | 8.300 | .475 | .1200 | .440 | 503.0 | 1.344 |
| 73287 | 0.00 | 11.800 | 5.500 | 8.300 | 5.600 | .477 | .1200 | .438 | 497.0 | 1.351 |
| 73288 | 0.00 | 14.200 | 3.900 | 8.400 | 4.800 | .462 | .1300 | .436 | 491.0 | 1.358 |
| 73289 | 0.00 | 12.300 | 5.200 | 8.800 | 6.500 | .411 | .1000 | .434 | 485.0 | 1.365 |
| 73290 | 0.00 | 12.100 | 8.100 | 9.800 | 8.100 | .377 | .0700 | .431 | 479.0 | 1.373 |
| 73291 | 0.00 | 12.700 | 7.700 | 9.800 | 9.100 | .397 | .0600 | .429 | 473.0 | 1.380 |
| 73292 | .56 | 8.600 | 8.300 | 8.400 | 8.300 | .272 | .1500 | .427 | 467.0 | 1.387 |
| 73293 | .33 | 12.000 | 10.900 | 11.400 | 11.300 | .219 | .0300 | .425 | 462.0 | 1.395 |
| 73294 | 1.18 | 9.000 | 8.600 | 8.800 | 8.800 | .200 | .0600 | .423 | 456.0 | 1.402 |
| 73295 | .13 | 9.200 | 6.900 | 7.900 | 7.800 | .185 | .0600 | .420 | 450.0 | 1.410 |
| 73296 | .44 | 7.000 | 6.100 | 6.500 | 6.500 | .111 | .0800 | .418 | 445.0 | 1.417 |
| 73297 | .68 | 7.200 | 4.700 | 5.700 | 5.600 | .167 | .0500 | .416 | 439.0 | 1.425 |
| 73298 | 0.00 | 7.100 | 2.600 | 4.500 | 3.500 | .374 | .0700 | .414 | 434.0 | 1.433 |
| 73299 | 0.00 | 8.900 | 2.500 | 5.100 | 3.900 | .263 | .1300 | .412 | 428.0 | 1.440 |
| 73300 | 0.00 | 11.300 | 3.900 | 6.900 | 6.000 | .301 | .1000 | .410 | 423.0 | 1.448 |
| 73301 | .67 | 7.400 | 5.900 | 6.500 | 6.300 | .151 | .1000 | .408 | 418.0 | 1.456 |
| 73302 | .04 | 7.600 | 3.900 | 5.400 | 4.300 | .286 | .0500 | .406 | 412.0 | 1.464 |
| 73303 | .02 | 9.100 | 6.000 | 7.300 | 6.000 | .134 | .0700 | .404 | 407.0 | 1.472 |
| 73304 | 2.77 | 10.000 | 6.900 | 8.100 | 8.100 | .069 | .4700 | .403 | 402.0 | 1.479 |
| 73305 | .11 | 2.600 | .900 | 1.600 | 1.600 | .154 | .1400 | .401 | 397.0 | 1.487 |
| 73306 | 0.00 | 1.800 | -2.300 | -.600 | -.600 | .195 | .0900 | .399 | 392.0 | 1.495 |
| 73307 | .53 | 1.300 | -1.500 | -.300 | -.600 | .105 | .0500 | .397 | 388.0 | 1.503 |
| 73308 | 1.69 | -.600 | -.700 | -.700 | -.800 | .079 | .1700 | .395 | 383.0 | 1.511 |
| 73309 | 2.52 | -.900 | -.900 | -.900 | -1.000 | .071 | .0200 | .394 | 378.0 | 1.519 |
| 73310 | .92 | -.300 | -.900 | -.700 | -.800 | .071 | .0200 | .392 | 374.0 | 1.527 |
| 73311 | .46 | .900 | -.400 | 0.000 | 0.000 | .089 | .0500 | .390 | 369.0 | 1.535 |
| 73312 | 1.46 | 1.700 | .100 | .700 | .600 | .071 | .1600 | .389 | 365.0 | 1.543 |
| 73313 | .69 | 2.300 | .800 | 1.400 | 1.200 | .090 | .1800 | .387 | 360.0 | 1.551 |
| 73314 | .52 | 4.300 | 1.800 | 2.800 | 2.500 | .090 | .1900 | .385 | 356.0 | 1.559 |
| 73315 | .94 | 5.100 | 2.800 | 3.700 | .300 | .090 | .1200 | .384 | 352.0 | 1.567 |
| 73316 | 1.27 | 3.100 | 2.800 | 2.900 | -.900 | .091 | .2900 | .382 | 348.0 | 1.575 |
| 73317 | 1.01 | 1.100 | 2.600 | 2.000 | 2.000 | .091 | .0400 | .381 | 344.0 | 1.583 |
| 73318 | 2.03 | 5.300 | 5.200 | 5.200 | 5.000 | .092 | 0.0000 | .379 | 340.0 | 1.591 |
| 73319 | .87 | 5.000 | 5.800 | 5.500 | 5.500 | .147 | .0300 | .378 | 337.0 | 1.599 |
| 73320 | .52 | 5.000 | 4.100 | 4.400 | 4.400 | .092 | .2500 | .377 | 333.0 | 1.606 |
| 73321 | .11 | 3.000 | 2.000 | 2.400 | 2.400 | .093 | .0400 | .375 | 329.0 | 1.614 |
| 73322 | .12 | 3.000 | .500 | 1.400 | 1.300 | .074 | .0900 | .374 | 326.0 | 1.621 |
| 73323 | .09 | 2.000 | .400 | 1.000 | 1.000 | .093 | .0500 | .373 | 322.0 | 1.629 |
| 73324 | 1.72 | 2.000 | .100 | .800 | .800 | .093 | .4400 | .372 | 319.0 | 1.636 |
| 73325 | 1.58 | 1.000 | -.900 | -.200 | -.300 | .056 | .3700 | .370 | 316.0 | 1.644 |
| 73326 | .68 | 2.000 | 0.000 | .700 | .600 | .056 | 0.0000 | .369 | 313.0 | 1.651 |
| 73327 | 1.38 | 1.000 | -.900 | -.200 | -.300 | .075 | .0500 | .368 | 310.0 | 1.658 |
| 73328 | .54 | 2.000 | 0.000 | .700 | .600 | .057 | .0900 | .367 | 307.0 | 1.665 |
| 73329 | 1.56 | 2.000 | 0.000 | .700 | .600 | .057 | .2100 | .366 | 304.0 | 1.671 |
| 73330 | .75 | 2.000 | -.200 | .500 | .500 | .076 | .0400 | .365 | 301.0 | 1.678 |
| 73331 | 1.06 | 3.000 | .800 | 1.600 | 1.600 | .095 | .0900 | .364 | 299.0 | 1.684 |
| 73332 | 1.18 | 2.000 | 1.500 | 1.700 | 1.700 | .115 | .0900 | .363 | 296.0 | 1.691 |
| 73333 | .67 | 2.000 | .300 | .900 | .800 | .096 | .0700 | .363 | 294.0 | 1.697 |
| 73334 | .36 | 7.000 | 2.200 | 3.900 | 3.900 | .096 | .2000 | .362 | 292.0 | 1.703 |
| 73335 | .39 | 3.000 | 1.900 | 2.300 | 2.200 | .077 | .0900 | .361 | 290.0 | 1.709 |
| 73336 | .22 | 2.000 | 1.200 | 1.500 | 1.500 | .077 | .0500 | .360 | 287.0 | 1.714 |
| 73337 | .66 | 3.000 | 1.700 | 2.200 | 2.200 | .058 | .0600 | .359 | 286.0 | 1.719 |
| 73338 | 0.00 | 2.000 | .100 | .800 | .100 | .077 | .1100 | .359 | 284.0 | 1.724 |
| 73339 | .45 | 3.000 | 2.000 | 2.400 | 2.400 | .078 | .0600 | .358 | 282.0 | 1.729 |
| 73340 | .91 | 4.000 | 2.800 | 3.200 | 3.200 | .087 | .1200 | .358 | 280.0 | 1.734 |
| 73341 | 1.45 | 3.000 | 3.800 | 3.500 | 3.500 | .078 | .0900 | .357 | 279.0 | 1.738 |
| 73342 | 0.00 | 3.000 | -.500 | .700 | -.600 | .078 | .1800 | .357 | 277.0 | 1.742 |
| 73343 | 0.00 | 2.000 | -.700 | .200 | -.800 | .088 | .2100 | .356 | 276.0 | 1.746 |
| 73344 | 0.00 | 4.000 | .400 | 1.700 | .300 | .078 | .1400 | .356 | 275.0 | 1.750 |
| 73345 | .34 | 4.000 | 2.900 | 3.300 | 3.200 | .059 | .4200 | .355 | 274.0 | 1.753 |
| 73346 | 1.37 | 2.000 | 1.000 | 1.400 | 1.300 | .059 | .0800 | .355 | 273.0 | 1.756 |
| 73347 | .69 | 2.000 | .300 | .900 | .800 | .068 | .0900 | .355 | 272.0 | 1.759 |
| 73348 | 1.40 | 4.000 | -.300 | 1.200 | 1.200 | .088 | .0500 | .355 | 271.0 | 1.761 |
| 73349 | .10 | 3.800 | 1.400 | 2.300 | 2.200 | .078 | .0900 | .354 | 270.0 | 1.763 |
| 73350 | .89 | 3.400 | 2.700 | 2.900 | 2.700 | .078 | .0700 | .354 | 270.0 | 1.765 |
| 73351 | .99 | 4.400 | 3.500 | 3.800 | 3.700 | .078 | .0500 | .354 | 269.0 | 1.767 |
| 73352 | 0.00 | 1.400 | .200 | .600 | .100 | .098 | .2000 | .354 | 269.0 | 1.768 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 73353 | .44 | 1.700 | .700 | 1.100 | 1.100 | .078 | .1800 | .354 | 268.0 | 1.769 |
| 73354 | 1.52 | 4.000 | 3.500 | 3.700 | 3.700 | .078 | .0600 | .354 | 268.0 | 1.769 |
| 73355 | .35 | 5.100 | 2.800 | 3.600 | 3.500 | .088 | .0500 | .354 | 268.0 | 1.770 |
| 73356 | 1.64 | 3.100 | 1.500 | 2.100 | 2.000 | .078 | .1900 | .354 | 268.0 | 1.769 |
| 73357 | .34 | 3.000 | 1.600 | 2.100 | 2.000 | .078 | .0500 | .355 | 268.0 | 1.769 |
| 73358 | 1.50 | 3.200 | 1.300 | 2.000 | 1.800 | .098 | .1700 | .355 | 269.0 | 1.768 |
| 73359 | 0.00 | .700 | -1.400 | -.600 | -1.000 | .059 | .0700 | .355 | 269.0 | 1.767 |
| 73360 | .67 | -.800 | -.800 | -.800 | -.800 | .059 | .0500 | .355 | 270.0 | 1.766 |
| 73361 | 2.38 | 3.300 | 4.000 | 3.800 | 3.500 | .078 | .3200 | .356 | 270.0 | 1.764 |
| 73362 | .84 | 3.600 | 2.000 | 2.600 | 2.500 | .088 | .5000 | .356 | 271.0 | 1.762 |
| 73363 | 1.87 | 3.400 | .100 | 1.300 | 1.100 | .078 | .3000 | .356 | 272.0 | 1.760 |
| 73364 | .07 | .700 | 0.000 | .200 | .200 | .058 | .0700 | .357 | 273.0 | 1.758 |
| 73365 | .16 | -.600 | -2.500 | -1.800 | -2.000 | .078 | .2100 | .357 | 274.0 | 1.755 |
| 74001 | 0.00 | -1.900 | -3.400 | -2.900 | -3.900 | .078 | .4700 | .358 | 275.0 | 1.751 |
| 74002 | 0.00 | -5.600 | -7.900 | -7.100 | -7.100 | .155 | .3800 | .359 | 276.0 | 1.747 |
| 74003 | 0.00 | -4.900 | -7.900 | -6.800 | -6.900 | .155 | .8300 | .359 | 278.0 | 1.744 |
| 74004 | 0.00 | -6.000 | -1.800 | -3.300 | -4.800 | .164 | .4300 | .360 | 279.0 | 1.740 |
| 74005 | 0.00 | -7.900 | -8.900 | -8.500 | -8.900 | .164 | 1.0500 | .361 | 281.0 | 1.735 |
| 74006 | 0.00 | -6.900 | -9.000 | -8.200 | -8.300 | .154 | .2300 | .361 | 283.0 | 1.731 |
| 74007 | 0.00 | -6.900 | -8.900 | -8.200 | -8.900 | .163 | .0900 | .362 | 284.0 | 1.726 |
| 74008 | 0.00 | -5.500 | -5.900 | -6.400 | -6.500 | .153 | .2300 | .363 | 286.0 | 1.721 |
| 74009 | 0.00 | -5.900 | -8.900 | -7.800 | -7.800 | .172 | .1100 | .364 | 288.0 | 1.716 |
| 74010 | 0.00 | -6.800 | -8.900 | -8.100 | -8.200 | .162 | .0500 | .365 | 290.0 | 1.710 |
| 74011 | .19 | -5.200 | -5.900 | -5.600 | -5.900 | .152 | .0500 | .366 | 293.0 | 1.705 |
| 74012 | 1.17 | -.200 | -1.800 | -1.200 | -1.200 | .076 | .0600 | .367 | 295.0 | 1.699 |
| 74013 | 1.25 | 2.400 | 0.000 | .800 | .800 | .075 | .0900 | .368 | 297.0 | 1.693 |
| 74014 | 1.53 | 4.700 | .900 | 2.300 | 2.300 | .141 | .0200 | .369 | 300.0 | 1.686 |
| 74015 | 3.00 | 4.000 | 3.900 | 3.900 | 3.900 | .094 | 0.0000 | .370 | 303.0 | 1.680 |
| 74016 | 1.54 | 5.500 | 4.200 | 4.700 | 4.600 | .112 | 0.0000 | .371 | 305.0 | 1.673 |
| 74017 | .16 | 2.100 | 2.000 | 2.000 | 2.000 | .093 | .0200 | .372 | 308.0 | 1.667 |
| 74018 | 1.32 | 5.600 | 1.400 | 3.000 | 3.000 | .149 | .1600 | .373 | 311.0 | 1.660 |
| 74019 | .10 | 2.600 | 4.900 | 4.000 | 4.000 | .093 | .3300 | .375 | 314.0 | 1.653 |
| 74020 | .09 | .400 | 0.000 | .200 | .200 | .111 | .1500 | .376 | 317.0 | 1.646 |
| 74021 | .22 | -1.500 | -1.600 | -1.600 | -1.700 | .111 | .0300 | .377 | 321.0 | 1.638 |
| 74022 | .21 | 0.000 | -1.400 | -.800 | -.800 | .128 | .0100 | .379 | 324.0 | 1.631 |
| 74023 | .29 | 1.300 | -.200 | .300 | .300 | .137 | .0500 | .380 | 327.0 | 1.624 |
| 74024 | .29 | 2.200 | .700 | 1.300 | 1.300 | .155 | .0800 | .382 | 331.0 | 1.616 |
| 74025 | 1.40 | 2.500 | 2.400 | 2.400 | 2.400 | .145 | .3300 | .383 | 335.0 | 1.609 |
| 74026 | .49 | 1.400 | .500 | .800 | .800 | .144 | .3300 | .385 | 338.0 | 1.601 |
| 74027 | 1.11 | -.800 | -.100 | -.400 | -.400 | .072 | .1900 | .386 | 342.0 | 1.593 |
| 74028 | .38 | 1.200 | -.500 | .100 | .100 | .152 | .0900 | .388 | 346.0 | 1.585 |
| 74029 | .37 | 2.100 | .900 | 1.400 | 1.400 | .161 | .1100 | .389 | 350.0 | 1.578 |
| 74030 | .33 | 4.500 | 3.000 | 3.600 | 3.600 | .151 | .3900 | .391 | 354.0 | 1.570 |
| 74031 | 2.56 | 4.700 | 2.500 | 3.400 | 3.400 | .141 | .1400 | .393 | 358.0 | 1.562 |
| 74032 | .67 | 2.400 | 2.600 | 2.500 | 2.500 | .150 | .6600 | .394 | 363.0 | 1.554 |
| 74033 | 0.00 | 2.000 | .600 | 1.200 | .200 | .193 | .0400 | .396 | 367.0 | 1.546 |
| 74034 | .51 | 2.200 | -1.000 | .200 | .200 | .262 | .1300 | .398 | 372.0 | 1.538 |
| 74035 | 1.28 | .800 | 2.300 | 1.700 | 1.700 | .174 | .2600 | .400 | 376.0 | 1.530 |
| 74036 | .06 | 1.000 | -1.300 | -.300 | -.700 | .190 | .0800 | .402 | 381.0 | 1.522 |
| 74037 | 0.00 | -.600 | -2.000 | -1.400 | -1.800 | .146 | .0500 | .404 | 386.0 | 1.514 |
| 74038 | 0.00 | 1.400 | -1.800 | -.500 | -.700 | .240 | .0900 | .405 | 390.0 | 1.506 |
| 74039 | 0.00 | 2.400 | -1.600 | 0.000 | -.300 | .256 | .1800 | .407 | 395.0 | 1.498 |
| 74040 | 0.00 | 3.000 | -1.600 | .200 | -.300 | .306 | .1500 | .409 | 400.0 | 1.490 |
| 74041 | 0.00 | 3.200 | -1.800 | .200 | 0.000 | .321 | .1600 | .411 | 405.0 | 1.482 |
| 74042 | 0.00 | 2.700 | -1.300 | .300 | -.700 | .370 | .2700 | .413 | 411.0 | 1.474 |
| 74043 | .18 | 1.500 | .200 | .700 | .700 | .151 | .2100 | .415 | 416.0 | 1.466 |
| 74044 | .26 | 3.200 | -.800 | .800 | .800 | .333 | .0300 | .417 | 421.0 | 1.458 |
| 74045 | .86 | 3.000 | .500 | 1.500 | 1.500 | .331 | .0400 | .419 | 426.0 | 1.450 |
| 74046 | .83 | .900 | .900 | .900 | .900 | .247 | .1200 | .422 | 432.0 | 1.443 |
| 74047 | 1.42 | .100 | .900 | .600 | .600 | .164 | .3500 | .424 | 437.0 | 1.435 |
| 74048 | .31 | 1.000 | 0.000 | .400 | .400 | .196 | .2300 | .426 | 443.0 | 1.427 |
| 74049 | 3.20 | -.900 | -.200 | -.500 | -.600 | .138 | .0300 | .428 | 449.0 | 1.420 |
| 74050 | .96 | .300 | 0.000 | .100 | .100 | .161 | .7600 | .430 | 454.0 | 1.412 |
| 74051 | .14 | .500 | -.400 | 0.000 | 0.000 | .161 | .0700 | .432 | 460.0 | 1.404 |
| 74052 | .82 | .400 | 0.000 | .200 | .200 | .160 | .2900 | .435 | 466.0 | 1.397 |
| 74053 | .71 | -.300 | -.900 | -.600 | -1.100 | .135 | .4000 | .437 | 472.0 | 1.390 |
| 74054 | 0.00 | -.100 | -.900 | -.500 | -.800 | .134 | .0300 | .439 | 478.0 | 1.382 |
| 74055 | 0.00 | .500 | -1.100 | -.300 | -.500 | .189 | .2000 | .441 | 484.0 | 1.375 |
| 74056 | .10 | 1.200 | 0.000 | .500 | .500 | .188 | .2000 | .444 | 490.0 | 1.368 |
| 74057 | .96 | -.300 | .100 | 0.000 | 0.000 | .132 | .2200 | .446 | 496.0 | 1.360 |
| 74058 | .41 | 0.000 | -.500 | -.200 | -.300 | .132 | .2200 | .448 | 502.0 | 1.353 |
| 74059 | .95 | -.200 | 0.000 | 0.000 | 0.000 | .185 | .2200 | .451 | 508.0 | 1.346 |
| 74060 | .38 | .800 | -.700 | 0.000 | 0.000 | .153 | .3500 | .453 | 514.0 | 1.339 |
| 74061 | .26 | .200 | -.400 | -.100 | -.100 | .183 | .1700 | .456 | 520.0 | 1.332 |
| 74062 | .19 | -.400 | -1.000 | -.700 | -1.500 | .136 | .2600 | .458 | 527.0 | 1.326 |
| 74063 | 1.64 | -.200 | -.900 | -.600 | -.600 | .128 | .0100 | .460 | 533.0 | 1.319 |
| 74064 | 2.84 | .600 | 0.000 | .200 | .200 | .127 | .3000 | .463 | 539.0 | 1.312 |
| 74065 | .05 | -.100 | -.700 | -.400 | -.600 | .149 | .0700 | .465 | 546.0 | 1.306 |
| 74066 | 0.00 | -.600 | -1.400 | -1.000 | -4.300 | .148 | .1300 | .468 | 552.0 | 1.299 |
| 74067 | 0.00 | .200 | -1.400 | -.600 | -3.300 | .236 | .0900 | .470 | 559.0 | 1.292 |
| 74068 | 0.00 | 1.600 | -.700 | .300 | -.300 | .294 | .1200 | .473 | 565.0 | 1.286 |
| 74069 | .12 | 1.000 | -.200 | .300 | .300 | .219 | .1200 | .475 | 572.0 | 1.280 |
| 74070 | .37 | 1.400 | .400 | .900 | .900 | .175 | .1000 | .477 | 578.0 | 1.273 |
| 74071 | .77 | .200 | .400 | .300 | .300 | .246 | .3000 | .480 | 585.0 | 1.267 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 74072 | .52 | .400 | -.800 | -.200 | -.200 | .231 | .3200 | .482 | 591.0 | 1.261 |
| 74073 | 2.94 | 1.200 | -.700 | .200 | .100 | .358 | .0400 | .485 | 598.0 | 1.255 |
| 74074 | .08 | 9.000 | 2.100 | 5.500 | 5.400 | .555 | .0100 | .487 | 604.0 | 1.249 |
| 74075 | .79 | 5.500 | 3.100 | 4.300 | 4.300 | .194 | 0.0000 | .490 | 611.0 | 1.243 |
| 74076 | .04 | 7.600 | 4.000 | 5.800 | 4.600 | .617 | 0.0000 | .492 | 617.0 | 1.237 |
| 74077 | 0.00 | 7.600 | -.700 | 3.400 | 1.500 | .714 | 0.0000 | .495 | 624.0 | 1.231 |
| 74078 | 0.00 | 11.000 | -.200 | 5.300 | .600 | .686 | 0.0000 | .497 | 630.0 | 1.226 |
| 74079 | 0.00 | 7.500 | 1.800 | 4.700 | -.700 | .690 | 0.0000 | .500 | 637.0 | 1.220 |
| 74080 | 0.00 | 8.300 | -1.100 | 3.600 | -.700 | .686 | 0.0000 | .503 | 644.0 | 1.215 |
| 74081 | 0.00 | 6.400 | -.200 | 3.100 | -1.100 | .716 | .1700 | .505 | 650.0 | 1.209 |
