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ABSTRACT

The models presented in this volume were designed to fit the typical situation. Each user of these techniques will have to modify them to ensure their applicability to his institution. Although the material exploits the capabilities of the PLANTRAN system, computer processing is not required for use of the models. The techniques dealt with here can all be implemented manually. Each is treated for its relation to overall planning; its underlying theory, assumptions, and problems; and a diversity of approaches. A micromodel is developed and applied to a set of realistic institutional data via the PLANTRAN system. Information is also provided on methods of data collection and on types of changes and adaptations that can be made in the models. (Author/WM)

Midwest Research Institute

ED 085824

Techniques of Institutional Research and Long Range Planning for Colleges and Universities

Volume I

--Enrollment Projections

--Induced Course Load Matrix

--Faculty Planning

Economics and Management Science Division

Midwest Research Institute

PREFACE

The material in this volume was developed by William L. Pickett, Senior Educational Administration Specialist, for use in a series of workshops on institutional research and planning for colleges and universities. These workshops were designed to address real planning problems. Participants were encouraged to collect and use data from their own institutions. As a result, participants not only learned research and planning techniques but also developed analyses which were immediately useful to institutional decision makers.

The workshop sessions made extensive use of computers. This was possible through the use of PLANTRAN. This is a computer simulation system developed by Midwest Research Institute. It was designed to make the power of the computer available to the higher education executive without special computer knowledge. It is in use by several dozen institutions of all levels and sizes.

While the material in this manual exploits the capabilities of the PLANTRAN system, computer processing is not required for use of the models. The techniques can all be implemented manually.

Approved for:

MIDWEST RESEARCH INSTITUTE

John McKelvey, Vice President
Economics and Management Science

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I. Introduction

This volume deals with three specific techniques of institutional research and planning for colleges and universities: enrollment projections, induced course load matrix, and faculty planning. Volume II of this series deals with facility planning, program cost analysis, and budgeting/finance.

Each of these topics receives a seven-fold development as follows:

1. Relation to overall planning. Each technique is placed in a comprehensive scheme for planning. This enables the planner to understand what is required to implement the technique as well as the use of the results.

2. Theory. This is a general discussion of the topics which treats the assumptions and problems of each.

3. Techniques. This is a brief review of the major techniques under each topic. This helps the planner to understand that there are usually several ways to approach a research/planning problem. The review includes criteria for the selection of the most appropriate technique.

4. Micro-Model. One technique is selected and presented in detail. This section includes worksheets to implement the technique as well as descriptions of needed data elements and their probable sources.

5. Case study. The micro-model is applied to a set of realistic institutional data. This implementation is in the PLANTRAN system. Complete documentation of a PLANTRAN model is included.

6. Data collection. In order to assist the planner in using each technique, this section includes a data collection document along with instructions for its use.

7. Model adaptation. This section discusses the reasons for changes in the model and the types of changes which will usually be encountered.

No matter how general it is, no single model is appropriate for every college and university. The models presented in this manual were designed to fit the typical situation. Obviously, each user of these techniques will have to modify them to insure their applicability to his institution. In most cases the required changes will be minor and easily made. In a few, more basic structural changes may be required.

A college planner using this material should always be conscious of the need to make the model fit his college rather than try to make the college fit the model. He should not hesitate to make changes in the structure of the models, the methods of calculation, data definitions, report formats, etc. It is only through this kind of flexibility that the techniques presented here can be useful to higher education.

II. Enrollment Projections

A. Relation to Overall Planning

1. Role of enrollment projections: College is an organization designed to provide educational services to students. The number and types of students are important in shaping the educational services provided by the college. Accurate projections of enrollments in colleges and universities are the key to institutional planning. Projection of enrollment is analogous to sales forecasting for a manufacturing firm, i.e., from this one planning factor come many implications. Enrollments influence the number and type of faculty, curricular offerings, research and teaching laboratories, student activities, student housing, student health care, food services, academic facility construction, and many other elements of campus administration that must be carefully planned in advance of need.

A college's enrollment is the major determinant of both resource requirements and resource availability. Resource requirements are usually developed by the application of a variety of planning factors to enrollment. Both philosophically and analytically the main driving force behind a college's resource requirements is the demand* for services made by students. The number of students also has a major impact on the college's income. This is clearly apparent in the case of a private college or university which is typically heavily dependent upon tuition income. Even in the public sector, however, a large portion of a university's income is tied to students. An example is a state university which is funded with a formula based on dollars per full-time equivalent students.

Figure 1 displays the relationship between enrollment projections and the total planning effort. Anyone trying to develop long range plans for a college must give his first attention to projections of enrollment.

2. Projections, estimates, goals: In dealing with the future it is helpful to keep in mind the distinction between three terms: projections, estimates, and goals. Projections are statements about future events on a long range basis. Typically they describe activities over multi-year periods and are not used as precise predictions of actual events but to indicate trends and long term developments. The central concern with projections, then, is the magnitude, direction and rate of change. An enrollment projection over five years which did not hit the exact figures but which did accurately describe the direction and pace of change would be considered a good projection. For example, if the projection shows the enrollment going down at a rapid rate, the administrator must take this into account in his planning for resource requirements and income. As one moves further out in time, the amount of precision possible and its importance decline. As long as the projections are based on accurate trends, long range planning will be realistic.

* "Demand" is used throughout this section in the economic sense of "the desire to purchase coupled with the ability to do so."

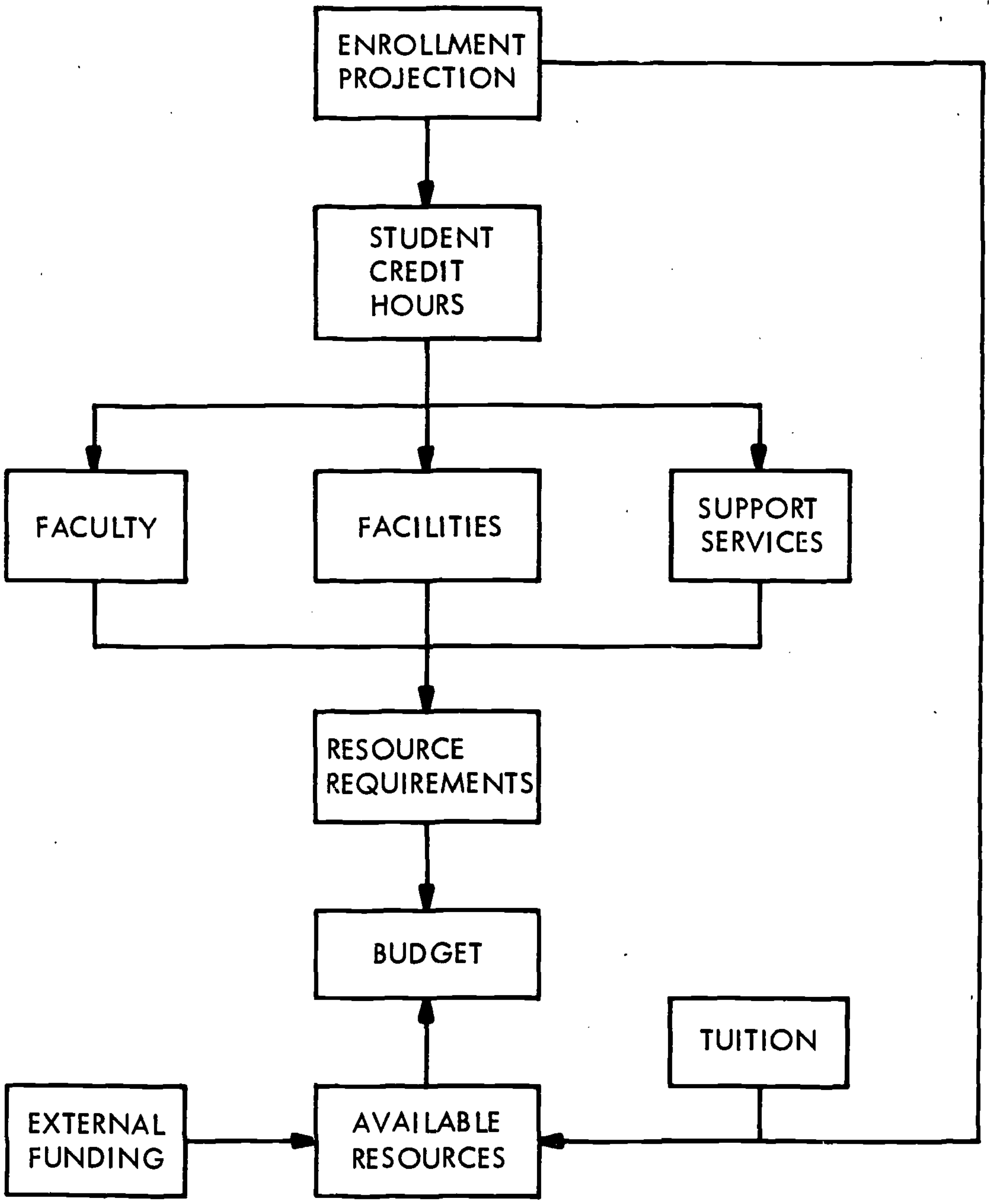
ENROLLMENT PROJECTION
STUDENT CREDIT HOURS
FACULTY
FACILITIES
SUPPORT SERVICES
RESOURCE REQUIREMENTS
BUDGET
TUITION
EXTERNAL FUNDING
AVAILABLE RESOURCES

Figure 1

An estimate is a statement about short run future events. Typically these will be monthly forecasts. Since enrollment does not significantly change from month to month, enrollment estimates are statements about next year's enrollment. In this case, the administrator is much more interested in the exact number of students since specific and critical decisions will follow from it. The more precise the estimate, the more precise the budget and staffing decisions can be. Trends, direction of change, and pace of change are not the direct concern of estimates.

Projections and estimates have different purposes and generally utilize different data in developing their forecasts. Since it is long run, a projection will be based on trend data from the past: numbers of students, percent of college attendance, share of market, etc. Estimates result from leading indicator research. What can the administrator look at in January which will give him a precise estimate of the number of students to be enrolled next fall? This kind of research looks at admissions and retention data: number of applications, enquiries, acceptances, deposits, pre-registrations, transcript requests, etc.

Goals are statements of desired achievements. An administrator develops a plan to achieve his goal and implements that plan. He builds in analysis points along the way so that he can monitor the progress of the plan and make statements about the probability of achieving his goal. A goal can either be long run or short run. Often a goal is set after a projection or estimate has been made because the projected results are unacceptable to decision makers.

It is important to keep projections and goals separate particularly in enrollment projections. While a planner might like a certain enrollment by 1980, he should not use that as the basis for his operating budget if the long run trend indicates a substantially lower enrollment. At the minimum, he should be aware of the conflict between the two.

B. Theory of Enrollment Projection

Most enrollment projections assume that there is relative stability in the factors controlling enrollment. This stability rests on the interrelatedness of time periods. Some relationship between the enrollment this year and last year is assumed. This stability results in some predictability about future events.

Figure 2 displays a generalized model of enrollment projection. The projection results from four factors: demographic (essentially population), historic trends, policy constraints, judgment.

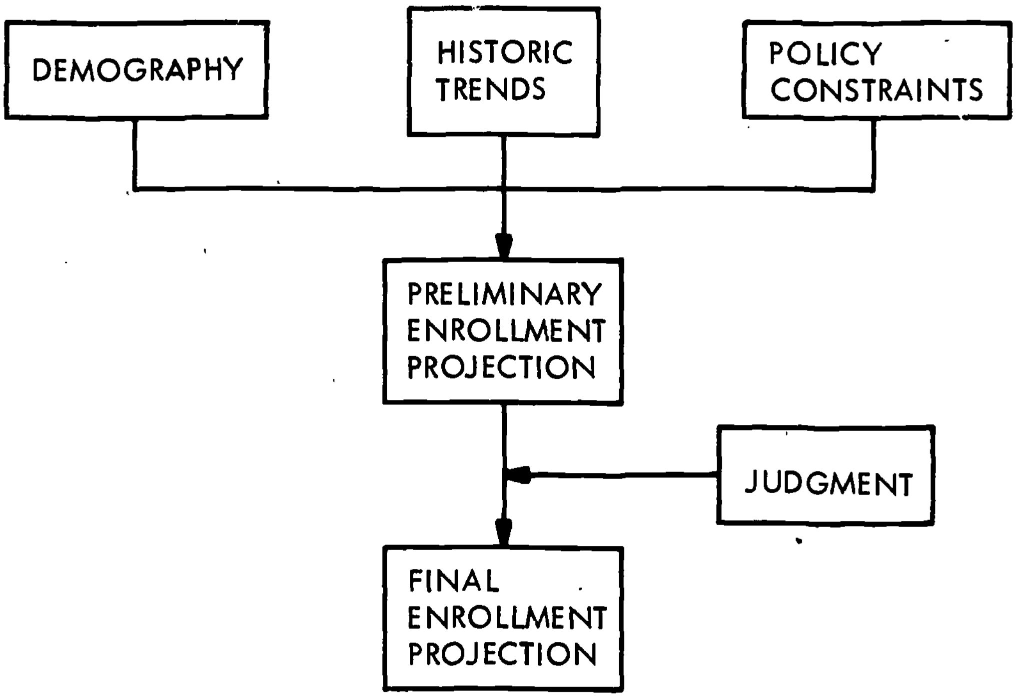
DEMOGRAPHY
HISTORIC TRENDS
POLICY CONSTRAINTS
PRELIMINARY ENROLLMENT PROJECTION
JUDGMENT
FINAL ENROLLMENT PROJECTION

Figure 2

1. Demography: The demographic information refers to the pool of students from which enrollment at a particular institution will come. It also includes socio-economic characteristics which will affect college attendance as well as the type of educational service required. This information will vary from institution to institution. For one it might be births 18 years previous; for another number of high school seniors the previous year; for another the number of baptisms in a particular religious denomination 18 years previous. These tend to be relatively hard data since the people who form the pool already exist and can generally be counted. The size and composition of the pool are the critical problem areas.

2. Historic trends: Historic trends relate to the number and rate of attendance of students in previous years. Past attendance can be viewed as a percentage of the pool or can be compared with the attendance in other years. This last method has serious shortcomings since it fails to relate enrollment to the basic demographic and population situation. These trends can be subjected to a variety of statistical analyses to determine methods of future projection.

3. Policy constraints: Policy constraints can be major determinants of enrollment. For example, a college which has a limit on student capacity and which decides not to expand that capacity has placed a constraint upon enrollment: an upper limit. Changes in fee and tuition policy, expansion into new student markets, increase in student financial aid, changes in program offerings to appeal to more students, launching a new admissions effort, starting up a branch campus, on development of a low tuition institution nearby are all examples of the type of policy constraints which will have an impact on enrollment above and beyond the population and historic trends.

4. Judgment: The professional judgment of knowledgeable college administrators is a valuable input to an enrollment projection. A person who has a good "feel" for his institution can make contributions to any research program, including enrollment projections. Typically these inputs are in the form of parameters. Such a person may react by saying that a certain projection is too low; another is too high. These types of judgment should be included in the projection.

