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Measurement of Priority Schedules in the
Acquisition of Durable Appliances

161-66

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Preliminary Report

The present paper attempts to substantiate the hypothesis that there exists a continuum on which most of the existing and known durable products can be placed in some fashion of a priority system both at the aggregate and at life cycle subgroup levels.

The notion of a product continuum is not a new one; it has been expressed by the essence of economic behavior namely satisfying unlimited wants with limited resources. However, such notion though expressed, has not been systematically tested and analyzed, at least with respect to durable goods.

Theoretical Analysis:

As stated above, a household, holding changes in income, education, dwelling, members of the family etc. constant, attempts to make the best use of the limited resources at its disposal in satisfying unlimited wants; and in doing so, it encounters the problem of scheduling the purchases of various durable products by the criterion that most urgently needed must be acquired first. The plain fact is that a household within a short-time interval of say one year or less, is not in a position to acquire all the appliances it may need; some acquisitions have to be deferred to a later time in order that more urgent may be acquired now. The yearly savings of a household (Disposable Personal Income less annual living expenses including repayments of loans, etc. in agreed upon terms) is not sufficient for the immediate investment needed in buying the existing and needed number of appliances. Besides, other expenditures compete for the savings like the life and medical insurances, recreation and vacationing, etc. Hence, the emergence of a product acquisition scheduling over a period of years on the part of the household.

The acquisition schedule or continuum of durable goods is dictated largely by the strengths of different unsatisfied needs. To the extent that some durable goods act complementarily and are very much like joint products in the sense that their simultaneous acquisition alone can satisfy one common and general need, the scheduling distance between such products may be very short almost amounting to an overlap. A good example is Range and Refrigerator, but not the washer and dryer. In the latter case, dryer acquisition is conditional upon prior acquisition of the washer, whereas washer is independent of the prior or even joint acquisition of a dryer. (Data reveal that, at the aggregate level, the conditional probability of acquiring a dryer given prior possession of a washer i.e. $P(D/W)$ is .97 whereas the vice versa $[P(W/D)]$ is only .28. But in the case of refrigerator and Range, the conditional probability of acquiring a refrigerator given the possession of a range $[P(Ref./Range)]$ is .94 and the vice versa $[P(Range/Ref.)]$ is .92.)

It seems also that a variety of needs for different durable products with their individual strengths does exist for a household given that it belongs to a particular socioeconomic class. Such needs are largely dictated by exogenous variables like class, culture and economic standing. A household would, therefore, go along the schedule of acquisition in a systematic way. The acquisition of a product later on the continuum will not be planned until all the earlier products are acquired or made available. For example, a household may not buy a dish-washer before it can get a refrigerator since the latter is likely to be more urgent.

One point must be clear. The product continuum hypothesis is not related to past ownership and future purchases; rather, it shows relation between past avail-ability and future acquisitions. Such availability may have been made by the

rented facilities or by a gift from someone, or it may even have been a prize in a drawing. So must be the case with future acquisitions; they also can result from sources other than purchase. However, it will be attempted, at the aggregate level, to find out whether acquisitions other than by purchases are radically affecting the acquisition schedule, and if so how to predict future purchases. Marketing strategies available to a company knowing first, that a scheduling process does exist and second, that there is a particular product continuum are immense.

Methodology:

The procedure chosen to measure a product continuum is the establishment of ordinal continuum scales in terms of past joint availability (PJA) and the current acquisition frequency or rate (A). As stated before, a household, on the average, will not buy say the 6th product on the continuum unless it has jointly availably to it the first five products. The relevance of past joint availability becomes apparent because of the continuum and the dependency of a product on past all the products prior on such continuum.

The following equation gives past joint availability scores for each durable appliance under consideration.

(1) $$PJA_i = \sum_{j=1}^{n} [x_{ij} - (y_{ij} + z_{ij})] - A_i$$

$i = 1, 2, 3, \ldots, n$ and $i \neq j$ where

PJA_i = Past joint availability score of ith appliance,

n = number of durable appliances in consideration

x_{ij} = the percentage joint possession of jth appliance given the possession of the ith appliance (conditional percentage probability).

y_{ij} = the percentage acquisition of the jth appliance during the past one year or less given the possession of ith appliance

z_{ij} = the percentage availability of jth appliance given the acquisition of ith appliance for one year or less.

A_i = percentage acquisition rate among sampled households of ith appliance during past one year or less.

In order to simplify the understanding of the equations, the following schematic may be useful:

j^{th} appliance

i^{th} appliance

| | Available | 1 | 2 | } Possession |
| Acquired | | 3 | 4 | |
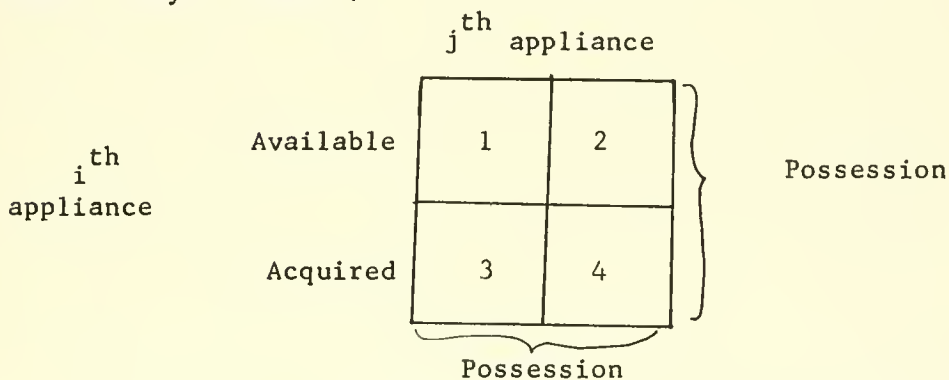
Possession

$$1 + 2 + 3 + 4 = x_{ij}$$
$$2 + 4 = y_{ij}$$
$$3 = z_{ij}$$

therefore $PJA_i = \left\{ (1 + 2 + 3 + 4) - [(2 + 4) + 3] \right\} = 1$

Also,   Possession = having appliance with the household at any time

Availability = having appliance with the household for more than one year, and

Acquisition = having appliance with the household for less than one year

The products when analyzed in terms of individual PJA_i scores then can be placed on an ordinal continuum of PJA_i score strengths. However, the ordinal scale will be reverse in order, the lowest PJA_i score getting the first rank on the continuum. This reversal of PJA_i scores is easy to understand. A product earlier on the continuum will have fewer prior products to account for than a product near the end of the continuum. For example, it may be assumed that a household prefers radio much more than a canopener so much so that the former is 3rd on the continuum and the latter is 20th on the continuum. Under this hypothetical situation, the only joint availability to be accounted for in case of radio is the satisfaction by prior possession of needs pertaining to the first two products which may, again for example, be refrigerator and range. But in the case of canopener the joint availability to be accounted for is with respect to 19 prior products including radio.

However, if one can use Bayesian statistics, one need not reverse the ordinal scale. The condition on which the acquisition of a product rests is that of joint probabilities of the prior product availabilities and, of course, the more the prior products, the smaller the probability because of multiplication rule. But in order to use Bayesian conditional probability theorem, the necessary condition is the knowledge of the product continuum itself: what products stand where on the continuum, and this is not available.

Coming back to the methodology, the one year or less time period used to define acquisition and purchase is largely the outcome of the data. The data available do not give information on a shorter interval base. If the analysis of acquisition were by quarters it would improve the whole study. However, for

durable appliances, it is generally felt that one year is not too long a time period.

If the product continuum hypothesis is true then there must exist positively high correlation between past joint availability (PJA_i) and acquisition rate (A_i) for the appliances under consideration. The rank correlation between the two ordinal scalings can be obtained by

$$(2) \qquad Rank_\gamma = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

where   D = Difference of rank position for an appliance

N = Number of ranked appliances.

Also, the obtained correlations can be tested for reliability at specified levels of significance by

$$(3) \qquad t = \gamma_\gamma \sqrt{\frac{(N - 2)}{(1 - \gamma_\gamma^2)}}$$

where   N = number of ranked appliances

γ_γ = rank correlation

and   df = degrees of freedom = N - 2

Analysis of Data:

A sample of 14,348 households is analyzed to substantiate the hypothesis, both at the aggregate and life cycle levels. The sample is a true probability sample of the U.S. population in 1962. The data gathered related, among other things, to 22 durable appliances in all the three categories — electronics, major and minor appliances. However, electric toothbrush was discarded from the analysis because it was then just introduced in the market. Only 117 households acquired an electric toothbrush out of the 14,348 households sampled, and no

household had available to it prior to one year because it was only introduced

during the past one year from the date of the sample.

The PJA_i scores both at the aggregate and life cycle levels were tabulated

on IBM 7090/94 unit of the Columbia University Computer Center. Owning to large

size of the sample, the total analysis took more than 7 hours of computer time

and an output of approximately 100,000 printed lines. Using cross-tabulation

program, a total of 3780 tables was produced with approximately 1200 control cards.

Each table, among other things, gave one conditional percentage availability score

for each cell entry of nine 21 x 21 matrices (one matrix for the aggregate level

and eight for eight life cycle levels), the diagonals of each matrix remaining

blank because of the condition in Equation (1) that $i \neq j$. The 9 matrices are

reproduced as Tables 1 through 9. As can be seen from the titles to these tables,

each cell entry is only one part of the final PJA_i scores, namely $[x_{ij} - (y_{ij} + z_{ij})]$.

Aggregate Level:

Using raw scores of Table 1 and Equation (1), Table 10 is created which gives

the final PJA_i score for each ith appliance of the aggregate level. Table 11

then ranks the products in terms of PJA_i scores and A_i scores (see Table 36).

At the bottom of Table 11, using equation (2), a rank correlation is obtained

$(\gamma_\gamma = .91)$. This when tested for reliability using equation (3) is found to be

significant at least at .0001 level.