| 74082 | 0.00 | 9.100 | 2.900 | 6.000 | 1.500 | .712 | .2600 | .508 | 657.0 | 1.204 |
| 74083 | 0.00 | 9.800 | .100 | 5.000 | 1.100 | .677 | .1500 | .510 | 663.0 | 1.198 |
| 74084 | .28 | 8.600 | 3.500 | 6.100 | 5.700 | .405 | .1700 | .513 | 670.0 | 1.193 |
| 74085 | 0.00 | 10.100 | 2.200 | 6.300 | 5.200 | .460 | .0600 | .515 | 676.0 | 1.188 |
| 74086 | .43 | 6.500 | 5.000 | 5.800 | 5.700 | .160 | .0800 | .518 | 683.0 | 1.183 |
| 74087 | 1.26 | 4.200 | 4.500 | 4.300 | 4.200 | .199 | .3100 | .520 | 689.0 | 1.178 |
| 74088 | 1.45 | 8.300 | 1.900 | 5.200 | 4.900 | .413 | .1000 | .523 | 695.0 | 1.172 |
| 74089 | 1.22 | 3.800 | 4.500 | 4.100 | 4.100 | .308 | .4500 | .525 | 702.0 | 1.168 |
| 74090 | .87 | 2.700 | 1.500 | 2.100 | 2.100 | .228 | .0500 | .527 | 708.0 | 1.163 |
| 74091 | 1.50 | 3.200 | 2.700 | 3.000 | 3.000 | .235 | .2200 | .530 | 715.0 | 1.158 |
| 74092 | .97 | 2.200 | 1.500 | 1.900 | 1.900 | .320 | .4800 | .532 | 721.0 | 1.153 |
| 74093 | .27 | 3.400 | .500 | 2.100 | 1.500 | .528 | .2900 | .535 | 727.0 | 1.148 |
| 74094 | .14 | 3.900 | -.400 | 1.900 | 1.800 | .387 | .0300 | .537 | 733.0 | 1.144 |
| 74095 | .21 | 6.000 | 2.700 | 4.500 | 4.500 | .199 | .1000 | .540 | 740.0 | 1.139 |
| 74096 | .40 | 5.400 | 2.400 | 4.000 | 2.200 | .345 | .0800 | .542 | 746.0 | 1.135 |
| 74097 | 0.00 | 9.100 | 3.000 | 6.300 | 2.700 | .673 | .0500 | .544 | 752.0 | 1.130 |
| 74098 | .20 | 7.900 | 3.300 | 5.800 | 3.000 | .311 | 0.0000 | .547 | 758.0 | 1.126 |
| 74099 | .38 | 2.800 | 2.500 | 2.700 | 2.500 | .317 | 0.0000 | .549 | 764.0 | 1.122 |
| 74100 | .22 | 5.500 | 1.800 | 3.800 | 3.100 | .429 | .2600 | .552 | 770.0 | 1.117 |
| 74101 | 1.21 | 5.800 | 4.000 | 5.000 | 5.000 | .217 | .1200 | .554 | 776.0 | 1.113 |
| 74102 | 0.00 | 5.300 | .100 | 3.000 | -.200 | .831 | .2900 | .556 | 782.0 | 1.109 |
| 74103 | 0.00 | 9.200 | -1.400 | 4.500 | -1.600 | .811 | .2700 | .559 | 788.0 | 1.105 |
| 74104 | 0.00 | 13.800 | 1.300 | 8.300 | 0.000 | .697 | .1900 | .561 | 793.0 | 1.101 |
| 74105 | 0.00 | 7.300 | 3.800 | 5.800 | 1.300 | .435 | 0.0000 | .563 | 799.0 | 1.097 |
| 74106 | 0.00 | 11.200 | .400 | 6.500 | -1.200 | .795 | 0.0000 | .565 | 805.0 | 1.093 |
| 74107 | 0.00 | 14.600 | 2.300 | 9.300 | 2.600 | .710 | .2400 | .568 | 810.0 | 1.089 |
| 74108 | .03 | 8.400 | 8.100 | 8.300 | 5.100 | .291 | .3700 | .570 | 816.0 | 1.085 |
| 74109 | .05 | 5.900 | 3.200 | 4.700 | 1.700 | .421 | .4000 | .572 | 821.0 | 1.082 |
| 74110 | 0.00 | 8.100 | 3.700 | 6.200 | 5.000 | .442 | .1700 | .574 | 827.0 | 1.078 |
| 74111 | 0.00 | 14.600 | 5.700 | 10.800 | 5.700 | .758 | .2700 | .576 | 832.0 | 1.074 |
| 74112 | .20 | 11.800 | 8.200 | 10.300 | 5.100 | .734 | .3800 | .578 | 837.0 | 1.071 |
| 74113 | .57 | 8.600 | 4.200 | 6.800 | 4.300 | .644 | .3200 | .581 | 843.0 | 1.067 |
| 74114 | .27 | 9.700 | 4.500 | 7.500 | 3.300 | .735 | .3300 | .583 | 848.0 | 1.064 |
| 74115 | .14 | 7.100 | 2.800 | 5.300 | 2.200 | .618 | .2700 | .585 | 853.0 | 1.061 |
| 74116 | .02 | 6.900 | -.300 | 3.900 | .800 | .560 | .2800 | .587 | 858.0 | 1.057 |
| 74117 | .12 | 7.400 | 4.700 | 6.300 | 4.600 | .388 | .2100 | .589 | 863.0 | 1.054 |
| 74118 | 0.00 | 10.700 | 5.300 | 8.500 | 5.500 | .584 | .2600 | .591 | 868.0 | 1.051 |
| 74119 | 0.00 | 16.400 | 2.900 | 10.900 | 4.900 | .666 | .3400 | .593 | 872.0 | 1.048 |
| 74120 | 0.00 | 13.900 | 7.000 | 11.100 | 6.600 | .559 | .4000 | .595 | 877.0 | 1.045 |
| 74121 | 0.00 | 7.600 | 7.200 | 7.400 | 2.600 | .425 | .5000 | .596 | 882.0 | 1.042 |
| 74122 | 0.00 | 12.300 | 3.900 | 8.900 | 2.800 | .737 | .2700 | .598 | 886.0 | 1.039 |
| 74123 | 0.00 | 14.100 | 4.200 | 10.100 | 3.500 | .721 | .3000 | .600 | 891.0 | 1.036 |
| 74124 | 0.00 | 18.800 | 4.000 | 12.900 | 4.700 | .684 | .3100 | .602 | 895.0 | 1.033 |
| 74125 | 0.00 | 19.400 | 7.200 | 14.600 | 7.200 | .675 | .3400 | .604 | 900.0 | 1.030 |
| 74126 | 0.00 | 18.600 | 10.700 | 15.500 | 7.900 | .556 | .2500 | .606 | 904.0 | 1.027 |
| 74127 | 0.00 | 19.400 | 9.900 | 15.700 | 7.500 | .610 | .3000 | .607 | 908.0 | 1.025 |
| 74128 | 0.00 | 17.600 | 11.700 | 15.300 | 6.700 | .710 | .4000 | .609 | 912.0 | 1.022 |
| 74129 | .20 | 8.100 | 7.300 | 7.800 | 2.900 | .347 | .4500 | .611 | 916.0 | 1.019 |
| 74130 | .07 | 9.400 | 5.000 | 7.700 | 4.700 | .496 | .2000 | .612 | 920.0 | 1.017 |
| 74131 | .53 | 10.100 | 7.100 | 8.900 | 8.200 | .399 | .3000 | .614 | 924.0 | 1.014 |
| 74132 | .05 | 6.500 | 6.500 | 6.500 | 3.600 | .575 | .2800 | .615 | 928.0 | 1.012 |
| 74133 | 0.00 | 6.600 | 1.100 | 4.500 | -.200 | .512 | .2500 | .617 | 931.0 | 1.010 |
| 74134 | .74 | 5.200 | 4.100 | 4.800 | 3.800 | .275 | .2300 | .618 | 935.0 | 1.007 |
| 74135 | .65 | 2.900 | .900 | 2.100 | 1.300 | .489 | .3200 | .620 | 938.0 | 1.005 |
| 74136 | .47 | 2.600 | 0.000 | 1.600 | 1.000 | .422 | .1500 | .621 | 942.0 | 1.003 |
| 74137 | .25 | 4.700 | 1.000 | 3.300 | 2.000 | .420 | .2200 | .623 | 945.0 | 1.001 |
| 74138 | .30 | 4.300 | 2.100 | 3.500 | 3.100 | .246 | .2000 | .624 | 948.0 | .999 |
| 74139 | .21 | 7.100 | 2.800 | 5.500 | 4.200 | .359 | .1500 | .625 | 951.0 | .997 |
| 74140 | 0.00 | 9.400 | 4.400 | 7.500 | 4.800 | .398 | .1000 | .627 | 954.0 | .995 |
| 74141 | .03 | 11.900 | 1.900 | 8.200 | 3.700 | .530 | .3400 | .628 | 957.0 | .993 |
| 74142 | 0.00 | 13.100 | 8.000 | 11.200 | 7.600 | .595 | .4000 | .629 | 960.0 | .991 |
| 74143 | 0.00 | 13.100 | 6.900 | 10.800 | 5.700 | .554 | .3500 | .630 | 963.0 | .989 |
| 74144 | .03 | 13.700 | 9.000 | 12.000 | 9.200 | .336 | .1100 | .631 | 966.0 | .987 |
| 74145 | 0.00 | 19.200 | 12.700 | 16.800 | 11.700 | .579 | .2500 | .632 | 968.0 | .986 |
| 74146 | 0.00 | 18.700 | 14.800 | 17.300 | 10.900 | .644 | .4700 | .633 | 971.0 | .984 |
| 74147 | 0.00 | 15.200 | 11.200 | 13.700 | 7.400 | .630 | .3300 | .634 | 973.0 | .983 |
| 74148 | 0.00 | 13.700 | 4.900 | 10.500 | 3.800 | .550 | .3500 | .635 | 975.0 | .981 |
| 74149 | 0.00 | 8.500 | 5.900 | 7.600 | 3.400 | .307 | .3800 | .636 | 978.0 | .980 |
| 74150 | 0.00 | 13.100 | 3.100 | 9.500 | 2.100 | .660 | .3000 | .637 | 980.0 | .978 |
| 74151 | 0.00 | 17.700 | 5.900 | 13.400 | 4.900 | .626 | .3100 | .638 | 982.0 | .977 |
| 74152 | 0.00 | 20.200 | 8.100 | 15.800 | 7.100 | .753 | .3300 | .639 | 984.0 | .976 |
| 74153 | 0.00 | 18.900 | 9.600 | 15.500 | 8.200 | .786 | .3100 | .639 | 985.0 | .974 |
| 74154 | .10 | 17.800 | 10.900 | 15.300 | 8.100 | .630 | .3800 | .640 | 987.0 | .973 |
| 74155 | 1.90 | 11.500 | 11.900 | 11.600 | 9.500 | .184 | .3300 | .641 | 989.0 | .972 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 74156 | .39 | 9.700 | 9.100 | 9.500 | 9.200 | .144 | .1600 | .641 | 990.0 | .971 |
| 74157 | .10 | 12.100 | 9.200 | 11.100 | 8.800 | .361 | .3000 | .642 | 992.0 | .970 |
| 74158 | 0.00 | 11.300 | 5.700 | 9.300 | 4.500 | .732 | .2300 | .643 | 993.0 | .969 |
| 74159 | 0.00 | 15.000 | 3.700 | 11.000 | 5.200 | .788 | .3500 | .643 | 994.0 | .968 |
| 74160 | 0.00 | 18.500 | 6.800 | 14.300 | 8.100 | .740 | .3600 | .644 | 995.0 | .968 |
| 74161 | 0.00 | 21.900 | 3.600 | 17.500 | 9.600 | .715 | .1100 | .644 | 997.0 | .967 |
| 74162 | 0.00 | 23.300 | 13.400 | 19.800 | 9.300 | .675 | .3000 | .644 | 997.0 | .966 |
| 74163 | 0.00 | 23.400 | 15.300 | 20.500 | 12.600 | .682 | .3400 | .645 | 998.0 | .966 |
| 74164 | 0.00 | 18.300 | 16.400 | 17.600 | 12.200 | .739 | .3800 | .645 | 999.0 | .965 |
| 74165 | 0.00 | 16.600 | 13.400 | 15.500 | 11.100 | .546 | .4300 | .645 | 1000.0 | .965 |
| 74166 | 0.00 | 19.700 | 14.900 | 18.000 | 12.300 | .739 | .4000 | .645 | 1000.0 | .964 |
| 74167 | 0.00 | 21.700 | 14.700 | 19.200 | 13.200 | .713 | .3600 | .646 | 1001.0 | .964 |
| 74168 | 0.00 | 22.700 | 17.700 | 20.900 | 14.500 | .689 | .3700 | .646 | 1001.0 | .963 |
| 74169 | .07 | 15.200 | 17.600 | 16.100 | 11.900 | .425 | .4100 | .646 | 1001.0 | .963 |
| 74170 | 0.00 | 18.200 | 11.000 | 15.700 | 8.600 | .761 | .4300 | .646 | 1002.0 | .963 |
| 74171 | 0.00 | 20.600 | 11.800 | 17.500 | 10.300 | .721 | .3300 | .646 | 1002.0 | .963 |
| 74172 | 0.00 | 16.800 | 14.400 | 15.900 | 10.700 | .625 | .3900 | .646 | 1002.0 | .963 |
| 74173 | 0.00 | 18.500 | 14.100 | 16.900 | 10.200 | .777 | .5000 | .646 | 1002.0 | .963 |
| 74174 | 0.00 | 17.700 | 10.300 | 15.100 | 7.700 | .745 | .3900 | .646 | 1001.0 | .963 |
| 74175 | 0.00 | 10.100 | 12.300 | 10.900 | 7.700 | .248 | .2700 | .645 | 1001.0 | .963 |
| 74176 | 0.00 | 13.900 | 7.100 | 11.500 | 6.200 | .465 | .2700 | .645 | 1001.0 | .963 |
| 74177 | .07 | 17.600 | 11.200 | 15.300 | 9.800 | .722 | .3200 | .645 | 1000.0 | .963 |
| 74178 | 0.00 | 19.500 | 8.700 | 15.700 | 8.400 | .730 | .3100 | .645 | 1000.0 | .964 |
| 74179 | 0.00 | 25.200 | 14.000 | 21.200 | 11.300 | .650 | .3000 | .644 | 999.0 | .964 |
| 74180 | 0.00 | 23.500 | 17.200 | 21.300 | 12.400 | .683 | .3400 | .644 | 998.0 | .964 |
| 74181 | 0.00 | 13.700 | 14.300 | 13.900 | 7.600 | .313 | .3700 | .643 | 997.0 | .965 |
| 74182 | 0.00 | 15.800 | 9.900 | 13.700 | 7.100 | .755 | .3200 | .643 | 996.0 | .965 |
| 74183 | 0.00 | 19.900 | 9.800 | 16.300 | 8.200 | .732 | .3600 | .642 | 995.0 | .966 |
| 74184 | 0.00 | 19.800 | 12.900 | 17.300 | 8.900 | .625 | .3700 | .642 | 994.0 | .967 |
| 74185 | 0.00 | 16.700 | 17.400 | 17.000 | 11.900 | .419 | .3300 | .641 | 993.0 | .967 |
| 74186 | .05 | 16.900 | 12.800 | 15.400 | 9.600 | .691 | .3500 | .641 | 991.0 | .968 |
| 74187 | 0.00 | 18.200 | 3.800 | 15.200 | 8.400 | .671 | .2900 | .640 | 990.0 | .969 |
| 74188 | 0.00 | 12.300 | 14.700 | 13.200 | 9.900 | .147 | .1200 | .639 | 988.0 | .970 |
| 74189 | .28 | 10.400 | 9.700 | 10.100 | 9.300 | .156 | .0500 | .638 | 987.0 | .971 |
| 74190 | 0.00 | 10.600 | 8.900 | 10.000 | 8.800 | .239 | .1500 | .637 | 985.0 | .972 |
| 74191 | .22 | 13.500 | 8.100 | 11.500 | 7.600 | .513 | .2500 | .637 | 983.0 | .973 |
| 74192 | 0.00 | 15.700 | 7.000 | 12.500 | 7.200 | .698 | .3500 | .636 | 981.0 | .974 |
| 74193 | 0.00 | 18.900 | 8.600 | 15.100 | 9.100 | .640 | .4200 | .635 | 979.0 | .975 |
| 74194 | 0.00 | 18.700 | 11.400 | 16.000 | 10.100 | .650 | .3400 | .634 | 977.0 | .976 |
| 74195 | 0.00 | 15.000 | 13.200 | 14.300 | 7.600 | .566 | .5000 | .633 | 975.0 | .978 |
| 74196 | 0.00 | 17.000 | 5.100 | 12.600 | 6.700 | .451 | .3200 | .632 | 973.0 | .979 |
| 74197 | 0.00 | 18.000 | 13.700 | 16.400 | 13.800 | .250 | .1100 | .631 | 970.0 | .981 |
| 74198 | .06 | 20.300 | 15.900 | 18.700 | 15.500 | .594 | .4000 | .630 | 968.0 | .982 |
| 74199 | 0.00 | 21.300 | 15.800 | 19.300 | 14.400 | .630 | .4000 | .628 | 965.0 | .984 |
| 74200 | 0.00 | 22.600 | 10.900 | 18.200 | 12.100 | .640 | .3800 | .627 | 963.0 | .985 |
| 74201 | 0.00 | 22.700 | 11.600 | 18.500 | 11.900 | .649 | .4100 | .626 | 960.0 | .987 |
| 74202 | 0.00 | 20.600 | 10.400 | 16.800 | 9.800 | .633 | .3300 | .625 | 957.0 | .989 |
| 74203 | 0.00 | 20.900 | 11.600 | 17.400 | 12.100 | .619 | .3500 | .623 | 954.0 | .990 |
| 74204 | 0.00 | 22.300 | 9.200 | 17.300 | 11.000 | .644 | .3700 | .622 | 951.0 | .992 |
| 74205 | 0.00 | 23.100 | 10.000 | 18.100 | 11.600 | .637 | .3700 | .621 | 948.0 | .994 |
| 74206 | 0.00 | 24.000 | 11.800 | 19.400 | 13.300 | .503 | .2800 | .619 | 945.0 | .996 |
| 74207 | 0.00 | 25.300 | 13.700 | 20.900 | 13.800 | .546 | .2900 | .618 | 941.0 | .998 |
| 74208 | 0.00 | 27.000 | 14.400 | 22.200 | 14.400 | .591 | .3000 | .616 | 938.0 | 1.000 |
| 74209 | 0.00 | 26.700 | 17.800 | 23.300 | 16.600 | .575 | .2900 | .615 | 935.0 | 1.002 |
| 74210 | .01 | 26.600 | 15.800 | 22.400 | 15.100 | .603 | .2600 | .613 | 931.0 | 1.004 |
| 74211 | 0.00 | 25.900 | 14.900 | 21.600 | 13.400 | .596 | .3200 | .611 | 927.0 | 1.007 |
| 74212 | 0.00 | 25.500 | 13.900 | 21.000 | 12.000 | .589 | .3400 | .610 | 924.0 | 1.009 |
| 74213 | 0.00 | 25.700 | 13.600 | 21.000 | 13.100 | .609 | .3200 | .608 | 920.0 | 1.011 |
| 74214 | 0.00 | 26.800 | 14.900 | 22.100 | 14.500 | .629 | .3100 | .606 | 916.0 | 1.014 |
| 74215 | 0.00 | 26.000 | 15.600 | 21.900 | 15.400 | .593 | .3100 | .605 | 912.0 | 1.016 |
| 74216 | 0.00 | 25.700 | 13.600 | 21.000 | 13.100 | .614 | .3000 | .603 | 908.0 | 1.019 |
| 74217 | 0.00 | 23.200 | 10.000 | 17.600 | 9.800 | .634 | .2500 | .601 | 904.0 | 1.021 |
| 74218 | 0.00 | 21.300 | 14.200 | 18.500 | 10.800 | .682 | .3400 | .599 | 900.0 | 1.024 |
| 74219 | 0.00 | 19.400 | 7.100 | 14.400 | 5.300 | .712 | .3000 | .597 | 896.0 | 1.026 |
| 74220 | 0.00 | 20.600 | 8.600 | 15.700 | 7.800 | .704 | .3900 | .596 | 891.0 | 1.029 |
| 74221 | 0.00 | 24.600 | 10.600 | 18.900 | 8.800 | .669 | .2700 | .594 | 887.0 | 1.032 |
| 74222 | 0.00 | 25.000 | 13.600 | 20.300 | 10.300 | .653 | .2900 | .592 | 882.0 | 1.035 |
| 74223 | 0.00 | 21.900 | 12.800 | 18.200 | 8.500 | .683 | .3100 | .590 | 878.0 | 1.038 |
| 74224 | 0.00 | 15.400 | 8.700 | 12.600 | 6.300 | .378 | .2400 | .588 | 873.0 | 1.041 |
| 74225 | 0.00 | 17.600 | 7.700 | 13.500 | 6.400 | .697 | .3800 | .586 | 869.0 | 1.044 |
| 74226 | 0.00 | 19.800 | 7.300 | 14.600 | 6.600 | .661 | .3300 | .584 | 864.0 | 1.047 |
| 74227 | 0.00 | 21.600 | 9.200 | 16.400 | 8.300 | .683 | .3700 | .582 | 859.0 | 1.050 |
| 74228 | 0.00 | 23.200 | 10.000 | 17.600 | 9.800 | .657 | .3500 | .580 | 854.0 | 1.053 |
| 74229 | 0.00 | 22.300 | 13.000 | 18.400 | 11.000 | .661 | .3600 | .577 | 849.0 | 1.056 |
| 74230 | .11 | 15.000 | 14.600 | 14.800 | 9.500 | .292 | .4000 | .575 | 844.0 | 1.060 |
| 74231 | .10 | 12.600 | 11.100 | 12.000 | 9.700 | .227 | .1500 | .573 | 839.0 | 1.063 |
| 74232 | 0.00 | 19.000 | 12.000 | 16.000 | 10.100 | .735 | .2600 | .571 | 834.0 | 1.066 |
| 74233 | 0.00 | 21.200 | 8.000 | 15.500 | 8.000 | .660 | .3300 | .569 | 828.0 | 1.070 |
| 74234 | 0.00 | 23.800 | 12.900 | 19.100 | 11.500 | .548 | .2600 | .566 | 823.0 | 1.073 |
| 74235 | 0.00 | 22.900 | 16.400 | 20.100 | 12.900 | .531 | .2800 | .564 | 818.0 | 1.077 |
| 74236 | 0.00 | 24.100 | 11.200 | 18.400 | 11.200 | .610 | .3100 | .562 | 812.0 | 1.081 |
| 74237 | 0.00 | 25.900 | 13.200 | 20.300 | 12.600 | .583 | .3000 | .560 | 807.0 | 1.084 |
| 74238 | 0.00 | 26.700 | 14.900 | 21.500 | 13.600 | .576 | .2900 | .557 | 801.0 | 1.088 |