The result of this process is that the projection of a college's enrollment is not a pure research exercise. It is administrative problem solving and should make use of all available data and expertise. Most of all it should be open to the professional judgment of key decision makers and should produce output in a form and of a nature which can be effectively used by these decision makers.

5. Interrelationships: A theory of enrollment projection must also take into account the interrelatedness of colleges and universities. The enrollment of a low cost community college will affect the enrollment of four-year colleges in the same area. Increased recruiting by a college does not significantly increase the total number attending college, but it will increase that college's share of those who attend. In other words, increased attendance at one college means decreased attendance somewhere else.

C. Techniques of Enrollment Projection

This section will review eight basic techniques of projecting enrollments.* These generalized techniques can be applied to any type of institution or groups of institutions and to any type of enrollment. The crucial task is the matching of projection methods with the objective of the projection effort. This requires the judgment of a knowledgeable administrator.

1. Trend analysis: The most logical and simple model for projection is to review the past behavior of the variable to determine if there are any stable trends and to further determine if the underlying causes of this past behavior will continue in the future. If both of these conditions are met, a simple time series analysis may be all that is needed for the projection. For example, if freshman enrollment has been increasing 5 percent a year for the last 10 years and if it is reasonable to assume that things will be pretty much the same for the next 10 years, a 5 percent annual increase in the freshman class is a reasonable projection.

The weakness of this approach is that the real world seldom conforms to this model. Such a condition may be true in a short run situation but rarely in the long run. The type of social, economic, and educational changes which have occurred in the United States in the last five years underscore the difficulty in justifying this type of approach.

Even if more sophisticated, non-linear models are used, the growing discontinuity between past and future vitiate their usefulness. Most planners have an intuitive feeling about the determinants of enrollment: population, economic conditions, cost, location, competition. They are also fairly confident that most of these factors will be changing through time and probably not according to past patterns of change.

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* The discussion of the first five techniques draws from a similar section in Methodology of Enrollment Projections for Colleges and Universities, by L.J. Lins (March, 1960).

2. Ratio method: This method concentrates on one determinant of enrollment: population. In essence it says that the enrollment of a college can be viewed as a ratio of a population grouping. The particular grouping will vary with each college. It has two parameters: age and geographic area. For the typical college, the population grouping will correspond to the normal college attendance age: 17 through 22 years of age. While this group does not account for all students enrolled, it will typically account for the vast majority. The geographic area will depend upon the college. A few universities draw from a national student pool, but most colleges and universities have a geographic region which produces most of their students. The area may be as small as a county in the case of a community college or as large as an entire state in the case of a public university. The fact that commuting distance is a variable in choice of college means that most schools have a major drawing or market area.

Once the age and the geographic area parameters have been determined, counts of the population are developed and compared with actual enrollment for the same time periods. The resulting ratio then becomes the basis for projecting future enrollments. The ratio can be subjected to various types of trend analysis to produce ratios for a future time series. This projected ratio is then applied to projections of population in the base grouping. The projected ratio is subject to the application of judgement and may be modified for valid, non-statistical reasons.

3. Cohort survival: This technique of enrollment projection uses a series of ratios to develop projections of enrollment on a grade by grade basis. It follows a group of students through the complete educational system and calculates the number that continue on each year. For example, the number of second graders is some ratio of last year's first graders. This year's third graders are some ratio of last year's second graders, and so on. The ratios are developed by analyzing past experience with grade to grade retention. Theoretically, this procedure, can be followed through elementary, secondary, collegiate, and post-graduate education. In practice the entire series is rarely constructed for projection purposes because of the lack of good data and the large amount of data to be manipulated when they are available.

4. Combined ratio and cohort survival: This technique combines the last two methods we have discussed. The ratio technique is used to project the size of the entering freshman class. The projections of the sophomore, junior, and senior classes utilize the cohort survival technique by applying ratios to last year's freshman class to produce this year's sophomore class; applying ratios to last year's sophomore class to produce this year's junior class, and so on. Graduate enrollments can be generated by defining the cohort as the bachelor's degree recipients of the last 2 years within a defined geographic area depending upon the present geographic composition of the graduate enrollment.

5. Correlation analysis: This is a more sophisticated technique for determining statistically valid relationships between enrollment (dependent) and one or more causal factors (independent). This type of analysis is often a helpful addition to any of the other methods discussed. To effectively use this technique, the sample size needs to be relatively large and the data as accurate as possible. Often data on the independent variables are difficult to accumulate in a form that lends itself to this analysis. One has the further problem of forecasting the independent variables which may require a substantial research effort.

6. Share-of-the-market: This technique approaches the problem of projecting enrollment in a fashion similar to that of a firm seeking to forecast sales. It is a two-step process of first determining the size of the market and then the individual firm's share of that market. For enrollment projections, the two steps are: first, to determine the number of students attending college under appropriate age and geographic parameters, and second, to determine what proportion of those will attend the individual college. This proportion will be changing through time and part of the projection problem is to forecast the college's future share. This approach is displayed in figure 3. The population cohort, the propensity of college attendance, and the college's share determine the projected enrollment.

The first step requires projections of the population cohort. This can be developed through births 18 years previously adjusted for mortality and migration (essentially the cohort survival method applied to age groups), twelfth grade enrollments, and projections based on census data often available from external sources. The first step also requires a determination of the proportion of the age cohort which is likely to attend college. This can be developed by a time series analysis, correlation analysis, and other techniques. It is often helpful to develop attendance rates for different sectors of higher education: junior college, private four-year, and tax supported colleges. The appropriate factors can be developed through a historic analysis.

The second step involves the calculation of the expected share of students at the particular institution. Again historic analysis and judgment will provide the factors to be used. This can be applied against the total college attending group or more realistically against the specific market of the institution. Thus a junior college would determine its share of the total number attending junior colleges; a private college would determine its share of the total projected to attend private colleges. Since there are identifiable factors associated with each of these sectors, a discriminate approach is justified.

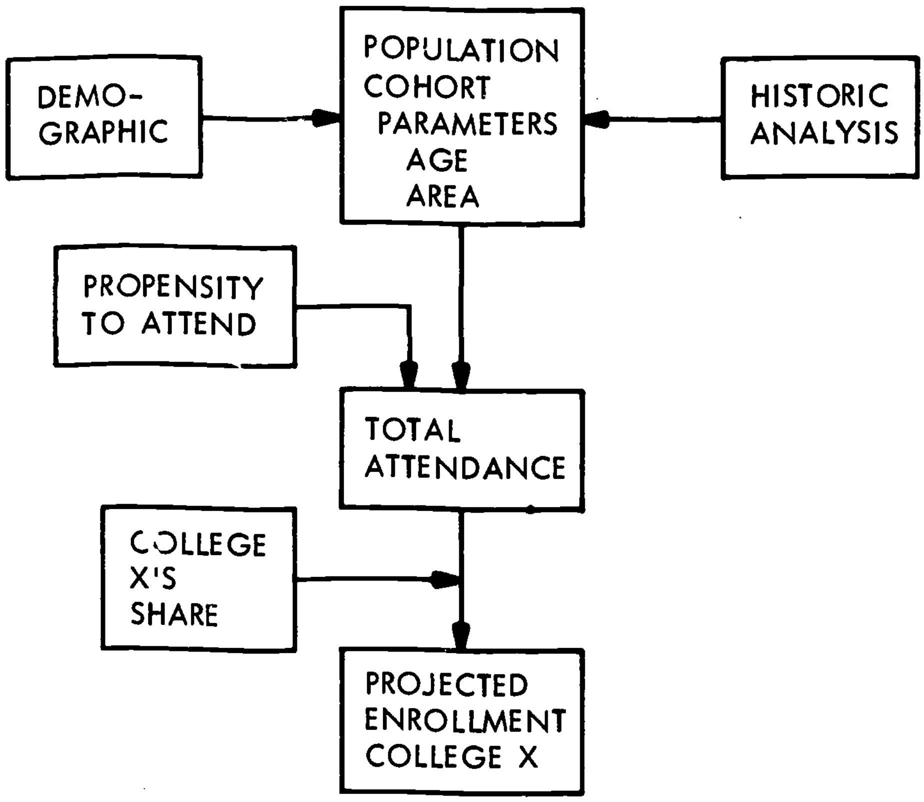
DEMO-
GRAPHIC
POPULATION
COHORT
PARAMETERS
AGE
AREA
HISTORIC
ANALYSIS
PROPENSITY
TO ATTEND
TOTAL
ATTENDANCE
COLLEGE
X'S
SHARE
PROJECTED
ENROLLMENT
COLLEGE X

Figure 3

7. Forced balancing: This technique can be used with any of the above projection techniques but is most applicable to the share-of-the-market method. It is based on a recognition of the fact that the market for any one school is finite. The total number of people who will seek higher education is not significantly affected by the recruiting and marketing efforts of individual colleges. Colleges can increase, maintain, or decrease their share of the total market but cannot expand or contract the market. This means that a college can increase its share of the market only at the expense of the other colleges competing in the same market.

During the sixties this was not so apparent since the enrollment of all colleges was increasing. This, of course, was due to the rapid expansion of the total market, not to the expansion of the share of all institutions. In fact it is now clear that one group, private colleges, was losing its share of the market while the public sector share was increasing. The rapid growth in the size of the market offset this reduction in market share of the private colleges.

With this experience, the interrelationship between colleges must be recognized in enrollment projections. This is especially critical in forecasts of enrollment for groups of institutions, statewide enrollments, for example. A forced balancing routine ensures that changes in enrollment for individual colleges will not cause changes in the total size of the market.

In mathematical notation we would say that

$$\sum (E_i + \Delta_i) = TE$$

when; TE - Total Enrollment for all of the class or group of institutions in question. This might be obtained, for example, from age population lation and propensity data.

E_i = Enrollment, college i

Δ_i = Subjection, judgmental, quantitative

adjustments to the Enrollment estimates, college i.

Then E_i', the final, adjusted enrollment estimate for college i would be calculated thus:

$$E_i' = \left(\frac{TE}{\sum E_i + \Delta_i} \right) E_i$$

8. Disaggregation techniques: Once gross enrollment projections have been made, the planner faces the problem of breaking down his total number into the various categories and levels required for further planning and decision making. The most straightforward method is to review the past record of constituent elements. For example, if the planner needs to project the number of men and women in the total enrollment, he can analyze the past ratios and subject them to a trend analysis. This is another area in which a good deal of informed judgment can be applied. The criteria for deciding whether to disaggregate enrollment and the degree to which this should be done is the use of this information in further planning and decision making. It is easy to spend a great deal of time producing a mass of information which is never really used. The time spent in accumulating that information is thus not justified.

9. General considerations:

a. Objective of the projection: The first decision in conducting a projection study is to determine its objective. While this might seem simple, it often is not. An objective of "forecasting future enrollments" is not specific enough to guide design decisions. The following types of questions need to be answered:

--Over how long a period are the projections to be made?
--What type of enrollment is to be projected: undergraduate, graduate, adult education, part-time, full-time?
--To what level of detail should the projections go: sex, department, in-state, out-of-state, academic classification?
--Under what policy constraints?
--Who will receive the projections and how will they use them?

Objectives stated in this specific fashion will enable the planner to make better decisions on the type of projection technique to use, the level of disaggregation, and the amount of effort required.

b. Judgment: The judgment of knowledgeable individuals is a resource to be used in the projection. Initially professional judgment is applied to the selection of the projection technique. Some methods are appropriate in some situations and inappropriate in others. The matching of technique with the problem to be solved is an art which improves with experience.

c. Ideal versus real: The design and objectives of a projection study will typically be ideal ones which will be difficult to implement. The model might call for information which is not available or which will be very difficult and thus expensive to obtain. These ideal designs serve as guides for future developments and expansions of the study. The planner will usually have to do the best job he can with the data he has available. The ideal procedure will highlight data gaps and stimulate a list of priorities for further work.

d. Junior colleges: While the sample analysis is designed for a four-year college, the adaptations needed for an analysis of junior college enrollment are evident. The analysis of juniors and seniors will be omitted and analyses of speical types of enrollment will be added. These include adult education, vocational-technical, and other special purpose programs. Adult education enrollment can be viewed as a percentage of district population over compulsory school attendance age who are not full time students.

Vocational-technical and other occupational programs often have maximums placed on enrollments or are otherwise under policy constraints. Manpower planning can be applied to these areas more easily than to the traditional college programs. Projected needs for certain types of manpower can be translated into enrollments in appropriate programs.

e. Graduate enrollment: Since the sample analysis is designed for undergraduate enrollments, modifications will have to be made to deal with graduate enrollments. Graduate education is not as free a market as undergraduate education. Program, facility, and financial constraints lead to careful screening of applicants and enrollment lids. Often these policy constraints will make a projection unnecessary.

If a projection is needed, it will proceed within the same framework as undergraduate. A share-of-the-market methodology can be used. The population pool can be defined by three parameters: recipients of the bachelor's degree over X number of years within a defined geographic area; size of the market proportion of that grouping which takes graduate work; the individual institution "share" of that market.

D. Micro-Model

1. Enrollment analysis: Figure 4 presents the worksheets for conducting an analysis of past enrollments. By inserting the input data items and performing the indicated calculations, a planner will generate an analysis of past enrollment behavior. This will enable him to better select methods of projecting future enrollments. Without this initial analysis, the planner will not know the exact shape and character of the data.

ENROLLMENT ANALYSIS WORKSHEET

No.	Item	Source	66	67	68	69	70	71	72
			Academic Year Beginning In:						
* 1	Population Pool	Input							
* 2	Size of Market	Input							
3	Propensity Factor	Line 2 ÷ Line 1x100							
4	Previous Year's Propensity Factor	Shift Line 3 to the Right 1 Space							
5	Change in Propensity Factor	Line 3 - Line 4							
6	Percent Change in Propensity Factor	Line 5 ÷ Line 4 x 100							
7	Accumulated Percent Change in Propensity Factor	Accumulate the Values in Line 6							
* 8	Time Periods	Input							
9	Moving Average of Percent Change in Propensity Factor	Line 7 ÷ Line 8							
*10	New Freshmen	Input							
11	Share of Market	Line 10 ÷ Line 2x100							
12	Previous Year's Share of Market	Shift Line 11 to the Right 1 Year							
13	Change in Share of Market	Line 11 - Line 12							
14	Percent Change in Share of Market	Line 13 ÷ Line 12x100							
15	Accumulated Percent Change in Share of Market	Accumulate Values in Line 14							
16	Moving Average of Percent Change in Share of Market	Line 15 ÷ Line 8							
*17	Old Freshmen	Input							
18	Previous Year's New Freshmen	Shift Line 10 to the Right 1 year							

* This is an input item. See section II. D. 1.