If two appliances are removed from the analysis (hair dryer and toaster) for

no reason other than being most deviant, the correlation goes up to .95 and,

is again, significant at least at .0001 level.

Life Cycle Levels:

The total aggregate sample was divided in terms of the life cycle position of a household in the sample. The following are the eight categories of life cycles.

Life Cycle 1 = Head under 45, not living with spouse, no children under 18

Life Cycle 2 = Head under 45, living with spouse, no children under 18

Life Cycle 3 = Head under 45, living with spouse, one or more children under 18 with youngest child under 6.

Life Cycle 4 = Head under 45, living with spouse, one or more children under 18 but none under 6

Life Cycle 5 = Head 45, or over, living with spouse, one or more children under 18

Life Cycle 6 = Head 45 or over, living with spouse, no children under 18

Life Cycle 7 = Head 45 or over, not living with spouse, no children under 18

Life Cycle 8 = Others.

Research on household decision-making has suggested with good evidence that life cycle as a single variable takes into account the effects of differences in income, education, age, dwelling unit and duration, region, occupation, etc. To replicate such evidence and to see that it does reflect in the present sample, Tables 12 - 19 show the contingency analysis of these variables with the life cycle. Non-parametric tests reveal that each analysis is significant at .005 level (one-tail test) and therefore, strengthens the hypothesis that differences in the variables are reflected in classification of life cycle groups. Thus, the choice of life cycle as one variable which will reflect the effects of some of the major

variables in household decision-making seems both relevant and adequate.

a. <u>Life Cycle 1</u>: Table 20 gives the PJA_i scores using Table 2 and Equation (1). Table 21 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .97 which is significant at least at .0001 level.

b. <u>Life Cycle 2</u>: Table 22 gives the PJA_i scores using Table 3 and Equation (1). Table 23 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .78 which is significant at least at .0001 level.

c. <u>Life Cycle 3</u>: Table 24 gives the PJA_i scores using Table 4 and equation (1). Table 25 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .91 which is significant at least at .0001 level.

d. <u>Life Cycle 4</u>: Table 26 gives the PJA_i scores using Table 5 and equation (1). Table 27 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .80 which is significant at least at .0001 level.

e. <u>Life Cycle 5</u>: Table 28 gives the PJA_i scores using Table 6 and equation (1). Table 29 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .87 which is significant at least at .0001 level.

f. <u>Life Cycle 6</u>: Table 30 gives the PJA_i scores using Table 7 and equation (1). Table 31 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .78 which is significant at least at .0001 level.

g. <u>Life Cycle 7</u>: Table 32 gives the PJA_i scores using Table 8 and equation (1). Table 33 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .91 which is significant at least at .0001 level.

h. <u>Life Cycle 8</u>: Table 34 gives the PJA_i scores using Table 9 and equation (1). Table 35 ranks the appliances in terms of PJA_i scores and A_i scores (Table 36). The rank correlation is .92 which is significant at least at .0001 level.

Thus rank correlations at life cycle levels range from .78 to .97 only; the variation is not too high.

It is interesting to note that any changes brought about by the life cycle in the placings of products on a continuum are all in the direction reasonably considered correct. For example, washing machine is quite low in life cycles 1 and 2 as compared to life cycles 3, 4, 5, and 6 for which some explanation may be available: households in life cycles 1 and 2 are young, only rent rather than own as compared to households in other life cycles. Many such instances of the effect of life cycles can be found. However, if we compare the product continuum of the 8 life cycles with the aggregate continuum, one is surprised at high correlations ranging from .84 to .97 (see Table 37). This suggests that product continuum hypothesis is not only substantiated but is sort of universal to American households.

The percentage of households who have a product j (column) given that they have a product i (row)

	Dish Washer	Flr. Plshr	Can Open	Blkt	Hr. Dryer	Ref	Freez	Rang	Air Cond.	Vac. Clean	TV	Radio	Phono	Food Mixer	Iron	Toast	Coffee Mkr.	Fry Pan	Wash. Mach.	Cloth. Dryer	Clock
Dish Washer		25	18	32	36	93	39	96	21	82	70	38	69	85	75	88	70	62	83	62	63
Floor Polisher	16		11	25	32	91	35	89	20	83	73	43	63	85	75	88	68	60	81	40	63
Can Opener	17	16		30	33	89	25	88	18	81	72	43	63	83	81	89	67	64	77	39	60
Blanket	9	12	9		25	87	29	87	17	75	76	52	49	78	79	81	62	56	66	28	60
Hair Dryer	11	15	10	25		88	26	85	17	79	74	45	63	82	78	86	64	57	75	35	59
Refrigerator	6	8	6	18	18		22	92	11	70	76	55	45	67	81	75	50	41	69	21	58
Freezer	10	14	7	25	23	93		90	14	80	78	49	49	81	80	77	61	57	80	37	59
Range	6	8	6	18	17	94	21		11	69	76	55	44	67	81	75	56	41	69	21	58
Air Conditioner	10	16	9	28	29	93	26	91		83	76	52	56	79	79	83	63	53	72	32	63
Vacuum Cleaner	6	10	7	20	21	91	24	90	13		78	53	50	77	81	84	57	48	73	25	62
Television	5	8	5	18	17	90	21	88	11	71		57	45	69	82	76	52	42	68	20	59
Radio	4	6	4	17	15	88	18	87	10	66	77		40	62	83	73	48	37	64	15	58
Phonograph	8	11	8	19	25	88	23	86	13	75	75	49		75	67	80	56	47	72	28	58
Food Mixer	7	10	7	21	22	90	25	88	13	78	78	52	51		80	83	59	51	74	27	61
Iron	5	8	6	17	17	88	20	86	10	67	75	56	43	66		75	50	40	66	19	58
Toaster	6	10	7	19	20	89	21	88	12	76	77	53	49	74	81		56	47	70	24	61
Coffee Maker	7	11	7	22	23	89	25	88	13	78	78	53	51	79	81	84		54	73	27	61
Frypan	8	12	9	24	25	88	29	87	14	79	77	50	52	83	80	86	66		74	30	62
Washing Machine	7	10	6	18	20	92	25	91	12	75	77	53	49	74	81	79	55	46		28	60
Clothes Dryer	16	16	11	25	30	92	38	91	17	83	75	42	62	87	77	87	66	62	97		61
Clock	6	9	6	19	18	83	21	88	12	73	77	56	46	71	83	80	54	44	66	22	

The percentage of households who have a product j (column) given that they have a product i (row)

	Clth. Dryer	Hair Dry.	Wash. Mach.	Clk.	Fry-pan	Cof. Mkr.	Toast	Iron	Food Mixer	Phono	Radio	TV	Vac. Clnr.	Air Cond.	Range	Re-Frig.	Free.a Frig.	El. Blk.	Can Op.	Flr. Polish	Dish. Wash.
Dishwasher	67	33	100	33	33	33	67	33	33	100	33	33	67	0	100	67	0	0	33	33	
Floor Polisher	25	42	83	58	58	58	92	50	100	67	25	83	92	8	92	83	8	25	25		8
Can opener	14	7	43	79	64	71	79	64	86	86	57	50	93	43	79	79	21	43		21	7
El. Blanket	4	10	19	50	44	40	54	65	52	63	48	52	46	8	63	60	6		13	6	0
Refrigerator	4	10	29	48	19	22	60	73	37	46	60	72	48	9	94		5	11	4	4	1
Freezer	4	0	46	62	31	46	62	62	62	69	62	77	69	15	100	92		23	23	8	0
Range	4	10	28	48	20	25	62	72	36	47	59	71	48	8		92	5	11	4	4	1
Air Conditioner	0	4	33	50	-38	50	67	50	58	63	67	63	67		96	100	8	17	25	4	0
Vacuum Cleaner	6	16	37	55	39	39	81	80	53	60	52	73		10	83	81	6	14	8	7	1
Television	4	11	26	51	23	23	67	78	39	48	61		50	6	84	84	4	11	3	4	0
Radio	2	7	20	43	22	18	48	72	29	39		65	39	7	75	74	4	11	4	1	1
Phonograph	3	16	25	48	24	30	60	65	40		48	61	54	8	71	69	5	17	7	4	2
Food Mixer	7	21	44	61	43	46	72	80		59	53	74	70	12	81	81	7	21	10	10	1
Iron	3	11	25	49	22	24	56		36	42	58	66	47	4	73	73	3	11	3	2	0
Toaster	3	14	31	54	31	32		74	43	52	50	75	63	8	82	78	4	13	5	5	1
Coffee Maker	6	13	38	61	40		76	75	64	61	46	60	71	14	77	68	7	22	11	8	1
Frypan	4	19	43	59		44	81	76	66	55	60	66	79	11	70	63	5	26	11	9	1
Clock	2	13	22		26	30	61	73	40	48	51	65	49	7	72	71	4	13	6	4	1
Wash. Mach.	13	16		47	39	38	74	77	62	52	51	70	60	9	90	89	7	10	7	12	3
Hair Dryer	2		34	59	37	27	71	76	63	71	37	61	61	2	66	60	0	12	2	12	2
Cloth. Dry.		8	92	25	25	42	58	67	67	50	33	75	75	0	83	92	0	17	17	25	17

The percentage of households who have a product j (column) given that they have a product i (row)