| 74239 | 0.00 | 26.500 | 15.900 | 21.800 | 13.600 | .578 | .3300 | .555 | 796.0 | 1.092 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 74240 | 0.00 | 26.900 | 17.300 | 22.600 | 14.700 | .590 | .3600 | .553 | 790.0 | 1.096 |
| 74241 | 0.00 | 24.500 | 15.900 | 20.600 | 14.300 | .593 | .3800 | .550 | 784.0 | 1.100 |
| 74242 | 0.00 | 22.500 | 15.500 | 19.300 | 14.000 | .585 | .3500 | .548 | 779.0 | 1.104 |
| 74243 | 0.00 | 24.200 | 18.200 | 21.500 | 15.000 | .580 | .3500 | .546 | 773.0 | 1.108 |
| 74244 | 0.00 | 27.500 | 16.300 | 22.400 | 13.100 | .583 | .2600 | .543 | 767.0 | 1.112 |
| 74245 | 0.00 | 27.200 | 16.300 | 22.200 | 10.000 | .543 | .2600 | .541 | 761.0 | 1.116 |
| 74246 | 0.00 | 23.300 | 15.900 | 19.900 | 11.000 | .620 | .3300 | .538 | 755.0 | 1.120 |
| 74247 | 0.00 | 18.500 | 12.400 | 15.700 | 10.000 | .463 | .2900 | .536 | 749.0 | 1.125 |
| 74248 | 0.00 | 19.100 | 10.500 | 15.100 | 9.400 | .540 | .2400 | .534 | 743.0 | 1.129 |
| 74249 | 0.00 | 19.300 | 11.600 | 15.700 | 8.600 | .543 | .2300 | .531 | 737.0 | 1.133 |
| 74250 | 0.00 | 18.100 | 12.200 | 15.300 | 7.600 | .545 | .3100 | .529 | 731.0 | 1.138 |
| 74251 | 0.00 | 18.200 | 15.000 | 16.700 | 9.300 | .450 | .4000 | .526 | 725.0 | 1.142 |
| 74252 | .14 | 13.700 | 14.800 | 14.200 | 11.400 | .127 | .1900 | .524 | 719.0 | 1.147 |
| 74253 | 0.00 | 13.500 | 11.100 | 12.400 | 9.100 | .553 | .1500 | .521 | 712.0 | 1.152 |
| 74254 | 0.00 | 14.100 | 7.700 | 11.000 | 4.700 | .467 | .2800 | .519 | 706.0 | 1.156 |
| 74255 | 0.00 | 15.500 | 9.000 | 12.400 | 2.900 | .690 | .5900 | .516 | 700.0 | 1.161 |
| 74256 | 0.00 | 17.800 | 9.600 | 13.800 | 1.800 | .516 | .3400 | .514 | 694.0 | 1.166 |
| 74257 | 0.00 | 16.600 | 10.100 | 13.400 | 1.800 | .474 | .2400 | .511 | 687.0 | 1.171 |
| 74258 | 0.00 | 16.000 | 11.600 | 13.800 | 3.500 | .476 | .3300 | .509 | 681.0 | 1.176 |
| 74259 | 0.00 | 14.300 | 12.600 | 13.500 | 4.100 | .479 | .3300 | .506 | 675.0 | 1.181 |
| 74260 | 0.00 | 14.900 | 14.800 | 14.900 | 3.600 | .504 | .1600 | .504 | 668.0 | 1.186 |
| 74261 | 0.00 | 15.500 | 14.800 | 15.200 | 6.400 | .484 | .3500 | .501 | 662.0 | 1.191 |
| 74262 | 0.00 | 17.800 | 15.700 | 16.700 | 7.400 | .452 | .3500 | .499 | 655.0 | 1.197 |
| 74263 | 0.00 | 19.400 | 15.900 | 17.600 | 6.600 | .420 | .3100 | .496 | 649.0 | 1.202 |
| 74264 | 0.00 | 20.400 | 13.700 | 17.000 | 5.900 | .422 | .2900 | .494 | 642.0 | 1.207 |
| 74265 | 0.00 | 21.400 | 13.600 | 17.400 | 5.900 | .405 | .3000 | .491 | 636.0 | 1.213 |
| 74266 | 0.00 | 21.900 | 11.900 | 16.800 | 4.400 | .426 | .2600 | .489 | 630.0 | 1.218 |
| 74267 | 0.00 | 21.300 | 10.400 | 15.700 | 2.900 | .452 | .2100 | .486 | 623.0 | 1.224 |
| 74268 | 0.00 | 20.200 | 10.600 | 15.200 | 4.400 | .419 | .3200 | .484 | 617.0 | 1.230 |
| 74269 | 0.00 | 14.700 | 10.300 | 12.400 | 4.300 | .445 | .2800 | .481 | 610.0 | 1.236 |
| 74270 | 0.00 | 14.000 | 3.300 | 8.400 | .900 | .483 | .3200 | .479 | 604.0 | 1.241 |
| 74271 | 0.00 | 16.100 | 5.100 | 10.300 | 2.400 | .449 | .3200 | .476 | 597.0 | 1.247 |
| 74272 | 0.00 | 15.600 | 5.900 | 10.500 | 3.000 | .463 | .3400 | .474 | 591.0 | 1.253 |
| 74273 | 0.00 | 16.000 | 6.300 | 10.900 | 3.700 | .442 | .3500 | .471 | 584.0 | 1.259 |
| 74274 | 0.00 | 17.100 | 6.300 | 11.400 | 3.000 | .471 | .3400 | .469 | 578.0 | 1.265 |
| 74275 | 0.00 | 11.900 | 7.000 | 9.300 | 4.500 | .320 | .2700 | .466 | 572.0 | 1.272 |
| 74276 | 0.00 | 9.500 | 1.600 | 5.300 | .600 | .450 | .3800 | .464 | 565.0 | 1.278 |
| 74277 | 0.00 | 10.800 | 1.000 | 5.500 | -.500 | .531 | .3500 | .462 | 559.0 | 1.284 |
| 74278 | 0.00 | 10.300 | -.700 | 4.300 | -2.900 | .508 | .3600 | .459 | 553.0 | 1.291 |
| 74279 | 0.00 | 13.000 | -.200 | 5.800 | -3.100 | .471 | .3200 | .457 | 546.0 | 1.297 |
| 74280 | 0.00 | 14.700 | 1.300 | 7.400 | -2.200 | .486 | .2500 | .454 | 540.0 | 1.304 |
| 74281 | 0.00 | 16.600 | 3.200 | 9.300 | -.600 | .476 | .2900 | .452 | 534.0 | 1.310 |
| 74282 | 0.00 | 14.600 | 5.600 | 9.600 | .100 | .478 | .2600 | .450 | 527.0 | 1.317 |
| 74283 | 0.00 | 12.100 | 3.200 | 7.200 | -.100 | .413 | .2600 | .447 | 521.0 | 1.324 |
| 74284 | 0.00 | 14.700 | 9.600 | 11.900 | 5.600 | .499 | .1300 | .445 | 515.0 | 1.330 |
| 74285 | 0.00 | 15.100 | 5.200 | 9.600 | 3.300 | .470 | .3300 | .443 | 509.0 | 1.337 |
| 74286 | 0.00 | 14.900 | 6.100 | 10.000 | 3.500 | .458 | .3300 | .440 | 503.0 | 1.344 |
| 74287 | 0.00 | 13.800 | 5.800 | 9.300 | 3.500 | .476 | .2900 | .438 | 497.0 | 1.351 |
| 74288 | 0.00 | 14.200 | 4.200 | 8.600 | 2.500 | .462 | .2600 | .436 | 491.0 | 1.358 |
| 74289 | 0.00 | 15.600 | 5.600 | 9.900 | 3.000 | .448 | .2300 | .434 | 485.0 | 1.365 |
| 74290 | 0.00 | 14.600 | 5.500 | 9.400 | 2.300 | .435 | .2300 | .431 | 479.0 | 1.373 |
| 74291 | 0.00 | 16.000 | 6.100 | 10.300 | 3.200 | .437 | .1700 | .429 | 473.0 | 1.380 |
| 74292 | 0.00 | 15.000 | 6.400 | 10.100 | 2.000 | .423 | .3400 | .427 | 467.0 | 1.387 |
| 74293 | .28 | 7.500 | 10.800 | 9.400 | 5.300 | .278 | .2600 | .425 | 462.0 | 1.395 |
| 74294 | 0.00 | 6.600 | 4.500 | 5.400 | 3.500 | .328 | .1200 | .423 | 456.0 | 1.402 |
| 74295 | 0.00 | 8.900 | 1.100 | 4.400 | 2.000 | .413 | .2400 | .420 | 450.0 | 1.410 |
| 74296 | 0.00 | 8.500 | 2.700 | 5.100 | 2.200 | .415 | .2100 | .418 | 445.0 | 1.417 |
| 74297 | 0.00 | 8.200 | 1.100 | 4.100 | .700 | .434 | .2200 | .416 | 439.0 | 1.425 |
| 74298 | 0.00 | 9.700 | 2.500 | 5.500 | 1.300 | .419 | .2700 | .414 | 434.0 | 1.433 |
| 74299 | 0.00 | 8.000 | 1.500 | 4.200 | 1.800 | .405 | .1700 | .412 | 428.0 | 1.440 |
| 74300 | .64 | 8.500 | 5.300 | 6.600 | 5.500 | .176 | .1100 | .410 | 423.0 | 1.448 |
| 74301 | .72 | 7.800 | 9.200 | 8.600 | 7.800 | .124 | .0400 | .408 | 418.0 | 1.456 |
| 74302 | .03 | 6.300 | 4.800 | 5.400 | 3.800 | .178 | .0900 | .406 | 412.0 | 1.464 |
| 74303 | .12 | 9.400 | 5.500 | 7.100 | 5.300 | .335 | .0900 | .404 | 407.0 | 1.472 |
| 74304 | .10 | 6.200 | 4.900 | 5.400 | 2.400 | .231 | .0500 | .403 | 402.0 | 1.479 |
| 74305 | .04 | 5.300 | 4.100 | 4.600 | .400 | .232 | 0.0000 | .401 | 397.0 | 1.487 |
| 74306 | 0.00 | 4.100 | 1.900 | 2.800 | 1.000 | .500 | .1600 | .399 | 392.0 | 1.495 |
| 74307 | 0.00 | -2.000 | 1.600 | .100 | -2.800 | .474 | .2700 | .397 | 388.0 | 1.503 |
| 74308 | 0.00 | 6.700 | 4.800 | 6.300 | 5.100 | .531 | .2000 | .395 | 383.0 | 1.511 |
| 74309 | 0.00 | 9.000 | 3.600 | 5.700 | 4.600 | .370 | .1200 | .394 | 378.0 | 1.519 |
| 74310 | .96 | 8.000 | 5.500 | 7.100 | 6.200 | .053 | .0800 | .392 | 374.0 | 1.527 |
| 74311 | .93 | 6.300 | 5.900 | 6.700 | 5.800 | .103 | .0800 | .390 | 369.0 | 1.535 |
| 74312 | .10 | 5.100 | 3.400 | 4.100 | 3.000 | .321 | .0900 | .389 | 365.0 | 1.543 |
| 74313 | .51 | 6.200 | 3.700 | 4.700 | 3.700 | .187 | .1000 | .387 | 360.0 | 1.551 |
| 74314 | 0.00 | 5.600 | 5.100 | 5.300 | 4.500 | .271 | .0800 | .385 | 356.0 | 1.559 |
| 74315 | 0.00 | 7.200 | 2.100 | 4.100 | 3.000 | .353 | .1400 | .384 | 352.0 | 1.567 |
| 74316 | 0.00 | 7.800 | 3.200 | 5.000 | 4.000 | .354 | .1300 | .382 | 348.0 | 1.575 |
| 74317 | 0.00 | 6.700 | 2.900 | 4.300 | 3.300 | .383 | .1700 | .381 | 344.0 | 1.583 |
| 74318 | 0.00 | 7.600 | 3.100 | 4.800 | 3.700 | .302 | .1900 | .379 | 340.0 | 1.591 |
| 74319 | 0.00 | 7.500 | 5.900 | 6.500 | 5.000 | .415 | .0700 | .378 | 337.0 | 1.599 |
| 74320 | 0.00 | 4.400 | 2.800 | 3.400 | 1.700 | .416 | .2300 | .377 | 333.0 | 1.606 |
| 74321 | 1.13 | 4.300 | 3.900 | 4.100 | 2.300 | .080 | .0800 | .375 | 329.0 | 1.614 |
| 74322 | 1.68 | 4.200 | 4.600 | 4.500 | 3.100 | .108 | .4800 | .374 | 326.0 | 1.621 |
| 74323 | .28 | 4.800 | 1.600 | 2.800 | 1.800 | .222 | .0500 | .373 | 322.0 | 1.629 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 74324 | 0.00 | 5.700 | 4.700 | 5.100 | 4.300 | .166 | .1000 | .372 | 319.0 | 1.636 |
| 74325 | .43 | 8.100 | 6.800 | 7.300 | 6.200 | .167 | .1900 | .370 | 316.0 | 1.644 |
| 74326 | .80 | 2.000 | .700 | 1.200 | 0.000 | .196 | .2000 | .369 | 313.0 | 1.651 |
| 74327 | 1.53 | 3.800 | 1.100 | 2.100 | 1.000 | .168 | .1100 | .368 | 310.0 | 1.658 |
| 74328 | .24 | 5.400 | 3.300 | 4.100 | 3.600 | .312 | .1500 | .367 | 307.0 | 1.665 |
| 74329 | .77 | 4.200 | 4.300 | 4.300 | 3.700 | .226 | .2100 | .366 | 304.0 | 1.671 |
| 74330 | .15 | 2.100 | -.100 | .600 | .600 | .285 | .2200 | .365 | 301.0 | 1.678 |
| 74331 | .53 | 2.700 | 1.300 | 1.800 | 1.300 | .170 | .1800 | .364 | 299.0 | 1.684 |
| 74332 | 0.00 | .700 | .903 | .800 | .500 | .344 | .1600 | .363 | 296.0 | 1.691 |
| 74333 | 0.00 | -.800 | -2.000 | -1.600 | -2.000 | .373 | .2000 | .363 | 294.0 | 1.697 |
| 74334 | .07 | -1.900 | -2.700 | -2.400 | -2.400 | .200 | .1300 | .362 | 292.0 | 1.703 |
| 74335 | .35 | 5.600 | -1.800 | .800 | .700 | .140 | .1800 | .361 | 290.0 | 1.709 |
| 74336 | .33 | 6.400 | 3.900 | 4.800 | 4.700 | .141 | .1300 | .360 | 287.0 | 1.714 |
| 74337 | .47 | 5.700 | 4.500 | 4.900 | 4.800 | .048 | .1600 | .359 | 286.0 | 1.719 |
| 74338 | .13 | 5.100 | 1.800 | 3.000 | 2.700 | .083 | .1400 | .359 | 284.0 | 1.724 |
| 74339 | .85 | 3.800 | 3.100 | 3.400 | 2.500 | .202 | .1200 | .358 | 282.0 | 1.729 |
| 74340 | .02 | 3.300 | 3.200 | 3.200 | 2.700 | .058 | .1200 | .358 | 280.0 | 1.734 |
| 74341 | 0.00 | 4.000 | 2.700 | 3.200 | 2.100 | .173 | .1600 | .357 | 279.0 | 1.738 |
| 74342 | 0.00 | 2.800 | -1.200 | .200 | -.800 | .113 | .2500 | .357 | 277.0 | 1.742 |
| 74343 | .07 | 5.400 | 3.500 | 4.200 | 3.900 | .084 | .1400 | .356 | 276.0 | 1.746 |
| 74344 | 1.33 | 4.000 | 2.800 | 3.200 | 2.900 | .113 | .1700 | .356 | 275.0 | 1.750 |
| 74345 | .20 | 6.600 | 3.400 | 4.500 | 3.900 | .233 | .1100 | .355 | 274.0 | 1.753 |
| 74346 | 1.14 | 3.400 | 3.800 | 3.700 | 2.400 | .049 | .2500 | .355 | 273.0 | 1.756 |
| 74347 | .99 | 1.000 | 1.200 | 1.100 | -.200 | .049 | .1600 | .355 | 272.0 | 1.759 |
| 74348 | 1.91 | .400 | -.800 | -.300 | -.900 | .049 | .1600 | .355 | 271.0 | 1.761 |
| 74349 | 1.21 | 4.800 | 1.300 | 2.500 | 2.400 | .049 | .0900 | .354 | 270.0 | 1.763 |
| 74350 | .69 | 6.900 | 4.500 | 5.400 | 4.700 | .049 | .1700 | .354 | 270.0 | 1.765 |
| 74351 | .24 | 3.700 | 3.500 | 3.600 | 2.100 | .204 | .2200 | .354 | 269.0 | 1.767 |
| 74352 | .54 | 1.000 | .100 | .400 | -.300 | .173 | .1600 | .354 | 269.0 | 1.768 |
| 74353 | 2.18 | 4.100 | 2.400 | 3.000 | 3.000 | .049 | .0500 | .354 | 268.0 | 1.769 |
| 74354 | 2.61 | 9.000 | 5.500 | 6.700 | 6.700 | .049 | .4800 | .354 | 268.0 | 1.769 |
| 74355 | 1.26 | -.300 | 3.900 | 2.400 | .600 | .059 | .6200 | .354 | 268.0 | 1.770 |
| 74356 | .48 | -.300 | -1.800 | -1.300 | -1.900 | .059 | .1000 | .354 | 268.0 | 1.769 |
| 74357 | 0.00 | -3.100 | -2.600 | -2.800 | -3.600 | .203 | .0900 | .355 | 268.0 | 1.769 |
| 74358 | 0.00 | -1.700 | -3.000 | -2.500 | -3.900 | .084 | .1100 | .355 | 269.0 | 1.768 |
| 74359 | 0.00 | -1.200 | -2.300 | -1.900 | -2.900 | .174 | .1600 | .355 | 269.0 | 1.767 |
| 74360 | .65 | -.900 | -1.800 | -1.500 | -2.000 | .049 | .1600 | .355 | 270.0 | 1.766 |
| 74361 | 1.16 | .300 | -.400 | -.100 | -1.300 | .113 | .1500 | .356 | 270.0 | 1.764 |
| 74362 | 0.00 | -1.500 | -1.700 | -1.600 | -3.400 | .203 | .0900 | .356 | 271.0 | 1.762 |
| 74363 | .57 | -1.300 | -3.400 | -2.700 | -3.500 | .059 | .1200 | .356 | 272.0 | 1.760 |
| 74364 | .15 | -.500 | -.900 | -.800 | -1.800 | .177 | .0900 | .357 | 273.0 | 1.758 |
| 74365 | 0.00 | -3.300 | -4.000 | -3.700 | -3.700 | .354 | .1500 | .357 | 274.0 | 1.755 |
| 75001 | .29 | -.200 | -1.700 | -1.200 | -1.200 | .355 | .0800 | .358 | 275.0 | 1.751 |
| 75002 | .02 | -.200 | -1.900 | -1.300 | -1.400 | .383 | .0700 | .359 | 276.0 | 1.747 |
| 75003 | 1.53 | -.300 | .500 | .200 | .200 | .235 | .4000 | .359 | 278.0 | 1.744 |
| 75004 | 1.57 | 0.000 | -1.400 | -.900 | -.900 | .205 | .0900 | .360 | 279.0 | 1.740 |
| 75005 | 3.10 | -.800 | .600 | .100 | 0.000 | .088 | .1700 | .361 | 281.0 | 1.735 |
| 75006 | .64 | .800 | -.700 | -.100 | -.200 | .205 | .0900 | .361 | 283.0 | 1.731 |
| 75007 | 1.90 | -.300 | 1.800 | 1.000 | .500 | .146 | .4000 | .362 | 284.0 | 1.726 |
| 75008 | 1.13 | -1.100 | -3.200 | -2.400 | -3.000 | .048 | .1600 | .363 | 286.0 | 1.721 |
| 75009 | 1.22 | -2.000 | -1.400 | -1.600 | -1.800 | .048 | .0600 | .364 | 288.0 | 1.716 |
| 75010 | .60 | -.300 | -1.400 | -1.000 | -1.100 | .174 | .1000 | .365 | 290.0 | 1.710 |
| 75011 | .12 | 1.000 | -.800 | -.100 | -.200 | .317 | .1100 | .366 | 293.0 | 1.705 |
| 75012 | .79 | .700 | 0.000 | .300 | .300 | .201 | .1000 | .367 | 295.0 | 1.699 |
| 75013 | .36 | 1.100 | .200 | .500 | .500 | .172 | .1300 | .368 | 297.0 | 1.693 |
| 75014 | .07 | 3.800 | 1.000 | 2.000 | 2.000 | .401 | .1500 | .369 | 300.0 | 1.686 |
| 75015 | .25 | 4.800 | 2.100 | 3.100 | 2.500 | .285 | .1200 | .370 | 303.0 | 1.680 |
| 75016 | .33 | 6.400 | 3.300 | 4.500 | 3.500 | .285 | .1300 | .371 | 305.0 | 1.673 |
| 75017 | .01 | 7.800 | 3.600 | 5.200 | 4.800 | .313 | .1200 | .372 | 308.0 | 1.667 |
| 75018 | .03 | 6.800 | -.400 | 2.200 | 1.900 | .425 | .2200 | .373 | 311.0 | 1.660 |
| 75019 | .01 | 4.000 | 2.500 | 3.100 | 2.500 | .479 | .1600 | .375 | 314.0 | 1.653 |
| 75020 | .02 | 5.800 | -1.600 | 1.100 | -.100 | .422 | .2000 | .376 | 317.0 | 1.646 |
| 75021 | 0.00 | .100 | -1.000 | -.500 | -1.000 | .421 | .2600 | .377 | 321.0 | 1.638 |
| 75022 | 0.00 | 4.000 | 3.100 | 3.400 | 2.800 | .390 | .1800 | .379 | 324.0 | 1.631 |
| 75023 | 1.04 | 6.200 | 5.200 | 5.600 | 5.100 | .194 | .0900 | .380 | 327.0 | 1.624 |
| 75024 | 1.37 | 9.100 | 9.300 | 9.200 | 9.000 | .166 | .2900 | .382 | 331.0 | 1.616 |
| 75025 | 1.79 | 7.900 | -.600 | 2.600 | 2.000 | .045 | .4400 | .383 | 335.0 | 1.609 |
| 75026 | .27 | -.200 | -3.400 | -2.200 | -2.700 | .192 | .1500 | .385 | 338.0 | 1.601 |
| 75027 | 0.00 | -2.900 | -4.000 | -3.600 | -4.400 | .493 | .1400 | .386 | 342.0 | 1.593 |
| 75028 | 0.00 | -2.900 | -4.500 | -3.900 | -4.200 | .491 | .1400 | .388 | 346.0 | 1.585 |
| 75029 | 0.00 | -2.000 | -1.400 | -1.600 | -1.800 | .460 | 0.0000 | .389 | 350.0 | 1.578 |
| 75030 | 0.00 | -4.300 | -3.200 | -3.600 | -4.500 | .346 | 0.0000 | .391 | 354.0 | 1.570 |
| 75031 | .02 | -1.900 | -1.800 | -1.800 | -2.700 | .133 | 0.0000 | .393 | 358.0 | 1.562 |