Figure 4

ENROLLMENT ANALYSIS WORKSHEET (CONT'D)

No.	Item	Source	64	65	66	67	68	69	70
			Academic Year Beginning In:						
19	Ratio of Old Freshmen to New	Line 17 ÷ Line 18	___	___	___	___	___	___	___
20	Accumulated Ratios	Accumulate Values in Line 20	___	___	___	___	___	___	___
21	Average Ratio	Line 20 ÷ Line 8	___	___	___	___	___	___	___
22	Total Freshmen	Line 10 + Line 17	___	___	___	___	___	___	___
*23	Sophomore Enrollment	Input	___	___	___	___	___	___	___
24	Previous Period's Freshmen	Shift Line 22 to the Right 1 Period	___	___	___	___	___	___	___
25	Ratio of Sophomores to Freshmen	Line 23 ÷ Line 24 x 100	___	___	___	___	___	___	___
26	Previous Period's Ratio	Shift Line 25 to the Right 1 Year	___	___	___	___	___	___	___
27	Change in Ratio	Line 25 - Line 26	___	___	___	___	___	___	___
28	Percent Change in Ratio	Line 27 ÷ Line 26 x 100	___	___	___	___	___	___	___
29	Accumulated Percent Change in Ratio	Accumulate Values in Line 28	___	___	___	___	___	___	___
30	Moving Average Percent Change	Line 29 ÷ Line 8	___	___	___	___	___	___	___
*31	Juniors	Input	___	___	___	___	___	___	___
32	Previous Years Sophomores	Shift Values in Line 23 to the Right 1 year	___	___	___	___	___	___	___
33	Ratio of Juniors to Sophomores	Line 31 ÷ Line 32x100	___	___	___	___	___	___	___
34	Previous Year's Ratio	Shift Values in Line 33 to the Right 1 Space	___	___	___	___	___	___	___
35	Change in Ratio	Line 33 - Line 34	___	___	___	___	___	___	___
36	Percent Change in Ratio	Line 35 ÷ Line 34x100	___	___	___	___	___	___	___

* This is an input item. See section II. D. 1.

Figure 4 (Continued)

ENROLLMENT ANALYSIS WORKSHEET (CONT'D)

No.	Item	Source	Academic Year Beginning In: 66	67	68	69	70	71	72
37	Accumulated Percent Change in Ratio	Accumulate Values in Line 36	___	___	___	___	___	___	___
38	Moving Average Percent Change in Ratio	Line 37 ÷ Line 8	___	___	___	___	___	___	___
*39	Seniors	Input	___	___	___	___	___	___	___
40	Previous Year's Juniors	Shift Values in Line 31 to the Right 1 Year	___	___	___	___	___	___	___
41	Ratio of Seniors to Juniors	Line 39 Line 40x100	___	___	___	___	___	___	___
42	Previous Year's Ratio	Shift Values in Line 41 to the Right 1 year	___	___	___	___	___	___	___
43	Change in Ratio	Line 41 - Line 42	___	___	___	___	___	___	___
44	Percent Change in Ratio	Line 43 ÷ Line 42x100	___	___	___	___	___	___	___
45	Accumulated Percent Change in Ratio	Accumulate Values in Line 44	___	___	___	___	___	___	___
46	Moving Average Percent Change in Ratio	Line 45 ÷ Line 8	___	___	___	___	___	___	___
*47	Special Students	Input	___	___	___	___	___	___	___
48	Total Enrollment	Line 10 + Line 17 + Line 23 + Line 31 + Line 39 + Line 47	___	___	___	___	___	___	___
49	Ratio of Special Students to Total	Line 47 ÷ Line 48x100	___	___	___	___	___	___	___
50	Accumulated Ratio	Accumulate Values in Line 49	___	___	___	___	___	___	___
51	Average Ratio	Line 50 ÷ Line 52	___	___	___	___	___	___	___
52	Time Periods	Input	___	___	___	___	___	___	___

* This is an input item, see section II. D. 1.

Figure 4 (Concluded)

a. Input: The actual input elements are Lines 1, 2, 8, 10 17, 23, 31, 39, and 47. A description of these data elements and their probable sources follows:

Line 1-Population pool: This is the population grouping which contains those individual most likely to attend post-secondary institutions. The exact dimensions of the pool will necessarily vary. Two parameters must be considered: age and geographic location. The selection of the parameters will be based on the general characteristics of the college's enrollment. For example, if the planner knows that a high percentage of the freshman class are eighteen years old and also come from a single state, he will most logically select a population pool of all eighteen-year-olds in that state for each time period:

The source of this type of information will vary with the dimensions of the pool. Age cohort data can be obtained from the U.S. Bureau of Census Reports. Number of births is usually available from the State Department of Vital Statistics. School enrollments by grade are generally available from departments of public instruction but frequently do not include private school statistics. If time and money permit, a planner can conduct a survey of feeder high schools to collect information on past enrollments.

It is likely that the ideal set of data needed for the analysis is not available. Rather than not conduct any analysis, the planner should proceed with the best information available under the assumption that some information is better than none.

Line 2-Size of market: This is the number of individuals from the population pool who actually enrolled in institutions of higher education. While this can be viewed in gross terms as attendance at all colleges and universities, the usual practice is to specify two parameters of geographic area and type of institution.

State lines provide handy geographic divisions and data on enrollment are easily available in this form. Since the proportion of the student body attending different types of institutions is probably changing through time, it is more accurate to view the market in terms of similar types of colleges rather than all colleges. The expansion of the community colleges is an enrollment factor that should not be obscured by lumping all institutions together.

Enrollment figures can usually be obtained from the publications of the National Center for Educational Statistics, especially Opening Fall Enrollment. Important supplementary information is available from state education offices and commissions as well as various associations of colleges and universities.

Line 8-time periods: These are used to compute the moving averages and will correspond to the time periods being analyzed.

Line 10-New freshmen: Typically these will be described as first-time-in college freshmen, i.e., freshmen who have not been previously enrolled. This information is available from the Registrar's Office. The question of how a planner defines "student" cannot really be answered. The planner should select either head count or full-time equivalent specifying the method of computing the latter. Once determined this definition should be used throughout so that the plan is internally consistent.

Line 17-old freshmen: These are the freshmen who have been previously enrolled at the college. The information should be available from the Registrar's Office.

Line 23-Sophomores: These are the sophomore students including transfer students. The institution's method of academic classification should be used so that the results approximate other information as closely as possible. These data should be obtained from the Registrar's Office.

Line 31-Juniors: These are the junior students including transfers. The information will be available from the Registrar's Office.

Line 39-Seniors: These are the senior students including transfer students. Information will be obtained from the Registrar's Office.

Line 47-Special students: These are the undergraduate students enrolled who do not fall into the other academic classifications. The definition of "special student" will vary from college to college. The planner should use the one recognized by his institution. The information should be available from the Registrar's Office.

Line 52-time periods: These are used to compute the moving averages and will correspond to the time periods being analyzed.

b. Output: The output of the enrollment analysis will provide the planner with information on the following items:

Propensity factor: Line 3 will display the calculated propensity factor for the time period analyzed. Line 9 will provide him with the average percent of change in the propensity factor through time.

Share of the market: Line 11 will display the college's share of its market in the form of a ratio of new freshmen to the size of the market. Line 16 will provide the average percentage of change in this ratio.

Old freshmen ratio: Line 19 displays the ratio between this year's returning freshmen and the first-time-in-college freshmen of last year. Line 21 provides the average of that ratio.

Sophomore ratio: Line 25 displays the ratio of this year's sophomores to last year's freshmen. Line 30 provides the average percentage change in that ratio.

Junior ratio: Line 33 displays the ratio of this year's juniors to last year's sophomores. Line 38 provides the average percent of change in that ratio.

Senior ratio: Line 41 presents the ratio between this year's seniors and last year's juniors. Line 46 provides the average percent of change in that ratio.

Special student ratio: Line 49 presents the calculated ratio of special students to total enrollment. Line 51 provides the average of that ratio through the time frame.

These analysis techniques are appropriate only to linear time series. If a data series is non-linear, additional analysis techniques may be required.

2. Enrollment disaggregation analysis: Total enrollment is composed of a number of constituent elements in addition to academic classification. Since some of these elements are important for further planning and decision making, an enrollment study should analyze them in terms of their relationship to the total enrollment. A framework analysis is given in figure 5.

a. Input: There are four input elements, Lines 1, 2, 5, and 15 which are discussed below.

Line 1-Total enrollment: The total enrollment for the college which is compatible with the figure used in the general enrollment analysis should be used.

Line 2-Discrete element: This is the particular element of the total enrollment which the planner wishes to analyze. The exact elements to be used will depend upon the local situation and the items which can serve a useful purpose for further planning. The following is a list of possible elements:

sex
resident/non-resident
major field
commuter/non-commuter
rank in high school class
financial aid recipient
full-time/part-time
credit/non-credit
religious affiliation
minority groups

The routine displayed in figure 5 would be repeated for each element selected for analysis.

Line 5-Time periods: These are used to compute the moving averages and will correspond to the extent of the time period being analyzed.

Line 15-Time periods: These are used to compute the moving averages and will correspond to the extent of the time period being analyzed.

Line 17-Time periods: These are used to compute the moving averages and will correspond to the extent of the time period being analyzed.

ENROLLMENT: DISAGGREGATION ANALYSIS WORKSHEET

No.	Item	Source	Academic Year Beginning In: 66	67	68	69	70	71	72
* 1	Total Enrollment	Input	___	___	___	___	___	___	___
* 2	Discrete Element	Input	___	___	___	___	___	___	___
3	Ratio of Element to Total	Line 2 ÷ Line 1x100	___	___	___	___	___	___	___
4	Accumulated Ratio	Accumulate Values in Line 3	___	___	___	___	___	___	___
* 5	Time Periods	Input	___	___	___	___	___	___	___
6	Average Ratio	Line 4 ÷ Line 5	___	___	___	___	___	___	___
7	Previous Year's Ratio	Shift Values in Line 3 to the Right 1 Year	___	___	___	___	___	___	___
8	Change in Ratio	Line 3 - Line 7	___	___	___	___	___	___	___
9	Percent Change in Ratio	Line 8 ÷ Line 7x100	___	___	___	___	___	___	___
10	Accumulated Percent Change in Ratio	Accumulate Values in Line 9	___	___	___	___	___	___	___
11	Moving Average Percent Change	Line 10 ÷ Line 17	___	___	___	___	___	___	___
12	Previous Year's Percent Change in Ratio	Shift the Values in Line 9 to the Right 1 Year	___	___	___	___	___	___	___
13	Change in Percent Change of Ratio	Line 9 - Line 12	___	___	___	___	___	___	___
14	Accumulated Change in Percent Change	Accumulate Values in Line 13	___	___	___	___	___	___	___
*15	Time Periods	Input	___	___	___	___	___	___	___
16	Average Change in Percent Change	Line 14 ÷ Line 15	___	___	___	___	___	___	___
*17	Time Periods	Input	___	___	___	___	___	___	___

* Input items. see section II. D. 2.

Figure 5

b. Output: There are three important results of this analysis for each discrete element of total enrollment.

Average ratio: The last data point in Line 6 gives the planner the average ratio of the element to the total enrollment over the time frame.

Average percent change: The last data point in Line 11 provides the planner with the average rate of change in the ratio of the element to the total enrollment.

Trend: The last data point in Line 16 gives the planner the average change in the rate of change of the ratio of the element to the total enrollment.

Thus the planner can say that over the period being analyzed, element A averaged .55 of the total. This ratio (.55) was increasing at an average rate of .003 per year and this rate of change (.003) was decreasing .0003 per period on the average. Notice that these techniques of analysis are useful only if the time series is linear or approximately linear. Non-linear time series may require additional analysis.

3. Enrollment projection:

a. Input: The enrollment projection model presented in figure 6 uses nine input items. These are described below.

Line 1-population pool: This population grouping will have the same parameters as that used in the historic analysis. Since the grouping consists of people who already exist, fairly accurate projections can be inserted. These will generally be available from the same source as the historic information.

With regard to the other eight input variables, the trends and change factors developed from the historic analysis can be used for the initial projection unless they are clearly inappropriate. Rarely will these result in projections which do not need further adjustment. However the development of a baseline gives the planner something with which to stimulate and evaluate alternative projections.

Line 2-propensity factor: Take the last value in Line 3 of the historic analysis (Figure 4) change it by the percent reflected in the last value of Line 9 and insert the calculated values into Line 2 of the projections.

Line 4-share of the market: Take the last value in Line 11 of the historic analysis, change it by the percent found in the last value of Line 16 and insert the resulting values into Line 4 of the projection worksheet.

ENROLLMENT PROJECTION WORKSHEET

No.	Item	Source	Academic Year Beginning In: 72	73	74	75	76	77	78
* 1	Population Pool	Input	___	___	___	___	___	___	___
* 2	Propensity Factor	Change By ___	___	___	___	___	___	___	___
3	Size of Market	Line 1 x Line 2 x .01	___	___	___	___	___	___	___
* 4	Share of Market	Change By ___	___	___	___	___	___	___	___
5	New Freshmen	Line 3 x Line 4 x .01	___	___	___	___	___	___	___
6	Previous Year's New Freshmen	Shift Line 5 to the Right 1 Year	___	___	___	___	___	___	___
* 7	Old Freshmen Ratio	Change By ___	___	___	___	___	___	___	___
8	Old Freshmen	Line 6 x Line 7 x .01	___	___	___	___	___	___	___
9	Total Freshmen	Line 5 + Line 8	___	___	___	___	___	___	___
10	Previous Year's Freshmen	Shift Values in Line 9 to the Right 1 Year	___	___	___	___	___	___	___
*11	Sophomore Ratio	Change By ___	___	___	___	___	___	___	___
12	Sophomores	Line 10 x Line 11 x .01	___	___	___	___	___	___	___
13	Previous Year's Sophomores	Shift Values in Line 12 to the Right 1 Year	___	___	___	___	___	___	___
*14	Junior Rate	Change By ___	___	___	___	___	___	___	___
15	Juniors	Line 13 x Line 14 x .01	___	___	___	___	___	___	___
16	Previous Year's Juniors	Shift Values in Line 15 to the Right 1 Year	___	___	___	___	___	___	___
*17	Senior Rate	Change By ___	___	___	___	___	___	___	___
18	Seniors	Line 16 x Line 17 x .01	___	___	___	___	___	___	___

* Input item, see section II. D. 3.

Figure 6

ENROLLMENT PROJECTION WORKSHEET (CONT'D)

No.	Item	Source	72	73	74	75	76	77	78
19	Subtotal	Line 9 + Line 12 + Line 15 + Line 18	___	___	___	___	___	___	___
*20	Special Student Ratio	Change By ___	___	___	___	___	___	___	___
21	Special Students	Line 22 - Line 19	___	___	___	___	___	___	___
22	Total Enrollment	Line 19 ÷ (100 - Line 20)	___	___	___	___	___	___	___
*23	Discrete Element Ratio	Change By ___	___	___	___	___	___	___	___
24	Discrete Element	Line 22 x Line 23 x 01	___	___	___	___	___	___	___

Figure 6 (Concluded)

Line 7-old freshmen ratio: Take the last value of Line 21 of the historic analysis, and insert it in all values in Line 7 of the projection.

