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Service Learning Coursebook • Ill Mathematics

Benjamin Winchester

University of Minnesota - Morris

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"Community Mathematical Services"

Service Learning Coursebook

in

Mathematics

University of Minnesota, Morris

1996 Edition

Created by Benjamin S. Winchester
March, 1996

In collaboration with Minnesota Campus Compact

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I. Overview

The Mathematics Discipline of the University of Minnesota, Morris has moved into the forefront of its academic excellence with the addition of a service learning component in its curriculum. Three professors, Dr. Jon Anderson, Dr. Peh Ng and Dr. Engin Sungur recently received SEAMS (Science, Engineering, Architecture, Mathematics and Computer Science) Mini Grants from Minnesota Campus Compact in 1996. These grants challenge the faculty to find innovative ways to address community/environmental hazards and concerns while enhancing students academic and civic understanding.

The initial grant is a two phase project, coordinated by Benjamin Winchester (UMM '95). The first phase begins with one Mathematics course in Winter quarter. During this time, project goals consist of 1) student awareness of service learning benefits and 2) building a partnership with the community from which future service learning can be addressed in a familiar setting. Students will have the opportunity to examine the current economic, demographic and environmental situation in the Stevens County area and to address community issues and problems, and how they relate to their coursework.

The second phase, beginning in Spring quarter, consists of two rigorous courses, will attain goals of sustain ability and commitment by all involved. Students enrolled in these courses will address issues of land use characteristics related to zoning, transportation, home values and environmental concerns.

This project initially came about in response to needs of the City of Morris, Minnesota in creation of the Ten Year Comprehensive Plan. Mr. Winchester determined appropriate areas of analysis for students in the various courses by attending meetings with community officials related to the completion of the Ten Year Comprehensive Plan. The City of Morris began working on its Plan in October of 1995, and during the ten week courses, various community and regional organizations, related and unrelated to the Plan, will be contacted to assist the students in their research. Following the student analysis, their individual reports will be compiled and presented to the City of Morris Planning Commission as a factual resource of Stevens County characteristics and baseline summaries to assist in the creation of the Ten Year Comprehensive Plan.

This is only the beginning. In following years, the projects will continue through both lower and upper division Mathematics courses. Incorporating data gathering, summarization, and analysis into a public database, this will be maintained and updated by the students in the Mathematics Computer Lab. Public awareness of these projects will expand on current collaborations and create new opportunities to address community needs

for analysis. In low income areas such as Stevens County, generalized traits of the region are not only unknown, but the means to obtain them are beyond the fiscal means of interested parties. These projects will be of added value to all who reside in West Central Minnesota.

This project will also be creating interdisciplinary research projects for students enrolled in Math 1150 and Math 3605, both introductory statistics courses. These courses are required by various disciplines for completion of their major and through faculty support, students with majors in various disciplines will now have the opportunity to study introductory statistics with projects in their major. This will not only enhance their statistical comprehension using familiar data, but also prepare students for analysis within their area of interest. It must be noted that the data from various disciplines will be made available to the students, and the ultimate choice of analysis will be up to the student. These opportunities are not traditional service learning in that the areas of analysis are within the campus community, not the community as a whole, yet these are still addressing needs by faculty as a whole.

This project has many interesting aspects. The Mathematics faculty, having recently been praised by external reviewers from Grinnell College, St. Olaf College, and the University of Minnesota, Twin Cities for its pedagogical creativity, now have the opportunity to incorporate service learning in a curriculum which historically has had little direct involvement in community issues. Through integrated coursework and contact with community officials and organizations, the students will gain an understanding not only of the material presented in the class, but the impact with which they can adapt their skills to be of benefit to the community. Finally, the increased contact between UMM faculty, students and the Stevens County community will help build a link which was considered extremely important to many who attended the Morris Town Meeting of October 3, 1995. It is hoped that with endeavors such as these, service learning will be more and more common and the community in which we all live will be strengthened through cooperation and understanding.

Initial Proposal
January, 1996

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GOALS AND OBJECTIVES

OVERALL

*   To introduce service learning opportunities to the students involved in upper division mathematics courses and to the University of Minnesota, Morris.

*   To provide training for faculty in service learning opportunities and to develop learning formats to enable students to become aware of community service activities.

*   To fully integrate service learning into coursework in such a way that students can use their educational skills for community efforts.

*   To begin annual service learning courses available to the students taking courses in mathematics.

*   To build partnerships with community organizations from which future activities can be based.

UMM SPECIFIC

*   To prepare a detailed analysis and solid foundation from which the city can use to build the Ten Year Comprehensive Plan for the City of Morris.

*   An overview and findings related to this project will be presented to faculty at "Talking About Teaching", a monthly general faculty session held through the Faculty Center for Teaching and Learning on the UMM campus.

*   To build partnerships with the City of Morris from which annual service learning projects can be completed in the Division of Science and Mathematics.

II. Evaluation

When approaching the initial stages of integration, we must first determine the structure of the program. Determination of resources and benefactors were of primary concern. In essence, what the students will produce will be small research reports for various organizations. These will address topics and projects deemed by the benefiting organization to be in need.

Initially, we address the situation of the College or University.

- How do the Service Learning projects fit in with the mission of the school, within the scope of both community service and research.
- What institutional resources are available, both personnel and funding, for use by the program.
- Determine levels of commitment by administration, faculty, and students.
- Determine human resources available, in particular this being previous Service Learning experience and time available for commitment.
- Availability of a centralized location within the Discipline to coordinate efforts. This is integral to the success of appropriate course projects.

An ideal stage would be a board of faculty to address underlying issues, and a coordinator (with intimate knowledge of both the mathematics curriculum and community organizations) to create and maintain a stable link between the campus and the community.

Within the context of this manual, a resource is defined as a community organization which makes available data to be utilized by the students to further their analytical techniques. These include "baseline" data sources which can not only have various applications in the course but can also be used to enhance other analytical techniques. An example of this would be climate data.

Here at UMM, we receive this data from the West Central Experiment Station. This consists of high/low temperature, precipitation, and ground temperature (among others). Here we find an application to statistical time series data analysis theory which is taught here at UMM in Math 3690. After the rudimentary techniques are taught, a project involving well water depths was brought in. Using chronological readings, a model was created to determine well depths dependent upon the time of year, the ground temperature, and precipitation.

This example show how one must find theory which has appropriate applications in the various courses.

Benefactors can be any organization in your target area. For UMM the target area is West Central Minnesota. The region contains predominantly rural industry and low wages. For that reason we have broadened our availability of services to include government agencies, whether they are at the federal, state or local level.

At times, a resource can also become a benefactor of the final analysis. Here a breakdown of benefactors is necessary. A *Direct* benefactor is any organization which requests specific research to be completed by the Mathematical Services. A *General* benefactor is any organization which asks to receive the reports generated by the students.

The research which is proposed could easily be completed by a consultant in the area. One issue which now arises is that of jobs. In the past, community service was just

that - a service to the community. Here, it is believed that the service would not be taking away someone's job. Now this becomes of utmost concern. We cannot encourage "free" analysis to any organization which asks. Therefore, a qualifying determination must be made. In the Community Based Resources questionnaire, it is asked :

> Would this proposed assistance normally have been completed by or through your organization ?

This is the final determination. If the answer is "yes", the assistance is denied, yet methodological assistance can still be provided.