	Dish Wash.	Fl. Pol.	Can Open.	Blan-ket	Refr.	Freez	Range	Air Cond.	Vac. Cl.	T.V.	Radio	Phono	Food Mix	Iron	Toast	Cof. Maker	Fry pan	Clck	Wash. Mach.	Hair Dryer	Cls. Dry.
Dish Washer		11	6	17	78	22	100	22	56	67	50	50	72	78	100	56	50	39	83	33	39
Floor Polisher	5		16	35	84	30	84	16	65	57	54	81	97	89	89	41	68	73	76	49	32
Can Opener	2	13		21	79	11	70	32	57	77	57	62	87	89	96	75	66	53	57	28	21
Blanket	2	9	7		65	17	63	14	59	72	56	70	66	81	79	59	52	47	34	32	12
Refrigerator	3	7	8	20		18	91	15	59	77	55	59	68	84	78	53	44	54	55	21	14
Freezer	5	63	6	30	84		88	23	71	81	55	51	86	78	72	52	61	58	75	29	28
Range	4	6	7	19	91	15		16	60	75	52	57	66	83	77	53	45	55	56	21	15
Air Conditioner	5	8	19	25	90	24	95		75	80	60	78	73	83	81	59	55	70	55	30	33
Vacuum Cleaner	3	7	8	24	80	17	80	17		73	54	63	73	81	83	57	50	62	55	26	17
Television	3	5	8	23	81	15	79	14	57		57	56	64	82	73	51	44	54	47	21	12
Radio	2	5	7	21	69	12	65	13	50	68		56	55	80	67	46	42	57	42	19	11
Phonograph	2	8	7	26	71	11	69	16	57	65	54		62	75	74	49	44	50	45	28	13
Food Mixer	3	9	10	24	81	18	79	15	65	73	52	61		82	87	61	58	61	54	26	16
Iron	3	6	8	22	75	12	74	12	54	70	57	55	62		75	50	45	56	44	21	10
Toaster	4	7	10	24	79	13	77	14	62	70	54	61	73	84		57	52	58	52	26	13
Coffee Maker	3	5	11	27	79	14	79	15	64	73	56	61	77	85	85		57	61	51	27	14
Frypan	3	9	11	27	73	18	75	16	62	70	56	60	81	84	88	64		60	52	29	20
Clock	2	8	7	20	75	14	76	16	64	71	56	58	71	87	80	56	49		49	25	12
Washing Machine	5	10	9	17	89	21	91	15	66	73	54	60	74	80	84	55	50	57		23	23
Hair Dryer	4	11	8	29	62	15	59	15	56	58	44	66	63	67	75	52	50	52	42		13
Clothes Dryer	10	16	14	23	89	31	97	35	80	76	55	66	84	70	85	60	76	54	93	30	

The percentage of households who have a product j (column) given that they have a product i (row)

	Dish Wash	Fl. Pol	Can Open	Blkt	Refr.	Freez	Ran	Air Cond	Vac. Clnr	TV	Radio	Phono	Food Mix	Iron	Toast	Cof. Mkr.	Fry pan	Clck	Wash Mach.	Hair Dry	Clth Dry
Dish Washer		32	19	27	92	35	96	26	87	69	30	75	86	76	84	75	63	65	84	36	70
Floor Polisher	18		11	24	91	33	82	21	81	68	37	71	86	72	84	71	61	60	81	31	51
Can Opener	19	19		19	88	20	82	14	80	70	42	69	84	81	91	67	63	61	82	37	47
Blanket	10	16	7		84	24	77	20	71	73	41	60	81	78	84	66	63	60	70	31	45
Refrig.	6	10	6	14		22	89	12	69	75	48	54	75	80	76	54	45	58	75	21	33
Freezer	9	15	5	17	93		88	14	78	76	43	57	81	79	78	59	54	55	82	25	51
Range	6	9	5	14	93	22		11	68	75	48	53	74	80	75	54	44	58	75	20	33
Air Conditioner	12	18	7	26	91	25	85		81	75	43	61	83	80	80	65	56	60	81	32	43
Vacuum Cleaner	7	12	7	15	90	24	85	14		77	47	59	83	79	85	62	53	61	78	24	39
Television	5	9	5	14	86	20	83	11	67		51	53	74	81	77	54	44	57	73	20	31
Radio	3	7	5	12	82	17	80	10	62	77		52	70	82	74	52	41	56	69	19	26
Phonograph	7	13	7	16	86	21	81	13	73	74	49		80	78	82	59	51	59	75	24	37
Food Mixer	6	11	6	17	87	22	82	13	74	75	47	58		80	82	60	52	60	75	23	36
Iron	5	8	5	14	83	19	80	11	64	74	50	51	72		75	52	43	58	70	20	30
Toaster	6	10	6	16	85	21	81	12	73	75	48	57	79	81		59	51	61	74	23	35
Coffee Maker	7	13	7	18	86	22	82	13	76	75	48	59	82	80	84		56	61	75	26	39
Frypan	7	13	8	20	85	24	81	14	78	74	46	61	85	79	87	67		62	73	27	40
Clock	6	10	6	15	86	19	82	12	70	74	49	55	77	82	82	56	49		73	22	33
Washing Machine	6	11	6	14	90	23	86	12	72	76	48	56	77	80	79	56	46	59		22	38
Hair Dryer	9	14	10	22	89	25	82	18	79	73	47	65	85	80	88	69	60	64	78		45
Clothes Dryer	12	16	8	21	92	33	88	16	83	75	41	64	87	79	87	68	59	3	89	30	

	Dish Wash	Flr. Pol.	Can Open	Blkt	Refr	Freez	Range	Air Cond.	Vac Cl.	TV	Radio	Phono	Food Mixer	Iron	Toast Mkr.	Cof. Mkr.	Fry pan	Clock	Wash Mach	Hair Dryer	Clths Dryer
Dish Washer	—	27	22	38	96	45	96	23	83	58	31	78	90	72	87	71	65	61	86	43	64
Floor Polisher	16	—	12	20	87	38	88	19	80	70	37	65	67	69	86	71	55	61	77	40	43
Can opener	23	22	—	27	93	36	86	23	76	61	27	74	82	71	86	71	61	58	83	45	57
Blanket	18	16	12	—	89	43	89	17	80	77	36	66	84	75	82	66	63	55	78	38	50
Refrigerator	8	12	7	16	—	29	91	11	77	74	42	63	76	76	77	55	43	57	77	26	32
Freezer	12	17	9	24	93	—	87	18	84	74	35	64	85	73	77	65	52	62	79	32	47
Range	8	13	7	16	95	28	—	11	79	75	42	63	76	76	78	55	42	57	77	25	32
Air Conditioner	15	22	15	25	94	47	89	—	80	69	40	72	86	74	87	66	53	60	80	38	46
Vacuum Cleaner	8	13	7	17	92	31	89	12	—	74	39	66	81	75	81	58	45	57	78	28	34
Television	6	12	6	16	89	28	87	10	76	—	46	63	76	75	77	54	41	57	76	25	30
Radio	6	12	5	12	92	24	89	11	73	83	—	61	72	79	73	51	36	56	74	21	25
Phonograph	9	13	8	17	90	29	87	13	80	75	40	—	79	77	79	59	45	58	77	29	35
Food Mixer	9	14	8	17	90	32	87	13	81	75	39	65	—	75	82	61	48	57	79	29	36
Iron	7	11	7	16	90	27	86	11	75	75	42	64	75	—	76	56	40	57	74	25	30
Toaster	8	14	8	17	90	28	87	12	80	74	39	65	81	75	—	60	47	57	77	29	34
Coffee Maker	10	16	9	19	90	33	85	13	80	73	37	66	84	76	83	—	51	58	78	30	36
Frypan	12	16	10	24	91	35	86	14	81	72	35	67	86	72	86	67	—	59	80	33	43
Clock	8	14	7	16	92	31	87	12	78	76	41	65	78	78	80	57	44	—	77	25	34
Washing Machine	9	13	8	17	92	29	89	12	79	75	41	65	80	75	79	58	45	58	—	28	37
Hair Dryer	12	20	12	23	90	35	84	16	81	72	34	70	86	73	86	65	54	55	82	—	43
Clothes Dryer	16	18	13	26	92	42	87	16	84	71	33	70	89	73	83	65	58	61	90	36	—

	Dish Wash	Flr. Pol.	Can Open	Blkt	Refr	Freez	Range	Air Cond.	Vac Cl.	TV	Radio	Radio Phono	Food Mixer	Iron	Toast	Cof. Mkr.	Fry Pan	Clock	Wash Mach	Hair Dryer	Cloths Dryer
Dish Washer		20	17	27	92	44	96	24	83	70	27	80	86	75	85	70	59	61	57	41	75
Floor Polisher	18		8	23	93	47	95	19	88	73	32	73	82	71	82	67	54	53	85	41	46
Can opener	26	13		17	97	37	98	16	87	78	28	77	78	80	73	66	59	58	80	35	45
Blanket	16	15	6		92	42	92	15	84	73	39	62	85	73	82	67	56	67	80	32	39
Refrigerator	9	10	6	15		30	92	11	74	75	43	60	73	76	74	53	43	57	80	23	27
Freezer	13	15	7	21	90		90	11	81	76	42	59	79	78	74	61	55	57	82	25	36
Range	10	10	6	15	93	30		11	73	74	43	60	73	76	74	54	43	58	80	23	28
Air Conditioner	21	18	9	22	92	31	93		86	71	35	71	82	79	81	65	55	64	80	36	43
Vacuum Cleaner	10	12	7	17	92	34	90	12		77	41	64	81	77	81	57	48	61	81	25	31
Television	8	10	6	15	91	31	89	10	75		43	60	75	78	73	53	43	58	79	23	26
Radio	6	8	4	14	92	30	92	9	71	77		56	69	80	71	51	36	59	78	20	23
Phonograph	12	12	7	16	91	31	91	13	79	75	39		77	75	80	58	45	60	82	27	33
Food Mixer	11	11	6	18	91	33	90	12	81	77	40	63		76	81	61	50	60	81	26	33
Iron	9	9	6	14	91	31	90	11	73	76	44	58	72		74	53	42	59	78	23	26
Toaster	10	11	7	17	92	31	91	11	81	75	41	65	81	77		59	49	62	81	26	33
Coffee Maker	12	12	7	19	91	35	91	13	79	75	40	65	83	76	81		53	59	82	29	34
Frypan	12	12	8	20	90	39	90	13	82	74	35	62	84	74	83	53		61	82	29	37
Clock	10	9	6	18	92	31	91	12	78	77	43	63	77	78	79	55	46		79	23	28
Washing Machine	10	11	6	15	93	32	91	11	75	76	42	62	75	76	75	56	45	58		24	31
Hair Dryer	17	18	9	22	94	34	93	17	82	75	37	71	83	78	84	69	55	59	82		44
Clothes	25	17	9	22	91	41	93	16	83	72	35	70	87	72	87	65	59	59	89	37	