Line 11-sophomore ratio: Take the final value in Line 25 of the historic analysis, change it by the percentage in the last value of Line 30, and insert the computed values in Line 11 of the projection.

Line 14-junior ratio: Take the last value in Line 33 of the historic analysis, change it by the percentage found in the last value of Line 38, and insert the results in Line 14 of the projection worksheet.

Line 17-senior ratio: Take the last value in Line 41 of the historic analysis, change it by the percentage found in the final value of Line 46, and put the results in Line 17 of the projection worksheet.

Line 20-special student ratio: Take the final value in Line 51 of the historic analysis and insert it throughout the values of Line 20 in the projection worksheet.

Line 23-discrete element ratio: Take the final value of Line 6 of the historic disaggregation analysis and insert it throughout Line 23 of the projection worksheet, or take the final value in Line 3 of the historic analysis, change it in accord with the analysis, and insert the results into Line 23 of the projection worksheet. Each element of the disaggregation will have its own ratio developed out of its own historic analysis.

b. Output: The projection model displayed in figure 6 produces the following information:

Size of Market
New Freshmen
Old Freshmen
Total Freshmen
Sophomores
Juniors
Seniors
Special Students
Total Enrollment
Disaggregation by various elements

E. Case Study

The techniques discussed above have been applied to a set of realistic institutional data. This application could have been conducted manually using the worksheets and directions given in Section D. However these same tasks can be accomplished in the PLANTRAN system.

The advantage in using a mechanical means for these tasks is the ease in making modifications. Use of the planning system provides an on-going flexibility to accommodate change into the institution's operation.

1. Enrollment analysis: Figure 7 shows the PLANTRAN system input required to conduct the analysis. Figure 8 presents the "Analysis of Planning Matrix," a unique, self-documenting feature of PLANTRAN which displays data input. Figure 9 shows the summary report output.

2. Disaggregation analysis: Figure 10 shows the system input. Figure 11 presents the "Analysis of Planning Matrix." Figure 12 shows the summary report output. This sample analyzes accounting majors as a component of total enrollment. The same technique is used on each discrete element to be analyzed. This is accomplished by use of the systems driver, a feature of PLANTRAN which permits iteration of the model with appropriate data changes.

3. Enrollment projection: Figure 13 shows the system input. Figure 14 presents the "Analysis of Planning Matrix." Figure 15 shows the summary report output.

NAME ______

PLANTRAN II DATA SHEET

PAGE 1 OF 3

MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)		RUN NO (78–80)
EXAMPLE	ENROLL ANALYSIS	CURRENT DATE	1966	T			T - TIME PERIOD H - HEADING R - REPLACEMENT	

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–44)	(45–80)
1	POPULATION POOL	76098	DATA	80208, 82663, 87182, 87901, 86724, 92309
2	SIZE OF MARKET	20000	DATA	20450, 20465, 20515, 20015, 20100, 20850
3	PROPENSITY FACTOR	26.3	EQUATION:	L2/L1 * 100
4	PREV PROPENSITY FACTOR		SHIFT	L3
5	PROPENSITY FACTOR CHANGE		EQUATION:	L3-L4
6	PCT CHANGE IN PROPENSITY		EQUATION:	L5/L4 * 100
7	MOVING AVG-PCT CHANGE		AVERAGE	LINE 6
8	NEW FRESHMEN	3000	DATA	3010, 2490, 2510, 2000, 2980, 3370
9	SHARE OF MARKET	15	EQUATION:	L8/L2 * 100
10	PREVIOUS YEARS SHARE		SHIFT	LINE 9
11	CHANGE IN MKT SHARE		EQUATION:	L9-L10
12	PCT CHANGE IN MKT SHARE		EQUATION:	L11/L10 * 100
13	MOVING AVG-PCT CHANGE		AVERAGE	OF LINE 12
14	OLD FRESHMEN STUDENTS	230	DATA	250, 370, 380, 270, 210, 230
15	PREV. YR NEW FRESHMEN		SHIFT	LINE 8
16	RATIO-OLD/NEW FRESHMEN		EQUATION:	L14/L15 * 100
17	AVE RATIO OLD/NEW FRESH		AVERAGE	LINE 16
18	TOTAL FRESHMEN STUDENTS	3230	SUM	OF 8, 14

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)

Figure 7

E ______________

PLANTRAN II DATA SHEET

PAGE 2 OF 3

MRI

IDENTIFICATION

ORGANIZATION	MODEL DESCRIPTION	DATE	BASE PERIOD T	H	R	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO
1 - 24	25 - 40	41 - 56	57 - 60	61 - 63	65		78 - 80

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	PERIOD 5	PERIOD 6	PERIOD 7	PERIOD 8	PERIOD 9	PERIOD 10	PERIOD 11	PERIOD 12
1 - 6	7 - 12	13 - 18	19 - 24	25 - 30	31 - 36	37 - 42	43 - 48	49 - 54	55 - 60	61 - 66	67 - 72

MODEL SPECIFICATION

LINE NO. (1-4)	PLANNING ITEM (5-28)	BASE LEVEL (29-40)	FREEFORM METHOD OF COMPUTATION (41-80)
19	SOPHOMORE STUDENTS	2010	DATA 2570, 2690, 2470, 2640, 2050, 2250
20	PREV. YEARS FRESHMEN		SHIFT LINE 18
21	RATIO-SOPH/FRESHMEN		EQUATION: L19/L20 * 100
22	PREV. YRS RATIO		SHIFT LINE 21
23	BLOCK LINE		DATA, 1, 1, 1, 1, 1
24	CHANGE IN RATIO SOPH/FR		EQUATION: L21 * L23 - L22
25	PCT CHANGE IN RATIO		EQUATION: L24/L22 * 100
26	SHIFT PCT CHG IN RATIO		SHIFT LINE 25 BACK 1 PERIOD
27	AVE PCT CHG SOPH/FRESH		AVERAGE LINE 26
28	JUNIORS STUDENTS	1990	DATA 1980, 2440, 2350, 2420, 2540, 2480
29	PREV. YR SOPHOMORES		SHIFT LINE 19
30	RATIO JUNIOR/SOPH		EQUATION: L28/L29 * 100
31	PREV. YR RATIO JUN/SOPH		SHIFT LINE 30
32	CHG IN RATIO		EQUATION: L30 * L23 - L31
33	PCT CHG IN RATIO JUN/SOP		EQUATION: L32/L31 * 100
34	SHIFT PCT CHG IN RATIO		SHIFT LINE 33 BACK 1 PERIOD
35	AVE PCT CHG JUN/SOPH		AVERAGE LINE 34
36	SENIORS	1210	DATA 1780, 1700, 2270, 2340, 2360, 2380

SUMMARY REPORTS

REPORT TITLE (1-24)	FREEFORM REPORT LINES (25-80)

Figure 7 (Continued)

PLANTRAN II DATA SHEET

MRI

NAME ______

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
37	PREV. YR JUNIORS		SHIFT LINE 28
38	RATIO SENIOR/JUNIOR		EQUATION: L36/L37*100
39	PREV. YRS RATIO SEN/JUN		SHIFT LINE 38
40	CHG IN RATIO SEN/JUN		EQUATION: L38*L23-L39
41	PCT CHG IN RATIO SEN/JUN		EQUATION: L40/L39*100
42	SHIFT PCT CHG IN RATIO		SHIFT LINE 41 BACK 1 PERIOD
43	AVE PCT CHG SEN/JUN		AVERAGE LINE 42
44	SPECIAL STUDENTS	270	DATA 260, 260, 190, 240, 290, 240
45	TOTAL ENROLLMENT	8710	SUM OF LINES 18, 19, 28, 36, 44
46	RATIO-SPECIAL TO TOTAL		EQUATION: L44/L45*100
47	AVE RATIO SPEC/TOTAL		AVERAGE LINE 46
48			

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)
OVERVIEW LINE ANALYSIS	1-48
ENROLLMENT FACTORS	3, 5-7, 48, 9, 11-13, 48, 16, 17, 48, 21, 24, 25, 27, 48, 30, 32, 33, C 35, 48, 38, 40, 41, 43, 48, 46, 47

Figure 7 (Concluded)

EXAMPLE ENROLL ANALYSIS RUN	ANALYSIS OF MATRIX FOR A 6 PERIOD FORECAST	CURRENT DATE BASE YR. 1966

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
1	POPULATION POOL	76098	DATA80208,82663,87182,87901,86724,92309
2	SIZE OF MARKET	20000	DATA20450,20465,20515,20015,20100,20850
3	PROPENSITY FACTOR	26.3	EQUATION: L2 / L1 * 100
4	PREV. PROPENSITY FACTOR		SHIFT L3
5	PROPENSITY FACTOR CHANGE		EQUATION: L3 - L4
6	PCT CHANGE IN PROPENSITY		EQUATION: L5 / L4 * 100
7	MOVING AVG-PCT CHANGE		AVERAGE LINE 6
8	NEW FRESHMEN	3000	DATA3010,2490,2510,2000,2980,3370
9	SHARE OF MARKET	15	EQUATION: L8 / L2 * 100
10	PREVIOUS YEARS SHARE		SHIFT LINE 9
11	CHANGE IN MKT SHARE		EQUATION: L9 - L10
12	PCT CHANGE IN MKT SHARE		EQUATION: L11 / L10 * 100
13	MOVING AVG-PCT CHANGE		AVERAGE OF LINE 12
14	OLD FRESHMEN STUDENTS	230	DATA290,370,380,270,210,230
15	PREV. YR NEW FRESHMEN		SHIFT LINE 8
16	RATIO-OLD/NEW FRESHMEN		EQUATION: L14 / L15 * 100
17	AVE RATIO OLD/NEW FRESH		AVERAGE LINE 16
18	TOTAL FRESHMEN STUDENTS	3230	SUM OF 8,14
19	SOPHOMORE STUDENTS	2010	DATA2570,2690,2470,2640,2050,2750

Figure 8

EXAMPLE
ENROLL ANALYSIS
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1966

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
20	PREV. YEARS FRESHMEN		SHIFT LINE 18
21	RATIO—SOPH/FRESHMEN		EQUATION: L19 / L20 * 100
22	PREV. YRS RATIO		SHIFT LINE 21
23	BLOCK LINE		DATA,1,1,1,1,1
24	CHANGE IN RATIO SOPH/FR		EQUATION: L21 * L23 - L22
25	PCT CHANGE IN RATIO		EQUATION: L24 / L22 * 100
26	SHIFT PCT CHG IN RATIO		SHIFT LINE 25 BACK 1 PERIOD
27	AVE PCT CHG SOPH/FRESH		AVERAGE LINE 26
28	JUNIOR STUDENTS	1990	DATA1980,2440,2350,2420,2540,2480
29	PREV. YR SOPHOMORES		SHIFT LINE 19
30	RATIO JUNIOR/SOPH		EQUATION: L28 / L29 * 100
31	PREV. YR RATIO JUN/SOPH		SHIFT LINE 30
32	CHG IN RATIO		EQUATION: L30 * L23 - L31
33	PCT CHG IN RATIO JUN/SOP		EQUATION: L32 / L31 * 100
34	SHIFT PCT CHG IN RATIO		SHIFT LINE 33 BACK 1 PERIOD
35	AVE PCT CHG JUN/SOPH		AVERAGE LINE 34
36	SENIORS	1210	DATA1780,1700,2270,2340,2360,2380
37	PREV. YR JUNIORS		SHIFT LINE 28
38	RATIO SENIOR/JUNIOR		EQUATION: L36 / L37 * 100

Figure 8 (Continued)

EXAMPLE
ENROLL ANALYSIS
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1966

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
39	PREV. YRS RATIO SEN/JUN		SHIFT LINE 38
40	CHG IN RATIO SEN/JUN		EQUATION: L38 * L23 - L39
41	PCT CHG IN RATIO SEN/JUN		EQUATION: L40 / L39 * 100
42	SHIFT PCT CHG IN RATIO		SHIFT LINE 41 BACK 1 PERIOD
43	AVE PCT CHG SEN/JUN		AVERAGE LINE 42
44	SPECIAL STUDENTS	270	DATA260,260,190,240,290,240
45	TOTAL ENROLLMENT	8710	SUM OF LINES 18,19,28,36,44
46	RATIO-SPECIAL TO TOTAL		EQUATION: L44 / L45 * 100
47	AVE RATIO SPEC/TOTAL		AVERAGE LINE 46
48			

Figure 8 (Continued)