The benefactors know what projects are occurring within their organization, and the College or University personnel best know their course objectives - it is bridging this gap that can prove to be the deciding factor. It was found here at UMM that once the community projects are understood by the coordinator, that person can then best apply this to the coursework, assuming the coordinator has fairly intimate knowledge of the topics being addressed. One now asks - why not have the faculty do this work? One answer - time. Making contact with community organization (especially the primary contact) and determining the projects which would best suit student research is not an easy task. At times, the data collection techniques have been distorted - making the data unreliable altogether. A clear explanation to the community agency of the applications and estimated results that are possible by the course is also deemed as necessary, so as the agency can better understand in what respect assistance can be obtained. This is also important, for the reason that future projects can then be recognized by the agencies - which will prompt future requests to Mathematical Services. However, this conclusion is only drawn for agencies which have had previous contact with the Mathematical Services. For this reason, models should be created to allow agencies with no previous contact to understand the scope of possible assistance. The following provides a visual model of the process occurring at UMM.
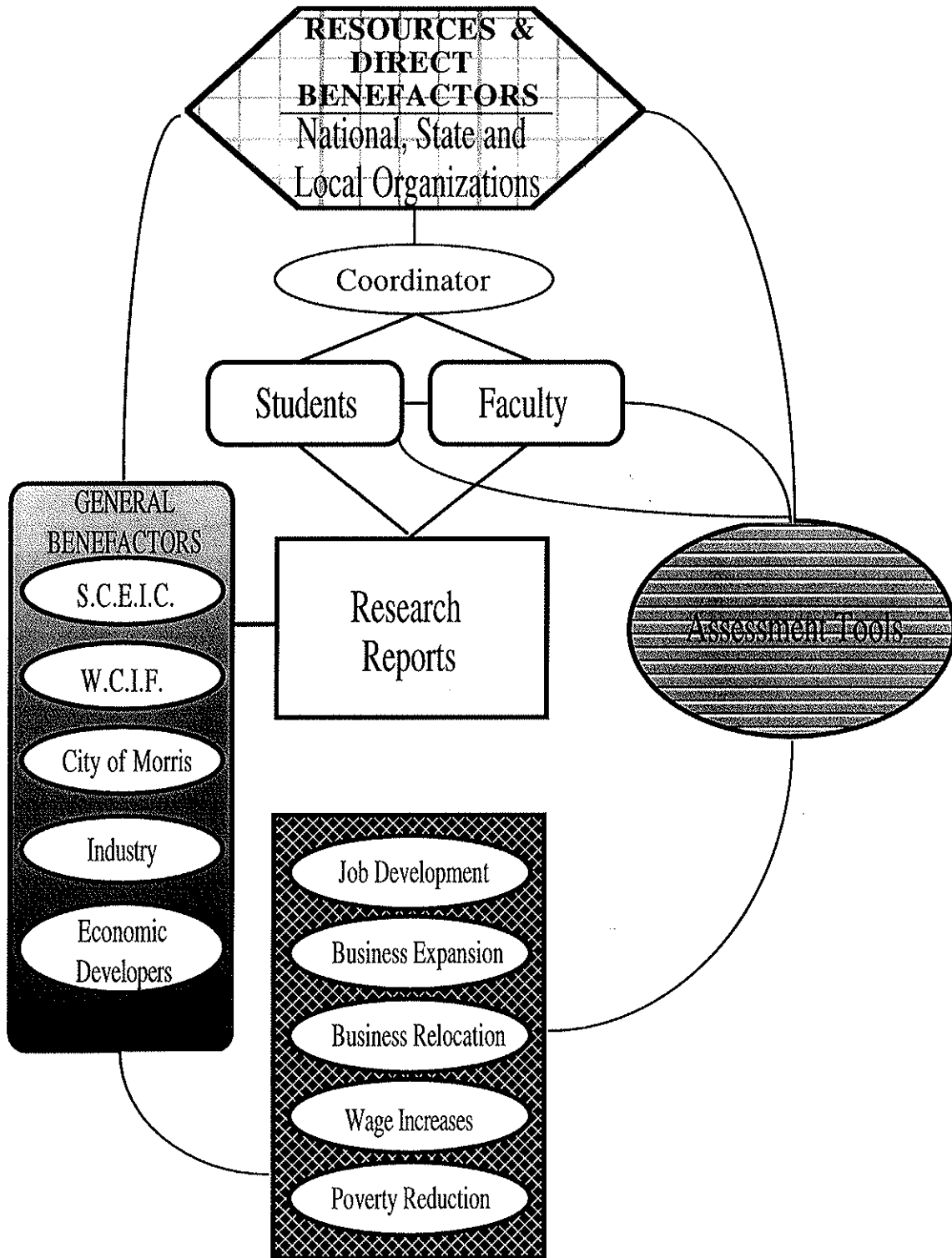
Figure : Model of UMM Service Learning Integration Process

III. Areas of Analysis

The following are the various areas of analysis which have been identified as community needs. Once projects are completed, some of the areas may be expanded on, or removed altogether and replaced with new community needs. For now, these outline the various areas, and the characteristics within these areas for examination by the students in the courses outline in Section IV.

A. ECONOMIC - Industrial Analysis
+   Wage levels
+   Employment & Unemployment levels
+   Number of establishments
+   Sales levels

B. DEMOGRAPHIC
•   Age distributions
•   Income and Poverty levels
•   Housing
•   Family Size and Type
+   Social Service Programs
             -Aid to Families with Dependent Children
             -Food Stamps
             -Social Services

C. ENVIRONMENTAL
•   Pollution
+   Climate
             -Temperature
             -Wind directions
             -Precipitation
             -Water levels, drainage, discharge, and erosion

D. LAND USE & TRANSPORTATION
+   Residential
+   Commercial
+   Industrial
+   Major and Minor Arterial highways and streets
             - Within Morris
             - Rural Morris Area
             - Regional Area

E. INTERDISCIPLINARY RESOURCES
•   Political Science
•   Biology
•   Economics

+ Indicates projects completed in the 1995-1996 academic year.

IV. UMM Course Descriptions

Math 1150 : Introduction to Statistics

Scope, nature, tools, language, and interpretation of elementary statistics. Descriptive statistics; graphical and numerical representation of information; measures of location, dispersion, position, and dependence; exploratory data analysis. Elementary probability theory, discrete and continuous probability models. Inferential statistics, point and interval estimation, tests of statistical hypotheses. Inferences involving one and two populations, ANOVA, regression analysis, and chi-square tests; use of statistical computer packages.

Math 3370 : Combinatorial Mathematics

For students in mathematics, computer science, natural sciences, and related areas in social sciences. Selected topics for permutations and combinations, generating functions, recurrence relations, 0-1 matrices, partitions, inclusion and exclusion, graphs, trees and circuits, bipartite graphs, planar graphs, and networks. Note : this class is offered once every two years.

Math 3605 : Statistical Methods

Descriptive statistics, elementary probability theory; laws of probability, random variables, discrete and continuous probability models, functions of random variables, mathematical expectation. Statistical inference; point estimation, classical and Bayesian methods of estimation, interval estimation, tests of hypotheses. Other statistical methods; linear regression and correlation, ANOVA, nonparametric statistics, statistical quality control, use of statistical computer packages.

Math 3620 : Elementary Statistical Data Analysis

Nature and objectives of statistical data analysis, exploratory and confirmatory data analysis techniques. Some types of statistical procedures; formulation of models, examination of the adequacy of the models. Some special models; simple regression, correlation analysis, multiple regression analysis, analysis of variance, use of statistical computer packages.