| 75032 | .03 | -1.500 | -2.000 | -1.800 | -2.700 | .132 | 0.0000 | .394 | 363.0 | 1.554 |
| 75033 | .14 | -.300 | -1.800 | -1.200 | -2.100 | .342 | 0.0000 | .396 | 367.0 | 1.546 |
| 75034 | .17 | -.800 | -1.500 | -1.200 | -2.200 | .152 | 0.0000 | .398 | 372.0 | 1.538 |
| 75035 | .33 | -.400 | -1.500 | -1.100 | -2.100 | .172 | .1000 | .400 | 376.0 | 1.530 |
| 75036 | .34 | -.700 | -1.800 | -1.400 | -2.300 | .171 | .0400 | .402 | 381.0 | 1.522 |
| 75037 | .42 | -.700 | -.800 | -.800 | -1.700 | .129 | .1500 | .404 | 386.0 | 1.514 |
| 75038 | .22 | 2.100 | .500 | 1.100 | .700 | .252 | .1000 | .405 | 390.0 | 1.506 |
| 75039 | .49 | 2.200 | 1.100 | 1.500 | 1.100 | .148 | .1300 | .407 | 395.0 | 1.498 |
| 75040 | .47 | 3.700 | 1.800 | 2.600 | 2.200 | .249 | .2100 | .409 | 400.0 | 1.490 |
| 75041 | .96 | 2.600 | 1.600 | 2.000 | 1.700 | .127 | .3200 | .411 | 405.0 | 1.482 |
| 75042 | .41 | 2.800 | 2.100 | 2.400 | 2.300 | .146 | .1000 | .413 | 411.0 | 1.474 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 75043 | 2.24 | 4.600 | 2.100 | 3.100 | 2.800 | .126 | .1600 | .415 | 416.0 | 1.466 |
| 75044 | .80 | 1.700 | -.700 | .200 | -.400 | .224 | .3500 | .417 | 421.0 | 1.458 |
| 75045 | .14 | 0.000 | -2.300 | -1.300 | -2.100 | .343 | .1000 | .419 | 426.0 | 1.450 |
| 75046 | .42 | -1.500 | -1.300 | -1.400 | -2.900 | .261 | .2000 | .422 | 432.0 | 1.443 |
| 75047 | .39 | -.500 | -1.800 | -1.200 | -2.400 | .162 | .0800 | .424 | 437.0 | 1.435 |
| 75048 | 0.00 | .300 | -.700 | -.200 | -1.400 | .357 | .1500 | .426 | 443.0 | 1.427 |
| 75049 | 1.18 | .400 | .100 | .200 | .200 | .122 | .1100 | .428 | 449.0 | 1.420 |
| 75050 | 2.07 | 2.000 | -.700 | .400 | -.100 | .141 | .3700 | .430 | 454.0 | 1.412 |
| 75051 | .37 | -1.400 | -3.600 | -2.600 | -3.600 | .255 | .2400 | .432 | 460.0 | 1.404 |
| 75052 | .02 | -3.000 | -2.100 | -2.500 | -2.800 | .464 | .1800 | .435 | 466.0 | 1.397 |
| 75053 | 0.00 | .400 | -2.000 | -.900 | -2.000 | .424 | .2200 | .437 | 472.0 | 1.390 |
| 75054 | 0.00 | 2.400 | 1.200 | 1.700 | 1.500 | .441 | .1500 | .439 | 478.0 | 1.382 |
| 75055 | .05 | 5.300 | -1.500 | 1.400 | .400 | .477 | .2200 | .441 | 484.0 | 1.375 |
| 75056 | .03 | 3.300 | -.100 | 1.400 | 0.000 | .417 | .2100 | .444 | 490.0 | 1.368 |
| 75057 | .02 | 3.200 | 2.800 | 3.000 | 2.700 | .172 | .1500 | .446 | 496.0 | 1.360 |
| 75058 | 2.17 | 4.200 | 6.000 | 5.200 | 5.200 | .116 | .0700 | .448 | 502.0 | 1.353 |
| 75059 | .43 | 11.700 | 5.200 | 8.700 | 8.500 | .281 | .1600 | .451 | 508.0 | 1.346 |
| 75060 | .39 | 8.000 | 4.300 | 6.000 | 5.800 | .170 | .1300 | .453 | 514.0 | 1.339 |
| 75061 | .57 | 6.000 | 4.200 | 5.000 | 5.000 | .169 | .1300 | .456 | 520.0 | 1.332 |
| 75062 | .10 | 7.900 | -.100 | 3.500 | 3.200 | .532 | .1900 | .458 | 527.0 | 1.326 |
| 75063 | 0.00 | 7.400 | -1.700 | 2.400 | .600 | .566 | .2600 | .460 | 533.0 | 1.319 |
| 75064 | 0.00 | 7.400 | -1.600 | 2.500 | -.300 | .598 | .2400 | .463 | 539.0 | 1.312 |
| 75065 | 0.00 | 6.500 | .700 | 3.400 | 1.000 | .452 | .2200 | .465 | 546.0 | 1.306 |
| 75066 | .02 | 6.500 | 3.700 | 5.000 | 3.700 | .289 | .2000 | .468 | 552.0 | 1.299 |
| 75067 | .02 | 5.400 | 1.500 | 3.300 | 2.500 | .181 | .2300 | .470 | 559.0 | 1.292 |
| 75068 | .78 | 5.500 | -2.100 | 1.400 | -1.400 | .497 | .2300 | .473 | 565.0 | 1.286 |
| 75069 | .02 | 4.300 | -1.700 | 1.100 | -1.700 | .425 | .2000 | .475 | 572.0 | 1.280 |
| 75070 | 0.00 | 6.000 | -.700 | 2.400 | -1.200 | .598 | .1700 | .477 | 578.0 | 1.273 |
| 75071 | .03 | 2.900 | -.200 | 1.200 | -.800 | .334 | .3400 | .480 | 585.0 | 1.267 |
| 75072 | .01 | 5.400 | -.500 | 2.300 | -1.400 | .540 | .1900 | .482 | 591.0 | 1.261 |
| 75073 | 0.00 | 6.000 | .900 | 3.400 | -1.000 | .554 | .2000 | .485 | 598.0 | 1.255 |
| 75074 | .80 | 2.800 | .300 | 1.500 | .500 | .192 | .2500 | .487 | 604.0 | 1.249 |
| 75075 | .78 | .400 | -.900 | -.200 | -.500 | .293 | .2000 | .490 | 611.0 | 1.243 |
| 75076 | 1.93 | .600 | 2.000 | 1.300 | 1.100 | .156 | .1200 | .492 | 617.0 | 1.237 |
| 75077 | 2.38 | -.200 | -.900 | -.600 | -1.000 | .105 | .0900 | .495 | 624.0 | 1.231 |
| 75078 | .66 | .300 | -1.200 | -.400 | -.500 | .255 | .2400 | .497 | 630.0 | 1.226 |
| 75079 | .16 | .200 | -.100 | 0.000 | 0.000 | .153 | 0.0000 | .500 | 637.0 | 1.220 |
| 75080 | .85 | -1.200 | -1.200 | -1.200 | -1.200 | .104 | 0.0000 | .503 | 644.0 | 1.215 |
| 75081 | 1.06 | -.100 | -.300 | -.200 | -.300 | .334 | 0.0000 | .505 | 650.0 | 1.209 |
| 75082 | 1.55 | -.400 | -.900 | -.600 | -.600 | .181 | 0.0000 | .508 | 657.0 | 1.204 |
| 75083 | 1.75 | 1.300 | 0.000 | .700 | .600 | .200 | 0.0000 | .510 | 663.0 | 1.198 |
| 75084 | .03 | 1.300 | -1.900 | -.200 | -2.000 | .523 | 0.0000 | .513 | 670.0 | 1.193 |
| 75085 | .04 | 1.300 | -2.200 | -.300 | -2.000 | .360 | 0.0000 | .515 | 676.0 | 1.188 |
| 75086 | .01 | 1.500 | -4.200 | -1.200 | -4.000 | .711 | 0.0000 | .518 | 683.0 | 1.183 |
| 75087 | 0.00 | 5.100 | -2.800 | 1.300 | -3.000 | .693 | 0.0000 | .520 | 689.0 | 1.178 |
| 75088 | 0.00 | 7.700 | -.900 | 3.500 | -1.000 | .673 | 0.0000 | .523 | 695.0 | 1.172 |
| 75089 | .10 | 4.000 | -.300 | 1.900 | .300 | .448 | 0.0000 | .525 | 702.0 | 1.168 |
| 75090 | .06 | 2.600 | -1.400 | .700 | -1.700 | .541 | 0.0000 | .527 | 708.0 | 1.163 |
| 75091 | 0.00 | 4.200 | .600 | 2.500 | .600 | .475 | 0.0000 | .530 | 715.0 | 1.158 |
| 75092 | .58 | 1.300 | -.300 | .200 | .200 | .286 | 0.0000 | .532 | 721.0 | 1.153 |
| 75093 | .30 | 1.200 | -.900 | .200 | -1.000 | .346 | 0.0000 | .535 | 727.0 | 1.148 |
| 75094 | .05 | .900 | -3.100 | -.900 | -3.000 | .469 | 0.0000 | .537 | 733.0 | 1.144 |
| 75095 | 0.00 | 3.400 | -3.400 | .200 | -3.700 | .513 | 0.0000 | .540 | 740.0 | 1.139 |
| 75096 | .01 | 3.100 | .400 | 1.900 | .200 | .603 | 0.0000 | .542 | 746.0 | 1.135 |
| 75097 | .13 | 3.600 | .300 | 2.100 | .100 | .387 | 0.0000 | .544 | 752.0 | 1.130 |
| 75098 | 0.00 | 6.200 | -.700 | 3.000 | -.800 | .537 | 0.0000 | .547 | 758.0 | 1.126 |
| 75099 | 0.00 | 6.500 | -.800 | 3.200 | -1.000 | .702 | 0.0000 | .549 | 764.0 | 1.122 |
| 75100 | 0.00 | 7.800 | -1.700 | 3.500 | -2.000 | .668 | .0400 | .552 | 770.0 | 1.117 |
| 75101 | 0.00 | 10.200 | -1.600 | 4.900 | -1.700 | .364 | .5000 | .554 | 776.0 | 1.113 |
| 75102 | 0.00 | 10.900 | 1.900 | 6.900 | -1.500 | .603 | .2000 | .556 | 782.0 | 1.109 |
| 75103 | 0.00 | 6.500 | 1.600 | 4.300 | -.900 | .257 | .1500 | .559 | 788.0 | 1.105 |
| 75104 | .19 | 4.800 | .700 | 3.000 | -1.400 | .360 | .1800 | .561 | 793.0 | 1.101 |
| 75105 | .01 | 4.100 | -.600 | 2.000 | -1.900 | .551 | .2500 | .563 | 799.0 | 1.097 |
| 75106 | .09 | 3.800 | 1.000 | 2.600 | -.700 | .343 | .1700 | .565 | 805.0 | 1.093 |
| 75107 | .01 | 3.800 | 2.000 | 3.000 | 0.000 | .162 | .0800 | .568 | 810.0 | 1.089 |
| 75108 | .19 | 5.400 | 3.100 | 4.400 | 2.000 | .223 | .1300 | .570 | 816.0 | 1.085 |
| 75109 | .07 | 4.900 | -2.000 | 1.900 | -1.200 | .411 | .2200 | .572 | 821.0 | 1.082 |
| 75110 | 0.00 | 8.400 | 0.000 | 4.800 | -1.600 | .671 | .2400 | .574 | 827.0 | 1.078 |
| 75111 | 0.00 | 10.100 | 2.100 | 6.700 | -1.400 | .654 | .3100 | .576 | 832.0 | 1.074 |
| 75112 | .27 | 7.100 | 1.900 | 4.900 | -.200 | .436 | .2800 | .578 | 837.0 | 1.071 |
| 75113 | .32 | 7.100 | 4.700 | 6.100 | 2.300 | .448 | .1500 | .581 | 843.0 | 1.067 |
| 75114 | 1.42 | 3.600 | -2.900 | .800 | .600 | .161 | .2600 | .583 | 848.0 | 1.064 |
| 75115 | .21 | 3.900 | 1.500 | 2.900 | -.700 | .516 | .2500 | .585 | 853.0 | 1.061 |
| 75116 | .10 | 4.400 | 1.600 | 3.200 | 2.900 | .216 | .2000 | .587 | 858.0 | 1.057 |
| 75117 | .27 | 3.700 | -.800 | 1.800 | .100 | .244 | .2800 | .589 | 863.0 | 1.054 |
| 75118 | 0.00 | 4.900 | -2.000 | 2.000 | -1.000 | .468 | .2700 | .591 | 868.0 | 1.051 |
| 75119 | 0.00 | 10.300 | .300 | 6.200 | .400 | .678 | .2400 | .593 | 872.0 | 1.048 |
| 75120 | 0.00 | 12.500 | 1.000 | 7.800 | .900 | .689 | .2500 | .595 | 877.0 | 1.045 |
| 75121 | 0.00 | 13.400 | 3.900 | 9.600 | .200 | .646 | .2900 | .596 | 882.0 | 1.042 |
| 75122 | .61 | 6.300 | 4.500 | 5.600 | 3.700 | .310 | .2600 | .598 | 886.0 | 1.039 |
| 75123 | .88 | 2.500 | .100 | 1.500 | .200 | .267 | .3100 | .600 | 891.0 | 1.036 |
| 75124 | .14 | 3.400 | 2.600 | 3.100 | 1.400 | .419 | .2900 | .602 | 895.0 | 1.033 |
| 75125 | .19 | 4.100 | 3.300 | 3.800 | 3.700 | .210 | .1600 | .604 | 900.0 | 1.030 |
| 75126 | 0.00 | 7.100 | .400 | 4.500 | 2.600 | .443 | .3000 | .606 | 904.0 | 1.027 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 75127 | 0.00 | 9.300 | 2.200 | 6.500 | 3.200 | .525 | .2300 | .607 | 908.0 | 1.025 |
| 75128 | 0.00 | 14.000 | 5.000 | 10.500 | 4.500 | .715 | .2200 | .609 | 912.0 | 1.022 |
| 75129 | 0.00 | 16.600 | 5.900 | 12.800 | 8.200 | .603 | .2400 | .611 | 916.0 | 1.019 |
| 75130 | .80 | 7.700 | 5.100 | 6.700 | 6.500 | .276 | .1900 | .612 | 920.0 | 1.017 |
| 75131 | .28 | 7.800 | 1.400 | 5.300 | 1.200 | .451 | .1800 | .614 | 924.0 | 1.014 |
| 75132 | 0.00 | 13.800 | 4.200 | 10.100 | 2.700 | .721 | .2800 | .615 | 928.0 | 1.012 |
| 75133 | 0.00 | 19.400 | 8.100 | 15.100 | 6.800 | .692 | .3100 | .617 | 931.0 | 1.010 |
| 75134 | 0.00 | 14.700 | 7.600 | 12.000 | 7.100 | .596 | .4300 | .618 | 935.0 | 1.007 |
| 75135 | 0.00 | 12.300 | 5.800 | 9.800 | 5.900 | .487 | .3200 | .620 | 938.0 | 1.005 |
| 75136 | 0.00 | 15.600 | 5.300 | 11.700 | 4.500 | .688 | .2300 | .621 | 942.0 | 1.003 |
| 75137 | 0.00 | 15.500 | 5.300 | 11.700 | 4.500 | .672 | .3000 | .623 | 945.0 | 1.001 |
| 75138 | 0.00 | 8.900 | 4.700 | 7.300 | 4.300 | .217 | .2200 | .624 | 948.0 | .999 |
| 75139 | .28 | 4.000 | 1.200 | 3.000 | 2.500 | .336 | .2300 | .625 | 951.0 | .997 |
| 75140 | 0.00 | 7.700 | 2.700 | 5.800 | 3.800 | .428 | .1600 | .627 | 954.0 | .995 |
| 75141 | .01 | 11.700 | 7.200 | 10.000 | 4.900 | .428 | .2700 | .628 | 957.0 | .993 |
| 75142 | .17 | 12.200 | 8.200 | 10.700 | 6.100 | .454 | .2600 | .629 | 960.0 | .991 |
| 75143 | .10 | 10.500 | 5.000 | 8.500 | 4.800 | .400 | .3300 | .630 | 963.0 | .989 |
| 75144 | .04 | 7.400 | -.100 | 4.600 | -1.400 | .377 | .2000 | .631 | 966.0 | .987 |
| 75145 | .01 | 14.900 | 6.800 | 11.900 | 1.100 | .715 | .1800 | .632 | 968.0 | .986 |
| 75146 | 0.00 | 13.700 | 6.300 | 11.000 | 6.500 | .372 | .2000 | .633 | 971.0 | .984 |
| 75147 | 0.00 | 16.600 | 5.700 | 12.600 | 5.600 | .608 | .2300 | .634 | 973.0 | .983 |
| 75148 | 0.00 | 18.500 | 8.200 | 14.700 | 6.500 | .699 | .2600 | .635 | 975.0 | .981 |
| 75149 | 0.00 | 20.300 | 8.800 | 16.100 | 9.300 | .711 | .2600 | .636 | 978.0 | .980 |
| 75150 | 0.00 | 21.900 | 8.800 | 17.100 | 9.600 | .683 | .2600 | .637 | 980.0 | .978 |
| 75151 | 0.00 | 23.600 | 10.900 | 19.000 | 9.900 | .695 | .2800 | .638 | 982.0 | .977 |
| 75152 | 0.00 | 24.800 | 16.100 | 21.700 | 10.900 | .642 | .3700 | .639 | 984.0 | .976 |
| 75153 | 0.00 | 17.500 | 8.800 | 14.400 | 7.900 | .459 | .3300 | .639 | 985.0 | .974 |
| 75154 | 0.00 | 18.800 | 14.000 | 17.100 | 7.100 | .680 | .2800 | .640 | 987.0 | .973 |
| 75155 | 0.00 | 21.300 | 11.000 | 17.600 | 10.900 | .601 | .2300 | .641 | 989.0 | .972 |
| 75156 | 0.00 | 20.300 | 8.000 | 15.900 | 9.700 | .614 | .2700 | .641 | 990.0 | .971 |
| 75157 | 0.00 | 17.700 | 4.900 | 13.100 | 6.400 | .691 | .2900 | .642 | 992.0 | .970 |
| 75158 | 0.00 | 14.200 | 3.200 | 10.300 | 2.400 | .729 | .2500 | .643 | 993.0 | .969 |
| 75159 | 0.00 | 16.600 | 6.800 | 13.100 | 4.200 | .742 | .2500 | .643 | 994.0 | .968 |
| 75160 | 0.00 | 20.600 | 7.800 | 16.000 | 3.800 | .715 | .3900 | .644 | 995.0 | .968 |
| 75161 | 0.00 | 22.600 | 9.300 | 17.900 | 4.800 | .702 | .2600 | .644 | 997.0 | .967 |
| 75162 | 0.00 | 20.800 | 8.900 | 16.600 | 7.800 | .689 | .2900 | .644 | 997.0 | .966 |
| 75163 | 0.00 | 22.300 | 11.500 | 18.500 | 8.800 | .707 | .3100 | .645 | 998.0 | .966 |
| 75164 | 0.00 | 20.100 | 9.400 | 16.300 | 3.800 | .733 | .4500 | .645 | 999.0 | .965 |
| 75165 | 0.00 | 20.500 | 11.800 | 17.400 | 7.700 | .746 | .3100 | .645 | 1000.0 | .965 |
| 75166 | 0.00 | 18.600 | 7.500 | 14.700 | 4.200 | .733 | .3200 | .645 | 1000.0 | .964 |
| 75167 | 0.00 | 12.400 | 7.800 | 10.800 | 4.600 | .667 | .3200 | .646 | 1001.0 | .964 |
| 75168 | .04 | 8.800 | 7.300 | 8.300 | 4.400 | .396 | .1800 | .646 | 1001.0 | .963 |
| 75169 | .04 | 10.100 | 9.100 | 9.700 | 7.200 | .261 | .1600 | .646 | 1001.0 | .963 |
| 75170 | .09 | 11.900 | 10.000 | 11.200 | 10.000 | .280 | .1700 | .646 | 1002.0 | .963 |
| 75171 | 0.00 | 16.700 | 6.300 | 13.000 | 7.000 | .732 | .3700 | .646 | 1002.0 | .963 |
| 75172 | 0.00 | 15.800 | 5.900 | 12.300 | 6.500 | .771 | .3100 | .646 | 1002.0 | .963 |
| 75173 | 0.00 | 13.800 | 9.400 | 12.200 | 6.400 | .726 | .2900 | .646 | 1002.0 | .963 |
| 75174 | .13 | 11.500 | 7.800 | 10.200 | 7.100 | .384 | .2300 | .646 | 1001.0 | .963 |
| 75175 | .20 | 6.500 | 5.500 | 6.100 | 5.300 | .229 | .1900 | .645 | 1001.0 | .963 |
| 75176 | .14 | 9.200 | 6.900 | 8.400 | 7.400 | .358 | .1400 | .645 | 1001.0 | .963 |
| 75177 | .24 | 7.600 | 5.500 | 6.900 | 5.900 | .339 | .1700 | .645 | 1000.0 | .963 |
| 75178 | .12 | 9.300 | 6.800 | 8.400 | 5.900 | .488 | .2400 | .645 | 1000.0 | .964 |
| 75179 | .13 | 10.400 | 4.900 | 8.400 | 5.600 | .417 | .1500 | .644 | 999.0 | .964 |
| 75180 | 0.00 | 14.200 | 7.600 | 11.800 | 7.000 | .728 | .2700 | .644 | 998.0 | .964 |
| 75181 | .31 | 12.800 | 10.000 | 11.800 | 9.900 | .470 | .2000 | .643 | 997.0 | .965 |
| 75182 | .20 | 11.900 | 9.100 | 10.900 | 9.900 | .327 | .1300 | .643 | 996.0 | .965 |
| 75183 | .02 | 12.900 | 9.600 | 11.700 | 10.200 | .373 | .1500 | .642 | 995.0 | .966 |
| 75184 | .01 | 13.900 | 11.800 | 13.100 | 11.500 | .425 | .1900 | .642 | 994.0 | .967 |
| 75185 | 0.00 | 23.000 | 19.900 | 21.900 | 15.800 | .725 | .2700 | .641 | 993.0 | .967 |
| 75186 | 0.00 | 22.900 | 17.000 | 20.800 | 15.100 | .731 | .3100 | .641 | 991.0 | .968 |
| 75187 | 0.00 | 20.500 | 16.300 | 19.000 | 13.700 | .550 | .2200 | .640 | 990.0 | .969 |
| 75188 | 0.00 | 22.900 | 18.000 | 21.100 | 13.900 | .720 | .2800 | .639 | 988.0 | .970 |
| 75189 | 0.00 | 22.000 | 17.700 | 20.400 | 14.100 | .722 | .2900 | .638 | 987.0 | .971 |