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THE FOLLOWING REPORTS ARE REQUESTED
OVERVIEW LINE ANALYSIS        1-48
ENROLLMENT FACTORS            3,5-7,48,9,11-13,48,16,17,48,21,24,25,27,48,30,32,33,C
                              35,48,38,40,41,43,48,46,47
```

Figure 8 (Concluded)

EXAMPLE
ENROLL ANALYSIS

OVERVIEW LINE ANALYSIS

CURRENT DATE RUN

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
1	POPULATION POOL	80208.00	82663.00	87182.00	87901.00	86724.00	92309.00
2	SIZE OF MARKET	20450.00	20465.00	20515.00	20015.00	20100.00	20850.00
3	PROPENSITY FACTOR	25.50	24.76	23.53	22.77	23.18	22.59
4	PREV. PROPENSITY FACTOR	26.30	25.50	24.76	23.53	22.77	23.18
5	PROPENSITY FACTOR CHANGE	-0.80	-0.74	-1.23	-0.76	0.41	-0.59
6	PCT CHANGE IN PROPENSITY	-3.06	-2.90	-4.95	-3.24	1.79	-2.54
7	MOVING AVG-PCT CHANGE	-3.06	-2.98	-3.64	-3.54	-2.47	-2.46
8	NEW FRESHMEN	3010.00	2490.00	2510.00	2000.00	2980.00	3370.00
9	SHARE OF MARKET	14.72	12.17	12.23	9.99	14.83	16.16
10	PREVIOUS YEARS SHARE	15.00	14.72	12.17	12.23	9.99	14.83
11	CHANGE IN MKT SHARE	-0.28	-2.55	0.07	-2.24	4.83	1.34
12	PCT CHANGE IN MKT SHARE	-1.87	-17.34	0.56	-18.33	48.37	9.02
13	MOVING AVG-PCT CHANGE	-1.87	-9.61	-6.22	-9.25	2.28	3.40
14	OLD FRESHMEN STUDENTS	290.00	370.00	380.00	270.00	210.00	230.00
15	PREV. YR NEW FRESHMEN	3000.00	3010.00	2490.00	2510.00	2000.00	2980.00
16	RATIO-OLD/NEW FRESHMEN	9.67	12.29	15.26	10.76	10.50	7.72
17	AVE RATIO OLD/NEW FRESH	9.67	10.98	12.41	11.99	11.70	11.03
18	TOTAL FRESHMEN STUDENTS	3300.00	2860.00	2890.00	2270.00	3190.00	3600.00
19	SOPHOMORE STUDENTS	2570.00	2690.00	2470.00	2640.00	2050.00	2750.00
20	PREV. YEARS FRESHMEN	3230.00	3300.00	2860.00	2890.00	2270.00	3190.00
21	RATIO-SOPH/FRESHMEN	79.57	81.52	86.36	91.35	90.31	86.21
22	PREV. YRS RATIO	0.0	79.57	81.52	86.36	91.35	90.31
23	BLOCK LINE	0.0	1.00	1.00	1.00	1.00	1.00

Figure 9

EXAMPLE
ENROLL ANALYSIS

OVERVIEW LINE ANALYSIS

CURRENT DATE
RUN

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
24	CHANGE IN RATIO SOPH/FR	0.0	1.95	4.85	4.99	-1.94	-4.10
25	PCT CHANGE IN RATIO	0.0	2.45	5.95	5.77	-1.14	-4.54
26	SHIFT PCT CHG IN RATIO	2.45	5.95	5.77	-1.14	-4.54	0.0
27	AVE PCT CHG SOPH/FRESH	2.45	4.20	4.72	3.26	1.70	1.41
28	JUNIOR STUDENTS	1980.00	2440.00	2350.00	2420.00	2540.00	2480.00
29	PREV. YR SOPHOMORES	2010.00	2570.00	2690.00	2470.00	2640.00	2050.00
30	RATIO JUNIOR/SOPH	98.51	94.94	87.36	97.98	96.21	120.98
31	PREV. YR RATIO JUN/SOPH	0.0	98.51	94.94	87.36	97.98	96.21
32	CHG IN RATIO	0.0	-3.57	-7.58	10.62	-1.76	24.7[illegible]
33	PCT CHG IN RATIO JUN/SOP	0.0	-3.62	-7.98	12.15	-1.80	25.7[illegible]
34	SHIFT PCT CHG IN RATIO	-3.62	-7.98	12.15	-1.80	25.74	0.0
35	AVE PCT CHG JUN/SOPH	-3.62	-5.80	0.18	-0.31	4.90	4.08
36	SENIORS	1780.00	1700.00	2270.00	2340.00	2360.00	2380.00
37	PREV. YR JUNIORS	1990.00	1980.00	2440.00	2350.00	2420.00	2540.00
38	RATIO SENIOR/JUNIOR	89.45	85.86	93.03	99.57	97.52	93.70
39	PREV. YRS RATIO SEN/JUN	0.0	89.45	85.86	93.03	99.57	97.52
40	CHG IN RATIO SEN/JUN	0.0	-3.59	7.17	6.54	-2.05	-3.82
41	PCT CHG IN RATIO SEN/JUN	0.0	-4.01	8.36	7.03	-2.06	-3.92
42	SHIFT PCT CHG IN RATIO	-4.01	8.36	7.03	-2.06	-3.92	0.0
43	AVE PCT CHG SEN/JUN	-4.01	2.17	3.75	2.33	1.[illegible]	0.90
44	SPECIAL STUDENTS	260.00	260.00	190.00	240.00	290.00	240.00
45	TOTAL ENROLLMENT	9890.00	9950.00	10170.00	9910.00	10430.00	11[illegible].00
46	RATIO-SPECIAL TO TOTAL	2.63	2.61	1.87	2.42	2.78	2.1[illegible]

Figure 9 (Continued)

EXAMPLE
ENROLL ANALYSIS

OVERVIEW LINE ANALYSIS

CURRENT DATE RUN

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
47	AVE RATIO SPEC/TOTAL	2.63	2.62	2.37	2.38	2.46	2.4[illegible]
48							

Figure 9 (Continued)

EXAMPLE
ENROLL ANALYSIS

ENROLLMENT FACTORS

CURRENT DATE
RUN

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
3	PROPENSITY FACTOR	25.56	24.76	23.53	22.77	23.18	22.59
5	PROPENSITY FACTOR CHANGE	-0.80	-0.74	-1.23	-0.76	0.41	-0.59
6	PCT CHANGE IN PROPENSITY	-3.06	-2.90	-4.95	-3.24	1.79	-2.54
7	MOVING AVG-PCT CHANGE	-3.06	-2.98	-3.64	-3.54	-2.47	-2.48
48							
9	SHARE OF MARKET	14.72	12.17	12.23	9.99	14.83	16.16
11	CHANGE IN MKT SHARE	-0.28	-2.55	0.07	-2.24	4.83	1.34
12	PCT CHANGE IN MKT SHARE	-1.87	-17.34	0.56	-18.33	48.37	9.02
13	MOVING AVG-PCT CHANGE	-1.87	-9.61	-6.22	-9.25	2.28	3.40
48							
16	RATIO-OLD/NEW FRESHMEN	9.67	12.29	15.26	10.76	10.50	7.72
17	AVE RATIO OLD/NEW FRESH	9.67	10.98	12.41	11.99	11.70	11.03
48							
21	RATIO-SOPH/FRESHMEN	79.57	81.52	86.36	91.35	90.31	86.21
24	CHANGE IN RATIO SOPH/FR	0.0	1.95	4.85	4.99	-1.04	-4.10
25	PCT CHANGE IN RATIO	0.0	2.45	5.95	5.77	-1.14	-4.54
27	AVE PCT CHG SOPH/FRESH	2.45	4.20	4.72	3.26	1.70	1.41
48							
30	RATIO JUNIOR/SOPH	98.51	94.94	87.36	97.98	96.21	120.95
32	CHG IN RATIO	0.0	-3.57	-7.58	10.62	-1.76	4.7
33	PCT CHG IN RATIO JUN/SOP	0.0	-3.62	-7.98	12.15	-1.80	25.74

Figure 9 (Continued)

EXAMPLE
ENROLL ANALYSIS

ENROLLMENT FACTORS

CURRENT DATE

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
35	AVE PCT CHG JUN/SOPH	-3.62	-5.80	0.18	-0.31	4.90	4.05
48							
38	RATIO SENIOR/JUNIOR	89.45	85.86	93.03	99.57	97.52	93.70
40	CHG IN RATIO SEN/JUN	0.0	-3.59	7.17	6.54	-2.05	-3.82
41	PCT CHG IN RATIO SEN/JUN	0.0	-4.01	8.36	7.03	-2.06	-3.92
43	AVE PCT CHG SEN/JUN	-4.01	2.17	3.79	2.33	1.08	0.90
48							
46	RATIO-SPECIAL TO TOTAL	2.63	2.61	1.87	2.42	2.78	2.10
47	AVE RATIO SPEC/TOTAL	2.63	2.62	2.37	2.38	2.46	2.40

Figure 9 (Concluded)

PLANTRAN II DATA SHEET

PAGE 1 OF 1 MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)		RUN NO. (78–80)
EXAMPLE	ELEMENT ANALYSIS	CURRENT DATE	1966	T			T - TIME PERIOD H - HEADING R - REPLACEMENT	

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–44)	(45–80)
1	TOTAL ENROLLMENT	8710	DATA	9890, 9950, 10170, 9910, 10430, 11450
2	ACCOUNTING MAJORS	452	DATA	500, 537, 560, 560, 610, 658
3	RATIO TO TOTAL	5.2	EQTN	L2/L1 * 100
4	AVERAGE RATIO		AVER	3
5	PREVIOUS YEARS RATIO		SHIF	L3
6	CHANGE IN RATIO		EQTN	L3-L5
7	PERCENT CHANGE IN RATIO	-.8	EQTN	L6/L5 * 100
8	AVE PERCENT CHANGE		AVER	7
9	PREVIOUS PERIODS PCT CHG		SHIF	L7
10	CHG IN PERC CHG IN RATIO		EQTN	L7-L9
11	AVE CHG IN PERCENT CHG		AVER	10

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)
OVERVIEW LINE ANALYSIS	1-11
ELEMENT ANALYSIS	1-4, 6-8, 10, 11

Figure 10

EXAMPLE
ELEMENT ANALYSIS
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1966

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
1	TOTAL ENROLLMENT	8710	DATA9890,9950,10170,9910,10430,11450
2	ACCOUNTING MAJORS	452	DATA500,537,560,560,610,658
3	RATIO TO TOTAL	5.2	EQTN L2 / L1 * 100
4	AVERAGE RATIO		AVER 3
5	PREVIOUS YEARS RATIO		SHIF L3
6	CHANGE IN RATIO		EQTN L3 - L5
7	PERCENT CHANGE IN RATIO	-.8	EQTN L6 / L5 * 100
8	AVE PERCENT CHANGE		AVER 7
9	PREVIOUS PERIODS PCT CHG		SHIF L7
10	CHG IN PERC CHG IN RATIO		EQTN L7 - L9
11	AVE CHG IN PERCENT CHG		AVER 10

Figure 11

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THE FOLLOWING REPORTS ARE REQUESTED
OVERVIEW LINE ANALYSIS        1-11
ELEMENT ANALYSIS              1-4,6-8,10,11
```

Figure 11 (Concluded)

EXAMPLE
ELEMENT ANALYSIS

OVERVIEW LINE ANALYSIS

CURRENT DATE
NO.

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
1	TOTAL ENROLLMENT	9890.00	9950.00	10170.00	9910.00	10430.00	11450.00
2	ACCOUNTING MAJORS	500.00	537.00	550.00	560.00	610.00	658.00
3	RATIO TO TOTAL	5.06	5.40	5.51	5.65	5.85	5.75
4	AVERAGE RATIO	5.13	5.22	5.29	5.36	5.44	5.49
5	PREVIOUS YEARS RATIO	5.20	5.06	5.40	5.51	5.65	5.85
6	CHANGE IN RATIO	-0.14	0.34	0.11	0.14	0.20	-0.10
7	PERCENT CHANGE IN RATIO	-2.78	6.75	2.03	2.62	3.50	-1.74
8	AVE PERCENT CHANGE	-1.79	1.06	1.30	1.57	1.89	1.37
9	PREVIOUS PERIODS PCT CHG	-0.60	-2.78	6.75	2.03	2.62	3.50
10	CHG IN PERC CHG IN RATIO	-1.98	9.53	-4.73	0.60	0.87	-5.24
11	AVE CHG IN PERCENT CHG	-1.98	3.78	0.94	0.86	0.86	-0.16

Figure 12

PLANTRAN II DATA SHEET

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MRI

NAME ______

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)		RUN NO. (78–80)
EXAMPLE	ENROLLMENT PROJ	CURRENT DATE	1972	T			T - TIME PERIOD H - HEADING R - REPLACEMENT	

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
1	POPULATION POOL	92309	DATA 93221, 94220, 94160, 95003, 94317, 94165
2	PROPENSITY FACTOR	22.6	PERCENT DECREASE OF 2.48
3	SIZE OF MARKET	20850	EQUATION: L1 * .01L2
4	SHARE OF MARKET	16.2	PERCENT INCREASE OF 3.4
5	NEW FRESHMEN	3370	EQUATION: L3 * .01L4
6	OLD FRESHMEN	230	SHIFT .11L5
7	FRESHMEN (TOTAL)	3600	SUM OF 5, 6
8	SHIFT		SHIFT L7
9	SOPHOMORE RATIO	86.2	PERCENT INCREASE OF 1.41
10	SOPHOMORES	2750	EQUATION: L8 * .01L9
11	SHIFT		SHIFT L10
12	JUNIOR RATIO	121	GOAL OF 93.3 IN PERIOD 1
13	JUNIORS	2480	EQUATION: L11 * .01L12
14	SHIFT		SHIFT L13
15	SENIOR RATIO	93.7	PERCENT INCREASE OF .9
16	SENIORS	2380	EQTN. L14 * .01L15
17	SUBTOTAL	11210	SUM OF 7, 10, 13, 16
18	SPECIAL STUDENT RATIO	3.4	CONSTANT

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)

Figure 13

NAME ______________________

PLANTRAN II DATA SHEET

PAGE 2 OF 2 — MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD T (57–60)	H (61–63)	R (65)	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–44, 45–80)
19	SPECIAL STUDENTS	240	EQUATION: L20-L17
20	TOTAL ENROLLMENT	11450	EQUATION: L17/(1.00-.01L18)
21	ACCOUNTING MAJORS	658	EQUATION: L20 * .01L22
22	ACCOUNTING RATIO		EQUATION: L23 * L24
23	BASE RATIO	5.7	CONSTANT
24	WORK LINE	1	ACCUMULATIVE PRODUCT OF LINE 26
25	RATE OF CHANGE IN RATIO	1.4	DECREASE .16 PER YEAR
26	WORK LINE	1	EQUATION: 1+.01L25
27			
28	DISCRETE ELEMENTS		

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)
OVERVIEW LINE ANALYSIS	1-28
ENROLLMENT	S1, 5, 6, 27, 10, 13, 16, 19, 20, 27, 28, 21

Figure 13 (Concluded)

EXAMPLE
ENROLLMENT PROJ
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE
BASE YR. 1972

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
1	POPULATION POOL	92309	DATA93221,94220,94160,95003,94317,94165
2	PROPENSITY FACTOR	22.6	PERCENT DECREASE OF 2.48
3	SIZE OF MARKET	20850	EQUATION: L1 * .01L2
4	SHARE OF MARKET	16.2	PERCENT INCREASE OF 3.4
5	NEW FRESHMEN	3370	EQUATION: L3 * .01L4
6	OLD FRESHMEN	230	SHIFT .11L5
7	FRESHMEN(TOTAL)	3600	SUM OF 5,6
8	SHIFT		SHIFT L7
9	SOPHOMORE RATIO	86.2	PERCENT INCREASE OF 1.41
10	SOPHOMORES	2750	EQUATION: L8 * .01L9
11	SHIFT		SHIFT L10
12	JUNIOR RATIO	121	GOAL OF 93.3 IN PERIOD 1
13	JUNIORS	2480	EQUATION: L11 * .01L12
14	SHIFT		SHIFT L13
15	SENIOR RATIO	93.7	PERCENT INCREASE OF .9
16	SENIORS	2380	EQTN L14 * .01L15
17	SUBTOTAL	11210	SUM OF 7,10,13,16
18	SPECIAL STUDENT RATIO	2.4	CONSTANT
19	SPECIAL STUDENTS	240	EQUATION: L20 - L17

Figure 14

EXAMPLE
ENROLLMENT PROJ
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1972

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
20	TOTAL ENROLLMENT	11450	EQUATION: L17 / (1.00 - .01L18)
21	ACCOUNTING MAJORS	658	EQUATION: L20 * .01L22
22	ACCOUNTING RATIO		EQUATION: L23 * L24
23	BASE RATIO	5.7	CONSTANT
24	WORK LINE	1	ACCUMULATIVE PRODUCT OF LINE 26
25	RATE OF CHANGE IN RATIO	1.4	DECREASE .4 PER YEAR
26	WORK LINE	1	EQUATION: 1 + .01L25
27			
28	DISCRETE ELEMENTS		

Figure 14 (Continued)