Math 3630 : Discrete Statistical Multivariate Analysis

Analysis of categorical data. Loglinear models for two- and higher dimensional contingency tables; model selection, ordered categories, fixed margins and logit models, casual analysis involving logit and loglinear models, fixed and random zeroes, use of statistical computer packages. Note : this course is offered every two years opposite Math 3640)

Math 3640 : Applied Continuous Statistical Multivariate Analysis

Aspects of multivariate analysis, random vectors, sample geometry and random sampling, multivariate normal distribution, inferences about mean vector, MANOVA. Analysis of covariance structures : principal components, factor analysis. Classification and grouping techniques : discrimination and classification, clustering, use of statistical computer packages. Note : this course is offered every two years opposite Math 3630)

Math 3690 : Topics in Statistics

Topics selected from nonparametric methods, linear and nonlinear regression analysis, ANOVA, design of experiments, sampling methods, time series analysis, simulation and statistical computing.

V. Course Integration With Service Learning and Processes

A. Fall Quarter Courses

Math 1150 : Introduction to Statistics

Areas of Analysis :	(1)	Age Distributions	
	(2)	Income & Poverty Levels	
	(3)	Pollution	
	(4)	Family Size & Type	
	(5)	Housing	

Data :   Permanent :   Age Distributions, Income & Poverty Levels, Family Size & Type, Housing

Needs Updating :   Pollution

Copy :   (BEGIN) Pollution to Math 3640 (if offered)

Math 3605 : Statistical Methods

Areas of Analysis :	(1)	Climate
	(2)	Average Covered Wages & Employment
	(3)	Sales Levels

Data :   Needs Updating :   Average Covered Wages & Employment, Sales Levels, Climate

Copy :   (BEGIN) Climate, Sales Levels to Math 3640 (if offered)

(END) Climate, Average Covered Wages to Math 3620

Math 3630 : Discrete Statistical Multivariate Analysis

Areas of Analysis :	(1)	Age Distributions
	(2)	Employment & Unemployment

Data :   Permanent :   Age Distributions.

Needs Updating :   Employment & Unemployment

Copy :   (END) Employment & Unemployment to Math 3620

Math 3640 : Applied Continuous Statistical Multivariate Analysis

Areas of Analysis :	(1)	Climate
	(2)	Pollution
	(3)	Sales Levels

Data :   Obtain :   Climate, Sales Levels from Math 3605

Pollution from Math 1150

Average Covered Wages
& Employment

Sales Levels

Employment &
Unemployment

Age Distributions

Income &
Poverty Levels

Housing

Family Size & Type

Social Service
Programs

Pollution

Climate

Land Use
Characteristics

Transportation
(City and Rural)

Transportation
(Regional)

Math 1150
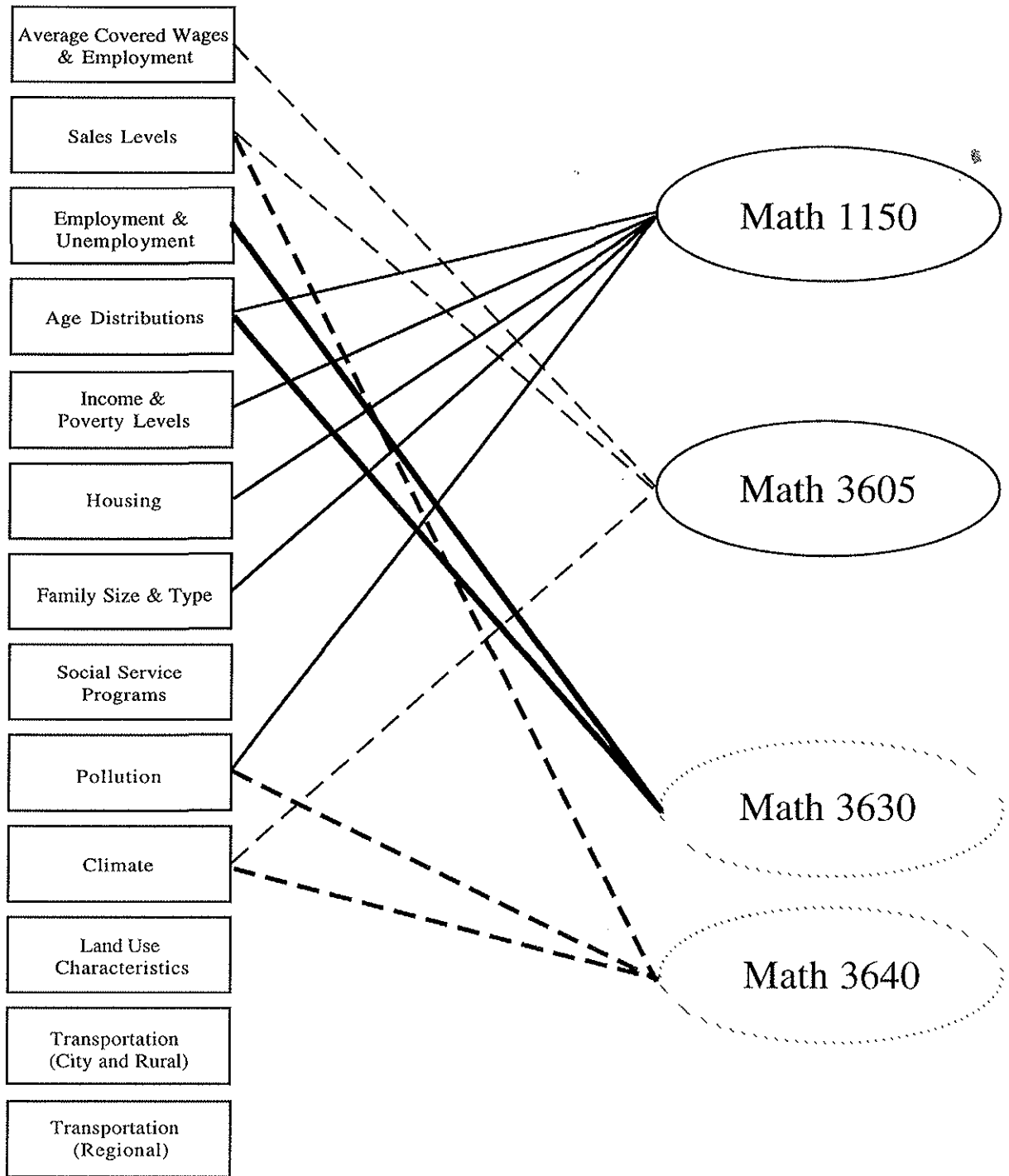
Math 3605

Math 3630

Math 3640

Figure : Mathematics Courses and Area of Analysis
Fall Quarter

B.   Winter Quarter Courses

Math 1150 : Introduction to Statistics

Areas of Analysis :

(1)   Age Distributions
(2)   Income & Poverty Levels
(3)   Pollution
(4)   Family Size & Type
(5)   Housing

Data :

Permanent :   Age Distributions, Income & Poverty Levels, Family Size & Type, Housing

Needs Updating :   Pollution

Copy :   (BEGIN) Pollution to Math 3620

Math 3620 : Elementary Statistical Data Analysis

Areas of Analysis :

(1)   Average Covered Wages & Employment
(2)   Social Service Programs
(3)   Employment & Unemployment
(4)   Pollution
(5)   Climate

Data :

Needs Updating :   Employment & Unemployment *, Social Service Programs

From Previous :   Climate, Average Covered Wages & Employment from Math 3605 in Fall