| 75190 | 0.00 | 23.200 | 19.900 | 22.000 | 15.700 | .716 | .2800 | .637 | 985.0 | .972 |
| 75191 | .44 | 21.900 | 19.400 | 21.000 | 16.000 | .710 | .3100 | .637 | 983.0 | .973 |
| 75192 | .05 | 21.300 | 20.000 | 20.800 | 16.800 | .462 | .2900 | .636 | 981.0 | .974 |
| 75193 | 0.00 | 19.500 | 13.600 | 17.300 | 12.000 | .732 | .3900 | .635 | 979.0 | .975 |
| 75194 | 0.00 | 18.800 | 12.800 | 16.600 | 10.600 | .772 | .3200 | .634 | 977.0 | .976 |
| 75195 | .03 | 16.600 | 16.400 | 16.500 | 12.100 | .431 | .2000 | .633 | 975.0 | .978 |
| 75196 | 0.00 | 17.900 | 13.100 | 16.100 | 12.200 | .372 | .1900 | .632 | 973.0 | .979 |
| 75197 | 0.00 | 20.300 | 17.600 | 19.300 | 11.400 | .650 | .2100 | .631 | 970.0 | .981 |
| 75198 | 0.00 | 16.600 | 14.700 | 17.200 | 11.100 | .565 | .2700 | .630 | 968.0 | .982 |
| 75199 | .02 | 17.500 | 17.100 | 17.400 | 13.900 | .375 | .1600 | .628 | 965.0 | .984 |
| 75200 | 0.00 | 22.900 | 13.900 | 19.500 | 12.400 | .661 | .2600 | .627 | 963.0 | .985 |
| 75201 | 0.00 | 23.700 | 14.800 | 20.400 | 11.800 | .749 | .3100 | .626 | 960.0 | .987 |
| 75202 | 0.00 | 22.300 | 13.600 | 19.000 | 11.400 | .730 | .2900 | .625 | 957.0 | .989 |
| 75203 | 0.00 | 22.300 | 13.400 | 18.900 | 11.600 | .726 | .2400 | .623 | 954.0 | .990 |
| 75204 | 0.00 | 24.000 | 14.300 | 20.300 | 10.500 | .733 | .2800 | .622 | 951.0 | .992 |
| 75205 | 0.00 | 24.700 | 18.000 | 22.200 | 10.900 | .714 | .2500 | .621 | 948.0 | .994 |
| 75206 | 0.00 | 23.500 | 14.800 | 20.200 | 13.600 | .737 | .2800 | .619 | 945.0 | .996 |
| 75207 | 0.00 | 24.500 | 17.400 | 21.800 | 15.700 | .731 | .2500 | .618 | 941.0 | .998 |
| 75208 | 0.00 | 23.700 | 13.300 | 19.700 | 13.800 | .713 | .2500 | .616 | 938.0 | 1.000 |
| 75209 | .25 | 20.300 | 10.100 | 16.400 | 12.100 | .660 | .2600 | .615 | 935.0 | 1.002 |
| 75210 | .03 | 11.200 | 8.300 | 10.100 | 7.100 | .357 | .1200 | .613 | 931.0 | 1.004 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 75211 | 0.00 | 11.800 | 7.300 | 10.100 | 7.700 | .249 | .0900 | .611 | 927.0 | 1.007 |
| 75212 | 0.00 | 16.700 | 8.900 | 13.700 | 9.600 | .816 | .2300 | .610 | 924.0 | 1.009 |
| 75213 | 0.00 | 20.700 | 10.800 | 16.800 | 11.000 | .723 | .2300 | .608 | 920.0 | 1.011 |
| 75214 | 0.00 | 20.400 | 9.800 | 16.200 | 10.400 | .732 | .2300 | .606 | 916.0 | 1.014 |
| 75215 | 0.00 | 21.300 | 13.100 | 18.100 | 11.700 | .726 | .2000 | .605 | 912.0 | 1.016 |
| 75216 | 0.00 | 21.700 | 11.100 | 17.500 | 11.500 | .729 | .1500 | .603 | 908.0 | 1.019 |
| 75217 | 0.00 | 15.900 | 13.300 | 14.900 | 10.500 | .759 | .2900 | .601 | 904.0 | 1.021 |
| 75218 | 0.00 | 16.900 | 11.000 | 14.500 | 7.900 | .692 | .3500 | .599 | 900.0 | 1.024 |
| 75219 | 0.00 | 17.900 | 12.800 | 15.800 | 8.400 | .778 | .2200 | .597 | 896.0 | 1.026 |
| 75220 | 0.00 | 20.300 | 8.900 | 15.700 | 9.600 | .682 | .2400 | .596 | 891.0 | 1.029 |
| 75221 | 0.00 | 19.800 | 9.700 | 15.700 | 8.700 | .754 | .3100 | .594 | 887.0 | 1.032 |
| 75222 | 0.00 | 19.600 | 10.600 | 15.900 | 9.200 | .756 | .2200 | .592 | 882.0 | 1.035 |
| 75223 | 0.00 | 19.900 | 10.300 | 16.000 | 10.500 | .752 | .2800 | .590 | 878.0 | 1.038 |
| 75224 | 0.00 | 20.600 | 10.400 | 16.400 | 9.600 | .747 | .2700 | .588 | 873.0 | 1.041 |
| 75225 | 0.00 | 21.100 | 10.400 | 16.700 | 9.200 | .736 | .2600 | .586 | 869.0 | 1.044 |
| 75226 | 0.00 | 20.500 | 12.600 | 17.200 | 10.700 | .717 | .2700 | .584 | 864.0 | 1.047 |
| 75227 | 0.00 | 20.100 | 11.700 | 16.600 | 11.300 | .641 | .2800 | .582 | 859.0 | 1.050 |
| 75228 | 0.00 | 17.400 | 13.100 | 15.600 | 12.500 | .391 | .1600 | .580 | 854.0 | 1.053 |
| 75229 | .70 | 13.700 | 11.100 | 12.600 | 12.500 | .206 | .0700 | .577 | 849.0 | 1.056 |
| 75230 | .62 | 13.400 | 11.300 | 12.500 | 12.100 | .402 | .1600 | .575 | 844.0 | 1.060 |
| 75231 | 0.00 | 13.300 | 9.200 | 11.500 | 10.500 | .360 | .1500 | .573 | 839.0 | 1.063 |
| 75232 | 0.00 | 16.800 | 11.000 | 14.300 | 11.700 | .719 | .3200 | .571 | 834.0 | 1.066 |
| 75233 | 0.00 | 17.500 | 13.700 | 15.900 | 13.100 | .692 | .3500 | .569 | 828.0 | 1.070 |
| 75234 | .17 | 16.200 | 12.400 | 14.600 | 11.200 | .570 | .3100 | .566 | 823.0 | 1.073 |
| 75235 | .52 | 14.200 | 8.800 | 11.800 | 11.000 | .366 | .3200 | .564 | 818.0 | 1.077 |
| 75236 | 0.00 | 15.800 | 7.700 | 12.300 | 8.800 | .715 | .3300 | .562 | 812.0 | 1.081 |
| 75237 | 0.00 | 16.400 | 8.000 | 12.700 | 9.000 | .710 | .3100 | .560 | 807.0 | 1.084 |
| 75238 | 0.00 | 17.900 | 10.900 | 14.800 | 10.500 | .692 | .2700 | .557 | 801.0 | 1.088 |
| 75239 | .38 | 16.100 | 8.800 | 12.900 | 10.400 | .394 | .2100 | .555 | 796.0 | 1.092 |
| 75240 | .23 | 11.500 | 9.600 | 10.700 | 9.600 | .328 | .0800 | .553 | 790.0 | 1.096 |
| 75241 | .18 | 11.400 | 10.500 | 11.000 | 10.800 | .284 | .0700 | .550 | 784.0 | 1.100 |
| 75242 | .22 | 11.200 | 8.700 | 10.100 | 9.700 | .346 | .1000 | .548 | 779.0 | 1.104 |
| 75243 | 0.00 | 13.100 | 5.300 | 9.600 | 7.700 | .584 | .1400 | .546 | 773.0 | 1.108 |
| 75244 | 0.00 | 12.200 | 5.400 | 9.100 | 6.200 | .725 | .3900 | .543 | 767.0 | 1.112 |
| 75245 | 0.00 | 13.500 | 6.900 | 10.500 | 7.100 | .705 | .3300 | .541 | 761.0 | 1.116 |
| 75246 | 0.00 | 16.100 | 7.900 | 12.300 | 8.500 | .678 | .3200 | .538 | 755.0 | 1.120 |
| 75247 | 0.00 | 17.800 | 9.300 | 13.900 | 9.600 | .657 | .2100 | .536 | 749.0 | 1.125 |
| 75248 | 0.00 | 20.100 | 11.300 | 16.000 | 11.100 | .667 | .1900 | .534 | 743.0 | 1.129 |
| 75249 | 0.00 | 21.400 | 9.500 | 15.800 | 10.400 | .639 | .2700 | .531 | 737.0 | 1.133 |
| 75250 | 0.00 | 17.100 | 7.900 | 12.800 | 9.200 | .681 | .2300 | .529 | 731.0 | 1.138 |
| 75251 | 0.00 | 17.300 | 8.500 | 13.100 | 9.700 | .677 | .2500 | .526 | 725.0 | 1.142 |
| 75252 | 0.00 | 19.100 | 9.700 | 14.600 | 11.200 | .608 | .1800 | .524 | 719.0 | 1.147 |
| 75253 | 0.00 | 20.100 | 7.900 | 14.300 | 9.600 | .596 | .2000 | .521 | 712.0 | 1.152 |
| 75254 | 0.00 | 21.900 | 11.600 | 16.900 | 9.600 | .734 | .3000 | .519 | 706.0 | 1.156 |
| 75255 | 0.00 | 19.900 | 13.400 | 16.800 | 12.400 | .642 | .1800 | .516 | 700.0 | 1.161 |
| 75256 | 0.00 | 20.200 | 14.600 | 17.500 | 13.400 | .677 | .2400 | .514 | 694.0 | 1.166 |
| 75257 | 0.00 | 20.800 | 14.400 | 17.700 | 14.100 | .624 | .1900 | .511 | 687.0 | 1.171 |
| 75258 | 0.00 | 21.400 | 11.900 | 16.700 | 13.000 | .659 | .1900 | .509 | 681.0 | 1.176 |
| 75259 | 0.00 | 18.700 | 10.900 | 14.800 | 9.500 | .646 | .2200 | .506 | 675.0 | 1.181 |
| 75260 | 0.00 | 14.700 | 7.200 | 11.000 | 7.600 | .649 | .2200 | .504 | 668.0 | 1.186 |
| 75261 | 0.00 | 16.600 | 5.900 | 11.800 | 5.000 | .678 | .2200 | .501 | 662.0 | 1.191 |
| 75262 | 0.00 | 16.400 | 8.800 | 12.600 | 6.800 | .647 | .1800 | .499 | 655.0 | 1.197 |
| 75263 | 0.00 | 17.300 | 8.300 | 12.800 | 5.000 | .668 | .2000 | .496 | 649.0 | 1.202 |
| 75264 | 0.00 | 16.400 | 8.300 | 12.300 | 5.000 | .670 | .2200 | .494 | 642.0 | 1.207 |
| 75265 | 0.00 | 15.400 | 8.900 | 12.100 | 6.300 | .530 | .2100 | .491 | 636.0 | 1.213 |
| 75266 | 0.00 | 15.600 | 7.500 | 11.500 | 6.700 | .626 | .1900 | .489 | 630.0 | 1.218 |
| 75267 | 0.00 | 15.100 | 7.700 | 11.300 | 6.900 | .656 | .2200 | .486 | 623.0 | 1.224 |
| 75268 | 0.00 | 14.000 | 6.300 | 10.000 | 6.500 | .650 | .2100 | .484 | 617.0 | 1.230 |
| 75269 | 0.00 | 15.800 | 7.100 | 11.300 | 6.700 | .611 | .1600 | .481 | 610.0 | 1.236 |
| 75270 | 0.00 | 16.300 | 7.800 | 11.900 | 5.800 | .613 | .2300 | .479 | 604.0 | 1.241 |
| 75271 | 0.00 | 14.300 | 6.500 | 10.200 | 6.700 | .617 | .1900 | .476 | 597.0 | 1.247 |
| 75272 | 0.00 | 15.400 | 7.400 | 11.200 | 5.600 | .620 | .2200 | .474 | 591.0 | 1.253 |
| 75273 | 0.00 | 16.900 | 7.800 | 12.100 | 7.000 | .597 | .1800 | .471 | 584.0 | 1.259 |
| 75274 | 0.00 | 16.800 | 10.400 | 13.400 | 8.000 | .536 | .1600 | .469 | 578.0 | 1.265 |
| 75275 | 0.00 | 12.000 | 8.600 | 10.200 | 8.000 | .289 | .1800 | .466 | 572.0 | 1.272 |
| 75276 | .49 | 10.600 | 10.600 | 10.600 | 10.500 | .138 | .0900 | .464 | 565.0 | 1.278 |
| 75277 | .28 | 13.200 | 9.000 | 10.900 | 10.200 | .409 | .1300 | .462 | 559.0 | 1.284 |
| 75278 | .57 | 14.500 | 7.800 | 10.900 | 9.100 | .511 | .1700 | .459 | 553.0 | 1.291 |
| 75279 | .21 | 8.500 | 5.000 | 6.600 | 6.000 | .322 | .1100 | .457 | 546.0 | 1.297 |
| 75280 | .92 | 6.100 | 4.500 | 5.200 | 5.200 | .196 | .1000 | .454 | 540.0 | 1.304 |
| 75281 | .07 | 7.500 | 7.300 | 7.400 | 7.400 | .243 | .0900 | .452 | 534.0 | 1.310 |
| 75282 | .07 | 8.400 | 6.000 | 7.100 | 7.000 | .160 | .0900 | .450 | 527.0 | 1.317 |
| 75283 | .02 | 9.200 | 7.900 | 8.500 | 8.400 | .366 | .0700 | .447 | 521.0 | 1.324 |
| 75284 | .42 | 7.500 | 6.200 | 6.800 | 6.800 | .134 | .0400 | .445 | 515.0 | 1.330 |
| 75285 | .03 | 8.400 | 6.500 | 7.300 | 7.300 | .210 | .0800 | .443 | 509.0 | 1.337 |
| 75286 | 0.00 | 8.900 | 5.500 | 7.000 | 6.500 | .334 | .1800 | .440 | 503.0 | 1.344 |
| 75287 | 0.00 | 9.700 | 7.700 | 8.600 | 7.900 | .469 | .1200 | .438 | 497.0 | 1.351 |
| 75288 | .08 | 10.500 | 8.200 | 9.200 | 9.200 | .318 | .0900 | .436 | 491.0 | 1.358 |
| 75289 | 0.00 | 13.500 | 5.700 | 9.100 | 8.400 | .406 | .1500 | .434 | 485.0 | 1.365 |
| 75290 | .34 | 10.000 | 7.200 | 8.400 | 8.400 | .254 | .1300 | .431 | 479.0 | 1.373 |
| 75291 | 0.00 | 8.500 | 3.900 | 5.900 | 5.600 | .450 | .1500 | .429 | 473.0 | 1.380 |
| 75292 | .15 | 8.400 | 8.800 | 8.600 | 8.600 | .179 | .1100 | .427 | 467.0 | 1.387 |
| 75293 | .36 | 11.100 | 9.200 | 10.000 | 10.000 | .258 | .1600 | .425 | 462.0 | 1.395 |
| 75294 | 1.74 | 7.600 | 2.600 | 4.700 | 4.400 | .121 | .2600 | .423 | 456.0 | 1.402 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 75295 | .28 | 4.300 | 2.200 | 3.100 | 2.500 | .390 | .1200 | .420 | 450.0 | 1.410 |
| 75296 | .23 | 4.500 | 3.200 | 3.700 | 3.100 | .272 | .1000 | .418 | 445.0 | 1.417 |
| 75297 | .34 | 5.600 | 2.900 | 4.000 | 3.300 | .354 | .1000 | .416 | 439.0 | 1.425 |
| 75298 | 3.39 | 6.500 | 3.900 | 5.000 | 4.900 | .104 | .2300 | .414 | 434.0 | 1.433 |
| 75299 | .75 | 3.800 | 2.600 | 3.100 | 3.100 | .185 | .0900 | .412 | 428.0 | 1.440 |
| 75300 | .74 | 2.300 | 1.700 | 1.900 | 1.500 | .125 | .0900 | .410 | 423.0 | 1.448 |
| 75301 | .03 | 4.400 | 2.600 | 3.300 | 3.200 | .248 | .1000 | .408 | 418.0 | 1.456 |
| 75302 | .19 | 6.800 | 6.400 | 6.600 | 6.600 | .280 | .0800 | .406 | 412.0 | 1.464 |
| 75303 | .39 | 5.500 | 2.800 | 3.900 | 3.800 | .210 | .0900 | .404 | 407.0 | 1.472 |
| 75304 | 0.00 | 5.700 | 1.900 | 3.400 | 1.200 | .189 | .1000 | .403 | 402.0 | 1.479 |
| 75305 | .07 | 7.300 | 7.500 | 7.400 | .200 | .367 | .1000 | .401 | 397.0 | 1.487 |
| 75306 | .51 | 10.700 | 11.400 | 11.100 | 3.600 | .230 | .0500 | .399 | 392.0 | 1.495 |
| 75307 | 0.00 | 14.900 | 6.100 | 9.600 | 6.400 | .136 | .1000 | .397 | 388.0 | 1.503 |
| 75308 | 0.00 | 12.900 | 6.600 | 9.100 | 4.700 | .369 | .1000 | .395 | 383.0 | 1.511 |
| 75309 | .22 | 7.700 | 3.500 | 5.200 | 3.400 | .317 | .1500 | .394 | 378.0 | 1.519 |
| 75310 | 1.61 | 4.000 | 3.900 | 3.900 | 3.900 | .117 | .1300 | .392 | 374.0 | 1.527 |
| 75311 | .68 | 4.900 | 1.900 | 3.100 | 3.100 | .053 | .0700 | .390 | 369.0 | 1.535 |
| 75312 | .38 | 2.300 | 1.000 | 1.500 | 1.500 | .118 | .0900 | .389 | 365.0 | 1.543 |
| 75313 | .22 | 2.800 | 1.100 | 1.800 | 1.800 | .140 | .1500 | .387 | 360.0 | 1.551 |
| 75314 | 1.13 | 1.800 | .900 | 1.200 | 1.200 | .151 | .0900 | .385 | 356.0 | 1.559 |
| 75315 | .14 | 3.300 | -.500 | .900 | -2.300 | .130 | .1300 | .384 | 352.0 | 1.567 |
| 75316 | 0.00 | 2.400 | -.800 | .400 | -1.700 | .316 | .1300 | .382 | 348.0 | 1.575 |
| 75317 | 0.00 | 3.600 | 2.100 | 2.700 | -2.600 | .284 | .1200 | .381 | 344.0 | 1.583 |
| 75318 | 1.11 | 6.500 | 7.200 | 6.900 | 6.900 | .220 | .1300 | .379 | 340.0 | 1.591 |
| 75319 | 1.37 | 5.600 | 2.500 | 3.700 | 3.700 | .110 | .0900 | .378 | 337.0 | 1.599 |
| 75320 | .52 | 2.900 | .300 | 1.300 | 1.300 | .088 | .2200 | .377 | 333.0 | 1.606 |
| 75321 | .29 | 1.600 | -1.800 | -.500 | -.500 | .111 | .0900 | .375 | 329.0 | 1.614 |
| 75322 | 0.00 | 2.100 | -3.600 | -1.400 | -3.800 | .167 | .1400 | .374 | 326.0 | 1.621 |
| 75323 | 0.00 | .600 | -.400 | 0.000 | -1.400 | .246 | .1200 | .373 | 322.0 | 1.629 |
| 75324 | .13 | 2.700 | .200 | 1.100 | -2.900 | .123 | .0800 | .372 | 319.0 | 1.636 |
| 75325 | .02 | 3.000 | -.700 | .600 | -2.500 | .101 | .1200 | .370 | 316.0 | 1.644 |
| 75326 | .55 | 2.600 | 2.600 | 2.600 | 2.600 | .203 | .0700 | .369 | 313.0 | 1.651 |
| 75327 | .01 | 6.300 | 1.400 | 3.200 | -.700 | .113 | .0800 | .368 | 310.0 | 1.658 |
| 75328 | .08 | 3.900 | 5.000 | 4.600 | -.300 | .147 | .0600 | .367 | 307.0 | 1.665 |
| 75329 | .04 | 6.000 | 5.400 | 5.600 | 2.600 | .068 | 0.0000 | .366 | 304.0 | 1.671 |
| 75330 | 1.82 | 5.400 | 3.300 | 4.100 | 3.400 | .160 | 0.0000 | .365 | 301.0 | 1.678 |
| 75331 | .34 | 3.400 | 0.000 | 1.200 | .800 | .091 | 0.0000 | .364 | 299.0 | 1.684 |
| 75332 | .10 | .800 | -2.200 | -1.100 | -1.200 | .126 | 0.0000 | .363 | 296.0 | 1.691 |
| 75333 | .61 | .100 | 3.500 | 2.300 | 2.300 | .138 | 0.0000 | .363 | 294.0 | 1.697 |
| 75334 | 3.85 | 7.000 | 5.300 | 5.900 | 5.900 | .058 | 0.0000 | .362 | 292.0 | 1.703 |
| 75335 | 1.51 | 2.300 | 1.000 | 1.500 | 1.100 | .125 | 0.0000 | .361 | 290.0 | 1.709 |
| 75336 | .02 | 4.300 | 1.100 | 2.300 | 1.900 | .173 | 0.0000 | .360 | 287.0 | 1.714 |
| 75337 | .41 | 4.100 | 3.600 | 3.800 | 3.800 | .127 | 0.0000 | .359 | 286.0 | 1.719 |
| 75338 | 2.25 | .800 | -1.600 | -.700 | -.700 | .081 | 0.0000 | .359 | 284.0 | 1.724 |
| 75339 | .38 | .100 | 1.100 | .700 | -.100 | .163 | 0.0000 | .358 | 282.0 | 1.729 |
| 75340 | 1.88 | 3.700 | 4.300 | 4.100 | 3.800 | .081 | 0.0000 | .358 | 280.0 | 1.734 |
| 75341 | .10 | 7.600 | 2.400 | 4.300 | 3.800 | .117 | 0.0000 | .357 | 279.0 | 1.738 |
| 75342 | 0.00 | 2.100 | -2.200 | -.600 | -.800 | .175 | 0.0000 | .357 | 277.0 | 1.742 |
| 75343 | 0.00 | .700 | -2.100 | -1.100 | -1.400 | .176 | 0.0000 | .356 | 276.0 | 1.746 |
| 75344 | 0.00 | 0.000 | -.200 | -.100 | -.200 | .105 | 0.0000 | .356 | 275.0 | 1.750 |
| 75345 | .29 | -.500 | -1.700 | -1.300 | -2.000 | .129 | 0.0000 | .355 | 274.0 | 1.753 |