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THE FOLLOWING REPORTS ARE REQUESTED
OVERVIEW LINE ANALYSIS        1-28
ENROLLMENT                    S1,5,6,27,10,13,16,19,20,27,28,21
```

Figure 14 (Concluded)

EXAMPLE
ENROLLMENT PROJ

OVERVIEW LINE ANALYSIS

CURRENT DATE
RUN

LINE NO.	PLANNING ITEM	1973	1974	1975	1976	1977	1978
1	POPULATION POOL	93221.00	94220.00	94160.00	95003.00	94317.00	94165.00
2	PROPENSITY FACTOR	22.04	21.49	20.96	20.44	19.93	19.44
3	SIZE OF MARKET	20545.45	20250.64	19735.85	19418.71	18800.38	18304.59
4	SHARE OF MARKET	16.75	17.32	17.91	18.52	19.15	19.[illegible]
5	NEW FRESHMEN	3441.53	3507.48	3534.53	3595.98	3599.85	3624.08
6	OLD FRESHMEN	370.70	378.57	385.82	386.80	395.56	395.99
7	FRESHMEN(TOTAL)	3812.23	3886.04	3920.36	3984.78	3995.41	4020.06
8	SHIFT	3600.00	3812.23	3886.04	3920.36	3984.78	3995.41
9	SOPHOMORE RATIO	87.42	88.65	89.90	91.17	92.45	93.75
10	SOPHOMORES	3146.95	3379.46	3493.47	3574.01	3683.96	3745.87
11	SHIFT	2750.00	3146.95	3379.46	3493.47	3574.01	3683.96
12	JUNIOR RATIO	93.30	93.30	93.30	93.30	93.30	93.30
13	JUNIORS	2565.75	2936.11	3153.04	3259.41	3334.55	3437.14
14	SHIFT	2480.00	2565.75	2936.11	3153.04	3259.41	3334.55
15	SENIOR RATIO	94.54	95.39	96.25	97.12	97.99	98.88
16	SENIORS	2344.67	2447.57	2826.08	3062.20	3193.99	3297.04
17	SUBTOTAL	11869.60	12649.19	13392.95	13880.39	14207.91	14500.11
18	SPECIAL STUDENT RATIO	2.40	2.40	2.40	2.40	2.40	2.40
19	SPECIAL STUDENTS	291.88	311.04	329.33	341.32	349.37	356.56
20	TOTAL ENROLLMENT	12161.48	12960.23	13722.28	14221.71	14557.29	14856.66
21	ACCOUNTING MAJORS	700.14	750.59	[illegible]6.32	823.65	838.03	846.71
22	ACCOUNTING RATIO	5.76	5.79	5.80	5.79	5.76	5.70
23	BASE RATIO	5.70	5.70	5.70	5.70	5.70	5.70

Figure 15

EXAMPLE
ENROLLMENT PROJ

OVERVIEW LINE ANALYSIS

CURRENT DATE
RUN

LINE NO.	PLANNING ITEM	1973	1974	1975	1976	1977	1978
24	WORK LINE	1.01	1.02	1.02	1.02	1.01	1.00
25	RATE OF CHANGE IN RATIO	1.00	0.60	0.20	-0.20	-0.60	-1.00
26	WORK LINE	1.01	1.01	1.00	1.00	0.99	0.99
27							
28	DISCRETE ELEMENTS						

Figure 15 (Continued)

EXAMPLE
ENROLLMENT PROJ

ENROLLMENT

CURRE T DATE
RUN

LINE NO.	PLANNING ITEM	1973	1974	1975	1976	1977	1978
5	NEW FRESHMEN	3442	3507	3535	3596	3600	3624
5	OLD FRESHMEN	371	379	386	389	396	396
27							
10	SOPHOMORES	3147	3379	3493	3574	3684	3746
13	JUNIORS	2566	2936	3153	3259	3335	3437
16	SENIORS	2345	2448	2826	3062	3194	3297
19	SPECIAL STUDENTS	292	311	329	341	349	357
20	TOTAL ENROLLMENT	12161	12960	13722	14222	14557	14857
27							
28	DISCRETE ELEMENTS						
21	ACCOUNTING MAJORS	700	751	796	824	838	847

Figure 15 (Concluded)

F. Data collection

Figure 16 is a copy of a data collection document for the historic analysis of enrollment. Figure 17 is a sample of a completed data collection document which conforms to the data used in the case study. The planner should review section II. F. 1 carefully before completing the document.

Figure 18 is a copy of the data collection document for the enrollment disaggregation analysis. Again figure 19 presents a sample collection document filled out to reflect the values used in the case study.

No single data collection document, just as no single model, will be appropriate for every institution. The planner should modify the data collection specifications rather than modify the data to fit the document or not collect data at all. To the greatest extent possible input and output from the model should resemble the operational data of the institution with which the decision makers are familiar.

G. Model Adaptation

No matter how good the data and no matter how sophisticated and precise the methodology, as planners and decision makers review the projection results, they will begin to suggest changes. Some will be changes that reflect a distrust of the projected values; others will simply be expressions of interest in what would happen if? Obviously both of these concerns are important to the model builder.

He is particularly interested in the second response. The decision maker who wants to investigate a number of alternatives; just to see what would happen is the decision maker who realizes how to use simulation. The chart in Figure 20 graphically represents this plan refining cycle which is the hallmark of a successful simulation effort.

Changes in the model can basically be of two types. The structure of the model itself can be changed in order to more closely approximate the real situation. For example, it may turn out that the most realistic enrollment projection method for a specific college is to look at total enrollment as a function of the total 18-24 year old cohort. This would necessitate a basic structural change in the initial model presented here.

The second type of change is the result of the application of informed judgment. A projection that reduced enrollment to a negative number is obviously not reasonable. Thus the values used to change enrollment will be adjusted in light of the judgment of the planner. This type if input to the modeling effort is important and should not be overlooked.

ENROLLMENT ANALYSIS
DATA COLLECTION DOCUMENT

Institution: ____________
Completed By: ____________
Date: ____________

No.	Item	Academic Year Beginning In: 66	67	68	69	70	71	72
1	Population Pool							
2	Size of Market							
3	New Freshmen							
4	Old Freshmen							
5	Total Freshmen							
6	Sophomores							
7	Juniors							
8	Seniors							
9	Special Students							
10	Total Undergraduate Enrollment							

Figure 16

ENROLLMENT ANALYSIS
DATA COLLECTION DOCUMENT
(Sample)

Institution: EXAMPLE
Completed By: Bill Pickett
Date: November 3, 1971

No.	Item	Academic Year Beginning In: 66	67	68	69	70	71	72
1	Population Pool	76098	80208	82663	87182	87901	86224	92309
2	Size of Market	20000	20450	20465	20515	20015	20100	20850
3	New Freshmen	3000	3010	2490	2510	2000	2980	3370
4	Old Freshmen	230	290	370	380	270	210	230
5	Total Freshmen	3230	3300	2860	2890	2270	3190	3600
6	Sophomores	2010	2570	2690	2420	2640	2950	2250
7	Juniors	1990	1980	2440	2350	2400	2540	2480
8	Seniors	1210	1780	1700	2270	2340	2360	2380
9	Special Students	270	260	260	190	240	290	240
10	Total Undergraduate Enrollment	8710	9890	9850	10170	9910	10430	11450

Figure 17

DISAGGREGATION ANALYSIS
DATA COLLECTION DOCUMENT

Institution: ____________
Completed By: ____________
Date: ____________

In this analysis the following elements (__________, __________, __________, __________, __________, __________, __________ will be viewed as components of __________.

No.	Item	66	67	68	69	70	71	72
		Academic Year Beginning In:						
1	Aggregate: ______	___	___	___	___	___	___	___
2	Element: ______	___	___	___	___	___	___	___
3	Element: ______	___	___	___	___	___	___	___
4	Element: ______	___	___	___	___	___	___	___
5	Element: ______	___	___	___	___	___	___	___
6	Element: ______	___	___	___	___	___	___	___
7	Element: ______	___	___	___	___	___	___	___
8	Element: ______	___	___	___	___	___	___	___
9	Element: ______	___	___	___	___	___	___	___
10	Element: ______	___	___	___	___	___	___	___
11	Element: ______	___	___	___	___	___	___	___
12	Element: ______	___	___	___	___	___	___	___

Figure 18

DISAGGREGATION ANALYSIS
DATA COLLECTION DOCUMENT

Institution: EXAMPLE
Completed By: Bill Pickett
Date: November 3, 1971

In this analysis the following elements (Acct majors, ________, ________, ________ will be viewed as components of Total Enroll.

No.	Item	Academic Year Beginning In: 66	67	68	69	70	71	72
1	Aggregate: Total Enroll	8710	9890	9950	10170	9910	10430	11450
2	Element: Acc't majors	452	500	537	560	560	610	658
3	Element:							
4	Element:							
5	Element:							
6	Element:							
7	Element:							
8	Element:							
9	Element:							
10	Element:							
11	Element:							
12	Element:							

Figure 19

PLAN REFINING CYCLE

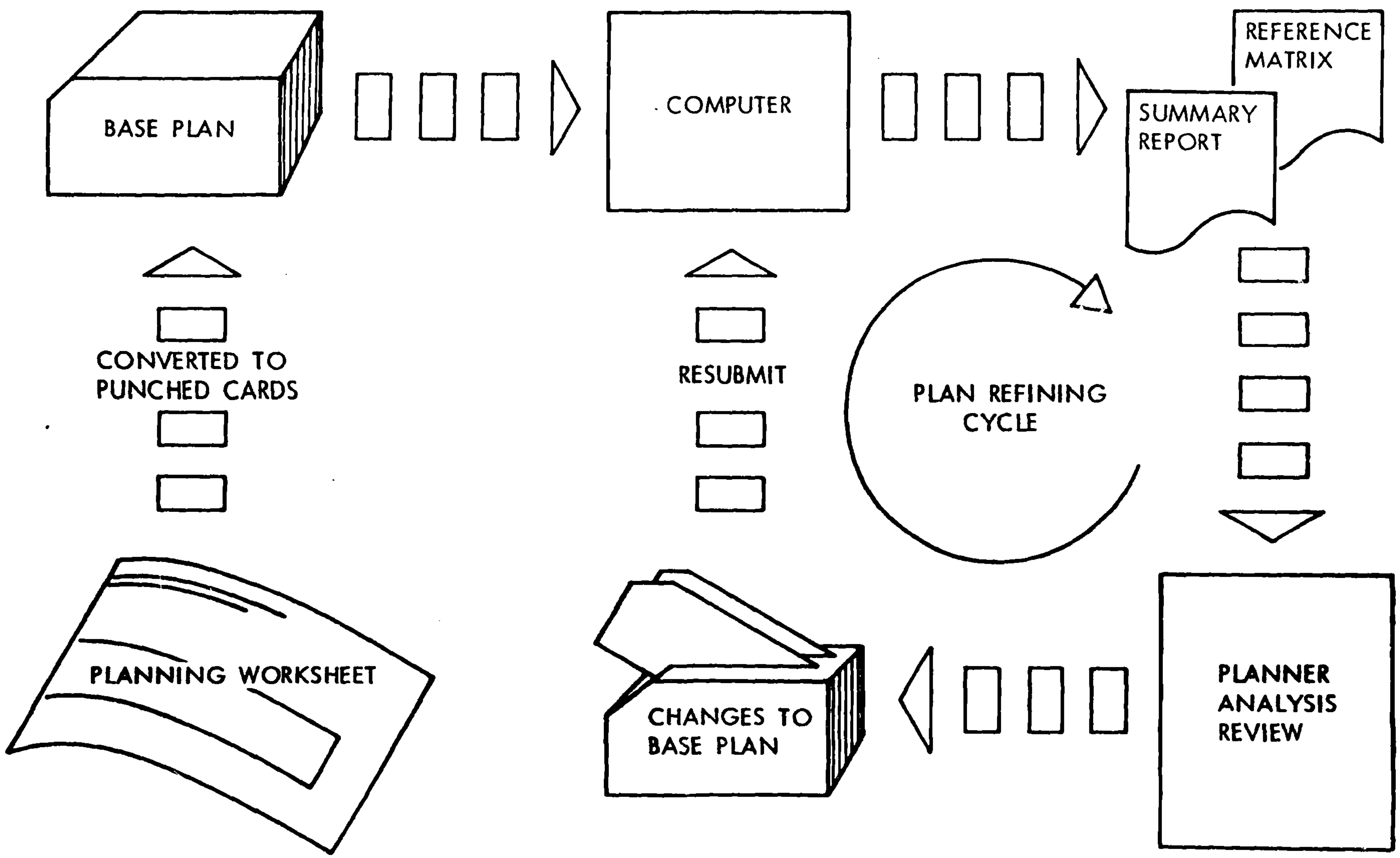

Figure 20

III. Induced Course Load Matrix

A. Relation to Overall Planning

After the planner has developed his enrollment projections and modified them in accord with the review by key decision makers, he needs to further refine his projections in order to make best use of them in calculating resource requirements. The typical cost unit in higher education is the student credit hour. This is a statistic which relates the student with the number of credits he earns. An Induced Course Load Matrix (ICLM) is a method for translating student enrollment projections into student credit hour units distributed among the academic cost centers.

Figure 21 presents the function of the ICLM in relation to the other major elements of overall planning. While it is possible to go directly from student enrollment projections to the development of resource requirements, the ICLM generally permits a more realistic approach to the instructional load placed on each cost center, typically the academic department.

B. Theory

The basic concept behind an ICLM is that a student creates a demand for educational services outside the department to which he majoring. For example, a major in biology takes the majority of his courses in departments other than biology. The exact number and location of these nonbiology courses depends upon the curriculum of the college and the program of the individual student. However, it is possible to assume that there is some stability in the distribution of the courses.

To view the cost of a biology degree program as equal to the cost of the biology department is inaccurate. The cost of the biology degree program is the cost of the student credit hours that the biology majors take, i.e.. those educational services on which they make demands. In fact this may turn out to be a rather small portion of the costs of the biology department. It may turn out that the major demand on the services of the biology department come from a pre-medical program, a secondary education major, etc.

This distinction is more than just intellectually satisfying. Failure to recognize this dynamic relationship between cost centers can lead to inaccurate projections of resource requirements. An expansion of the secondary education program may tempt the planner to focus his attention on that department in calculating increased resource needs. He may overlook the fact that this expansion will increase the demand for services on other departments and that these demands may be significant. His total resource requirement projection may be fairly close to the actual but the departmental elements of the total may be distorted. Since budget decisions are made at the micro rather than the macro level, projections made without recognizing the interrelationships of departments may not be very helpful.

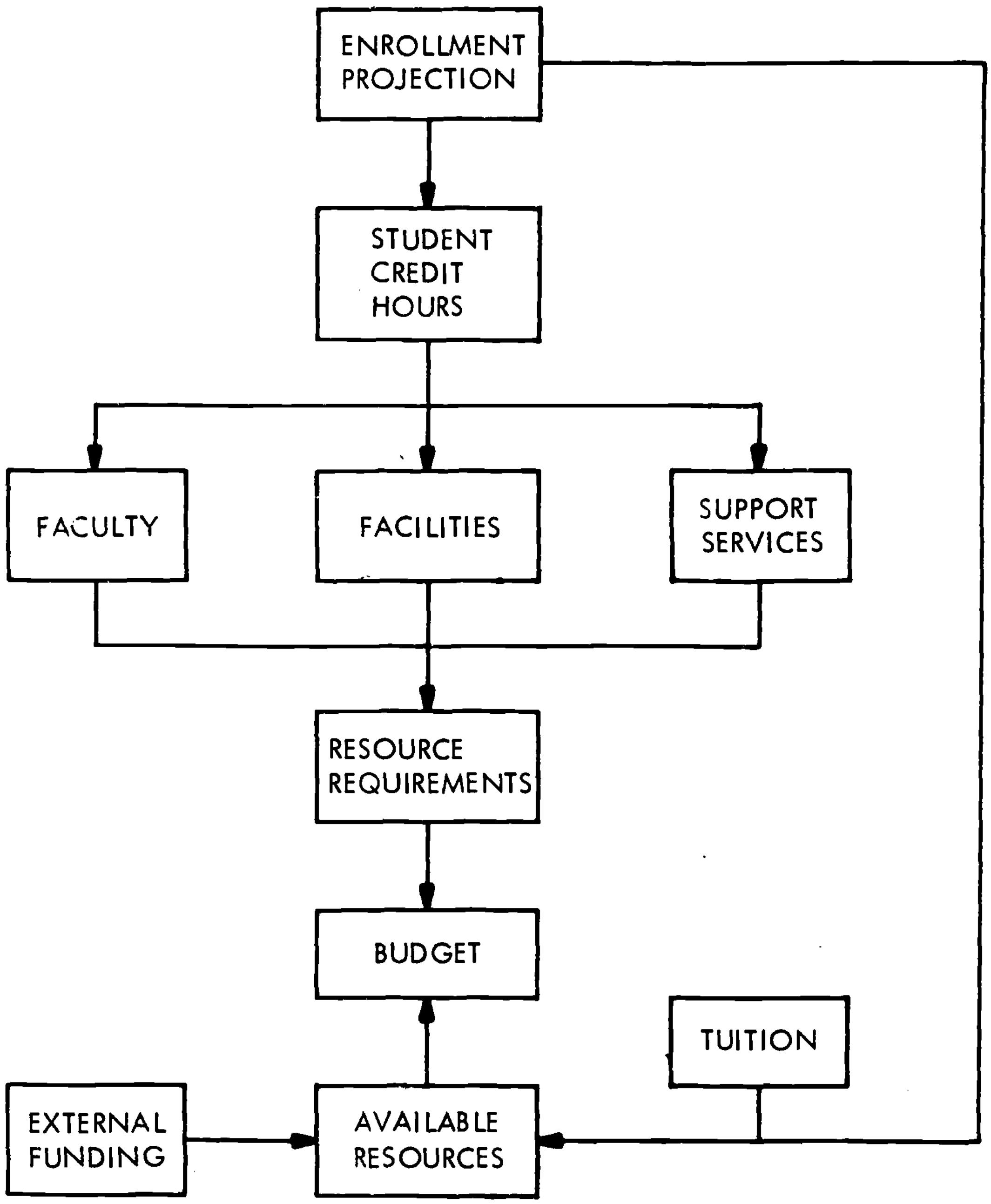
ENROLLMENT PROJECTION
STUDENT CREDIT HOURS
FACULTY
FACILITIES
SUPPORT SERVICES
RESOURCE REQUIREMENTS
BUDGET
TUITION
EXTERNAL FUNDING
AVAILABLE RESOURCES

Figure 21

An ICLM is a method of accounting for this interdependence among departments. An ICLM relates a student to the courses he can be expected to take and the departmental location of these courses. Once this is done for types of students (typically students by major field) a given enrollment projection by academic major can be translated into student credit requirements especially faculty.