Obtain :   Pollution from Math 1150

* No updating needed if Math 3630 was offered in Fall Quarter
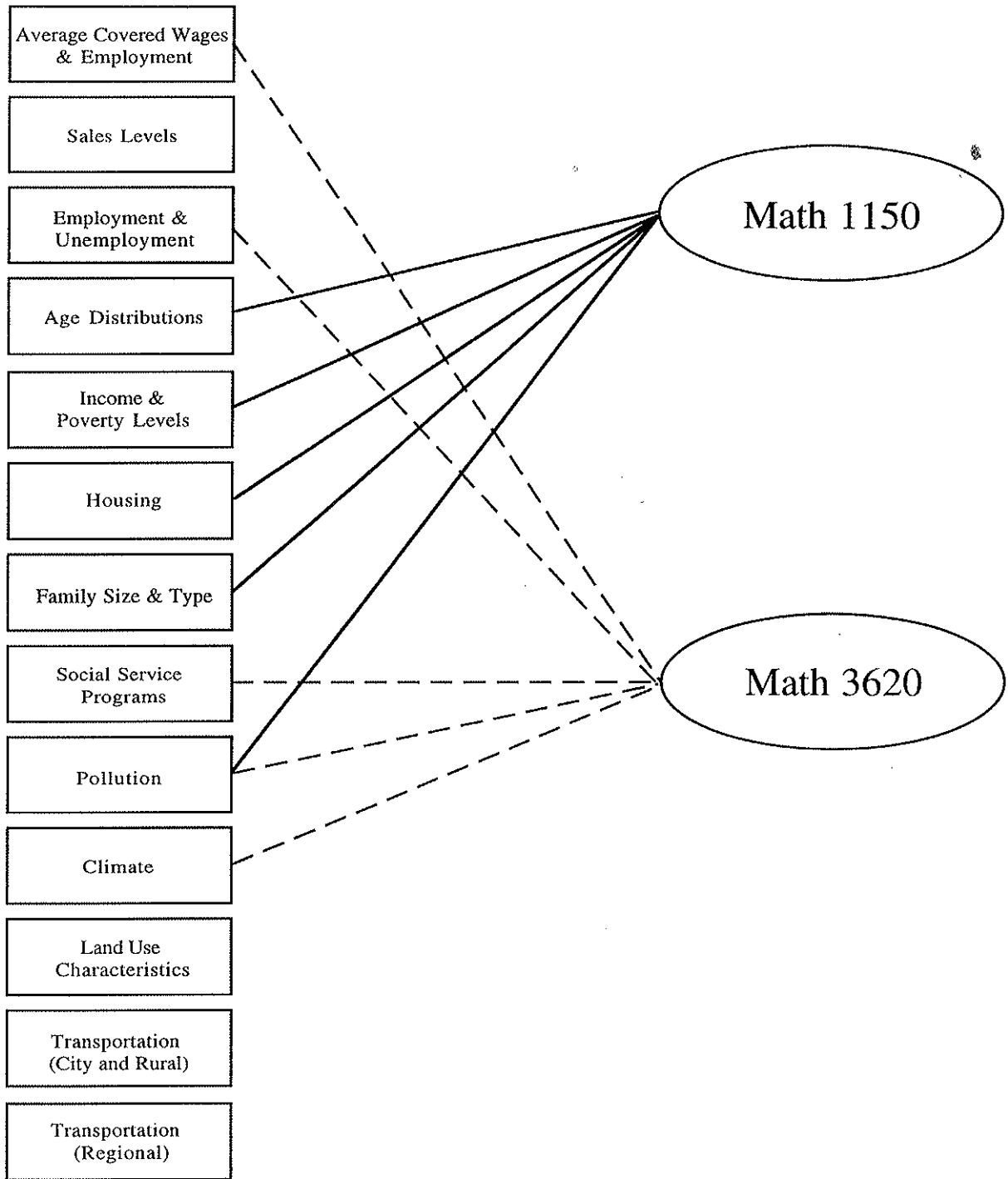
Figure : Mathematics Courses and Area of Analysis
Winter Quarter

The diagram contains the following boxes (left column, top to bottom):
- Average Covered Wages & Employment
- Sales Levels
- Employment & Unemployment
- Age Distributions
- Income & Poverty Levels
- Housing
- Family Size & Type
- Social Service Programs
- Pollution
- Climate
- Land Use Characteristics
- Transportation (City and Rural)
- Transportation (Regional)

And two ovals (right column):
- Math 1150
- Math 3620

C. Spring Quarter Courses

Math 1150 : Introduction to Statistics

Areas of Analysis :
- (1) Age Distributions
- (2) Income & Poverty Levels
- (3) Pollution
- (4) Family Size & Type
- (5) Housing

Data :

Permanent : Age Distributions, Income & Poverty Levels, Family Size & Type, Housing

Needs Updating : Pollution

Math 3370 : Combinatorial Mathematics

Areas of Analysis :
- (1) Land Use Characteristics
- (2) Transportation (City and Rural)

Data :

Permanent : GIS Type maps of area, City & Rural Transportation maps

Needs Updating : Land Use Changes
Transportation Changes

Math 3690 : Topics In Statistics

Note : This course will be addressing different topics through the years, this is only the first year course outline.

Areas of Analysis :
- (1) Land Use Characteristics
- (2) Transportation (Regional)

Data :

Permanent : GIS Type maps of area, Regional Transportation maps
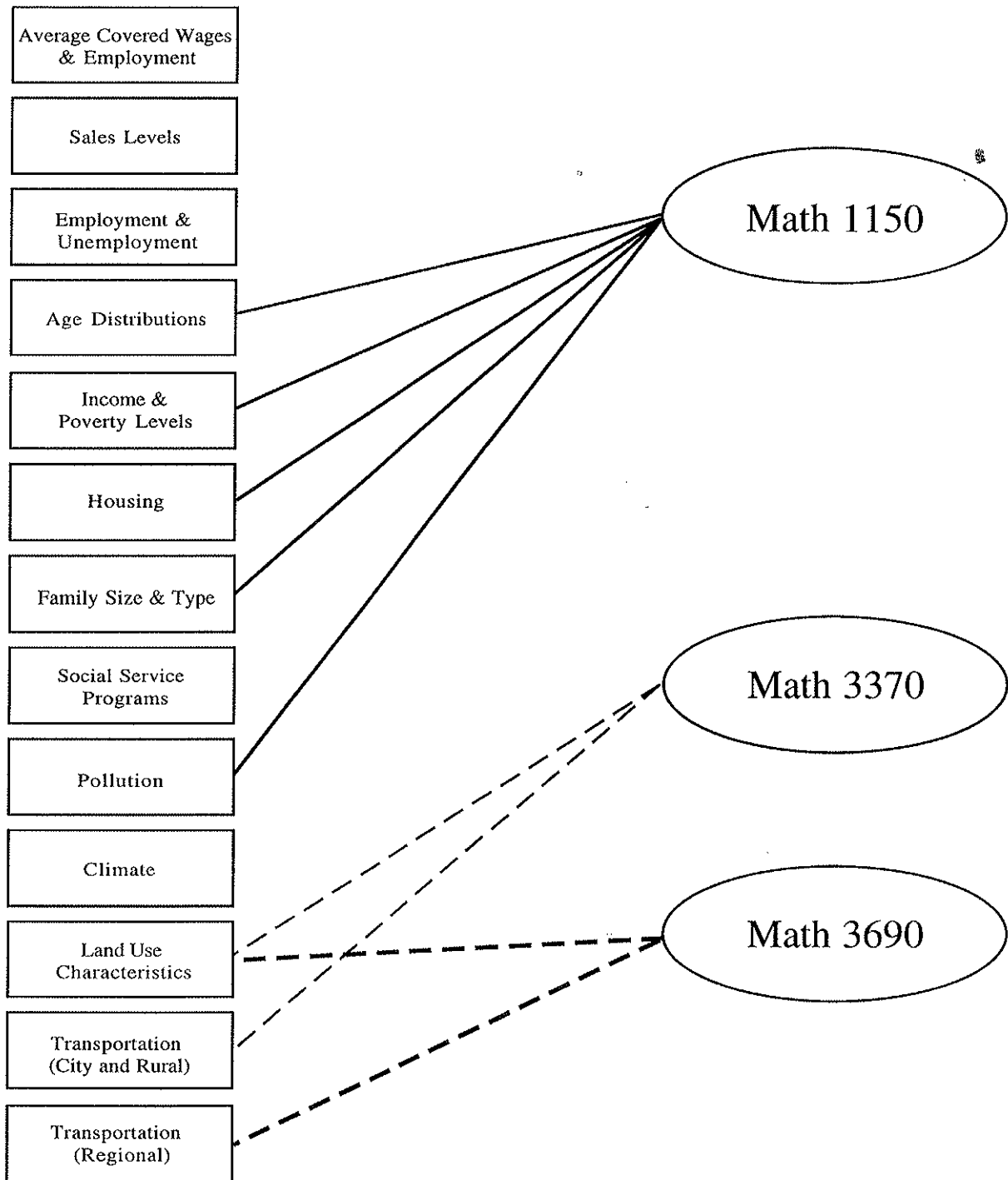
Needs Updating : Land Use Changes
Transportation Changes