	Dish Wash	Flr. Pol.	Can Open	Blkt	Refr	Freezr	Range	Air Cond.	Vac Cl.	TV	Radio	Phono	Food Mixer	Iron	Toast	Cof. Mkr.	Fry pan	Clock	Wash Mach	Hair Dryer	Clths Dryer
Dish Washer		25	19	37	95	41	96	18	81	80	56	58	45	76	92	68	66	67	82	30	51
Floor Polisher	16		12	28	93	33	93	21	86	80	52	49	86	83	96	90	65	67	82	23	30
Can opener	15	15		43	89	26	92	13	83	76	52	54	85	85	88	66	72	62	76	26	31
Blanket	9	11	13		91	35	92	18	79	81	63	40	82	83	81	66	59	61	74	20	24
Refrigerator	6	9	7	22		24	96	12	75	81	64	34	73	85	80	55	46	61	73	14	16
Freezer	10	12	7	33	94		94	13	81	83	61	36	81	85	80	63	62	59	81	18	27
Range	6	9	7	23	95	24		13	76	82	64	34	72	85	80	55	46	61	73	15	16
Air Conditioner	8	15	7	33	92	25	95		86	80	61	47	80	80	86	67	55	66	72	22	25
Vacuum Cleaner	6	10	8	24	94	26	94	14		83	64	36	80	85	86	61	52	64	75	16	18
Television	6	9	7	23	93	24	94	12	77		65	34	74	85	81	57	47	62	72	14	16
Radio	5	7	6	23	93	23	93	12	75	75		31	71	88	78	55	43	62	71	12	13
Phonograph	10	13	11	27	93	25	93	17	80	81	58		78	81	87	60	55	59	77	24	24
Food Mixer	7	11	8	26	93	27	93	14	82	83	63	37		84	84	62	54	64	75	17	19
Iron	5	9	7	14	93	24	93	12	75	82	66	32	72		79	55	46	61	71	14	15
Toaster	7	11	8	23	93	24	93	13	81	83	63	37	77	84		6	51	64	74	16	18
Coffee Maker	7	12	8	27	92	27	93	15	82	84	63	37	81	84	86		58	64	75	17	20
Frypan	8	13	11	29	92	32	91	15	83	82	59	39	83	83	86	69		62	77	19	25
Clock	6	10	7	23	93	23	94	14	79	83	66	33	77	86	84	58	48		73	4	16
Washing Machine	6	10	7	24	94	27	94	12	77	81	63	36	76	84	81	58	50	61		16	21
Hair Dryer	12	14	13	31	92	29	94	19	84	80	54	56	85	81	90	65	63	60	80		28
Clothes	18	17	14	34	94	41	94	19	83	79	51	50	87	80	91	68	71	61	95	25	

The percentage of households who have a product j (column) given that they have a product i (row)

	Dish Wash	Flr Pol.	Can Open	Blkt	Refr	Freez	Range	Air Cond.	Vac Cl.	TV	Radio	Phono	Food Mixer	Iron	Toast	Cof. Mkr.	Fry pan	Clock	Wash Mach	Hair Dryer	Clths Dryer
Dish Washer		7	14	48	98	29	100	10	76	74	29	45	74	83	98	69	57	67	57	19	41
Floor Polisher	6		7	33	91	24	98	24	86	76	64	55	75	87	93	66	62	84	80	18	26
Can opener	11	7		33	89	13	96	24	91	82	51	33	76	84	93	62	56	56	69	20	27
Blanket	5	5	5		90	13	96	13	72	76	67	27	58	83	83	48	41	63	49	15	8
Refrigerator	2	3	3	19		10	94	9	61	72	69	22	45	83	71	38	30	58	50	9	5
Freezer	6	7	7	26	94		95	11	77	79	67	24	73	85	79	58	62	68	70	11	17
Range	2	3	3	20	94	10		8	61	72	69	22	45	83	71	38	30	58	49	9	6
Air Conditioner	2	8	8	31	95	13	91		81	75	71	30	59	82	82	51	38	64	51	23	11
Vacuum Cleaner	3	4	4	23	93	12	94	11		81	70	28	59	88	84	47	39	64	60	13	8
Television	2	3	3	20	92	10	93	9	68		69	23	50	85	75	42	33	61	53	10	5
Radio	1	2	2	18	91	9	91	8	61	72		21	42	84	71	40	28	59	48	9	4
Phonograph	4	7	4	24	95	10	92	12	77	77	67		59	85	81	48	41	64	58	19	10
Food Mixer	3	5	5	25	94	16	95	11	81	82	67	29		87	86	55	49	64	66	17	9
Iron	2	3	3	19	90	10	90	8	62	72	69	22	45		73	38	30	58	49	9	6
Toaster	3	3	3	22	91	10	91	-9	71	76	69	25	52	86		44	37	63	53	11	7
Coffee Maker	4	5	4	24	91	14	92	11	75	80	68	27	64	86	83		50	64	58	15	10
Frypan	4	5	5	26	92	20	94	10	78	79	65	30	72	86	89	63		66	62	17	11
Clock	2	4	3	21	91	11	92	9	66	75	71	28	48	84	77	42	34		52	9	6
Washing Machine	2	4	4	18	96	14	94	7	74	78	69	26	59	86	79	45	38	63		12	10
Hair Dryer	4	5	8	30	89	11	92	20	80	78	64	42	77	84	85	60	54	57	61		10
Clothes	16	13	14	29	95	31	100	17	92	72	58	40	78	90	93	72	64	68	96	17	

The percentage of households who have a product j (column) given that they have a product i (row)

	Dish Wash	Flr Pol.	Can Open	Blkt	Refr	Freez	Range	Air Cond.	Vac Cl.	TV	Radio	Phono	Food Mixer	Iron	Toast	Cof. Mkr.	Fry pan	Clock	Wash Mach	Hair Dryer	Cloths Dryer
Dish Washer		25	0	13	100	0	100	0	88	50	50	88	100	63	50	63	38	63	88	38	50
Floor Polisher	17		0	42	100	33	67	25	92	67	67	75	75	67	75	50	33	58	83	8	42
Can opener	0	0		40	60	40	80	20	80	20	20	40	100	80	80	40	60	60	80	40	60
Blanket	2	9	4		87	22	80	15	71	63	30	54	74	72	56	35	43	54	59	20	15
Refrigerator	2	3	1	12		13	89	6	50	71	44	50	54	80	57	33	25	47	60	12	15
Freezer	0	7	4	21	93		79	9	65	67	39	53	79	72	61	44	51	56	75	19	42
Range	2	2	1	10	88	11		6	46	71	45	47	52	76	55	33	23	47	59	11	13
Air Conditioner	0	12	4	31	92	19	96		85	81	54	54	89	81	92	58	58	73	77	39	23
Vacuum Cleaner	3	5	2	16	85	18	80	9		72	41	61	70	82	74	43	35	60	73	18	23
Television	1	2	0	10	83	11	84	6	50		49	54	52	79	59	38	27	43	60	13	16
Radio	2	3	0	7	78	9	79	6	43	74		48	48	80	58	28	19	47	52	-12	12
Phonograph	3	4	1	12	84	12	79	6	59	77	45		60	76	62	38	27	51	62	19	17
Food Mixer	3	3	2	15	83	17	80	9	63	68	52	56		76	70	39	39	55	66	19	22
Iron	1	2	1	10	82	10	79	5	49	69	47	46	50		57	30	22	46	56	13	12
Toaster	1	3	1	10	82	12	79	-8	62	72	47	53	64	79		40	31	56	63	17	20
Coffee Maker	3	4	1	12	86	16	87	10	65	85	41	60	65	78	74		40	57	71	20	21
Frypan	3	3	3	19	84	24	78	12	69	78	36	55	86	73	74	52		55	69	26	31
Clock	2	3	1	12	83	14	83	8	61	72	47	54	62	79	69	38	28		61	14	17
Washing Machine	3	4	1	11	87	15	86	7	61	74	43	54	62	79	63	39	30	50		15	21
Hair Dryer	5	2	3	18	78	18	72	16	67	73	63	73	81	79	78	49	49	51	67		22
Clothes	6	7	4	12	88	35	79	9	79	79	41	62	87	71	85	57	56	57	88	21	

Table 10

Aggregate
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4 = 2 - 3 PJA_i
1. Dish Washer	2007	1	2006
2. Floor Polisher	1141	2	1139
3. Can Opener	1135	5	1130
4. Blanket	1036	7	1029
5. Refrigerator	889	13	876
6. Freezer	1064	2	1062
7. Range	887	15	872
8. Air Conditioner	1091	3	1088
9. Vacuum Cleaner	970	9	961
10. Television	904	19	885
11. Radio	872	39	833
12. Phonograph	963	9	954
13. Food Mixer	977	7	970
14. Iron	872	18	854
15. Toaster	940	7	933
16. Coffee Maker	1001	7	994
17. Frypan	1035	4	1031
18. Clock	934	21	913
19. Washing Machine	958	10	948
20. Hair Dryer	1054	9	1045
21. Clothes Dryer	1135	3	1132