The planner assumes that the pattern of courses taken by the different majors is more or less stable. While there are changes, they are not sudden and unexpected but can themselves be projected. If it happens that a planner finds a situation in which there is very little stability, he probably will be unable to make very meaningful projections.

An ICLM is generally developed out of a historical analysis. In a college with a tightly structured curriculum (high percentage of required courses with few options), it may be possible to determine adequate coefficients a priori, i.e., the average number of student credit hours by majors across data. This analysis involves calculating the student credit hours produced by each student level in each division. These are further divided by level of course offering. Averages are then computed and these become the coefficients.

C. Technique

1. Basic structure: The basic structure of an ICLM is that of a matrix. A matrix allows us to interrelate two dimensions of a phenomenon. In this case, the two dimensions are students and cost centers. The interrelationship takes the form of student credit hours. Figure 22 is an example of such a matrix. Across the top of the matrix are students by academic classification. The left side represents the departments in which students take courses. The intersections contain the number of student credit hours taken by that level of student in that particular department.

MATRIX OF TOTAL STUDENT CREDIT HOURS

	Freshmen	Sophomores	Juniors	Seniors	Special
Humanities	6,000	3,200	1,200	1,000	50
Social Science	2,000	4,800	2,400	2,000	50
Natural Science	4,000	2,400	3,000	2,750	50
Education	0	800	1,800	1,250	150
Fine Arts	3,000	600	600	500	0
Total	15,000	12,000	9,000	7,500	300

Freshmen	=	500
Sophomores	=	400
Juniors	=	300
Seniors	=	250
Special	=	50
Total	=	1,500

Figure 22

Figure 23 takes this basic structure and instead of looking at all students and total student credit hours, displays information about the typical student and the average student credit hours. While in Figure 22 the 500 freshmen too, 2,000 student credit hours in social science, Figure 23 shows that the average freshman takes 4 credit hours in the social science department. This is a "factor" which can be applied to any number of students in order to generate total student credit hours. An ICLM is the matrix which displays all these factors for whatever level of student and courses we select.

MATRIX OF AVERAGE STUDENT CREDIT HOURS (ANNUAL)

	Freshmen	Sophomores	Juniors	Seniors	Special
Humanities	12	8	4	4	1
Social Science	4	12	8	8	1
Natural Science	8	6	10	11	1
Education	0	2	6	5	3
Fine Arts	6	2	2	2	0
Total	30	30	30	30	6

Figure 23

2. Parameters:

a. Student level: The planner can specify the degree to which he will subdivide students. Typical schemes use the normal academic classifications. The following is an example:

freshmen
sophomores
juniors
seniors and fifth year undergraduate
graduate: master's level
graduate: doctorate level
special

b. Academic divisions: The planner must also specify the cost centers to which he wants to relate students. The typical choice, depending upon the size of the institution, is the academic department. These may be aggregated into divisions, colleges, and finally the university totals, again depending upon the size of the institution.

c. Course level: Within each academic division, the planner must decide what course levels he will use. The typical four-fold scheme is:

lower division
upper division
upper division/graduate
graduate only

Other distinctions are possible.

d. Student field of study: Since the courses a student takes are usually determined by his academic major, it is generally useful to look at students by their major field. While the first three parameters relate to the dimensions of an ICLM, the implication of the fourth is that an ICLM will be required for each type of student. The results of these several ICLM's are then aggregated for the institution.

3. Model versus data: An important question is whether the analytical model should conform to the program being analyzed or whether the program should conform to the model. Although this is similar to the chicken and the egg question, the first alternative is the better one particularly in the early phases of modeling and planning. The design of the model must also take into account the decision-making style of the college's administrators, the tradition of decision making, and the best estimate of the utilization to be made of the research results.

The crucial design decision deals with the level of detail or aggregation required in the data and thus in the model. There is no one correct answer to this question. The level used takes into consideration institutional size, stability of student mix, nature of data itself, budgeting system, and resources available for research effort.

D. Micro-Model

1. Input: The Induced Course Load Matrix presented in figure 24 is used to develop student credit hour demands for students in each major field. The complete worksheet will be calculated for accounting majors. Another complete worksheet will be filled in for biology majors; another for chemistry majors, and so on until all majors have been accounted for.

For each major to be analyzed, there are two types of input data:

a. Average student credit hours per student by department: This information can be developed either historically or a priori depending upon the local situation. See section III.F. following for a discussion of the source of this type of information. For each department listed on the left, there will be five entries corresponding to the five student classifications listed across the top. For example, if we are looking at history majors, we might enter the following on the line we have identified as English department: 6 6 3 3 2. That is, a freshman history major will take 6 credit hours in the English department. A sophomore history major will take 6 credit hours in English. A junior history major, 3 credits; a senior, 3; and a special student 2.

There will not necessarily be an entry for every department. The total line will carry the total number of credits usually carried by a major in the particular field in each year.

Lines 2 through 21 provide spaces for entering information for departments or disciplines. The user should identify each department expanding or contracting the worksheet to meet his particular situation.

b. Enrollment projection: For each major an enrollment projection should be inserted in Line 23. This enrollment projection will be for one time period but must contain projections corresponding to the student classifications listed at the head of the worksheet. Again using the example of history majors, the relevant projection might be 100 freshman history majors, 95 sophomore history majors, 75 junior history majors, 70 senior history majors, and 10 special student history majors. Each major being considered plus the group undecided on a major will require an enrollment projection.

2. Process: The calculations to be performed are all listed on the worksheet. One worksheet needs to be completed for each major. Thus if a college offers 25 academic majors, twenty-five worksheets will be needed, one for each major. There may be need for one additional worksheet to account for those students who are undecided about their major field. Each worksheet will deal with the instructional load placed on all departments by each major.

3. Output: The output of these worksheets will be a matrix showing the total student credit hours demanded by each major in all departments. (Lines 25 through 45 in each completed worksheet.) These results are then added to determine the total instructional demand on all departments, i.e., the total student credit hours (column "Total") credit hour production for each department for the time period under consideration. This becomes input to further planning for resource allocation.

This series of multi-worksheet manipulations must be carried out for each time period. Each time period requires a new enrollment projection. The coefficients (average credit hours per student) may also change through time but this is not likely to be significant in the short run.

E. Case Study

The techniques discussed above have been applied to a set of data. This application could have been conducted manually using the worksheets and directions given in Section D. The same tasks, however, can be accomplished in the PLANTRAN system. The computer not only increases the speed and accuracy of the calculations but, with the PLANTRAN system, also permits easy modification.

Figure 25 shows the PLANTRAN system input required to conduct the analysis. Figure 26 presents the "Analysis of Planning Matrix," a unique, self-documenting feature of PLANTRAN which displays data input, instructions, calculations, and results. Figure 27 shows the summary report output.

INDUCED COURSE LOAD MATRIX WORKSHEET

Major: ____________

No.	Item	Source	Student Classification 1	2	3	4	5	Total
* 1	Average Credit Hours	Per Student	___	___	___	___	___	___
* 2	Department ________	Input	___	___	___	___	___	___
* 3	Department ________	Input	___	___	___	___	___	___
* 4	Department ________	Input	___	___	___	___	___	___
* 5	Department ________	Input	___	___	___	___	___	___
* 6	Department ________	Input	___	___	___	___	___	___
* 7	Department ________	Input	___	___	___	___	___	___
* 8	Department ________	Input	___	___	___	___	___	___
* 9	Department ________	Input	___	___	___	___	___	___
*10	Department ________	Input	___	___	___	___	___	___
*11	Department ________	Input	___	___	___	___	___	___
*12	Department ________	Input	___	___	___	___	___	___
*13	Department ________	Input	___	___	___	___	___	___
*14	Department ________	Input	___	___	___	___	___	___
*15	Department ________	Input	___	___	___	___	___	___
*16	Department ________	Input	___	___	___	___	___	___
*17	Department ________	Input	___	___	___	___	___	___
*18	Department ________	Input	___	___	___	___	___	___
*19	Department ________	Input	___	___	___	___	___	___
*20	Department ________	Input	___	___	___	___	___	___

* Input items, see section III. D. 1.

Figure 24

INDUCED COURSE LOAD MATRIX WORKSHEET (CONT'D)

No.	Item	Source	Student Classification 1	2	3	4	5	Total
*21	Department____	Input	___	___	___	___	___	___
*22	Total	Input	___	___	___	___	___	___
*23	Enrollment Projection	Input	___	___	___	___	___	___
	Student Credit Hours by Department							
25	Department____	L23 x L2; Sum Col 1-5	___	___	___	___	___	___
26	Department____	L23 x L3; Sum Col 1-5	___	___	___	___	___	___
27	Department____	L23 x L4; Sum Col 1-5	___	___	___	___	___	___
28	Department____	L23 x L5; Sum Col 1-5	___	___	___	___	___	___
29	Department____	L23 x L6; Sum Col 1-5	___	___	___	___	___	___
30	Department____	L23 x L7; Sum Col 1-5	___	___	___	___	___	___
31	Department____	L23 x L8; Sum Col 1-5	___	___	___	___	___	___
32	Department____	L23 x L9; Sum Col 1-5	___	___	___	___	___	___
33	Department____	L23 x L10; Sum Col 1-5	___	___	___	___	___	___
34	Department____	L23 x L11; Sum Col 1-5	___	___	___	___	___	___
35	Department____	L23 x L12; Sum Col 1-5	___	___	___	___	___	___