Figure : Mathematics Courses and Area of Analysis
Spring Quarter

VI. Data Descriptions, Sources and Contacts

Average Covered Wages & Employment
Description : This data will provide the number of units (establishments), average employment, and average weekly wages for various industries.

Report : Minnesota Average Covered Employment and Wages by Economic Region and County. Note : This is available in either Annual Averages or Quarterly. Quarterly is recommended.

Source : Minnesota Department of Economic Security, Research & Statistics Office
Frequency of Source : Quarterly

Contact :   Mary Benton Hummel, Research Analysis Specialist
                Minnesota Department of Jobs & Training
                309 N. Robert St., St. Paul, MN 55101
                (612) 296-7892

Sales Levels
Description : This data provides Gross Sales, Deductions, Net Sales, Use Tax Purchases, Total Taxable Sales, and Tax Liability for various industries in both the City of Morris and Stevens County.

Report : Minnesota Sales and Use Tax Data : Annual Averages, City by Industry

Source : Minnesota Department of Revenue
Frequency of Source : Annual

Contact :   Diane Carter, Senior Research Analyst
                Minnesota Department of Revenue
                10 River Park Plaza, Mail Station 2230, St. Paul, MN 55146-2230
                (612) 296-3425

Employment and Unemployment
Description : Civilian labor force, employed persons, unemployed persons, and the unemployment rate is given on a month by month summary.

Report : Monthly Unemployment Rates

Source : Minnesota Department of Economic Security, Research & Statistics Office
Frequency of Source : Monthly

Contact :   Mary Benton Hummel, Research Analysis Specialist
                Minnesota Department of Jobs & Training
                309 N. Robert St., St. Paul, MN 55101
                (612) 296-7892

Age Distributions
Income & Poverty Levels
Housing
Family Size & Type
Description : Various indicators of census data - The areas of each analysis shall be determined at the beginning of the course.

Report : 1990, 1980, 1970 Census Data : STF 3A; P1 - P127, H1 - H71

Source : Census Bureau
Frequency of Source : Every decade

Internet :   http://www.census.gov/cdrom/lookup

Social Service Programs
Description : Aid to Families with Dependent Children, viewed as total, regular and unemployed parent recipients for calendar years. This data indicates the number cases, caretakers, children, total persons and total payments to the different programs. Food Stamp Allotments for calendar years. Data includes average monthly households, average monthly allotment, and total allotments to the various counties.

Report : Minnesota Aid to Families with Dependent Children, Calendar Year Summary
            Minnesota Food Stamp Allotments, Calendar Year Summary

Source : State of Minnesota Department of Human Services
Frequency of Source : Annual

Contact :   Fred Bettenberg-Pohl   John Byhre
                Reports and Forecasts Division Technical Assistance
                Department of Human Services   (612) 296-7474
                444 Lafayette Road
                St. Paul, MN 55155-3838
                (612) 296-6975

Pollution
To be determined.

Climate

Description : Temperature readings, wind directions, and precipitation levels will be documented through the Barrett High School and the West Central Experiment Station (WCES). Soil temperature at various depths will also be documented through WCES. Water levels, drainage, discharge and erosion will be measured at two sites (the Pomme De Terre River in Morris, and the P.D.T. river at its intersection with County Road 8, downriver from Morris, and downriver from the Muddy Creek drain in to the Pomme De Terre River) and documented at the Soil and Water Conservation District (SWCD).

Source : WCES documentation is for the previous day, and should be accounted for accordingly (e.g. the 2nd of the month entry is for the 1st of the month readings) These will be automatically sent to the University on a monthly basis.

Frequency of Source : WCES : Continuous
SWCD : Monthly

Contact :   Barrett High School
               Carol McCannon
               UMM Campus Compact
               Morris, MN 56267
               (320) 589-6083

               West Central Experiment Station
               Jean Spohr / George Nelson
               PO Box 471
               Morris, MN 56267
               (320) 589-1711

Land Use

Description : Students will use existing GIS type maps to analyze various land use characteristics of the Morris area. Maps with residential, commercial, and industrial zonings will be created, analyzed and updated.

Frequency of Source : Annual

Contact :
         Maps : Larry Zilliox   Chad Swanson
                Douglas Co. Extension Service   Computer Professionals LTD.
              - 305 8th Ave West   509 Atlantic Ave
                Alexandria, MN 56308   Morris, MN 56267
                (320) 762-3890   (320) 589-2110
                lzilliox@mes.umn.edu
         Zoning Updates : Stevens County Economic Improvement Commission

                Tom Gillespie
                City of Morris - Building Inspector
                609 Oregon Avenue
                Morris, MN 56267
                (320) 589-3141

Transportation (City, Rural, and Regional)
Description : Local, County and Regional traffic maps, along with usage statistics and estimates will be examined and tested by students. Also, source and destination optimization will examine current and proposed traffic networks.

Source : Minnesota Department of Transportation
Frequency of Source : Continuous

Contact :   (Local Highway Data)   (Regional Data)
                Dean Olson   Al Wolffe
                MN Dep't of Transportation   (218) 847-1540
                610 Hwy 9 South   MN DOT
                Morris, MN 56267   PO Box 666
                (320) 589-7300   Detroit Lakes, MN 56502

                (City Data)
                Bill Storck
                City of Morris Public Works Director
                (320) 589 - 2996

Interdisciplinary Resources
Description : These resources are to assist the campus community in preparatory and research analysis. Requests will be obtained on a personal basis through meetings with various faculty from different disciplines.

Political Science :   Greg Thorson
                        (320) 589-6208
                        Social Science 145c
                        U of MN, Morris

Biology :   Ellen Ordway
                        (320) 589-6308
                        Science 213
                        U of MN, Morris

VII. Community Based Resources

This section describes some of the other various local, county, regional, and state resources which can be utilized in the various courses. These are meant for additional personnel and expertise, beyond those contacts listed in Section VI. To be used as consultants, this increased contact with students will enable a better understanding of some of the underlying issues which are associated with the various areas of study. Also, the increased interpersonal skills will bring full circle the comfortable atmosphere of service leaning - direct contact with the community.

Larry Hutchins   Stevens County Historical Society
(612) 589-1719

Audrey Arner   Land Stewardship Project
103 W. Nichols, Montevideo, MN 56265
(612) 269-2105

In its work to foster an ethic of stewardship toward farmland, LSP develops and promotes sustainable practices and policies. LSP combines grassroots organizing with cultural programs, participatory research, and public policy initiatives.

Darrell Haugen   Morris Wetland Management District
(612) 589-1001

Guided tour through headquarters demonstration area and waterfowl management unit showing wildlife habitat management technique. Private landowners can use to improve their own habitat.