Table 11

Aggregate
Rank Correlation Between PJA_i and A_i

Product Rank in terms of PJA_i scores	Product Rank in terms of Acquisition Rate	Rank Difference D	D^2
1. Radio	Radio	0	0
2. Iron	Clock	2	4
3. Range	Television	2	4
4. Refrigerator	Iron	2	4
5. Television	Range	2	4
6. Clock	Refrigerator	4	16
7. Toaster	Washing Machine	6	36
8. Washing Machine	Hair Dryer	1	1
9. Phonograph	Phonograph	0	0
10. Vacuum Cleaner	Vacuum Cleaner	0	0
11. Food Mixer	Coffee Maker	1	1
12. Coffee Maker	Food Mixer	1	1
13. Blanket	Toaster	1	1
14. Frypan	Blanket	2	4
15. Hair Dryer	Can Opener	7	49
16. Freezer	Frypan	3	9
17. Air Conditioner	Dryer	1	1
18. Can Opener	Air Conditioner	3	9
19. Clothes Dryer	Freezer	2	4
20. Floor Polisher	Floor Polisher	0	0
21. Dish Washer	Dish Washer	0	0
			$\Sigma D^2 = 148$

Rank Correlation $= 1 - \dfrac{6\Sigma d^2}{N(n^2-1)}$ $\qquad \dfrac{6(148)}{21(440)} = \dfrac{888}{9240} = 1 - .09 = .91$

TOTAL PERCENTAGE
INCLUDING EXTREME CLASSES

CHI-SQUARE = 275.038
DEGREES OF FREEDOM = 63

TABLE 12

Contingency Analysis Between Life Cycle and Metropolitan Area

LIFE CYCLE VS MET NON MET

LIFE CYCLE	ROW SUMS	0	1	2	3	4	5	6	7	8	9
1	421 2.9	(153) 1.1	(103) 0.7	(59) 0.4	(29) 0.2	(6) 0.0	(10) 0.1	(14) 0.1	(19) 0.1	(17) 0.1	(11) 0.1
2	752 5.2	(186) 1.3	(166) 1.2	(130) 0.9	(89) 0.6	(31) 0.2	(16) 0.1	(38) 0.3	(22) 0.2	(43) 0.3	(31) 0.2
3	3329 23.2	(796) 5.5	(565) 3.9	(532) 3.7	(299) 2.1	(237) 1.7	(168) 1.2	(228) 1.6	(115) 0.8	(215) 1.5	(174) 1.2
4	1624 11.3	(407) 2.8	(275) 1.9	(269) 1.9	(146) 1.0	(130) 0.9	(65) 0.5	(97) 0.7	(55) 0.4	(86) 0.6	(94) 0.7
5	1786 12.4	(360) 2.5	(309) 2.2	(231) 1.6	(173) 1.2	(129) 0.9	(87) 0.6	(128) 0.9	(89) 0.6	(166) 1.2	(114) 0.8
6	3702 25.8	(758) 5.3	(589) 4.1	(590) 4.1	(348) 2.4	(275) 1.9	(153) 1.1	(276) 1.9	(182) 1.3	(340) 2.4	(191) 1.3
7	2205 15.4	(454) 3.2	(378) 2.6	(326) 2.3	(221) 1.5	(160) 1.1	(70) 0.5	(161) 1.1	(109) 0.8	(196) 1.4	(130) 0.9
8	529 3.7	(137) 1.0	(97) 0.7	(88) 0.6	(40) 0.3	(35) 0.2	(14) 0.1	(29) 0.2	(24) 0.2	(42) 0.3	(23) 0.2
COLUMN SUMS		3251 22.7	2482 17.3	2225 15.5	1345 9.4	1003 7.0	583 4.1	971 6.8	515 4.3	1105 7.7	768 5.4

TOTAL SUM = 14348

LIFE CYCLE AND OCCUPATION

TOTAL PERCENTAGE INCLUDING EXTREME CLASSES

CHI-SQUARE = 7906.891
DEGREES OF FREEDOM = 84

TABLE 13

Contingency Analysis Between Life Cycle and Occupation

LIFE CYCLE VS OCCUPATION

ROW SUMS	BLANK	0	1	2	3	4	5	6	7	8	9	11	12
421 / 2.9	5) 0.0	13) 0.1	89) 0.6	9) 0.1	36) 0.3	74) 0.5	50) 0.3	7) 0.0	13) 0.1	10) 0.1	29) 0.2	14) 0.1	72) 0.5
752 / 5.2	1C) 0.1	31) 0.2	39) 0.3	46) 0.3	141) 1.0	2C1) 1.4	24) 0.2	41) 0.3	0) 0.	45) 0.3	23) 0.2	41) 0.3	110) 0.8
3329 / 23.2	21) 0.1	208) 1.4	210) 1.5	183) 1.3	695) 4.8	832) 5.8	140) 1.0	215) 1.5	0) 0.	72) 0.5	80) 0.6	159) 1.1	514) 3.6
1624 / 11.3	13) 0.1	82) 0.6	96) 0.7	74) 0.5	351) 2.4	376) 2.6	86) 0.6	174) 1.2	1) 0.0	24) 0.2	43) 0.3	98) 0.7	206) 1.4
1786 / 12.4	23) 0.2	183) 1.3	87) 0.6	73) 0.5	372) 2.6	357) 2.5	76) 0.5	208) 1.4	0) 0.	10) 0.1	115) 0.8	113) 0.8	169) 1.2
3702 / 25.8	44) 0.3	296) 2.1	138) 1.0	101) 0.7	514) 3.6	477) 3.3	166) 1.2	320) 2.2	7) 0.0	0) 0.	1262) 8.8	163) 1.1	214) 1.5
2205 / 15.4	1C) 0.1	75) 0.5	128) 0.9	43) 0.3	46) 0.3	139) 1.0	219) 1.5	52) 0.4	723) 5.0	0) 0.	636) 4.4	22) 0.2	112) 0.8
529 / 3.7	0) 0.	9) 0.1	60) 0.4	16) 0.1	12) 0.1	78) 0.5	84) 0.6	16) 0.1	175) 1.2	3) 0.0	31) 0.2	10) 0.1	35) 0.2
	126 / 0.9	897 / 6.3	847 / 5.9	545 / 3.8	2167 / 15.1	2534 / 17.7	845 / 5.9	1033 / 7.2	919 / 6.4	164 / 1.1	2219 / 15.5	620 / 4.3	1432 / 10.0

TOTAL SUM = 14348

LIFE CYCLE AND AGE AND SEX OF HH

TABLE 14

Contingency Analysis Between Life Cycle and Age and Sex of Household Head

LIFE CYCLE   VS   ACE SEX HHH

Each cell is shown as (count) over percentage of total.

LIFE CYCLE (ROW SUMS)	1	2	3	4	5	6	7	8	9	10	11	12
421 / 2.9	(88) 0.6	(0) 0.	(0) 0.	(0) 0.	(39) 0.3	(49) 0.3	(116) 0.8	(0) 0.	(0) 0.	(0) 0.	(79) 0.6	(50) 0.3
752 / 5.2	(322) 2.2	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(276) 1.9	(154) 1.1
3329 / 23.2	(1194) 8.3	(1) 0.0	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(1788) 12.5	(346) 2.4
1624 / 11.3	(1332) 9.3	(6) 0.0	(2) 0.0	(0) 0.	(0) 0.	(0) 0.0	(1) 0.0	(0) 0.	(0) 0.	(0) 0.	(281) 2.0	(2) 0.0
1786 / 12.4	(3) 0.	(1433) 10.0	(288) 2.0	(62) 0.4	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.
3702 / 25.8	(8) 0.1	(977) 6.8	(1318) 9.2	(1387) 9.7	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.	(0) 0.
2205 / 15.4	(0) 0.	(120) 0.8	(139) 1.0	(289) 2.0	(0) 0.	(0) 0.	(2) 0.0	(303) 2.1	(467) 3.3	(885) 6.2	(0) 0.	(0) 0.
529 / 3.7	(32) 0.2	(23) 0.2	(10) 0.1	(26) 0.2	(65) 0.5	(101) 0.7	(194) 1.4	(104) 0.7	(24) 0.2	(5) 0.0	(6) 0.0	(2) 0.0
Column sums	2979 / 20.8	2560 / 17.8	1757 / 12.2	1740 / 12.1	65 / 0.5	150 / 1.0	313 / 2.2	407 / 2.8	497 / 3.5	896 / 6.2	2430 / 16.9	554 / 3.9

TOTAL SUM = 14348

TABLE 15

Contingency Analysis Between Life Cycle and Residence Length

LIFE CYCLE VS RESIDENCE

LIFE CYCLE	ROW SUMS	2 - 3 YEARS	3 - 5 YEARS	5 - 10 YRS	10-15 YEARS	15-20 YEARS	2C-25 YEARS	OVER 25 YRS	NO	NO	DONT NOW	K 1 - 2 YEARS	TO INC L 1 YR
1	421 / 2.9	(33) 0.2	(34) 0.2	(46) 0.3	(24) 0.2	(12) 0.1	(2) 0.0	(15) 0.1	(0) 0.	(0) 0.	(0) 0.	(95) 0.7	(160) 1.1
2	752 / 5.2	(60) 0.4	(71) 0.5	(95) 0.7	(24) 0.2	(18) 0.1	(4) 0.0	(6) 0.0	(0) 0.	(0) 0.	(3) 0.0	(142) 1.0	(329) 2.3
3	3329 / 23.2	(412) 2.9	(454) 3.2	(604) 4.2	(147) 1.0	(23) 0.2	(5) 0.0	(11) 0.1	(0) 0.	(0) 0.	(6) 0.0	(645) 4.5	(1022) 7.1
4	1624 / 11.3	(130) 0.9	(235) 1.6	(486) 3.4	(233) 1.6	(70) 0.5	(11) 0.1	(5) 0.0	(0) 0.	(0) 0.	(5) 0.0	(172) 1.2	(277) 1.9
5	1786 / 12.4	(127) 0.9	(186) 1.3	(412) 2.9	(329) 2.3	(181) 1.3	(124) 0.9	(48) 0.3	(0) 0.	(0) 0.	(5) 0.0	(175) 1.2	(199) 1.4
6	3702 / 25.8	(242) 1.7	(275) 1.9	(729) 5.1	(578) 4.0	(427) 3.0	(372) 2.6	(562) 3.9	(0) 0.	(0) 0.	(10) 0.1	(247) 1.7	(260) 1.8
7	2205 / 15.4	(133) 0.9	(184) 1.3	(333) 2.3	(247) 1.7	(200) 1.4	(163) 1.1	(463) 3.2	(0) 0.	(0) 0.	(14) 0.1	(226) 1.6	(242) 1.7
8	529 / 3.7	(62) 0.4	(57) 0.4	(112) 0.8	(31) 0.2	(21) 0.1	(16) 0.1	(15) 0.1	(0) 0.	(4) 0.0	(3) 0.0	(81) 0.6	(127) 0.9
COLUMN SUMS		1199 / 8.4	1496 / 10.4	2817 / 19.6	1613 / 11.2	952 / 6.6	697 / 4.9	1125 / 7.8	0 / 0.	4 / 0.0	46 / 0.3	1783 / 12.4	2616 / 18.2