| 75346 | .26 | -2.000 | -1.900 | -1.900 | -3.400 | .199 | 0.0000 | .355 | 273.0 | 1.756 |
| 75347 | .38 | -1.600 | -1.900 | -1.800 | -2.700 | .059 | 0.0000 | .355 | 272.0 | 1.759 |
| 75348 | .02 | -1.600 | -1.900 | -1.800 | -2.600 | .082 | 0.0000 | .355 | 271.0 | 1.761 |
| 75349 | 1.08 | -1.200 | -1.600 | -1.500 | -1.700 | .071 | 0.0000 | .354 | 270.0 | 1.763 |
| 75350 | .09 | -.800 | -2.000 | -1.600 | -2.900 | .165 | 0.0000 | .354 | 270.0 | 1.765 |
| 75351 | 0.00 | -1.700 | -2.300 | -2.100 | -2.100 | .153 | 0.0000 | .354 | 269.0 | 1.767 |
| 75352 | 0.00 | -1.500 | -2.300 | -2.000 | -2.000 | .165 | 0.0000 | .354 | 269.0 | 1.768 |
| 75353 | 0.00 | -1.900 | -2.400 | -2.200 | -2.200 | .165 | 0.0000 | .354 | 268.0 | 1.769 |
| 75354 | 0.00 | -2.100 | -2.600 | -2.400 | -2.400 | .165 | 0.0000 | .354 | 268.0 | 1.769 |
| 75355 | .16 | -1.800 | -.900 | -1.200 | -1.300 | .106 | 0.0000 | .354 | 268.0 | 1.770 |
| 75356 | .35 | 0.000 | -1.100 | -.700 | -.700 | .153 | 0.0000 | .354 | 268.0 | 1.769 |
| 75357 | 2.18 | -1.300 | -.900 | -1.000 | -1.100 | .059 | 0.0000 | .355 | 268.0 | 1.769 |
| 75358 | .42 | 1.100 | 3.800 | 2.800 | 2.800 | .105 | 0.0000 | .355 | 269.0 | 1.768 |
| 75359 | .64 | 4.200 | 5.100 | 4.800 | 4.700 | .088 | 0.0000 | .355 | 269.0 | 1.767 |
| 75360 | 1.35 | 6.400 | 2.000 | 3.600 | 3.500 | .059 | 0.0000 | .355 | 270.0 | 1.766 |
| 75361 | .14 | 3.200 | 3.100 | 3.100 | 3.100 | .129 | 0.0000 | .356 | 270.0 | 1.764 |
| 75362 | .50 | 5.400 | 6.000 | 5.800 | 5.800 | .059 | 0.0000 | .356 | 271.0 | 1.762 |
| 75363 | .49 | 8.800 | 2.300 | 4.600 | 4.600 | .093 | 0.0000 | .356 | 272.0 | 1.760 |
| 75364 | .49 | .700 | 0.000 | .200 | .200 | .105 | 0.0000 | .357 | 273.0 | 1.758 |
| 75365 | .02 | 1.000 | -3.200 | -1.700 | -1.800 | .132 | 0.0000 | .357 | 274.0 | 1.755 |
| 76001 | 0.00 | -3.400 | -4.500 | -4.100 | -4.100 | .128 | 0.0000 | .358 | 275.0 | 1.751 |
| 76002 | 0.00 | -.900 | -1.000 | -1.000 | -1.000 | .093 | 0.0000 | .359 | 276.0 | 1.747 |
| 76003 | .70 | 0.000 | 0.000 | 0.000 | 0.000 | .058 | 0.0000 | .359 | 278.0 | 1.744 |
| 76004 | 2.96 | 0.000 | .100 | .100 | .100 | .058 | 0.0000 | .360 | 279.0 | 1.740 |
| 76005 | 1.79 | 1.600 | .100 | .700 | .700 | .092 | 0.0000 | .361 | 281.0 | 1.735 |
| 76006 | .61 | 1.100 | .100 | .500 | .500 | .058 | 0.0000 | .361 | 283.0 | 1.731 |
| 76007 | 5.16 | 0.000 | 0.000 | 0.000 | 0.000 | .058 | 0.0000 | .362 | 284.0 | 1.726 |
| 76008 | 1.96 | 1.400 | .300 | .700 | .700 | .058 | 0.0000 | .363 | 286.0 | 1.721 |
| 76009 | .27 | 2.600 | .300 | 1.100 | 1.100 | .137 | 0.0000 | .364 | 288.0 | 1.716 |
| 76010 | .81 | 1.200 | .700 | .900 | .900 | .057 | 0.0000 | .365 | 290.0 | 1.710 |
| 76011 | 1.23 | 2.700 | .900 | 1.600 | 1.600 | .091 | 0.0000 | .366 | 293.0 | 1.705 |
| 76012 | .73 | 1.200 | .100 | .500 | .500 | .102 | 0.0000 | .367 | 295.0 | 1.699 |
| 76013 | .77 | 1.800 | 1.100 | 1.400 | 1.400 | .091 | 0.0000 | .368 | 297.0 | 1.693 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 76014 | 1.31 | 2.900 | 2.300 | 2.500 | 2.500 | .057 | 0.0000 | .369 | 300.0 | 1.686 |
| 76015 | .24 | 4.300 | -.100 | 1.500 | 1.500 | .090 | 0.0000 | .370 | 303.0 | 1.680 |
| 76016 | .02 | 2.800 | -.300 | .900 | .900 | .112 | 0.0000 | .371 | 305.0 | 1.673 |
| 76017 | 0.00 | 2.800 | .900 | 1.600 | 1.600 | .101 | 0.0000 | .372 | 308.0 | 1.667 |
| 76018 | 0.00 | 3.100 | -1.700 | .100 | 0.000 | .123 | 0.0000 | .373 | 311.0 | 1.660 |
| 76019 | 0.00 | .600 | -2.000 | -1.000 | -1.000 | .133 | 0.0000 | .375 | 314.0 | 1.653 |
| 76020 | .02 | .200 | -2.500 | -1.500 | -1.500 | .122 | 0.0000 | .376 | 317.0 | 1.646 |
| 76021 | .03 | -.100 | -2.100 | -1.300 | -1.600 | .110 | 0.0000 | .377 | 321.0 | 1.638 |
| 76022 | .11 | 1.300 | 1.100 | 1.200 | 1.000 | .077 | 0.0000 | .379 | 324.0 | 1.631 |
| 76023 | .01 | 3.900 | .900 | 2.100 | 1.400 | .131 | 0.0000 | .380 | 327.0 | 1.624 |
| 76024 | 0.00 | .700 | -3.200 | -1.700 | -2.100 | .120 | 0.0000 | .382 | 331.0 | 1.616 |
| 76025 | .47 | -.800 | -1.900 | -1.500 | -1.800 | .098 | 0.0000 | .383 | 335.0 | 1.609 |
| 76026 | .01 | 1.600 | .300 | .800 | .400 | .108 | 0.0000 | .385 | 338.0 | 1.601 |
| 76027 | .01 | 3.300 | 1.600 | 2.300 | 1.700 | .054 | 0.0000 | .386 | 342.0 | 1.593 |
| 76028 | 0.00 | 3.400 | -1.100 | .700 | .200 | .118 | 0.0000 | .388 | 346.0 | 1.585 |
| 76029 | 0.00 | 1.500 | -1.700 | -.400 | -1.000 | .118 | 0.0000 | .389 | 350.0 | 1.578 |
| 76030 | 0.00 | .600 | -1.100 | -.400 | -1.000 | .117 | 0.0000 | .391 | 354.0 | 1.570 |
| 76031 | 0.00 | 3.200 | -.600 | .900 | 0.000 | .148 | 0.0000 | .393 | 358.0 | 1.562 |
| 76032 | 0.00 | 2.200 | -.900 | .300 | -.400 | .172 | 0.0000 | .394 | 363.0 | 1.554 |
| 76033 | 0.00 | 2.400 | -1.300 | .200 | -.500 | .161 | 0.0000 | .396 | 367.0 | 1.546 |
| 76034 | .02 | 0.000 | -.400 | -.200 | -1.900 | .119 | 0.0000 | .398 | 372.0 | 1.538 |
| 76035 | 0.00 | -2.700 | -5.500 | -4.400 | -4.600 | .191 | 0.0000 | .400 | 376.0 | 1.530 |
| 76036 | 0.00 | -2.300 | -5.000 | -3.900 | -4.700 | .211 | 0.0000 | .402 | 381.0 | 1.522 |
| 76037 | 0.00 | -.100 | -3.900 | -2.400 | -4.100 | .200 | 0.0000 | .404 | 386.0 | 1.514 |
| 76038 | 0.00 | .500 | -2.000 | -1.000 | -3.100 | .189 | 0.0000 | .405 | 390.0 | 1.506 |
| 76039 | 0.00 | 1.400 | 1.300 | 1.400 | -1.000 | .136 | 0.0000 | .407 | 395.0 | 1.498 |
| 76040 | 0.00 | 2.400 | -1.800 | -.100 | -2.000 | .156 | 0.0000 | .409 | 400.0 | 1.490 |
| 76041 | 0.00 | .600 | -2.400 | -1.200 | -2.700 | .216 | 0.0000 | .411 | 405.0 | 1.482 |
| 76042 | .25 | -1.300 | 1.500 | .400 | -.200 | .084 | 0.0000 | .413 | 411.0 | 1.474 |
| 76043 | .09 | 7.500 | 1.400 | 3.900 | 2.600 | .134 | 0.0000 | .415 | 416.0 | 1.466 |
| 76044 | .74 | 4.900 | 3.400 | 4.000 | 3.100 | .103 | 0.0000 | .417 | 421.0 | 1.458 |
| 76045 | .51 | 3.800 | 2.200 | 2.900 | 2.000 | .122 | 0.0000 | .419 | 426.0 | 1.450 |
| 76046 | .91 | 2.200 | 1.100 | 1.600 | 1.400 | .082 | 0.0000 | .422 | 432.0 | 1.443 |
| 76047 | 2.54 | 4.500 | 2.800 | 3.500 | 2.800 | .102 | 0.0000 | .424 | 437.0 | 1.435 |
| 76048 | 2.10 | 4.000 | 1.200 | 2.400 | 1.700 | .049 | 0.0000 | .426 | 443.0 | 1.427 |
| 76049 | .29 | 2.300 | .500 | 1.300 | .600 | .136 | 0.0000 | .428 | 449.0 | 1.420 |
| 76050 | .59 | 2.200 | .500 | 1.200 | .800 | .145 | 0.0000 | .430 | 454.0 | 1.412 |
| 76051 | 0.00 | 4.000 | -.800 | 1.300 | .300 | .347 | 0.0000 | .432 | 460.0 | 1.404 |
| 76052 | 0.00 | 3.900 | 1.000 | 2.300 | 1.300 | .211 | 0.0000 | .435 | 466.0 | 1.397 |
| 76053 | 0.00 | 7.300 | 2.300 | 4.500 | 2.900 | .324 | 0.0000 | .437 | 472.0 | 1.390 |
| 76054 | .28 | 4.500 | 2.400 | 3.300 | 2.700 | .095 | 0.0000 | .439 | 478.0 | 1.382 |
| 76055 | 1.13 | 3.700 | 1.800 | 2.600 | 2.600 | .075 | 0.0000 | .441 | 484.0 | 1.375 |
| 76056 | 1.06 | .800 | .500 | .600 | .600 | .075 | 0.0000 | .444 | 490.0 | 1.368 |
| 76057 | 1.02 | 2.500 | 1.100 | 1.700 | 1.700 | .093 | 0.0000 | .446 | 496.0 | 1.360 |
| 76058 | .72 | 2.700 | .100 | 1.300 | 1.100 | .084 | 0.0000 | .448 | 502.0 | 1.353 |
| 76059 | .26 | 1.300 | -.800 | .200 | -.200 | .148 | 0.0000 | .451 | 508.0 | 1.346 |
| 76060 | .03 | 1.300 | -1.200 | -.100 | -.400 | .267 | 0.0000 | .453 | 514.0 | 1.339 |
| 76061 | 0.00 | 1.200 | -2.100 | -.600 | -2.000 | .283 | 0.0000 | .456 | 520.0 | 1.332 |
| 76062 | 0.00 | 2.300 | -3.800 | -1.000 | -4.200 | .355 | 0.0000 | .458 | 527.0 | 1.326 |
| 76063 | 0.00 | .400 | -.800 | -.200 | -3.300 | .271 | 0.0000 | .460 | 533.0 | 1.319 |
| 76064 | 0.00 | 2.500 | -3.400 | -.700 | -2.700 | .180 | 0.0000 | .463 | 539.0 | 1.312 |
| 76065 | .02 | 4.100 | -2.200 | .700 | -3.600 | .446 | 0.0000 | .465 | 546.0 | 1.306 |
| 76066 | 0.00 | 6.700 | -.900 | 2.700 | -1.400 | .429 | 0.0000 | .468 | 552.0 | 1.299 |
| 76067 | .27 | .600 | -.100 | .200 | -.300 | .081 | 0.0000 | .470 | 559.0 | 1.292 |
| 76068 | .01 | 6.200 | -.600 | 2.600 | 1.200 | .450 | 0.0000 | .473 | 565.0 | 1.286 |
| 76069 | 0.00 | 8.800 | -.300 | 4.000 | 1.400 | .437 | 0.0000 | .475 | 572.0 | 1.280 |
| 76070 | .28 | 4.900 | .500 | 2.600 | 1.800 | .252 | 0.0000 | .477 | 578.0 | 1.273 |
| 76071 | .02 | 4.200 | -1.900 | 1.000 | -.600 | .250 | 0.0000 | .480 | 585.0 | 1.267 |
| 76072 | 0.00 | 5.400 | .100 | 2.700 | -.500 | .384 | 0.0000 | .482 | 591.0 | 1.261 |
| 76073 | .60 | 5.600 | 2.100 | 3.800 | 1.900 | .169 | 0.0000 | .485 | 598.0 | 1.255 |
| 76074 | .43 | 6.100 | 4.100 | 5.100 | 4.500 | .235 | 0.0000 | .487 | 604.0 | 1.249 |
| 76075 | 0.00 | 9.500 | 5.300 | 7.400 | 4.900 | .390 | 0.0000 | .490 | 611.0 | 1.243 |
| 76076 | 0.00 | 12.400 | 5.500 | 8.900 | 7.100 | .365 | 0.0000 | .492 | 617.0 | 1.237 |
| 76077 | .03 | 10.000 | 5.600 | 7.800 | 5.700 | .393 | 0.0000 | .495 | 624.0 | 1.231 |
| 76078 | .79 | 3.000 | .200 | 1.600 | 1.400 | .144 | 0.0000 | .497 | 630.0 | 1.226 |
| 76079 | .77 | .300 | 0.000 | .200 | .200 | .103 | 0.0000 | .500 | 637.0 | 1.220 |
| 76080 | .62 | 2.300 | 1.300 | 1.800 | 1.300 | .163 | 0.0000 | .503 | 644.0 | 1.215 |
| 76081 | 0.00 | 5.900 | 2.000 | 4.000 | 2.800 | .466 | 0.0000 | .505 | 650.0 | 1.209 |
| 76082 | 1.03 | 2.300 | .700 | 1.500 | 1.200 | .272 | 0.0000 | .508 | 657.0 | 1.204 |
| 76083 | .55 | 4.100 | 2.200 | 3.200 | 1.700 | .473 | 0.0000 | .510 | 663.0 | 1.198 |
| 76084 | 1.48 | 3.400 | .300 | 1.900 | 1.300 | .329 | 0.0000 | .513 | 670.0 | 1.193 |
| 76085 | .26 | 3.500 | 1.400 | 2.500 | 1.200 | .507 | 0.0000 | .515 | 676.0 | 1.188 |
| 76086 | .86 | 1.500 | .500 | 1.000 | .700 | .326 | 0.0000 | .518 | 683.0 | 1.183 |
| 76087 | .61 | 2.500 | 1.000 | 1.800 | 1.300 | .365 | 0.0000 | .520 | 689.0 | 1.178 |
| 76088 | .40 | 3.200 | .900 | 2.100 | 1.600 | .383 | 0.0000 | .523 | 695.0 | 1.172 |
| 76089 | 0.00 | 6.100 | .600 | 3.500 | 1.600 | .576 | 0.0000 | .525 | 702.0 | 1.168 |
| 76090 | .08 | 9.200 | 5.800 | 7.600 | 4.300 | .475 | 0.0000 | .527 | 708.0 | 1.163 |
| 76091 | .59 | 1.400 | -.500 | .500 | -.100 | .319 | 0.0000 | .530 | 715.0 | 1.158 |
| 76092 | .06 | 2.200 | -.700 | .900 | -.300 | .414 | 0.0000 | .532 | 721.0 | 1.153 |
| 76093 | 0.00 | 6.800 | 3.300 | 5.200 | 1.900 | .584 | 0.0000 | .535 | 727.0 | 1.148 |
| 76094 | 0.00 | 12.200 | 4.300 | 8.600 | 2.900 | .620 | 0.0000 | .537 | 733.0 | 1.144 |
| 76095 | 0.00 | 14.300 | 5.500 | 10.300 | 4.500 | .598 | 0.0000 | .540 | 740.0 | 1.139 |
| 76096 | .10 | 7.700 | 5.600 | 6.700 | 5.300 | .331 | 0.0000 | .542 | 746.0 | 1.135 |
| 76097 | .11 | 10.400 | 4.900 | 7.900 | 5.400 | .555 | 0.0000 | .544 | 752.0 | 1.130 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 76098 | .03 | 13.500 | 8.300 | 11.200 | 7.300 | .473 | 0.0000 | .547 | 758.0 | 1.126 |
| 76099 | .13 | 9.700 | 5.600 | 7.900 | 5.900 | .517 | 0.0000 | .549 | 764.0 | 1.122 |
| 76100 | .03 | 11.600 | 6.100 | 9.100 | 4.200 | .652 | 0.0000 | .552 | 770.0 | 1.117 |
| 76101 | .09 | 10.700 | 4.500 | 7.900 | 5.000 | .466 | 0.0000 | .554 | 776.0 | 1.113 |
| 76102 | .05 | 9.800 | 5.000 | 7.700 | 4.000 | .669 | 0.0000 | .556 | 782.0 | 1.109 |
| 76103 | .11 | 6.500 | 4.300 | 5.500 | 4.400 | .418 | 0.0000 | .559 | 788.0 | 1.105 |
| 76104 | .06 | 7.800 | .300 | 4.500 | 1.900 | .640 | 0.0000 | .561 | 793.0 | 1.101 |
| 76105 | .65 | 8.500 | 2.200 | 5.800 | 1.600 | .549 | 0.0000 | .563 | 799.0 | 1.097 |
| 76106 | .60 | 1.100 | 0.000 | .600 | .300 | .435 | 0.0000 | .565 | 805.0 | 1.093 |
| 76107 | .12 | 4.600 | 2.700 | 3.800 | 2.100 | .589 | 0.0000 | .568 | 810.0 | 1.089 |
| 76108 | .30 | 5.200 | 3.000 | 4.300 | 3.300 | .343 | 0.0000 | .570 | 816.0 | 1.085 |
| 76109 | 0.00 | 6.100 | 3.300 | 4.900 | 2.600 | .452 | 0.0000 | .572 | 821.0 | 1.082 |
| 76110 | .91 | 6.900 | 7.600 | 7.200 | 6.200 | .385 | 0.0000 | .574 | 827.0 | 1.078 |
| 76111 | .35 | 8.100 | 3.400 | 6.100 | 4.800 | .471 | 0.0000 | .576 | 832.0 | 1.074 |
| 76112 | .16 | 7.400 | 3.900 | 5.900 | 3.400 | .425 | 0.0000 | .578 | 837.0 | 1.071 |
| 76113 | .15 | 6.100 | 4.400 | 5.400 | 4.000 | .402 | 0.0000 | .581 | 843.0 | 1.067 |
| 76114 | .49 | 8.800 | 7.300 | 8.200 | 6.300 | .422 | 0.0000 | .583 | 848.0 | 1.064 |
| 76115 | .52 | 6.500 | 2.500 | 4.800 | 3.900 | .442 | 0.0000 | .585 | 853.0 | 1.061 |
| 76116 | .18 | 5.000 | 2.400 | 3.900 | 2.200 | .527 | 0.0000 | .587 | 858.0 | 1.057 |
| 76117 | .06 | 7.900 | 4.300 | 6.400 | 2.800 | .525 | 0.0000 | .589 | 863.0 | 1.054 |
| 76118 | 0.00 | 11.700 | 7.000 | 9.800 | 4.800 | .502 | 0.0000 | .591 | 868.0 | 1.051 |
| 76119 | 0.00 | 13.800 | 5.900 | 10.600 | 5.600 | .500 | 0.0000 | .593 | 872.0 | 1.048 |
| 76120 | 0.00 | 15.200 | 8.100 | 12.300 | 6.400 | .499 | 0.0000 | .595 | 877.0 | 1.045 |
| 76121 | 0.00 | 20.400 | 9.200 | 15.900 | 7.900 | .582 | 0.0000 | .596 | 882.0 | 1.042 |
| 76122 | .09 | 17.400 | 8.500 | 13.800 | 8.300 | .537 | 0.0000 | .598 | 886.0 | 1.039 |
| 76123 | .14 | 12.200 | 4.900 | 9.300 | 5.100 | .536 | 0.0000 | .600 | 891.0 | 1.036 |
| 76124 | 0.00 | 13.000 | 6.100 | 10.300 | 5.500 | .534 | 0.0000 | .602 | 895.0 | 1.033 |
| 76125 | 0.00 | 12.300 | 8.600 | 10.800 | 7.000 | .323 | 0.0000 | .604 | 900.0 | 1.030 |
| 76126 | .02 | 10.400 | 4.700 | 8.200 | 4.700 | .490 | 0.0000 | .606 | 904.0 | 1.027 |
| 76127 | 0.00 | 14.900 | 5.600 | 11.300 | 6.100 | .572 | 0.0000 | .607 | 908.0 | 1.025 |
| 76128 | 0.00 | 19.300 | 8.600 | 15.100 | 6.200 | .652 | 0.0000 | .609 | 912.0 | 1.022 |
| 76129 | 0.00 | 20.900 | 9.400 | 16.400 | 9.300 | .569 | 0.0000 | .611 | 916.0 | 1.019 |
| 76130 | 0.00 | 22.000 | 12.000 | 18.100 | 9.600 | .587 | 0.0000 | .612 | 920.0 | 1.017 |
| 76131 | .12 | 12.000 | 6.300 | 9.800 | 7.400 | .299 | 0.0080 | .614 | 924.0 | 1.014 |
| 76132 | 0.00 | 14.600 | 6.200 | 11.400 | 5.300 | .339 | 0.0000 | .615 | 928.0 | 1.012 |
| 76133 | 0.00 | 20.900 | 10.900 | 17.100 | 8.900 | .588 | 0.0000 | .617 | 931.0 | 1.010 |
| 76134 | 0.00 | 18.600 | 7.300 | 14.300 | 7.800 | .623 | 0.0000 | .618 | 935.0 | 1.007 |
| 76135 | 0.00 | 14.300 | 5.100 | 10.800 | 4.300 | .729 | 0.0000 | .620 | 938.0 | 1.005 |
| 76136 | 0.00 | 19.600 | 8.000 | 15.200 | 3.400 | .721 | 0.0000 | .621 | 942.0 | 1.003 |
| 76137 | 0.00 | 11.600 | 5.200 | 9.200 | 5.100 | .539 | 0.0000 | .623 | 945.0 | 1.001 |
| 76138 | .03 | 12.300 | 3.700 | 9.100 | 2.400 | .671 | 0.0000 | .624 | 948.0 | .999 |