Ciaran Mannion   Minnesota Environment Initiative
Mike Harley   (612) 334-3388
(works with business/industry)

Ann Johnson   MN Attorney General's Office
(612) 296-0924
working with outstate cities on sustainable city issues

Barb Hannegan   Minnesota Pollution Control Agency
520 Lafayette Road, St. Paul, MN 55155
(612) 296-6619 1-800-657-3864

MPCA has staff members prepared to speak on air quality, water quality, and solid or hazardous waste issues. Many audio, visual and print materials are also available.

Scott Bradley   MN Department of Transportation
(612) 779-5076

(no contact)   Citizens League
708 S. 3rd St - Suite 500, Mpls, MN 55415
(612) 338-0791

| Lisa Doerr | Citizens for a Better Environment
3255 Hennepin Ave S. - Suite 150, Mpls, MN 66408
(612) 824-8637
e-mail : cbe@lgc.apc.org |
| (no contact) | MN Office of Environmental Assistance
520 Lafayette Rd N. - Second Floor, St. Paul, MN 55155-4100
(612) 215-0232 |

The Office of Environmental Assistance is dedicated to promoting an environmentally sound future through education, assistance, and partnership-building to prevent waste and pollution, conserve and recover resources, and plan for responsible management of all wastes.

VIII. Availability and Distribution of Reports

I. Internet
As of now, an internet web page is in theoretical design. It is hoped that all reports generated will be available to the public, free of charge, through the electronic medium. In this regard, any interested parties may download the entire reports, or selected portions of each which are needed. Currently, a service learning project will be proposed to create this web page, along with continued support and maintenance. The UMM Mathematics Discipline will be donating the use of a DEC 5000/240 workstation, and needed hard disk space needed for the creation of this site.

II. Stevens County Economic Improvement Commission (SCEIC)
It is hoped that through partnerships with organizations such as the SCEIC and the UMM Service Learning courses will enhance the attractiveness of the Stevens County area not only to current businesses, but to businesses in other regions or states. The completed reports can be used to examine employment and industry trends, demographic traits, and environmental concerns in our area to assist businesses in determining optimal business expansion or relocation advantages which the Stevens County area holds.

III. West Central Initiative Fund (WCIF)
WCIF is an organization based in Fergus Falls dedicated to enhancing community growth through grants and loans to area businesses for startup and expansion costs in the hopes of creating jobs in West Central Minnesota. It is hoped that generated Service Learning reports will be utilized to determine areas of growth and decline both economically and demographically. With continuous updates, the reports will not only save costs normally incurred in data gathering, but provide a dedicated source of objective information.

IV. Benefactors
Other regional and non regional agencies will be contacted and placed on a mailing list to receive updates related to the Service Learning reports as needed or requested.

V. Campus Compact
Service Learning in Mathematics courses is in its infant stages, and with more research and continues commitment by the University of Minnesota, Morris, the generated reports will bring service learning into a professional atmosphere. As more schools become aware of the benefits to the community, the faculty, the students and the institution, the distribution of service learning resources can be used by Campus Compact to examine future growth and potential within the service learning aspects.

VI. City of Morris
The creation of baseline data for the City of Morris and its work on the Ten Year Comprehensive Plan is the initial goal for these courses. It is hoped that a better understanding of the current economic, demographic and land use characteristics will assist in the projections and highlight traits of the region which normally would not have been fiscally possible in the creation of the Ten Year Comprehensive Plan. The contacts created through this collaboration are deemed essential in the continuation of this project, as the community saw "Increased University Contact" as one of the primary concern of persons in the community.

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IX. Assessment Tools

As of now, there are few assessment tools available for this type of service learning, as it is more of a professional service available to the community. Also, student responses will be within certain restrictions, as the students will not have firsthand awareness of their increased comprehension of the material until they are placed in an atmosphere with others not given these opportunities. The contact with the community in these projects is minimal, as most of the analysis is done behind a computer and in the classroom. Therefore, the following assessment tools will be used.

A. Pre & Post Surveys

A.1. Students - The very act of assessment may stress the importance of addressed issues to them, and the relation to coursework. It is hoped that these will encourage increased self esteem, a sense of personal power, and increased academic understanding.

A.2. Faculty - The committed faculty will be able to rate the knowledge gained through these courses, in relation to past courses of the same content, through the professional knowledge which the individual faculty have.

A.3. Community - Involved community officials will be asked to give their opinion of student contact in relation to awareness, knowledge, and responsibility.

A.4. University Administration - Surveys will be distributed to the Division of Science & Mathematics Division Chairperson, Admissions Counselors, and Campus Compact to help determine the awareness of Service Learning and it's impact within admissions requests, research sustain ability, and University Mission statements.

B. Future Post-Graduate Surveys

The distribution of surveys to alumni will include a service learning survey to those who have and have not participated in service learning courses. Examination of graduate placements, job placements, and continued service activity will hold valuable information as to the extent which service learning impacted their education. Since these surveys will be administered approximately every three to five years, there will be a reflective period during which students can examine the strengths and weaknesses of the service learning projects and provide valuable input to assist in the success of future projects.

C. Economic Development

It is hoped that the generated reports will lead to increased economic development in the low income areas surrounding and including the City of Morris. Examination of job development, business expansion, business relocation, wage increases, employee training, poverty reduction, and decreased social service dependence, in coordination with local development agencies, can provide concrete impact measures for these projects. Also, the number of internet "hits" on the web site can indicate the frequency with which persons are utilizing the generated reports.

X. Individual Course Projects

A. Math 3620 - Regression Analysis

Project I : Historical Time Trends in Industry
During this project, the students will examine quarterly data provided from the Department of Jobs and Training. This includes units (number of establishments), average employment, and average weekly wage.

Project II : Employment and Unemployment
Students will examine data from the Department of Jobs and Training concerning Civilian Labor Force, Number of employed persons, number of unemployed persons, and the unemployment rate. This will be for the years 1985 - 1995, broken down by month.

Project III : Social Service Program Trends
Using data provided from Social Services, students will analyze and summarize Aid to Families with Dependent Children, Food Stamps, and Social Security payments in Stevens County.

Project IV : Demographic Strengths/Weaknesses
Using data provided from the 1990 Census, students will be given a majority of the census data, and be asked to integrate findings of their choice in previous project results. Data emphasized will be age distributions, minority representations, income levels, and gender. Benjamin Winchester, chairperson of the Demographic Focus Group will speak with the group about demographic traits in Stevens County and comparisons with the state.

Project V : Industrial Environmental Impact
Ciaran Mannion and Mike Harley of the Minnesota Environment Initiative will be asked to come and speak about the relationships which exist between the environment and business in rural areas. Students will then use data provided to them, gather needed data from the Minnesota Pollution Control Agency, and summarize their findings in conjunction with Project I.

Coordinator Notes
This course began late due to the late notification of acceptance of the grants from Campus Compact. Due to this, only projects I, II, and III were completed.

Faculty Notes - Dr. Jon Anderson
The students in this course were able to use plots and simple statistical models to examine the behavior of Stevens County economic data over time. They were able to see seasonal employment fluctuations in certain industries, as well as evaluating trends in these variables. I believe the students were able to obtain a clearer picture of the Stevens County economy, and able to document aspects of the economic health of this county.

B. Math 3370 - Combinatorial Mathematics

Project I : Transportation and Network Flow

Using maps provided from the MN Department of Transportation and the City of Morris, students will analyze the transportation networks in and about the City of Morris. This includes source and destination problems, using zoning as a basis for flow.
In particular, four main issues looked into are :
- Where (optimal locations) to construct new "Welcome to Morris" signs.
- Possible routes to by-pass the city using Highway 28.
- General traffic flow diagram In/Out of the city.
- Zoning issues, as consequences of the aforementioned items.