TCTAL SUM = 14348

TOTAL PERCENTAGE
INCLUDING EXTREME CLASSES

CHI-SQUARE = 1284.196
DEGREES OF FREEDOM =

TABLE 16

Contingency Analysis Between Life Cycle and Manner of Dwelling

LIFE CYCLE VS CWN RENT

ROW SUMS	NEW NA P C N — A	NEW NA P C N — N	NEW OW P O CW — N	NEW OW P O CW — NT	NEW RE P O RE NO — NT	NEW RE P O RE NO — NT	NA OWN — T	NA REN	DONT K NOW	DONT K NOW
421 / 2.9	(0) 0.	(0) 0.	(21) 0.1	(78) 0.5	(10) 0.1	(307) 2.1	(0) 0.0	(3) 0.0	(3) 0.0	(1) 0.0
752 / 5.2	(0) 0.	(0) 0.	(126) 0.9	(192) 1.3	(25) 0.2	(388) 2.7	(0) 0.	(13) 0.1	(12) 0.1	(6) 0.0
3329 / 23.2	(0) 0.	(0) 0.	(783) 5.5	(1109) 7.7	(45) 0.3	(1280) 8.9	(0) 0.	(39) 0.3	(46) 0.3	(27) 0.2
1624 / 11.3	(0) 0.	(3) 0.0	(515) 3.6	(610) 4.3	(28) 0.2	(404) 2.8	(0) 0.	(41) 0.3	(12) 0.1	(11) 0.1
1786 / 12.4	(1) 0.0	(1) 0.0	(456) 3.2	(825) 5.7	(16) 0.1	(421) 2.9	(0) 0.	(44) 0.3	(11) 0.1	(11) 0.1
3702 / 25.8	(1) 0.0	(1) 0.0	(953) 6.6	(1820) 12.7	(54) 0.4	(729) 5.1	(0) 0.	(88) 0.6	(30) 0.2	(26) 0.2
2205 / 15.4	(0) 0.	(0) 0.	(339) 2.4	(875) 6.1	(42) 0.3	(840) 5.9	(0) 0.	(56) 0.4	(35) 0.2	(18) 0.1
529 / 3.7	(0) 0.	(0) 0.	(57) 0.4	(141) 1.0	(13) 0.1	(294) 2.0	(0) 0.	(14) 0.1	(7) 0.0	(3) 0.0
COLUMN SUMS	2 / 0.0	5 / 0.0	3250 / 22.7	5640 / 39.3	233 / 1.6	4663 / 32.5	0 / 0.	298 / 2.1	154 / 1.1	103 / 0.7

TOTAL SUM = 14348

TOTAL PERCENTAGE
INCLUDING EXTREME CLASSES

CHI-SQUARE = 3534.285
DEGREES OF FREEDOM =

TABLE 17

Contingency Analysis Between Life Cycle and Income

LIFE CYCLE VS INCOME

ROW SUMS	UNDER $2000	2000-2999	3000-3999	4000-4999	5000-6999	7000-9999	10000-14999	15000 PLUS	DONT KNOW
1 421 / 2.9	(44) 0.3	(59) 0.4	(56) 0.4	(81) 0.6	(48) 0.3	(12) 0.1	(19) 0.1	(38) 0.3	
2 752 / 5.2	(33) 0.2	(62) 0.4	(125) 0.9	(166) 1.2	(149) 1.0	(99) 0.7	(32) 0.2	(46) 0.3	
3 3329 / 23.2	(66) 0.5	(292) 2.0	(547) 3.8	(998) 7.0	(703) 4.9	(262) 1.8	(74) 0.5	(202) 1.4	
4 1624 / 11.3	(24) 0.2	(51) 0.4	(98) 0.7	(205) 1.4	(399) 2.8	(468) 3.3	(203) 1.4	(69) 0.5	(107) 0.7
5 1786 / 12.4	(82) 0.6	(108) 0.8	(138) 1.0	(203) 1.4	(397) 2.8	(353) 2.5	(225) 1.6	(105) 0.7	(175) 1.2
6 3702 / 25.8	(469) 3.3	(408) 2.8	(376) 2.6	(415) 2.9	(606) 4.2	(532) 3.7	(343) 2.4	(138) 1.0	(415) 2.9
7 2205 / 15.4	(817) 5.7	(341) 2.4	(256) 1.8	(197) 1.4	(189) 1.3	(109) 0.8	(58) 0.4	(25) 0.2	(213) 1.5
8 529 / 3.7	(121) 0.8	(99) 0.7	(104) 0.7	(63) 0.4	(69) 0.5	(34) 0.2	(15) 0.1	(3) 0.6	(21) 0.1
COLUMN SUMS	1656 / 11.5	1296 / 9.0	1385 / 9.7	1811 / 12.6	2905 / 20.2	2356 / 16.7	1217 / 8.5	465 / 3.2	1217 / 8.5

TOTAL SUM = 14348

CHI-SQUARE = 1197.555
DEGREES OF FREEDOM =

TOTAL PERCENTAGE
INCLUDING EXTREME CLASSES

TABLE 18

Contingency Analysis Between Life Cycle and Type of Dwelling Unit

LIFE CYCLE   VS   TYPE DWELL

ROW SUMS	ONE FA MILY	TWO FA MILY	3 PLUS MILY	TRAILE R
421	(148)	(55)	(208)	(10)
2.9	1.0	0.4	1.4	0.1
752	(411)	(113)	(190)	(38)
5.2	2.9	0.8	1.3	0.3
3329	(2590)	(317)	(349)	(73)
23.2	18.1	2.2	2.4	0.5
1624	(1360)	(123)	(129)	(12)
11.3	9.5	0.9	0.9	0.1
1786	(1543)	(99)	(129)	(15)
12.4	10.8	0.7	0.9	0.1
3702	(2995)	(301)	(351)	(55)
25.8	20.9	2.1	2.4	0.4
2205	(1418)	(253)	(494)	(40)
15.4	9.9	1.8	3.4	0.3
529	(330)	(87)	(105)	(7)
3.7	2.3	0.6	0.7	0.0
COLUMN SUMS	10795	1348	1955	250
	75.2	9.4	13.6	1.7

TOTAL SUM = 14348

LIFE CYCLE AND EDUCATION

TOTAL PERCENTAGE
INCLUDING EXTREME CLASSES

CHI-SQUARE = 1717.737
DEGREES OF FREEDOM =

TABLE 19

Contingency Analysis Between Life Cycle and Education

LIFE CYCLE   VS   EDUCATION H

ROW	ROW SUMS	NO YR COMPLT	1-8 YR GS	YR 1-3 YR H S	4 YR H S COMP	1-3 YR S COLL	4 YRS COLLEG	NO	DONT K NOW
1	421 2.9	(1) 0.0	(72) 0.5	(66) 0.5	(144) 1.0	(62) 0.4	(75) 0.5	(0) 0.	(1) 0.0
2	752 5.2	(3) 0.0	(126) 0.9	(125) 0.9	(254) 1.8	(110) 0.8	(128) 0.9	(0) 0.	(6) 0.0
3	3329 23.2	(17) 0.1	(498) 3.5	(678) 4.7	(1204) 8.4	(415) 2.9	(510) 3.6	(0) 0.	(7) 0.0
4	1624 11.3	(5) 0.0	(280) 2.0	(370) 2.6	(560) 3.9	(208) 1.4	(193) 1.3	(0) 0.	(8) 0.1
5	1786 12.4	(35) 0.2	(576) 4.0	(359) 2.5	(455) 3.2	(142) 1.0	(200) 1.4	(0) 0.	(19) 0.1
6	3702 25.8	(100) 0.7	(1592) 11.1	(685) 4.8	(745) 5.2	(253) 1.8	(297) 2.1	(0) 0.	(30) 0.2
7	2205 15.4	(107) 0.7	(1024) 7.1	(373) 2.6	(361) 2.5	(177) 1.2	(151) 1.1	(0) 0.	(12) 0.1
8	529 3.7	(7) 0.0	(164) 1.1	(133) 0.9	(153) 1.1	(42) 0.3	(26) 0.2	(2) 0.0	(2) 0.0
COLUMN SUMS		275 1.9	4332 30.2	2789 19.4	3876 27.0	1409 9.8	1580 11.0	2 0.0	85 0.6