| 76139 | 0.00 | 13.900 | 9.000 | 12.100 | 5.100 | .716 | 0.0000 | .625 | 951.0 | .997 |
| 76140 | .12 | 7.900 | 5.700 | 7.100 | 5.200 | .342 | 0.0000 | .627 | 954.0 | .995 |
| 76141 | .02 | 15.200 | 5.800 | 11.700 | 5.000 | .714 | 0.0000 | .628 | 957.0 | .993 |
| 76142 | 0.00 | 18.300 | 7.400 | 14.300 | 5.700 | .732 | 0.0000 | .629 | 960.0 | .991 |
| 76143 | 0.00 | 15.100 | 9.000 | 12.900 | 6.600 | .691 | 0.0000 | .630 | 963.0 | .989 |
| 76144 | 0.00 | 13.100 | 7.800 | 11.200 | 6.900 | .386 | 0.0000 | .631 | 966.0 | .987 |
| 76145 | .33 | 10.400 | 7.200 | 9.200 | 8.200 | .221 | 0.0000 | .632 | 968.0 | .986 |
| 76146 | .04 | 13.100 | 5.700 | 10.400 | 5.700 | .615 | 0.0000 | .633 | 971.0 | .984 |
| 76147 | 0.00 | 20.700 | 10.900 | 17.100 | 9.000 | .719 | 0.0000 | .634 | 973.0 | .983 |
| 76148 | .08 | 10.400 | 4.000 | 8.100 | 5.900 | .312 | 0.0000 | .635 | 975.0 | .981 |
| 76149 | .05 | 9.100 | 6.100 | 8.000 | 3.000 | .442 | 0.0000 | .636 | 978.0 | .980 |
| 76150 | .31 | 10.700 | 7.200 | 9.400 | 7.400 | .389 | 0.0000 | .637 | 980.0 | .978 |
| 76151 | .47 | 6.900 | 4.400 | 6.000 | 5.400 | .258 | 0.0000 | .638 | 982.0 | .977 |
| 76152 | .65 | 7.700 | 5.900 | 7.100 | 5.900 | .421 | 0.0000 | .639 | 984.0 | .976 |
| 76153 | .11 | 8.500 | 5.200 | 7.300 | 5.500 | .531 | 0.0000 | .639 | 985.0 | .974 |
| 76154 | 0.00 | 11.700 | 3.300 | 8.700 | 3.600 | .687 | 0.0000 | .640 | 987.0 | .973 |
| 76155 | 0.00 | 11.400 | 2.900 | 8.400 | 2.800 | .640 | 0.0000 | .641 | 989.0 | .972 |
| 76156 | 0.00 | 12.700 | 4.000 | 9.600 | 3.300 | .633 | 0.0000 | .641 | 990.0 | .971 |
| 76157 | .12 | 12.100 | 10.700 | 11.600 | 7.300 | .483 | 0.0000 | .642 | 992.0 | .970 |
| 76158 | 0.00 | 15.500 | 13.100 | 14.700 | 10.400 | .665 | 0.0000 | .643 | 993.0 | .969 |
| 76159 | .03 | 14.900 | 11.700 | 13.800 | 9.900 | .470 | 0.0000 | .643 | 994.0 | .968 |
| 76160 | 0.00 | 15.700 | 8.900 | 13.300 | 8.400 | .521 | 0.0000 | .644 | 995.0 | .968 |
| 76161 | 0.00 | 17.400 | 12.800 | 15.800 | 9.100 | .510 | 0.0000 | .644 | 997.0 | .967 |
| 76162 | .01 | 12.900 | 9.600 | 11.700 | 7.900 | .454 | 0.0000 | .644 | 997.0 | .966 |
| 76163 | .18 | 13.600 | 10.600 | 12.500 | 9.200 | .352 | 0.0000 | .645 | 998.0 | .966 |
| 76164 | .19 | 11.500 | 6.900 | 9.900 | 7.900 | .384 | 0.0000 | .645 | 999.0 | .965 |
| 76165 | 0.00 | 12.900 | 5.800 | 10.400 | 5.200 | .772 | 0.0000 | .645 | 1000.0 | .965 |
| 76166 | 0.00 | 17.400 | 9.600 | 14.600 | 8.700 | .675 | 0.0000 | .645 | 1000.0 | .964 |
| 76167 | .06 | 16.300 | 12.800 | 15.100 | 12.500 | .403 | 0.0000 | .646 | 1001.0 | .964 |
| 76168 | .03 | 15.300 | 9.900 | 13.400 | 8.900 | .339 | 0.0000 | .646 | 1001.0 | .963 |
| 76169 | 0.00 | 21.500 | 10.900 | 17.800 | 10.000 | .694 | 0.0000 | .646 | 1001.0 | .963 |
| 76170 | 0.00 | 24.400 | 13.000 | 20.400 | 11.500 | .719 | 0.0000 | .646 | 1002.0 | .963 |
| 76171 | 0.00 | 20.400 | 11.800 | 17.400 | 11.100 | .668 | 0.0000 | .646 | 1002.0 | .963 |
| 76172 | 0.00 | 18.700 | 9.500 | 15.500 | 9.700 | .577 | 0.0000 | .646 | 1002.0 | .963 |
| 76173 | 0.00 | 15.400 | 7.100 | 12.500 | 7.700 | .720 | 0.0000 | .646 | 1002.0 | .963 |
| 76174 | 0.00 | 16.400 | 6.100 | 12.800 | 6.100 | .687 | 0.0000 | .646 | 1001.0 | .963 |
| 76175 | 0.00 | 16.900 | 10.500 | 14.600 | 7.600 | .681 | 0.0000 | .645 | 1001.0 | .963 |
| 76176 | 0.00 | 19.100 | 7.600 | 15.000 | 8.000 | .668 | 0.0000 | .645 | 1001.0 | .963 |
| 76177 | 0.00 | 14.400 | 4.600 | 10.900 | 3.900 | .766 | 0.0000 | .645 | 1000.0 | .963 |
| 76178 | 0.00 | 18.800 | 7.900 | 14.900 | 5.100 | .734 | 0.0000 | .645 | 1000.0 | .964 |
| 76179 | 0.00 | 21.700 | 10.100 | 17.600 | 7.300 | .741 | 0.0000 | .644 | 999.0 | .964 |
| 76180 | 0.00 | 23.300 | 14.800 | 20.300 | 10.700 | .741 | 0.0000 | .644 | 998.0 | .964 |
| 76181 | 0.00 | 19.300 | 14.000 | 17.400 | 9.700 | .606 | 0.0000 | .643 | 997.0 | .965 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 76182 | .39 | 11.900 | 8.500 | 10.700 | 8.400 | .353 | 0.0000 | .643 | 996.0 | .965 |
| 76183 | 0.00 | 15.000 | 5.900 | 12.100 | 7.500 | .678 | 0.0000 | .642 | 995.0 | .966 |
| 76184 | 0.00 | 19.100 | 12.800 | 16.900 | 10.000 | .730 | 0.0000 | .642 | 994.0 | .967 |
| 76185 | .03 | 18.300 | 14.300 | 16.900 | 11.900 | .426 | 0.0000 | .641 | 993.0 | .967 |
| 76186 | 0.00 | 20.200 | 13.400 | 17.800 | 12.900 | .582 | 0.0000 | .641 | 991.0 | .968 |
| 76187 | 0.00 | 23.400 | 15.400 | 20.500 | 13.900 | .707 | 0.0000 | .640 | 990.0 | .969 |
| 76188 | 0.00 | 22.300 | 17.600 | 20.600 | 13.300 | .629 | 0.0000 | .639 | 988.0 | .970 |
| 76189 | .08 | 20.300 | 17.400 | 19.300 | 15.100 | .336 | 0.0000 | .638 | 987.0 | .971 |
| 76190 | .21 | 17.600 | 14.700 | 16.600 | 13.900 | .350 | 0.0000 | .637 | 985.0 | .972 |
| 76191 | 0.00 | 18.900 | 9.900 | 15.600 | 10.200 | .625 | 0.0000 | .637 | 983.0 | .973 |
| 76192 | 0.00 | 19.500 | 17.200 | 18.700 | 12.600 | .600 | 0.0000 | .636 | 981.0 | .974 |
| 76193 | .57 | 17.000 | 15.400 | 16.400 | 14.800 | .253 | 0.0000 | .635 | 979.0 | .975 |
| 76194 | 0.00 | 18.300 | 10.300 | 15.400 | 10.900 | .733 | 0.0000 | .634 | 977.0 | .976 |
| 76195 | 0.00 | 20.100 | 10.600 | 16.600 | 10.800 | .734 | 0.0000 | .633 | 975.0 | .978 |
| 76196 | 0.00 | 21.500 | 13.700 | 18.600 | 12.200 | .735 | 0.0000 | .632 | 973.0 | .979 |
| 76197 | 0.00 | 25.200 | 15.800 | 21.700 | 13.200 | .717 | 0.0000 | .631 | 970.0 | .981 |
| 76198 | 0.00 | 25.700 | 16.200 | 22.200 | 15.000 | .705 | 0.0000 | .630 | 968.0 | .982 |
| 76199 | 0.00 | 21.000 | 12.800 | 18.000 | 13.000 | .507 | 0.0000 | .628 | 965.0 | .984 |
| 76200 | 0.00 | 21.900 | 9.200 | 17.200 | 10.400 | .694 | 0.0000 | .627 | 963.0 | .985 |
| 76201 | 0.00 | 21.400 | 11.000 | 17.500 | 8.300 | .729 | 0.0000 | .626 | 960.0 | .987 |
| 76202 | 0.00 | 20.300 | 11.700 | 17.100 | 10.700 | .637 | 0.0000 | .625 | 957.0 | .989 |
| 76203 | 0.00 | 21.100 | 9.700 | 16.800 | 8.500 | .732 | 0.0000 | .623 | 954.0 | .990 |
| 76204 | 0.00 | 23.700 | 13.400 | 19.800 | 9.400 | .727 | 0.0000 | .622 | 951.0 | .992 |
| 76205 | 0.00 | 24.400 | 15.600 | 21.100 | 14.600 | .534 | 0.0000 | .621 | 948.0 | .994 |
| 76206 | 0.00 | 25.800 | 14.400 | 21.500 | 14.400 | .710 | 0.0000 | .619 | 945.0 | .996 |
| 76207 | 0.00 | 26.500 | 14.200 | 21.800 | 14.200 | .685 | 0.0000 | .618 | 941.0 | .998 |
| 76208 | 0.00 | 23.300 | 10.900 | 18.500 | 11.400 | .713 | 0.0000 | .616 | 938.0 | 1.000 |
| 76209 | 0.00 | 24.300 | 13.100 | 20.000 | 11.900 | .722 | 0.0000 | .615 | 935.0 | 1.002 |
| 76210 | 0.00 | 25.100 | 12.200 | 20.100 | 10.800 | .703 | 0.0000 | .613 | 931.0 | 1.004 |
| 76211 | 0.00 | 24.500 | 14.700 | 20.700 | 12.300 | .685 | 0.0000 | .611 | 927.0 | 1.007 |
| 76212 | 0.00 | 22.800 | 11.300 | 18.300 | 11.700 | .687 | 0.0000 | .610 | 924.0 | 1.009 |
| 76213 | 0.00 | 23.900 | 17.000 | 21.200 | 12.700 | .716 | 0.0000 | .608 | 920.0 | 1.011 |
| 76214 | 0.00 | 19.300 | 16.100 | 18.100 | 14.200 | .271 | 0.0000 | .606 | 916.0 | 1.014 |
| 76215 | .01 | 22.500 | 15.900 | 19.900 | 13.400 | .465 | 0.0000 | .605 | 912.0 | 1.016 |
| 76216 | .01 | 22.800 | 16.100 | 20.100 | 13.300 | .653 | 0.0000 | .603 | 908.0 | 1.019 |
| 76217 | .02 | 15.700 | 14.700 | 15.300 | 12.400 | .191 | 0.0000 | .601 | 904.0 | 1.021 |
| 76218 | .01 | 18.300 | 14.800 | 16.900 | 13.200 | .428 | 0.0000 | .599 | 900.0 | 1.024 |
| 76219 | .22 | 15.900 | 13.000 | 14.700 | 12.800 | .199 | 0.0000 | .597 | 896.0 | 1.026 |
| 76220 | .42 | 14.200 | 12.300 | 13.400 | 12.000 | .248 | 0.0000 | .596 | 891.0 | 1.029 |
| 76221 | 0.00 | 19.100 | 10.700 | 15.700 | 11.300 | .677 | 0.0000 | .594 | 887.0 | 1.032 |
| 76222 | 0.00 | 20.300 | 12.700 | 17.200 | 12.500 | .602 | 0.0000 | .592 | 882.0 | 1.035 |
| 76223 | 0.00 | 23.300 | 13.100 | 19.100 | 13.100 | .696 | 0.0000 | .590 | 878.0 | 1.038 |
| 76224 | 0.00 | 23.100 | 13.600 | 19.200 | 13.400 | .698 | 0.0000 | .588 | 873.0 | 1.041 |
| 76225 | 0.00 | 21.900 | 15.200 | 19.100 | 13.300 | .686 | 0.0000 | .586 | 869.0 | 1.044 |
| 76226 | .30 | 14.100 | 12.500 | 13.400 | 12.400 | .261 | 0.0000 | .584 | 864.0 | 1.047 |
| 76227 | .44 | 15.500 | 11.100 | 13.700 | 12.300 | .412 | 0.0000 | .582 | 859.0 | 1.050 |
| 76228 | .60 | 11.100 | 8.700 | 10.100 | 9.400 | .370 | 0.0000 | .580 | 854.0 | 1.053 |
| 76229 | .49 | 12.600 | 10.400 | 11.700 | 10.500 | .372 | 0.0000 | .577 | 849.0 | 1.056 |
| 76230 | .13 | 16.800 | 12.000 | 14.800 | 11.500 | .655 | 0.0000 | .575 | 844.0 | 1.060 |
| 76231 | .21 | 17.400 | 11.400 | 14.800 | 12.000 | .549 | 0.0000 | .573 | 839.0 | 1.063 |
| 76232 | .08 | 18.000 | 12.100 | 15.500 | 12.700 | .514 | 0.0000 | .571 | 834.0 | 1.066 |
| 76233 | 0.00 | 20.600 | 13.200 | 17.400 | 13.500 | .524 | 0.0000 | .569 | 828.0 | 1.070 |
| 76234 | 0.00 | 22.900 | 14.700 | 19.400 | 14.100 | .688 | 0.0000 | .566 | 823.0 | 1.073 |
| 76235 | 0.00 | 18.900 | 14.500 | 17.000 | 14.100 | .388 | 0.0000 | .564 | 818.0 | 1.077 |
| 76236 | 0.00 | 22.400 | 12.900 | 18.200 | 13.200 | .678 | 0.0000 | .562 | 812.0 | 1.081 |
| 76237 | .10 | 20.300 | 16.000 | 18.400 | 14.500 | .547 | 0.0000 | .560 | 807.0 | 1.084 |
| 76238 | .52 | 13.400 | 10.100 | 11.900 | 10.700 | .385 | 0.0000 | .557 | 801.0 | 1.088 |
| 76239 | .01 | 15.900 | 8.300 | 12.500 | 8.500 | .649 | 0.0000 | .555 | 796.0 | 1.092 |
| 76240 | 0.00 | 19.500 | 13.000 | 16.600 | 12.200 | .667 | 0.0000 | .553 | 790.0 | 1.096 |
| 76241 | 0.00 | 23.300 | 16.800 | 20.400 | 15.600 | .655 | 0.0000 | .550 | 784.0 | 1.100 |
| 76242 | 0.00 | 24.000 | 16.600 | 20.700 | 15.300 | .658 | 0.0000 | .548 | 779.0 | 1.104 |
| 76243 | 0.00 | 24.600 | 16.300 | 20.800 | 15.300 | .645 | 0.0000 | .546 | 773.0 | 1.108 |
| 76244 | 0.00 | 24.700 | 15.800 | 20.600 | 15.300 | .640 | 0.0000 | .543 | 767.0 | 1.112 |
| 76245 | 0.00 | 23.200 | 12.100 | 18.100 | 11.900 | .651 | 0.0000 | .541 | 761.0 | 1.116 |
| 76246 | 0.00 | 19.100 | 12.900 | 16.200 | 11.800 | .623 | 0.0000 | .538 | 755.0 | 1.120 |
| 76247 | 0.00 | 22.600 | 17.500 | 20.200 | 13.800 | .633 | 0.0000 | .536 | 749.0 | 1.125 |
| 76248 | 0.00 | 22.500 | 12.600 | 17.900 | 13.100 | .644 | 0.0000 | .534 | 743.0 | 1.129 |
| 76249 | 0.00 | 19.900 | 12.000 | 16.200 | 12.200 | .592 | 0.0000 | .531 | 737.0 | 1.133 |
| 76250 | .17 | 14.200 | 4.500 | 9.600 | 6.300 | .532 | 0.0000 | .529 | 731.0 | 1.138 |
| 76251 | 0.00 | 15.200 | 6.700 | 11.200 | 7.000 | .653 | 0.0000 | .526 | 725.0 | 1.142 |
| 76252 | 0.00 | 19.100 | 7.500 | 13.600 | 6.300 | .656 | 0.0000 | .524 | 719.0 | 1.147 |
| 76253 | 0.00 | 21.100 | 10.600 | 16.100 | 9.700 | .627 | 0.0000 | .521 | 712.0 | 1.152 |
| 76254 | 0.00 | 22.500 | 13.100 | 18.000 | 11.500 | .614 | 0.0000 | .519 | 706.0 | 1.156 |
| 76255 | 0.00 | 16.000 | 12.500 | 14.300 | 9.400 | .609 | 0.0000 | .516 | 700.0 | 1.161 |
| 76256 | 0.00 | 17.100 | 6.600 | 12.000 | 7.300 | .588 | 0.0000 | .514 | 694.0 | 1.166 |
| 76257 | .48 | 17.800 | 12.400 | 15.200 | 10.500 | .623 | 0.0000 | .511 | 687.0 | 1.171 |
| 76258 | .07 | 13.200 | 10.100 | 11.700 | 11.000 | .242 | 0.0000 | .509 | 681.0 | 1.176 |
| 76259 | 0.00 | 16.800 | 11.500 | 14.200 | 11.900 | .448 | 0.0000 | .506 | 675.0 | 1.181 |
| 76260 | 0.00 | 16.100 | 13.800 | 15.000 | 13.000 | .351 | 0.0000 | .504 | 668.0 | 1.186 |
| 76261 | 0.00 | 14.800 | 13.300 | 14.100 | 12.300 | .229 | 0.0000 | .501 | 662.0 | 1.191 |
| 76262 | 0.00 | 19.300 | 10.800 | 15.000 | 11.800 | .597 | 0.0000 | .499 | 655.0 | 1.197 |
| 76263 | 0.00 | 21.000 | 14.500 | 17.700 | 12.700 | .592 | 0.0000 | .496 | 649.0 | 1.202 |
| 76264 | .09 | 20.300 | 15.800 | 18.000 | 14.500 | .451 | 0.0000 | .494 | 642.0 | 1.207 |
| 76265 | 0.00 | 18.300 | 13.600 | 14.900 | 12.700 | .284 | 0.0000 | .491 | 636.0 | 1.213 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 76266 | 0.00 | 18.400 | 11.600 | 14.900 | 11.600 | .558 | 0.0000 | .489 | 630.0 | 1.218 |
| 76267 | 0.00 | 19.200 | 10.100 | 14.500 | 10.800 | .561 | 0.0000 | .486 | 623.0 | 1.224 |
| 76268 | 0.00 | 17.900 | 9.300 | 13.500 | 9.600 | .573 | 0.0000 | .484 | 617.0 | 1.230 |
| 76269 | 0.00 | 19.200 | 11.700 | 15.300 | 11.100 | .576 | 0.0000 | .481 | 610.0 | 1.236 |
| 76270 | 0.00 | 20.200 | 12.800 | 16.400 | 11.900 | .570 | 0.0000 | .479 | 604.0 | 1.241 |
| 76271 | 0.00 | 20.700 | 13.700 | 17.000 | 13.100 | .529 | 0.0000 | .476 | 597.0 | 1.247 |
| 76272 | 0.00 | 21.000 | 13.000 | 16.800 | 13.600 | .532 | 0.0000 | .474 | 591.0 | 1.253 |
| 76273 | 0.00 | 21.000 | 12.600 | 16.600 | 13.100 | .535 | 0.0000 | .471 | 584.0 | 1.259 |
| 76274 | 0.00 | 20.900 | 12.200 | 16.300 | 12.300 | .536 | 0.0000 | .469 | 578.0 | 1.265 |
| 76275 | .10 | 19.300 | 13.100 | 16.000 | 12.900 | .459 | 0.0000 | .466 | 572.0 | 1.272 |
| 76276 | .21 | 11.200 | 8.500 | 9.800 | 9.100 | .281 | 0.0000 | .464 | 565.0 | 1.278 |
| 76277 | 0.00 | 11.000 | 3.800 | 7.100 | 5.000 | .373 | 0.0000 | .462 | 559.0 | 1.284 |
| 76278 | 0.00 | 11.200 | 6.000 | 8.400 | 4.800 | .439 | 0.0000 | .459 | 553.0 | 1.291 |
| 76279 | 0.00 | 13.900 | 8.400 | 10.900 | 7.700 | .477 | 0.0000 | .457 | 546.0 | 1.297 |
| 76280 | 0.00 | 16.400 | 9.600 | 12.700 | 9.200 | .498 | 0.0000 | .454 | 540.0 | 1.304 |
| 76281 | 0.00 | 18.000 | 10.900 | 14.100 | 9.900 | .492 | 0.0000 | .452 | 534.0 | 1.310 |
| 76282 | 0.00 | 16.000 | 7.800 | 11.500 | 8.900 | .522 | 0.0000 | .450 | 527.0 | 1.317 |
| 76283 | .01 | 16.300 | 7.000 | 11.200 | 7.900 | .516 | 0.0000 | .447 | 521.0 | 1.324 |
| 76284 | 0.00 | 13.300 | 10.800 | 11.900 | 10.300 | .303 | 0.0000 | .445 | 515.0 | 1.330 |
| 76285 | 0.00 | 17.200 | 6.500 | 11.200 | 8.100 | .493 | 0.0000 | .443 | 509.0 | 1.337 |
| 76286 | 0.00 | 16.000 | 6.400 | 10.600 | 7.700 | .505 | 0.0000 | .440 | 503.0 | 1.344 |
| 76287 | 0.00 | 16.600 | 5.500 | 10.400 | 6.600 | .507 | 0.0000 | .438 | 497.0 | 1.351 |
| 76288 | 0.00 | 14.600 | 4.300 | 8.800 | 5.400 | .472 | 0.0000 | .436 | 491.0 | 1.358 |
| 76289 | 0.00 | 13.500 | 3.500 | 7.800 | 4.400 | .474 | 0.0000 | .434 | 485.0 | 1.365 |
| 76290 | 0.00 | 13.500 | 2.400 | 7.200 | 3.000 | .477 | 0.0000 | .431 | 479.0 | 1.373 |
| 76291 | 0.00 | 12.100 | .500 | 5.500 | .500 | .469 | 0.0000 | .429 | 473.0 | 1.380 |