Project II : Congestion

Using population estimates and land use characteristics, traffic patterns will be viewed within both the City of Morris and the region as a whole. Usage estimates are provided at the regional level only by the MN DOT regional coordinator Al Wolffe. These results will then be used as baseline data for Project III : Network Design.

Project III : Network Design

This project will examine past, present, and future road constructions to examine feasibility, benefits, and recommendations. Through contact with Dean Olson at the Minnesota Department of Transportation, students will discover and discuss factors which play in to expansion and location decisions.

Projects II & III were combined. In particular, three main issues looked into are :
- Parking on main streets and around the city center.
- Relation of by-passes to traffic flow within the city.
- Reconstruction of main street, Atlantic Avenue, to alleviate congestion between the 5th and 7th street blocks.

Project IV : Snow Plowing Routes

The current routes are provided by Bill Storck, the City of Morris Public Works Director, and will be examined using distances and intersections as indicators and represented as a network flow problem.

The main objective of this project is to design a mechanism and a cost-effective way for the City of Morris to complete its snow-plowing routes around the city limit areas. These routes include the main streets (with the exception of Atlantic Avenue which is taken care of by Stevens County) and the alleys.

Project V : Expansion

Through meeting with various local officials from the Department of Transportation and the City of Morris Planning Commission, the students will examine estimated future growth of the area, and formulate efficient networks to accommodate transportation needs.

Coordinator Notes

This course was extremely surprising, as the various applications of theory gave rise to many opportunities. Dr. Ng must be commended for her personal involvement and commitment to the project. Her knowledge and applications of the subject matter was found to be vast and appealing. This course has taken on all levels of transportation analysis - examining regional, county and local data.

Faculty Notes

Objectives of Projects :

This project assignment is to give Math 3370 students the opportunity to work on real world applications of the modeling and analysis approaches we study in the course. In particular, we will see how some of the ideas that we used could actually be applied to the development and infrastructure of the communities surrounding Morris, Minnesota.

Overall, the integration of service learning into Combinatorial Mathematics was a success, notwithstanding the obstacles that the students encountered. The results and proposals recommended by the students were very thorough, meticulously thought out, and well-organized. Hopefully, the City of Morris will find their proposals useful, and this experience will be the beginning of a collaborative partnership between the City of Morris and the University of Minnesota, Morris.

Problems Encountered :
- Time constraints, i.e. 10 weeks is quite restrictive in terms of trying to learn the material and then to apply the concepts to applications. Hopefully, when UMM goes into the semester system, it will alleviate this problem a little.
- Difficulties in getting some pertinent data or information, and in setting up meetings with a few city officials.

Texts Used :
- Discrete and Combinatorial Mathematics by *Ralph Grimaldi*, 3rd Edition, Addison-Wesley.
- Applied Combinatorics by *Alan Tucker*, 3rd Edition, John-Wiley.
- Network Flows : Theory, Algorithms, and Applications, by *R.K. Ahuja; T.L. Magnanti; J.B. Orlin*, 1st Edition, Prentice-Hall.

Mathematical Concepts
- Euler tours and circuits
- Network flows and design
- Maximal flow and minimal cut problems
- Basic graph theory concepts

Additional Sources

Morris Police Department - Data related to parking citations and accidents were used to examine congestion in the City of Morris. Contact : Cindy Swenson (320) 589-1155.

C.   Math 3690 : Design of Experiments

Project I :   Climate and Weather Patterns
Using historical data from the West Central Experiment Station, students will examine weather patterns, temperature fluctuations, precipitation levels, and ground soil temperatures in the City of Morris.

Project II :   Pomme de Terre River Characteristics
The Soil and Water Conservation District provides data related to river velocity, water levels, and erosion for two sites of the Pomme de Terre river. One site is in the City of Morris and the other is South of Morris, after which Muddy Creek drains into the Pomme de Terre.

Project III :   Climate Impact on the Pomme de Terre River
Using results from the first two projects, students will then integrate the results from each to build climate models to predict water levels, velocity and erosion of the Pomme de Terre dependent upon the climate conditions. This can then be used by the Soil and Water Conservation District to assess the various climate related conditions which may affect the Pomme de Terre River.

Project IV :   The Impact of Muddy Creek on the Pomme de Terre River
Using model building techniques and impact analysis, and results from the three previous projects will be used to help assess the impact which Muddy Creek has on the Pomme de Terre as it relates to river flow velocity, water levels, and erosion.

Project V :   Land and Property Values
Using data from the Stevens County Assessors Office, characteristics of land and property values will be summarized and examined within the City of Morris. This includes homestead designations, lot size, and the property tax rates.

Project VI :   Zoning and its Relation to Land and Property Values
The designation of either residential, commercial, and industrial zones provides some insight as to the impact which these have on land and property values. Maps will be created indicating various subdivisions in the City of Morris, and the value characteristics which they hold will be reported.

Project VII : Plant Species Analysis
This is part of the interdisciplinary assistance which is offered to UMM faculty involved in research. Here, Ellen Ordway, Professor of Biology, examined the growth of various plant species over time.

Project VIII : Non-game Migratory Bird Inventory Analysis
Working with the Morris Wetland Management District, students will examine migration patterns and bird counts of 10 classifications of bird categories in 12 wetland sites in 6 West Central Minnesota counties.

Coordinator Notes

Originally, plans were made to study Land Use Characteristics and Regional Transportation. However, the topics in this course proved to be beneficial to many community agencies, and for this reason no set areas of analysis were sought.

Projects V and VI were not completed due to insufficient data from the Stevens County Assessors office. They determined that the data should be available within 2 years, as they are not yet computerized to the point that data can be given out on a disk. Project VII was not completed due to errors in the data collection process.

On May 10, 1996 the students went to the Morris Wetland Management District and met with Bernie Angus and Donna Rieckmann for "Migratory Bird Day". The history of Wetland Management, alone with the current and future projects were discussed, followed by a Prairie Tour with emphasis on the various species of birds seen.

Faculty Notes

The project went very smoothly, and it was actually easier having the data provided by the project coordinaotr. Normally, it would take time to examine texts and to find appropriate data sets for the students to analyze. Because the data was first given to myself and the students at the same time, I learned along with the students. I believe they saw the real practice of statistical data analysis - initial examination of the data and exploratory techniques. The students have seen all stages of analysis - design and data collection, initial data manipulations, exploratory and confirmatory data analysis, and most importantly the student could see the possible impact of the results. I did not lose any coverage of material in the course, and if anything enhanced the students understanding of the material provided.

Texts Used : _Statistics for Experimenters : An Introduction to Design, Data Analysis, and Model Building_ by _Box, Hunter & Hunter._

Mathematical Concepts

Project I : Exploratory data analysis techniques, quantile plots, box plots, stem plots, normal plots, external reference distributions for inference, time series analysis, auto correlations, and ACF plots.

Projects II & VIII : Randomized blocks, multi-way factorial designs, multiple comparisons.

Project III : Comparisons of 2 treatment means, data transformations, general linear models.

Additional Sources

Soil and Water Conservation District : Data related to water well depths, discharge rates and soil types along the Pomme de Terre River. Contact : Andrew Gomer or Dave Jungst, RR 3 Box 10, Morris MN 56267. (320) 589-2266

Morris Wetland Management District : Data related to bird migration and counts, as this will be the analysis for the **Non-Game Migratory Bird Inventory on Waterfowl Production Areas, Morris Wetland Management District, 1995** study. Contact Bernie Angus (320) 589-1001.