TOTAL SUM = 14248

Table 20

Life Cycle 1
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	898	2	896
2. Floor Polisher	1092	.09	1092
3. Can Opener	1086	.09	1086
4. Blanket	703	6	697
5. Refrigerator	656	32	624
6. Freezer	936	.09	936
7. Range	655	32	623
8. Air Conditioner	860	3	857
9. Vacuum Cleaner	765	7	758
10. Television	677	20	657
11. Radio	581	38	543
12. Phonograph	657	10	647
13. Food Mixer	893	8	885
14. Iron	608	21	587
15. Toaster	718	10	708
16. Coffee Maker	822	8	814
17. Frypan	848	3	845
18. Clock	658	16	642
19. Washing Machine	835	5	830
20. Hair Dryer	755	9	746
21. Clothes Dryer	898	1	897

Table 21

Life Cycle 1
Rank Correlation between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Iron	Refrigerator	2	4
Range	Range	0	0
Refrigerator	Iron	2	4
Clock	Television	1	1
Phonograph	Clock	2	4
Television	Toaster	2	4
Blanket	Phonograph	4	16
Toaster	Hair Dryer	2	4
Hair Dryer	Coffee Maker	1	1
Vacuum Cleaner	Vacuum Cleaner	0	0
Coffee Maker	Blanket	2	4
Washing Machine	Washing Machine	0	0
Frypan	Food Mixer	2	4
Air Conditioner	Air Conditioner	0	0
Food Mixer	Frypan	2	4
Dish Washer	Dish Washer	0	0
Clothes Dryer	Clothes Dryer	0	0
Freezer	Freezer	0	0
Can Opener	Can Opener	0	0
Floor Polisher	Floor Polisher	0	0
			50

Rank Correlation $= 1 - \dfrac{6 \Sigma D^2}{N(N^2 - 1)} = 1 - \dfrac{300}{9240} = 1 - .03 = .97$

Table 22

Life Cycle 2
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1029	1	1028
2. Floor Polisher	1161	2	1159
3. Can Opener	1053	8	1048
4. Blanket	896	7	889
5. Refrigerator	880	35	845
6. Freezer	1046	2	1044
7. Range	873	36	837
8. Air Conditioner	1098	5	1093
9. Vacuum Cleaner	930	15	915
10. Television	846	30	816
11. Radio	781	41	740
12. Phonograph	826	10	816
13. Food Mixer	933	17	916
14. Iron	811	27	784
15. Toaster	870	18	852
16. Coffee Maker	944	16	928
17. Frypan	958	13	945
18. Clock	896	28	868
19. Washing Machine	956	14	942
20. Hair Dryer	841	13	828
21. Clothes Dryer	1144	4	1140

Table 23

Life Cycle 2
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Iron	Range	4	16
Television	Refrigerator	1	1
Phonograph	Television	10	100
Hair Dryer	Clock	7	49
Range	Iron	4	16
Refrigerator	Toaster	4	16
Toaster	Food Mixer	1	1
Clock	Coffee Maker	4	16
Blanket	Vacuum Cleaner	6	36
Vacuum Cleaner	Washing Machine	1	1
Food Mixer	Hair Dryer	4	16
Coffee Maker	Frypan	4	16
Washing Machine	Phonograph	3	9
Frypan	Can Opener	2	4
Dish Washer	Blanket	5	25
Can Opener	Air Conditioner	2	4
Freezer	Clothes Dryer	2	4
Air Conditioner	Floor Polisher	2	4
Clother Dryer	Freezer	2	4
Floor Polisher	Dish Washer	2	4

$$\Sigma D^2 = 342$$

$$\text{Rank Correlation} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)} = 1 - \frac{2052}{9240} = 1 - .22 = .78$$

Table 24

Life Cycle 3
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1227	2	1125
2. Floor Polisher	1135	3	1132
3. Can Opener	1135	3	1132
4. Blanket	1068	3	1065
5. Refrigerator	922	17	905
6. Freezer	1059	4	1055
7. Range	917	21	896
8. Air Conditioner	1104	4	1100
9. Vacuum Cleaner	1004	11	993
10. Television	915	23	892
11. Radio	896	44	852
12. Phonograph	983	13	970
13. Food Mixer	966	8	958
14. Iron	924	19	905
15. Toaster	953	7	946
16. Coffee Maker	1009	8	1001
17. Frypan	1051	5	1046
18. Clock	958	22	936
19. Washing Machine	957	16	941
20. Hair Dryer	1102	11	1091
21. Clothes Dryer	1111	6	1105

Table 25

Life Cycle 3
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Television	Television	0	0
Range	Clock	1	1
Iron	Range	1	1
Refrigerator	Iron	1	1
Clock	Refrigerator	3	9
Washing Machine	Washing Machine	0	0
Toaster	Phonograph	5	25
Food Mixer	Vacuum Cleaner	2	4
Phonograph	Hair Dryer	2	4
Vacuum Cleaner	Food Mixer	2	4
Coffee Maker	Coffee Maker	0	0
Frypan	Toaster	2	4
Freezer	Clothes Dryer	4	16
Blanket	Frypan	2	4
Hair Dryer	Can Opener	6	36
Air Conditioner	Blanket	2	4
Clothes Dryer	Freezer	4	16
Dish Washer	Air Conditioner	2	4
Can Opener	Floor Polisher	4	16
Floor Polisher	Dish Washer	1	1

$$\Sigma D^2 = 150$$

$$\text{Rank Correlation} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)} = 1 - \frac{900}{9240} = 1 - .09 - .91$$

Table 26

Life Cycle 4
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1246	3	1243
2. Floor Polisher	1121	3	1118
3. Can Opener	1162	5	1157
4. Blanket	1128	7	1121
5. Refrigerator	949	10	939
6. Freezer	1089	4	1085
7. Range	955	15	940
8. Air Conditioner	1089	3	1086
9. Vacuum Cleaner	985	11	974
10. Television	940	24	916
11. Radio	955	50	905
12. Phonograph	999	16	983
13. Food Mixer	997	7	990
14. Iron	945	24	921
15. Toaster	983	7	976
16. Coffee Maker	1027	7	1020
17. Frypan	1069	4	1065
18. Clock	1000	25	975
19. Washing Machine	999	13	986
20. Hair Dryer	1093	16	1077
21. Clothes Dryer	1125	5	1120

Table 27

Life Cycle 4
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Television	Clock	1	1
Iron	Television	1	1
Refrigerator	Iron	6	36
Range	Phonograph	2	4
Vacuum Cleaner	Hair Dryer	3	9
Clock	Range	5	25
Toaster	Washing Machine	6	36
Phonograph	Vacuum Cleaner	4	16
Washing Machine	Refrigerator	2	4
Food Mixer	Food Mixer	0	0
Coffee Maker	Blanket	1	1
Frypan	Coffee Maker	4	16
Hair Dryer	Toaster	8	64
Freezer	Can Opener	3	9
Air Conditioner	Clothes Dryer	3	9
Floor Polisher	Frypan	3	9
Clothes Dryer	Freezer	2	4
Blanket	Air Conditioner	7	49
Can Opener	Floor Polisher	5	25
Dish Washer	Dish Washer	0	0

$$\Sigma D^2 = 318$$

$$\text{Rank Correlation} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)} = 1 - \frac{6(318)}{9240} = 1 - .20 = .80$$

Table 28

Life Cycle 5
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1221	2	1219
2. Floor Polisher	1149	2	1147
3. Can Opener	1168	6	1162
4. Blanket	1117	9	1108
5. Refrigerator	931	10	921
6. Freezer	1052	3	1049
7. Range	934	10	924
8. Air Conditioner	1114	4	1110
9. Vacuum Cleaner	997	9	988
10. Television	948	21	927
11. Radio	946	52	894
12. Phonograph	1003	12	991
13. Food Mixer	1001	8	993
14. Iron	939	19	920
15. Toaster	1000	7	993
16. Coffee Maker	1036	9	1027
17. Frypan	1052	4	1048
18. Clock	995	24	971
19. Washing Machine	964	11	953
20. Hair Dryer	1123	13	1110
21. Clothes Dryer	1129	3	1126

Table 29

Life Cycle 5
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Iron	Clock	1	1
Refrigerator	Iron	6	36
Range	Television	4	16
Television	Hair Dryer	1	1
Washing Machine	Phonograph	1	1
Clock	Washing Machine	5	25
Vacuum Cleaner	Range	2	4
Phonograph	Refrigerator	3	9
Food Mixer	Vacuum Cleaner	3	9
Toaster	Blanket	3	9
Coffee Maker	Coffee Maker	0	0
Frypan	Food Mixer	3	9
Freezer	Toaster	4	16
Blanket	Can Opener	4	16
Hair Dryer	Frypan	11	121
Air Conditioner	Air Conditioner	0	0
Clothes Dryer	Freezer	1	1
Floor Polisher	Clothes Dryer	2	4
Can Opener	Dish Washer	5	25
Dish Washer	Floor Polisher	1	1

$$\Sigma D^2 = 304$$

$$\text{Rank Correlation} = 1 - \frac{6 \Sigma D^2}{N(N^2 - 1)} = 1 - \frac{6(304)}{9240} = 1 - .19 = .81$$

Table 30

Life Cycle 6
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1186	1	1185
2. Floor Polisher	1187	1	1186
3. Can Opener	1148	6	1142
4. Blanket	1082	8	1074
5. Refrigerator	936	7	929
6. Freezer	1081	2	1079
7. Range	936	7	929
8. Air Conditioner	1102	2	1100
9. Vacuum Cleaner	996	8	988
10. Television	952	14	938
11. Radio	936	29	907
12. Phonograph	1053	4	1049
13. Food Mixer	977	6	971
14. Iron	925	14	911
15. Toaster	984	5	979
16. Coffee Maker	1012	7	1005
17. Frypan	1058	3	1055
18. Clock	987	20	967
19. Washing Machine	978	6	972
20. Hair Dryer	1140	6	1134
21. Clothes Dryer	1172	2	1170