| 76292 | 0.00 | 12.000 | .800 | 5.600 | .500 | .462 | 0.0000 | .427 | 467.0 | 1.387 |
| 76293 | 0.00 | 11.800 | 1.500 | 5.900 | 1.700 | .435 | 0.0000 | .425 | 462.0 | 1.395 |
| 76294 | 0.00 | 12.500 | 3.200 | 7.100 | 3.000 | .437 | 0.0000 | .423 | 456.0 | 1.402 |
| 76295 | 0.00 | 11.900 | 3.500 | 7.000 | 3.400 | .459 | 0.0000 | .420 | 450.0 | 1.410 |
| 76296 | 0.00 | 10.000 | 6.200 | 7.800 | 5.000 | .432 | 0.0000 | .418 | 445.0 | 1.417 |
| 76297 | 0.00 | 10.800 | 3.900 | 6.800 | 4.400 | .384 | 0.0000 | .416 | 439.0 | 1.425 |
| 76298 | 1.69 | 6.500 | 7.300 | 7.000 | 6.500 | .114 | 0.0000 | .414 | 434.0 | 1.433 |
| 76299 | .99 | 8.700 | 6.100 | 7.200 | 6.500 | .165 | 0.0000 | .412 | 428.0 | 1.440 |
| 76300 | .03 | 8.800 | 2.600 | 5.200 | 4.200 | .389 | 0.0000 | .410 | 423.0 | 1.448 |
| 76301 | 0.00 | 9.100 | 2.700 | 5.300 | 3.500 | .381 | 0.0000 | .408 | 418.0 | 1.456 |
| 76302 | 0.00 | 8.200 | 8.300 | 8.300 | 6.500 | .352 | 0.0000 | .406 | 412.0 | 1.464 |
| 76303 | .06 | 9.100 | 7.900 | 8.400 | 7.400 | .107 | 0.0000 | .404 | 407.0 | 1.472 |
| 76304 | 0.00 | 11.300 | 8.600 | 9.700 | 8.900 | .376 | 0.0000 | .403 | 402.0 | 1.479 |
| 76305 | 1.31 | 9.800 | 10.900 | 10.500 | 10.200 | .097 | 0.0000 | .401 | 397.0 | 1.487 |
| 76306 | .53 | 11.500 | 11.300 | 11.400 | 10.900 | .188 | 0.0000 | .399 | 392.0 | 1.495 |
| 76307 | .07 | 14.900 | 10.200 | 12.100 | 11.000 | .378 | 0.0000 | .397 | 388.0 | 1.503 |
| 76308 | 0.00 | 12.100 | 6.800 | 8.900 | 7.800 | .337 | 0.0000 | .395 | 383.0 | 1.511 |
| 76309 | 0.00 | 10.500 | 5.700 | 7.600 | 6.100 | .349 | 0.0000 | .394 | 378.0 | 1.519 |
| 76310 | 0.00 | 8.700 | 6.700 | 7.500 | 6.300 | .245 | 0.0000 | .392 | 374.0 | 1.527 |
| 76311 | 0.00 | 11.000 | 5.100 | 7.400 | 5.900 | .278 | 0.0000 | .390 | 369.0 | 1.535 |
| 76312 | 0.00 | 9.300 | 8.600 | 8.900 | 8.000 | .215 | 0.0000 | .389 | 365.0 | 1.543 |
| 76313 | 0.00 | 11.700 | 5.200 | 7.700 | 6.800 | .291 | 0.0000 | .387 | 360.0 | 1.551 |
| 76314 | 0.00 | 8.900 | 4.800 | 6.400 | 5.200 | .249 | 0.0000 | .385 | 356.0 | 1.559 |
| 76315 | 0.00 | 8.100 | 5.800 | 6.700 | 5.500 | .250 | 0.0000 | .384 | 352.0 | 1.567 |
| 76316 | 0.00 | 8.900 | 2.900 | 5.200 | 3.800 | .273 | 0.0000 | .382 | 348.0 | 1.575 |
| 76317 | 0.00 | 6.600 | 1.100 | 3.200 | 1.800 | .284 | 0.0000 | .381 | 344.0 | 1.583 |
| 76318 | .24 | 5.200 | 6.500 | 6.000 | 4.900 | .286 | 0.0000 | .379 | 340.0 | 1.591 |
| 76319 | .51 | 8.600 | 8.300 | 8.400 | 7.500 | .187 | 0.0000 | .378 | 337.0 | 1.599 |
| 76320 | 1.15 | 10.600 | 11.100 | 10.900 | 10.200 | .100 | 0.0000 | .377 | 333.0 | 1.606 |
| 76321 | .01 | 13.300 | 8.400 | 10.200 | 9.700 | .255 | 0.0000 | .375 | 329.0 | 1.614 |
| 76322 | .13 | 11.200 | 11.100 | 11.100 | 10.400 | .145 | 0.0000 | .374 | 326.0 | 1.621 |
| 76323 | .01 | 11.200 | 5.900 | 7.900 | 7.100 | .279 | 0.0000 | .373 | 322.0 | 1.629 |
| 76324 | 0.00 | 6.800 | 2.100 | 3.900 | 3.000 | .213 | 0.0000 | .372 | 319.0 | 1.636 |
| 76325 | 0.00 | 5.800 | 5.300 | 5.500 | 4.500 | .236 | 0.0000 | .370 | 316.0 | 1.644 |
| 76326 | 0.00 | 7.700 | 5.300 | 6.200 | 5.300 | .203 | 0.0000 | .369 | 313.0 | 1.651 |
| 76327 | 0.00 | 6.000 | 3.200 | 4.200 | 3.600 | .215 | 0.0000 | .368 | 310.0 | 1.658 |
| 76328 | 0.00 | 5.000 | 2.300 | 3.300 | 2.600 | .227 | 0.0000 | .367 | 307.0 | 1.665 |
| 76329 | .04 | 4.800 | 5.100 | 5.000 | 4.400 | .205 | 0.0000 | .366 | 304.0 | 1.671 |
| 76330 | .07 | 5.900 | .500 | 2.500 | 1.800 | .126 | 0.0000 | .365 | 301.0 | 1.678 |
| 76331 | 0.00 | 1.000 | -3.200 | -1.700 | -3.700 | .240 | 0.0000 | .364 | 299.0 | 1.684 |
| 76332 | 0.00 | -.900 | -4.300 | -3.100 | -4.600 | .218 | 0.0000 | .363 | 296.0 | 1.691 |
| 76333 | 0.00 | .100 | -2.600 | -1.600 | -3.200 | .230 | 0.0000 | .363 | 294.0 | 1.697 |
| 76334 | 0.00 | 1.300 | -1.300 | -.300 | -.500 | .196 | 0.0000 | .362 | 292.0 | 1.703 |
| 76335 | 0.00 | 1.400 | -1.500 | -.400 | -.600 | .231 | 0.0000 | .361 | 290.0 | 1.709 |
| 76336 | 0.00 | 1.900 | -1.300 | -.100 | -.300 | .243 | 0.0000 | .360 | 287.0 | 1.714 |
| 76337 | 0.00 | .800 | -1.400 | -.600 | -1.600 | .232 | 0.0000 | .359 | 286.0 | 1.719 |
| 76338 | 0.00 | 2.000 | 1.100 | 1.400 | .600 | .186 | 0.0000 | .359 | 284.0 | 1.724 |
| 76339 | 0.00 | 3.800 | .700 | 1.800 | .800 | .221 | 0.0000 | .358 | 282.0 | 1.729 |
| 76340 | 0.00 | 2.700 | -.400 | .700 | -.600 | .198 | 0.0000 | .358 | 280.0 | 1.734 |
| 76341 | 0.00 | 3.400 | 1.900 | 2.400 | 1.100 | .198 | 0.0000 | .357 | 279.0 | 1.738 |
| 76342 | 0.00 | 5.600 | 2.500 | 3.600 | 2.200 | .222 | 0.0000 | .357 | 277.0 | 1.742 |
| 76343 | .74 | 4.100 | 1.700 | 2.600 | 1.100 | .070 | 0.0000 | .356 | 276.0 | 1.746 |
| 76344 | .16 | 3.800 | -1.800 | .200 | -1.500 | .211 | 0.0000 | .356 | 275.0 | 1.750 |
| 76345 | 0.00 | .400 | -1.800 | -1.000 | -3.200 | .211 | 0.0000 | .355 | 274.0 | 1.753 |
| 76346 | 0.00 | .800 | -1.800 | -.900 | -3.300 | .223 | 0.0000 | .355 | 273.0 | 1.756 |
| 76347 | 0.00 | .300 | -1.000 | -.500 | -2.700 | .200 | 0.0000 | .355 | 272.0 | 1.759 |
| 76348 | 0.00 | .900 | -1.500 | -.600 | -3.200 | .188 | 0.0000 | .355 | 271.0 | 1.761 |
| 76349 | .05 | 1.200 | .300 | .600 | -1.600 | .129 | 0.0000 | .354 | 270.0 | 1.763 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 76350 | 0.00 | 3.000 | .600 | 1.500 | -1.900 | .212 | 0.0000 | .354 | 270.0 | 1.765 |
| 76351 | 0.00 | 4.400 | .400 | 1.800 | -.500 | .177 | 0.0000 | .354 | 269.0 | 1.767 |
| 76352 | .04 | 1.200 | 2.500 | 2.000 | 1.100 | .200 | 0.0000 | .354 | 269.0 | 1.768 |
| 76353 | 0.00 | 4.400 | -1.700 | .500 | -1.100 | .224 | 0.0000 | .354 | 268.0 | 1.769 |
| 76354 | 0.00 | -.200 | -2.600 | -1.700 | -3.200 | .224 | 0.0000 | .354 | 268.0 | 1.769 |
| 76355 | 0.00 | -.900 | -3.100 | -2.300 | -3.800 | .200 | 0.0000 | .354 | 268.0 | 1.770 |
| 76356 | 0.00 | -1.000 | -1.800 | -1.500 | -2.800 | .165 | 0.0000 | .354 | 268.0 | 1.769 |
| 76357 | .06 | -.200 | .400 | .200 | -1.200 | .200 | 0.0000 | .355 | 268.0 | 1.769 |
| 76358 | .26 | 3.400 | -.300 | 1.000 | -.500 | .176 | 0.0000 | .355 | 269.0 | 1.768 |
| 76359 | 0.00 | .300 | -.300 | -.100 | -1.400 | .164 | 0.0000 | .355 | 269.0 | 1.767 |
| 76360 | .81 | 2.300 | 3.200 | 2.900 | 1.700 | .106 | 0.0000 | .355 | 270.0 | 1.766 |
| 76361 | .67 | 4.100 | 4.500 | 4.400 | 3.100 | .070 | 0.0000 | .356 | 270.0 | 1.764 |
| 76362 | .07 | 4.800 | -.900 | 1.100 | -3.300 | .187 | 0.0000 | .356 | 271.0 | 1.762 |
| 76363 | .03 | .200 | .600 | .500 | -4.800 | .175 | 0.0000 | .356 | 272.0 | 1.760 |
| 76364 | 0.00 | 3.900 | -.600 | 1.000 | -1.200 | .164 | 0.0000 | .357 | 273.0 | 1.758 |
| 76365 | 0.00 | .100 | -2.900 | -1.800 | -3.500 | .210 | 0.0000 | .357 | 274.0 | 1.755 |
| 76366 | 0.00 | -1.600 | -3.000 | -2.500 | -4.200 | .210 | 0.0000 | .358 | 274.0 | 1.755 |

# APPENDIX IV. Sample Output

The sample output of Appendix IV is reproduced directly from computer output.

G125491 - 25APR 79 - C/W -
79/04/25. 22.04.32.
MODEL VERSION IS GUP-CW     XUP-CW     YUP-CW     ZUP-CW

INITIAL VALUES FOR B CONSTANTS -

| | - 0- | - 1- | - 2- | - 3- | - 4- | - 5- | - 6- | - 7- | - 8- | - 9- | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0- | | 1.500 | 1.000 | 2.000 | .7000 | 73.71 | 3.000 | 3.480 | .7000 | 2.160 | - 0 |
| 10- | 1.080 | .3600 | .1000 | 3900. | 9970. | .2000 | 1.1896E+04 | -2.500 | 3.000 | 0. | - 10 |
| 20- | .7000 | .1870 | .2800 | 4.600 | 3.5600E-02 | 0. | 2.1900E-02 | 1.110 | 9.1000E-02 | .1070 | - 20 |
| 30- | 3.1000E-03 | 2.5300E-04 | 36.40 | .3460 | .1000 | .5200 | 3.6700E-02 | 120.0 | .3000 | .3800 | - 30 |
| 40- | .1000 | .3460 | .1000 | 1.8380E-39 | .1000 | 7.9000E-02 | 6.000 | 9.3100E-03 | 6.000 | 2.2000E-02 | - 40 |
| 50- | 7.0000E-02 | 2.2210E-04 | 1.9100E-04 | 1.4600E-03 | 3.4400E-02 | 0. | 6.0600E-04 | 1.0000E-05 | 1.0000E-04 | 1.0000E-04 | - 50 |
| 60- | 1.200 | 1.0500E-03 | 3.1000E-03 | 3.9000E-03 | 0. | 2.5600E-04 | 0. | 3288. | 5.0000E-03 | .5000 | - 60 |
| 70- | .9290 | .5640 | 1.0000E-02 | 0. | .2500 | 5.0000E-02 | 45.00 | 1.350 | 6.000 | -2.000 | - 70 |
| 80- | 5.000 | 5.000 | 2600. | 1.0000E-02 | 248.6 | 9.3300E-02 | 300.0 | 19.00 | .7550 | .3150 | - 80 |
| 90- | 16.00 | 12.00 | .5000 | 3000. | 3.0000E-02 | .1000 | 0. | 0. | 0. | 0. | - 90 |
| 100- | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | -100 |
| 110- | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | -110 |
| 120- | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | -120 |
| 130- | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | -130 |
| 140- | 0. | 6.9000E-02 | 0. | 0. | 0. | 7.3000E-02 | 1.7400E-04 | .8000 | .6140 | .4000 | -140 |
| 150- | .1360 | 0. | 3.8460E-03 | 0. | 4.0000E-02 | 0. | .6700 | 2.5000E+06 | .6600 | 8.6400E+05 | -150 |
| 160- | .1000 | 0. | 0. | 1.0000E-03 | .4000 | 10.00 | 0. | 0. | 30.00 | 0. | -160 |
| 170- | 6.000 | 100.0 | 1.0000E-02 | 1.5000E-02 | .3200 | 0. | .7100 | 2.7400E-03 | 45.00 | 1.350 | -170 |
| 180- | 45.00 | 1.350 | 1.0600E-03 | .4000 | | | | | | | -180 |

INITIAL VALUES FOR M CONSTANTS -

| | - 1- | - 2- | - 3- | - 4- | - 5- | - 6- | - 7- | - 8- | - 9- | -10- |
|---|---|---|---|---|---|---|---|---|---|---|
| 0- | 18 | 18 | 40 | 40 | 12 | | | | | |

INDICES OF DEFINED G FUNCTIONS-

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
| 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 67 | 68 | 69 | 70 | 71 | 72 | 74 | 75 | 76 | 77 | 79 | 80 | 81 | 82 | 83 |
| 84 | 85 | 86 | 87 | 88 | 90 | 91 | 92 | 93 | 94 | 95 | 97 | 98 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 |
| 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 138 |
| 139 | 140 | 160 | 161 | 168 | 170 | | | | | | | | | | | | | | | | | | | |

DATA YEAR  = 1972
TIME START =  131
DT         =    1
TIME STOP  = 1225
PRINT INT. =   91

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| TIME | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIME | X( 1) | X( 2) | X( 3) | X( 4) | X( 5) | X( 6) | X( 7) | X( 8) | X( 9) | X( 10) |
| | X( 11) | X( 12) | X( 13) | X( 14) | X( 15) | X( 16) | X( 17) | X( 18) | X( 19) | X( 20) |
| | X( 21) | X( 22) | X( 25) | X( 26) | X( 37) | X( 38) | X( 62) | X( 64) | X( 98) | |
| IC | 0. | 0. | 3980. | 9970. | 1.1896E+04 | 1.000 | 129.5 | 0. | 108.0 | .3000 |
| | 4.550 | 15.50 | 350.0 | 70.00 | 5.610 | 5.5500E-17 | 1.0000E-02 | 9.730 | 7.170 | 8.700 |
| | 56.50 | 80.00 | 7.500 | 4.100 | 0. | 9.8300E-03 | 7.700 | 1.000 | 0. | |
| 221 | 0. | 0. | 2891. | 9970. | 1.1896E+04 | 1.000 | 8.362 | 0. | 108.4 | 1.157 |
| | 4.483 | 8.859 | 350.3 | 69.91 | 5.279 | 5.7356E-03 | 3.8299E-02 | 9.731 | 6.966 | 8.825 |
| | 56.56 | 80.00 | 19.29 | 12.14 | 0. | 9.7214E-03 | 7.991 | 1.000 | 0. | |
| 312 | 11.67 | 0. | 3250. | 9970. | 1.1896E+04 | 1.000 | 60.96 | 10.90 | 108.9 | 1.4968E-15 |
| | 5.021 | 4.245 | 349.9 | 69.83 | 5.581 | 9.7773E-03 | 3.6816E-02 | 9.684 | 7.186 | 8.874 |
| | 56.65 | 80.00 | 4.565 | 12.69 | 0. | 0. | 7.662 | 1.000 | 0. | |
| 403 | 13.58 | 0. | 3940. | 1.0073E+04 | 1.2002E+04 | 1.000 | 66.04 | 13.35 | 109.7 | 1.4943E-15 |
| | 4.621 | 7.742 | 348.9 | 69.72 | 5.773 | 9.7746E-03 | 2.0076E-02 | 9.715 | 7.350 | 8.828 |
| | 56.71 | 80.00 | 3.000 | 5.438 | 0. | 0. | 7.366 | 1.000 | 0. | |
| 494 | 0. | 0. | 3522. | 9970. | 1.1896E+04 | 1.000 | 42.20 | 0. | 110.4 | 1.4879E-15 |
| | 4.557 | 16.48 | 347.9 | 69.60 | 5.819 | 9.7676E-03 | 1.9298E-02 | 9.741 | 7.169 | 8.773 |
| | 56.74 | 80.00 | 7.174 | 4.278 | 0. | 0. | 7.348 | 1.000 | 0. | |
| 585 | 0. | 0. | 3083. | 9970. | 1.1896E+04 | 1.000 | 8.312 | 0. | 110.9 | 1.149 |
| | 4.485 | 11.37 | 348.2 | 69.50 | 5.317 | 5.6930E-03 | 4.8115E-02 | 9.670 | 6.798 | 8.768 |
| | 56.80 | 80.00 | 20.89 | 11.78 | 0. | 9.6622E-03 | 7.799 | 1.000 | 0. | |
| 676 | 68.46 | 92.19 | 4129. | 1.0290E+04 | 1.2178E+04 | 1.000 | 112.7 | 50.86 | 111.3 | 2.6214E-15 |
| | 5.016 | 8.822 | 348.0 | 69.44 | 5.659 | 9.8512E-03 | 4.5779E-02 | 9.579 | 6.936 | 8.753 |
| | 56.89 | 80.00 | 7.368 | 13.02 | 0. | 0. | 7.320 | 1.000 | 3.127 | |
| 767 | 37.14 | 0. | 4013. | 1.0121E+04 | 1.2039E+04 | 1.000 | 87.49 | 31.14 | 112.1 | 2.6177E-15 |
| | 4.616 | 10.55 | 347.0 | 69.34 | 5.839 | 9.8489E-03 | 2.5185E-02 | 9.632 | 7.155 | 8.726 |
| | 56.95 | 80.00 | 1.256 | 4.496 | 0. | 0. | 7.029 | 1.000 | 0. | |
| 858 | 0. | 0. | 3398. | 9978. | 1.1896E+04 | 1.000 | 40.57 | 0. | 112.9 | 2.6094E-15 |
| | 4.553 | 19.19 | 346.0 | 69.21 | 5.841 | 9.8437E-03 | 2.1179E-02 | 9.696 | 7.062 | 8.714 |
| | 56.97 | 80.00 | 7.001 | 3.289 | 0. | 0. | 7.097 | 1.000 | 0. | |
| 949 | 0. | 0. | 2992. | 9970. | 1.1896E+04 | 1.000 | 8.490 | 0. | 113.4 | 1.154 |
| | 4.481 | 12.30 | 346.3 | 69.10 | 5.305 | 5.1084E-03 | 4.7254E-02 | 9.677 | 6.805 | 8.790 |
| | 57.01 | 80.00 | 18.70 | 10.70 | 0. | 9.7491E-03 | 7.646 | 1.000 | 0. | |
| 1040 | 0. | 0. | 2556. | 9970. | 1.1896E+04 | 1.000 | 57.04 | 0. | 113.8 | 3.9963E-15 |
| | 5.021 | 5.265 | 346.1 | 69.04 | 5.595 | 9.5218E-03 | 4.7090E-02 | 9.725 | 7.231 | 9.067 |
| | 57.08 | 80.00 | 7.218 | 13.35 | 0. | 0. | 7.355 | 1.000 | 0. | |
| 1131 | 11.32 | 28.73 | 3864. | 9970. | 1.1896E+04 | 1.000 | 60.43 | 5.547 | 114.5 | 3.9866E-15 |
| | 4.621 | 9.473 | 345.1 | 68.94 | 5.804 | 9.5180E-03 | 2.6274E-02 | 9.728 | 7.335 | 8.983 |
| | 57.13 | 80.00 | 1.992 | 5.866 | 96.03 | 0. | 7.049 | 1.000 | 0. | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIME | X( 1) | X( 2) | X( 3) | X( 4) | X( 5) | X( 6) | X( 7) | X( 8) | X( 9) | X( 10) |
| | X( 11) | X( 12) | X( 13) | X( 14) | X( 15) | X( 16) | X( 17) | X( 18) | X( 19) | X( 20) |
| | X( 21) | X( 22) | X( 25) | X( 26) | X( 37) | X( 38) | X( 62) | X( 64) | X( 98) | |
| 1222 | 12.31 | 0. | 3658. | 9970. | 1.1896E+04 | 1.000 | 62.36 | 12.33 | 115.4 | 3.9789E-15 |
| | 4.557 | 18.54 | 344.1 | 68.81 | 5.831 | 9.5150E-03 | 1.7721E-02 | 9.814 | 7.290 | 8.991 |
| | 57.15 | 80.00 | 3.261 | 2.662 | 0. | 0. | 7.072 | 1.000 | 0. | |
| 1226 | 0. | 0. | 3583. | 9970. | 1.1896E+04 | 1.000 | 55.88 | 0. | 115.4 | .1418 |
| | 4.552 | 18.22 | 344.1 | 68.80 | 5.747 | 1.3319E-17 | 1.8135E-02 | 9.816 | 7.277 | 8.987 |
| | 57.16 | 80.00 | 4.275 | 2.722 | 0. | 9.5150E-03 | 7.163 | 1.000 | 0. | |

ENO OF SIMULATION RUN