Community Mathematical Services

A Service Learning Project - University of Minnesota, Morris

Questionnaire : Community Based Resources

I. Background

Organization Name   :   Date :

Address   :

Phone / Fax   :

e-mail   :

II. Mission

Briefly describe the mission of your organization.

III. Personnel
Please list the personnel which would be involved with *Community Mathematical Services.*

Name   Title   Area of Expertise

_____   _____   _____

_____   _____   _____

_____   _____   _____

If a person is available for consultation in the course, please place a star next to their name.

IV. Needs

In what ways do you believe *Community Mathematical Services* can assist your organization ?

Would this proposed assistance normally have been completed by or through your organization ?

If not, what prevents you from doing this ?

Is there a time requirement on this request ? If so, what is it ?

Community Mathematical Services
A Service Learning Project -- University of Minnesota, Morris

Post Project Questionnaire : Community Based Resources

Organization Name　　:　　　　　　　　　　　　　　Date :

Please describe the Service Project you were involved with.

Date of Service Project :

Did any member of your organization speak with students involved in the project ? If so, on how many occasions ?

If so, what areas did you speak of ?

Please answer the following (5 - excellent, 3 - mediocre, 1 - poor, N/A - no opinion)

STUDENTS

Sense of Purpose	5	4	3	2	1	N/A
Educational Knowledge	5	4	3	2	1	N/A
Tolerance and Appreciation	5	4	3	2	1	N/A
Willingness	5	4	3	2	1	N/A
Overall treatment of your organization	5	4	3	2	1	N/A

FACULTY

Sense of Purpose	5	4	3	2	1	N/A
Educational Knowledge	5	4	3	2	1	N/A
Tolerance and Appreciation	5	4	3	2	1	N/A
Willingness	5	4	3	2	1	N/A
Overall treatment of your organization	5	4	3	2	1	N/A

ADMINISTRATION

Sense of Purpose	5	4	3	2	1	N/A
Educational Knowledge	5	4	3	2	1	N/A
Tolerance and Appreciation	5	4	3	2	1	N/A
Willingness	5	4	3	2	1	N/A
Overall treatment of your organization	5	4	3	2	1	N/A

OVERALL PROJECT

Did this project address your needs	5	4	3	2	1	N/A
Was this done in a professional manner	5	4	3	2	1	N/A
How did the results meet your expectations	5	4	3	2	1	N/A
Overall view of *The Connection*	5	4	3	2	1	N/A

Additional Comments :

COMMUNITY MATHEMATICAL SERVICES

Climate Data - Summaries From CR10 Data Logger
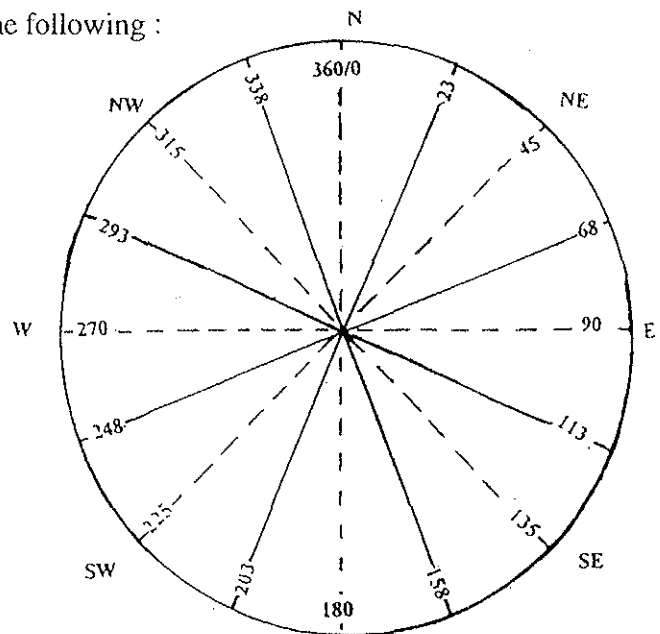West Central Experiment Station - Morris, MN

This dataset is set up with the following variables :

VAR	DESCRIPTION
1	Julian Day (Subtract 1 to get actual date, as the results are from the previous day)
2	Maximum Air Temperature, C
3	Minimum Air Temperature, C
4	Total Precipitation, inches.
5	Max. 4" soil temp, F
6	Min. 4" soil temp, F
7	Max. 8" soil temp, F
8	Min. 8" soil temp, F
9	Max. Relative Humidity, %
10	Min. Relative Humidity, %
11	Mean wind speed, m/sec
12	Vector Wind Direction, degrees
13	Max. Surface Soil Temperature, F
14	Min. Surface Soil Temperature, F
15	Max. 2" Soil Temperature, F
16	Min. 2" Soil Temperature, F
17	Max. 20" Soil Temperature, F
18	Min. 20" Soil Temperature, F
19	Max. 40" Soil Temperature, F
20	Min. 40" Soil Temperature, F
21	8a.m. 20" Soil Temperature, F
22	8a.m. 40" Soil Temperature, F

Notes :
- The Centigrade temperature can be converted to Farenheit by multiplying the ºC by 1.8 and adding 32.0.
- There are no months, just the day number of the year. Use the MATH option to code a new variable for month, if needed.
- Speed in meters per second can be converted to miles per hour by multiplying it by 2.237.
- The various vector degree locations are the following :

COMMUNITY MATHEMATICAL SERVICES

Math 3690 - Design of Experiments

Climate Data : The 199* climate data files on the diskettes you have received contains data from the West Central Experiment Station, located in Morris, Minnesota. This data is explained in a seperate handout.

Pomme de Terre Discharge Data : This data is provided from the Soil and Water Conservation District. This data gives the cubic feet per second which the water is moving at, for two sites along the Pomme de Terre River : One here in Morris, and one south of the area, after which Muddy Creek flows in to the PDT River. Using climate data, such as precipitation, we can examine these effects on the Pomme de Terre, and the effect which Muddy Creek has on the PDT river flow patterns. The data is set up as follows :

JDAY93   CFS193   JDAY94   CFS194   CFS294
JDAY95   CFS195   CFS295

Whereas JDAY is the Julian day of the corresponding year. CFS1 indicates the site measurement here in Morris, and CFS2 indicates the site measurement after Muddy Creek has flown into the Pomme de Terre River, and is given in cubic feet per second.

These data sets, and documentation can be found on the Macintosh in the Mathematics Computer Lab, in Science room 250. Also available in the Data Library in Science, room 250, are the following :

1. The original data sheets of climate data. Use these to verify data enteries, or to examine other variables not included in the original data set. Included on these sheets are snow depth (column 6 on the observation sheets), precipitation in the winter months (column 4 contains water amounts in inches, column 5 contains snowfall amount in inches). It must be noted that the data files on diskette do not contain precipitation data during the winter months, and must be entered manually for the year you wish to observe. Also, 1992 was a leap year, with February containing 29 observations. For all of this climate data, the observations are for the previous 24 hours, therefore adjust your results accordingly, where necessary.

2. Well readings from various metering stations surrounding Morris. These will be used to examine the effect of climate related data on the various underground water wells in the area. Using the map attached to the top of the data, select data sheets corresponding to the map. These readings give the month, day and year of the observation. The only data field which is necessary is the "Depth below Measuring point (ft)" column. These are easy to enter, but must be related to the climate data in Julian days. Therefore, convert the date given to julian days, and enter in the climate data set for the appropriate year.

3. Sales and Use tax data is available in the library also. These consist of gross sales, deductions, net sales, use tax purchases (purchases which the buyer is not going to resell, therefore they must pay the sales tax on it), total taxable, and tax liability for Stevens County (among other counties, including the state as a whole).