Table 31

Life Cycle 6
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Iron	Clock	1	1
Refrigerator	Iron	5	25
Range	Television	5	25
Television	Vacuum Cleaner	1	1
Clock	Blanket	4	16
Food Mixer	Coffee Maker	5	25
Washing Machine	Refrigerator	3	9
Toaster	Range	5	25
Vacuum Cleaner	Can Opener	5	25
Coffee Maker	Washing Machine	4	16
Phonograph	Food Mixer	3	9
Frypan	Hair Dryer	3	9
Blanket	Toaster	8	64
Freezer	Phonograph	3	9
Air Conditioner	Frypan	1	1
Hair Dryer	Air Conditioner	4	16
Can Opener	Freezer	8	64
Clothes Dryer	Clothes Dryer	0	0
Floor Polisher	Floor Polisher	0	0
Dish Washer	Dish Washer	0	0

$$\Sigma D^2 = 340$$

$$\text{Rank Correlation} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)} = 1 - \frac{6(340)}{9240} = 1 - .22 = .78$$

Table 32

Life Cycle 7
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1095	0	1095
2. Floor Polisher	1155	-	1155
3. Can Opener	1073	3	1070
4. Blanket	917	5	912
5. Refrigerator	753	9	744
6. Freezer	1013	-	1013
7. Range	755	9	746
8. Air Conditioner	966	2	964
9. Vacuum Cleaner	865	4	861
10. Television	806	11	795
11. Radio	761	18	743
12. Phonograph	934	2	932
13. Food Mixer	948	3	945
14. Iron	758	8	750
15. Toaster	826	4	822
16. Coffee Maker	927	3	924
17. Frypan	974	2	972
18. Clock	825	13	812
19. Washing Machine	879	3	876
20. Hair Dryer	1102	2	1100
21. Clothes Dryer	1115	-	1115

Table 33

Life Cycle 7
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Refrigerator	Clock	3	9
Range	Television	1	1
Iron	Range	2	4
Television	Refrigerator	2	4
Clock	Iron	4	16
Toaster	Blanket	2	4
Vacuum Cleaner	Vacuum Cleaner	0	0
Washing Machine	Toaster	3	9
Blanket	Food Mixer	3	9
Coffee Maker	Coffee Maker	0	0
Phonograph	Washing Machine	2	4
Food Mixer	Can Opener	3	9
Air Conditioner	Phonograph	3	9
Frypan	Hair Dryer	1	1
Freezer	Frypan	4	16
Can Opener	Air Conditioner	4	16
Dish Washer	Clothes Dryer	3	9
Hair Dryer	Floor Polisher	4	16
Clothes Dryer	Freezer	2	4
Floor Polisher	Dish Washer	2	4

$$\Sigma D^2 = 140$$

$$\text{Rank Correlation} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)} = 1 - \frac{6(140)}{9240} = 1 - .09 = .91$$

Table 34

Life Cycle 8
PJA_i Scores

1 Product	2 $\Sigma[x_{ij} - (y_{ij} + z_{ij})]$	3 A_i	4=2-3 PJA_i
1. Dish Washer	1067	2	1065
2. Floor Polisher	1074	1	1073
3. Can Opener	1090	3	1087
4. Blanket	863	6	857
5. Refrigerator	724	18	706
6. Freezer	936	1	935
7. Range	698	18	680
8. Air Conditioner	1098	2	1096
9. Vacuum Cleaner	888	7	881
10. Television	737	19	718
11. Radio	705	43	662
12. Phonograph	794	13	781
13. Food Mixer	837	7	830
14. Iron	687	22	665
15. Toaster	800	9	791
16. Coffee Maker	900	6	894
17. Frypan	930	4	926
18. Clock	808	15	793
19. Washing Machine	815	9	806
20. Hair Dryer	954	11	943
21. Clothes Dryer	1043	2	1041

Table 35

Life Cycle 8
Rank Correlation Between PJA_i and A_i

Product Rank in Terms of PJA_i Scores	Product Rank in Terms of Acquisition Rate	Rank Difference D	D^2
Radio	Radio	0	0
Iron	Iron	0	0
Range	Range	0	0
Refrigerator	Refrigerator	0	0
Television	Television	0	0
Phonograph	Clock	1	1
Toaster	Phonograph	3	9
Clock	Washing Machine	2	4
Washing Machine	Hair Dryer	1	1
Food Mixer	Toaster	1	1
Blanket	Food Mixer	2	4
Vacuum Cleaner	Vacuum Cleaner	0	0
Coffee Maker	Blanket·	1	1
Frypan	Coffee Maker	1	1
Freezer	Frypan	5	25
Hair Dryer	Can Opener	7	49
Clothes Dryer	Air Conditioner	1	1
Dish Washer	Clothes Dryer	1	1
Floor Polisher	Dish Washer	2	4
Can Opener	Freezer	4	16
Air Conditioner	Floor Polisher	4	16

$$\Sigma D^2 = 124$$

$$\text{Rank Correlation} = 1 - \frac{6\Sigma D^2}{N(N^2-1)} = 1 - \frac{6(124)}{9240} = 1 - .08 = .92$$

Table 36

Number of Households Acquiring a Product i (row)
at Life Cycle and Aggregate Levels

Product	Life Cycle I	Life Cycle II	Life Cycle III	Life Cycle IV	Life Cycle V	Life Cycle VI	Life Cycle VII	Life Cycle VIII	Aggregate
Dish Washer	9	12	74	44	30	37	3	8	217
Floor Polisher	4	18	83	44	29	51	11	6	246
Can Opener	4	56	157	81	108	229	62	17	714
Blanket	26	51	151	118	160	297	115	30	948
Hair Dryer	38	101	361	255	236	214	52	56	1313
Refrigerator	136	268	576	172	165	261	204	94	1876
Freezer	4	15	142	56	57	63	7	6	350
Range	135	275	707	235	191	265	205	96	2109
Air Conditioner	14	35	126	52	60	76	35	11	409
Vacuum Cleaner	29	115	372	175	163	299	94	37	1284
Television	83	230	772	392	371	500	233	99	2680
Radio	161	308	1457	900	931	1075	406	225	5463
Phonograph	41	77	448	260	208	130	53	68	1285
Food Mixer	19	125	275	118	140	222	72	37	1008
Iron	89	200	683	391	418	517	180	115	2593
Toaster	44	130	230	115	128	188	78	47	960
Coffee Maker	34	120	256	117	154	277	71	30	1059
Frypan	11	96	165	71	65	126	38	22	594
Clock	69	211	726	407	433	732	297	77	2952
Washing Machine	21	106	545	216	195	226	66	48	1423
Clothes Dryer	5	29	208	73	50	56	11	9	441

Table 37

Rank Correlations of Product Continua at Different Life Cycle Levels
with Aggregate Product Continuum

Aggregate	Life Cycle I	Life Cycle II	Life Cycle III	Life Cycle IV	Life Cycle V	Life Cycle VI	Life Cycle VII	Life Cycle VIII
Radio	Radio	Radio	Radio	Radio	Radio	Radio	Radio	Radio
Iron	Iron	Iron	TV	TV	Iron	Iron	Refrig.	Iron
Range	Range	TV	Range	Iron	Refrig.	Refrig.	Range	Range
Refrigerator	Refrig.	Phono	Refrig.	Refrig.	Range	Range	Iron	Refrig.
Television	Clock	Hair Dry.	Iron	Range	TV	TV	TV	TV
Clock	Phono	Range	Clock	V. Clnr	W. Mach.	Clock	Clock	Phonograph
Toaster	TV	Refrig.	W. Mach.	Clock	Clock	F. Mixer	Toaster	Toaster
Washing Mach.	Blanket	Toaster	Toaster	Toaster	V. Clnr.	W. Mach.	V. Clnr.	Clock
Phonograph	Toaster	Clock	F. Mixer	Phono.	Phono.	Toaster	W. Mach.	W. Mach.
Vacuum Cleaner	Hair Dry	Blanket	Phono	W. Mach.	F. Mixer	V. Clnr.	Blanket	F. Mixer
Food Mixer	V. Clnr.	V. Clnr.	V. Clnr.	F. Mixer	Toaster	C. Maker	C. Maker	Blanket
Coffee Maker	C. Maker	F. Mixer	C. Maker	C. Maker	C. Maker	Phono	Phono	V. Clnr.
Blanket	W. Mach.	C. Maker	Frypan	Frypan	Frypan	Frypan	F. Mixer	C. Maker
Frypan	Frypan	W. Mach.	Freezer	Hair Dry	Freezer	Blanket	A. Cond.	Frypan
Hair Dryer	A. Cond.	Frypan	Blanket	Freezer	Blanket	Freezer	Frypan	Freezer
Freezer	F. Mixer	D. Wash.	Hair Dry	A. Cond.	Hair Dry	A. Cond.	Freezer	Hair Dry
Air Conditioner	D. Wash.	Can open	A. Cond.	Fl. Polish	A. Cond	Hair Dry	Can op.	Clths. Dry
Can opener	Clths. Dry	Freezer	Clthes Dry	Clthes.D	Clths.Dry	Can op.	D. Wash.	D. Wash.
Clothes Dryer	Freezer	A. Cond.	D. Wash.	Blanket	Flr. Pol	Clths Dry	Hair Dry	Fl. Polish.
Floor Polisher	Can open.	Clths.Dry	Can op.	Can op.	Can op.	Fl. Pol.	Clths.Dry	Can opener
Dish Washer	Fl. Pol.	Fl. Pol.	Fl. Pol.	D. Wash.	D. Wash.	D. Wash.	Fl. Pol.	A. Cond.
	$\gamma = .90$	$\gamma = .84$	$\gamma = .97$	$\gamma = .94$	$\gamma = .94$	$\gamma = .97$	$\gamma = .95$	$\gamma = .96$