36	Department____	L23 x L13; Sum Col 1-5	___	___	___	___	___	___
37	Department____	L23 x L14; Sum Col 1-5	___	___	___	___	___	___

* Input item, see section III. D. 1.

Figure 24 (Continued)

INDUCED COURSE LOAD MATRIX WORKSHEET (CONT'D)

No.	Item	Source	Student Classification 1	2	3	4	5	Total
38	Department ______	L23 x 15; Sum Col 1-5	___	___	___	___	___	___
39	Department ______	L23 x 16; Sum Col 1-5	___	___	___	___	___	___
40	Department ______	L23 x 17; Sum Col 1-5	___	___	___	___	___	___
41	Department ______	L23 x 18; Sum Col 1-5	___	___	___	___	___	___
42	Department ______	L23 x 19; Sum Col 1-5	___	___	___	___	___	___
43	Department ______	L23 x 20; Sum Col 1-5	___	___	___	___	___	___
44	Department ______	L23 x 21; Sum Col 1-5	___	___	___	___	___	___
45	Total	Sum of Lines 25-44	___	___	___	___	___	___

Figure 24 (Concluded)

PLANTRAN II DATA SHEET

NAME ______________ PAGE 1 OF 5 MRI

IDENTIFICATION

ORGANIZATION	MODEL DESCRIPTION	DATE	BASE PERIOD	T	H	R	RUN NO
EXAMPLE	I C L M	CURRENT DATE	0	T	H		

T - TIME PERIOD
H - HEADING
R - REPLACEMENT

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	PERIOD 5	PERIOD 6	PERIOD 7	PERIOD 8	PERIOD 9	PERIOD 10	PERIOD 11	PERIOD 12
FROSH	SOPH	JUNIOR	SENIOR	SPEC	TOTAL						

MODEL SPECIFICATION

LINE NO.	PLANNING ITEM	BASE LEVEL	FREEFORM METHOD OF COMPUTATION
1	CREDIT HOURS PER STUDENT		HEADING
2	ACCOUNTING DEPARTMENT		DATA 0
3	BIOLOGY DEPARTMENT		DATA 2,,,,,2
4	BUSINESS DEPARTMENT		DATA 0,
5	CHEMISTRY DEPARTMENT		DATA 2,,,,,2
6	CLASSICS DEPARTMENT		DATA 1,1.5,1,,,3.5
7	ECONOMICS DEPARTMENT		DATA .5,3,,,,,3.5
8	EDUCATION DEPARTMENT		DATA ,1.5,3,3,1,,8.5
9	ENGINEERING DEPARTMENT		DATA 0
10	ENGLISH DEPARTMENT		DATA 6,6,12,15,4,43
11	FRENCH DEPARTMENT		DATA 8,6,3,3,,20
12	GERMAN DEPARTMENT		DATA 3,3,1,1,,8
13	HISTORY DEPARTMENT		DATA 6,3,6,6,21
14	MATHEMATICS DEPARTMENT		DATA .5,,,,,.5
15	PHILOSOPHY DEPARTMENT		DATA 1,2,2,2,,7
16	PHYSICS DEPARTMENT		DATA 0
17	POLITICAL SCIENCE DEPT		DATA ,1,,,,1
18	PSYCHOLOGY DEPARTMENT		DATA ,1,,,,1

SUMMARY REPORTS

REPORT TITLE	FREEFORM REPORT LINES

Figure 2

NAME ______

PLANTRAN II DATA SHEET

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MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO. (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
19	SOCIOLOGY DEPARTMENT		DATA 0
20	SPEECH DEPARTMENT		DATA ,2,2,,,4
21	TOTAL		SUM OF 2,3,4,5,6,7,8,9,10,11,12,13,14 C
			15,44
22	ENROLLMENT 1972-1973		DATA 130,115,100,101,20
23	STUDENT CREDIT HOURS		HEADING
24	ACCOUNTING DEPARTMENT		EQUATION: L22*L2
25	BIOLOGY DEPARTMENT		EQUATION: L22*L3
26	BUSINESS DEPARTMENT		EQUATION: L22*L4
27	CHEMISTRY DEPARTMENT		EQUATION: L22*L5
28	CLASSICS DEPARTMENT		EQUATION: L22*L6
29	ECONOMICS DEPARTMENT		EQUATION: L22*L7
30	EDUCATION DEPARTMENT		EQUATION: L22*L8
31	ENGINEERING DEPARTMENT		EQUATION: L22*L9
32	ENGLISH DEPARTMENT		EQUATION: L22*L10
33	FRENCH DEPARTMENT		EQUATION: L22*L11
34	GERMAN DEPARTMENT		EQUATION: L22*L12
35	HISTORY DEPARTMENT		EQUATION: L22*L13

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)

Figure 25 (Continued)

NAME ____________

PLANTRAN II DATA SHEET

PAGE 3 OF 5 MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD T (57–60)	H (61–63)	R (65)	T - TIME PERIOD, H - HEADING, R - REPLACEMENT	RUN NO. (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–44, 45–80)
36	MATHEMATICS DEPARTMENT		EQUATION: L22*L14
37	PHILOSOPHY DEPARTMENT		EQUATION: L22*L15
38	PHYSICS DEPARTMENT		EQUATION: L22*L16
39	POLITICAL SCIENCE DEPT		EQUATION: L22*L17
40	PSYCHOLOGY DEPARTMENT		EQUATION: L22*L18
41	SOCIOLOGY DEPARTMENT		EQUATION: L22*L19
42	SPEECH DEPARTMENT		EQUATION: L22*L20
43	TOTAL		EQUATION: L22*L21
44	WORK		SUM OF 16,17,18,19,20
45	WORK LINE		ACCUMULATIVE SUM OF LINE 24
46	WORK LINE		ACCUMULATIVE SUM OF LINE 25
47	WORK LINE		ACCUMULATIVE SUM OF LINE 26
48	WORK LINE		ACCUMULATIVE SUM OF LINE 27
49	WORK LINE		ACCUMULATIVE SUM OF LINE 28
50	WORK LINE		ACCUMULATIVE SUM OF LINE 29
51	WORK LINE		ACCUMULATIVE SUM OF LINE 30
52	WORK LINE		ACCUMULATIVE SUM OF LINE 31
53	WORK LINE		ACCUMULATIVE SUM OF LINE 32

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)

Figure 25 (Continued)

NAME ____________

PLANTRAN II DATA SHEET

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IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
54	WORK LINE		ACCUMULATIVE SUM OF LINE 33
55	WORK LINE		ACCUMULATIVE SUM OF LINE 34
56	WORK LINE		ACCUMULATIVE SUM OF LINE 35
57	WORK LINE		ACCUMULATIVE SUM OF LINE 36
58	WORK LINE		ACCUMULATIVE SUM OF LINE 37
59	WORK LINE		ACCUMULATIVE SUM OF LINE 38
60	WORK LINE		ACCUMULATIVE SUM OF LINE 39
61	WORK LINE		ACCUMULATIVE SUM OF LINE 40
62	WORK LINE		ACCUMULATIVE SUM OF LINE 41
63	WORK LINE		ACCUMULATIVE SUM OF LINE 42
64	WORK LINE		ACCUMULATIVE SUM OF LINE 43
65	ACCOUNTING DEPARTMENT		EQUATION: L85 * L45 + L24
66	BIOLOGY DEPARTMENT		EQUATION: L85 * L46 + L25
67	BUSINESS DEPARTMENT		EQUATION: L85 * L47 + L26
68	CHEMISTRY DEPARTMENT		EQUATION: L85 * L48 + L27
69	CLASSICS DEPARTMENT		EQUATION: L85 * L49 + L28
70	ECONOMICS DEPARTMENT		EQUATION: L85 * L50 + L29
71	EDUCATION DEPARTMENT		EQUATION: L85 * L51 + L30

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)

Figure 25 (Continued)

NAME ____________

PLANTRAN II DATA SHEET

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MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO. (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
72	ENGINEERING DEPARTMENT		EQUATION: L85 * L52 + L31
73	ENGLISH DEPARTMENT		EQUATION: L85 * L53 + L32
74	FRENCH DEPARTMENT		EQUATION: L85 * L54 + L33
75	GERMAN DEPARTMENT		EQUATION: L85 * L55 + L34
76	HISTORY DEPARTMENT		EQUATION: L85 * L56 + L35
77	MATHEMATICS DEPARTMENT		EQUATION: L85 * L57 + L36
78	PHILOSOPHY DEPARTMENT		EQUATION: L85 * L58 + L37
79	PHYSICS DEPARTMENT		EQUATION: L85 * L59 + L38
80	POLITICAL SCI DEPT		EQUATION: L85 * L60 + L39
81	PSYCHOLOGY DEPARTMENT		EQUATION: L85 * L61 + L40
82	SOCIOLOGY DEPARTMENT		EQUATION: L85 * L62 + L41
83	SPEECH DEPARTMENT		EQUATION: L85 * L63 + L42
84	TOTAL		EQUATION: L85 * L64 + L43
85	MASK		DATA ,,,,,1

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)
OVERVIEW LINES	1-85
ENGLISH MAJOR I: LM	$1, 23, 65-84

Figure 25 (Concluded)

EXAMPLE
I C L M
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE
BASE YR. 0

USER SUPPLIED HEADING   FRCSH   SOPH   JUNIOR   SENIOR   SPEC   TOTAL

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
1	CREDIT HOURS PER STUDENT		HEADING
2	ACCOUNTING DEPARTMENT		DATA 0
3	BIOLOGY DEPARTMENT		DATA 2,,,,,2
4	BUSINESS DEPARTMENT		DATA 0,
5	CHEMISTRY DEPARTMENT		DATA 2,,,,,2
6	CLASSICS DEPARTMENT		DATA 1,1.5,1,,,3.5
7	ECONOMICS DEPARTMENT		DATA .5,3,,,,3.5
8	EDUCATION DEPARTMENT		DATA ,1.5,3,3,1,,8.5
9	ENGINEERING DEPARTMENT		DATA 0
10	ENGLISH DEPARTMENT		DATA 6,6,12,15,4,43
11	FRENCH DEPARTMENT		DATA 8,6,3,3,,20
12	GERMAN DEPARTMENT		DATA 3,3,1,1,,8
13	HISTORY DEPARTMENT		DATA 6,3,6,6,,21
14	MATHEMATICS DEPARTMENT		DATA .5,,,,,.5
15	PHILOSOPHY DEPARTMENT		DATA 1,2,2,2,,7
16	PHYSICS DEPARTMENT		DATA 0
17	POLITICAL SCIENCE DEPT		DATA ,1,,,,1
18	PSYCHOLOGY DEPARTMENT		DATA ,1,,,,1

Figure 26

EXAMPLE
I C L M
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 0

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
19	SOCIOLOGY DEPARTMENT		DATA 0
20	SPEECH DEPARTMENT		DATA ,2,2,,,4
21	TOTAL		SUM OF 2,3,4,5,6,7,8,9,10,11,12,13,14,C 15,44
22	ENROLLMENT 1972-1973		DATA 130,115,100,101,20
23	STUDENT CREDIT HOURS		HEADING
24	ACCOUNTING DEPARTMENT		EQUATION: L22 * L2
25	BIOLOGY DEPARTMENT		EQUATION: L22 * L3
26	BUSINESS DEPARTMENT		EQUATION: L22 * L4
27	CHEMISTRY DEPARTMENT		EQUATION: L22 * L5
28	CLASSICS DEPARTMENT		EQUATION: L22 * L6
29	ECONOMICS DEPARTMENT		EQUATION: L22 * L7
30	EDUCATION DEPARTMENT		EQUATION: L22 * L8
31	ENGINEERING DEPARTMENT		EQUATION: L22 * L9
32	ENGLISH DEPARTMENT		EQUATION: L22 * L10
33	FRENCH DEPARTMENT		EQUATION: L22 * L11
34	GERMAN DEPARTMENT		EQUATION: L22 * L12
35	HISTORY DEPARTMENT		EQUATION: L22 * L13
36	MATHEMATICS DEPARTMENT		EQUATION: L22 * L14
37	PHILOSOPHY DEPARTMENT		EQUATION: L22 * L15

Figure 26 (Continued)

EXAMPLE
I C L M
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 0

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
38	PHYSICS DEPARTMENT		EQUATION: L22 * L16
39	POLITICAL SCIENCES DEPT		EQUATION: L22 * L17
40	PSYCHOLOGY DEPARTMENT		EQUATION: L22 * L18
41	SOCIOLOGY DEPARTMENT		EQUATION: L22 * L19
42	SPEECH DEPARTMENT		EQUATION: L22 * L20
43	TOTAL		EQUATION: L22 * L21
44	WORK		SUM OF 16,17,18,19,20
45	WORK LINE		ACCUMULATIVE SUM OF LINE 24
46	WORK LINE		ACCUMULATIVE SUM OF LINE 25
47	WORK LINE		ACCUMULATIVE SUM OF LINE 26
48	WORK LINE		ACCUMULATIVE SUM OF LINE 27
49	WORK LINE		ACCUMULATIVE SUM OF LINE 28
50	WORK LINE		ACCUMULATIVE SUM OF LINE 29
51	WORK LINE		ACCUMULATIVE SUM OF LINE 30
52	WORK LINE		ACCUMULATIVE SUM OF LINE 31
53	WORK LINE		ACCUMULATIVE SUM OF LINE 32
54	WORK LINE		ACCUMULATIVE SUM OF LINE 33
55	WORK LINE		ACCUMULATIVE SUM OF LINE 34
56	WORK LINE		ACCUMULATIVE SUM OF LINE 35

Figure 26 (Continued)

EXAMPLE I C L M RUN	ANALYSIS OF MATRIX FOR A 6 PERIOD FORECAST	CURRENT DATE BASE YR. 0

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
57	WORK LINE		ACCUMULATIVE SUM OF LINE 36
58	WORK LINE		ACCUMULATIVE SUM OF LINE 37
59	WORK LINE		ACCUMULATIVE SUM OF LINE 38
60	WORK LINE		ACCUMULATIVE SUM OF LINE 39
61	WORK LINE		ACCUMULATIVE SUM OF LINE 40
62	WORK LINE		ACCUMULATIVE SUM OF LINE 41
63	WORK LINE		ACCUMULATIVE SUM OF LINE 42
64	WORK LINE		ACCUMULATIVE SUM OF LINE 43
65	ACCOUNTING DEPARTMENT		EQUATION: L85 * L45 + L24
66	BIOLOGY DEPARTMENT		EQUATION: L85 * L46 + L25
67	BUSINESS DEPARTMENT		EQUATION: L85 * L47 + L26
68	CHEMISTRY DEPARTMENT		EQUATION: L85 * L48 + L27
69	CLASSICS DEPARTMENT		EQUATION: L85 * L49 + L28
70	ECONOMICS DEPARTMENT		EQUATION: L85 * L50 + L29
71	EDUCATION DEPARTMENT		EQUATION: L85 * L51 + L30
72	ENGINEERING DEPARTMENT		EQUATION: L85 * L52 + L31
73	ENGLISH DEPARTMENT		EQUATION: L85 * L53 + L32
74	FRENCH DEPARTMENT		EQUATION: L85 * L54 + L33
75	GERMAN DEPARTMENT		EQUATION: L85 * L55 + L34

Figure 26 (Continued)

EXAMPLE
I C L M
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 0

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
76	HISTORY DEPARTMENT		EQUATION: L85 * L56 + L35
77	MATHEMATICS DEPARTMENT		EQUATION: L85 * L57 + L36
78	PHILOSOPHY DEPARTMENT		EQUATION: L85 * L58 + L37
79	PHYSICS DEPARTMENT		EQUATION: L85 * L59 + L38
80	POLITICAL SCI DEPT		EQUATION: L85 * L60 + L39
81	PSYCHOLOGY DEPT		EQUATION: L85 * L61 + L40
82	SOCIOLOGY DEPT		EQUATION: L85 * L62 + L41
83	SPEECH DEPARTMENT		EQUATION: L85 * L63 + L42
84	TOTAL		EQUATION: L85 * L64 + L43
85	MASK		DATA......1

Figure 26 (Continued)

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THE FOLLOWING REPORTS ARE REQUESTED
OVERVIEW LINES                       1-85
ENGLISH MAJOR ICLM                   S1,23,65-84
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Figure 26 (Concluded)

EXAMPLE
I C L M

OVERVIEW LINES

CURRENT DATE

LINE NO.	PLANNING ITEM	FROSH	SOPH	JUNIOR	SENIOR	SPEC	TOTAL
1				CREDIT HOURS PER STUDENT			
2	ACCOUNTING DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
3	BIOLOGY DEPARTMENT	2.00	0.0	0.0	0.0	0.0	2.00
4	BUSINESS DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
5	CHEMISTRY DEPARTMENT	2.00	0.0	0.0	0.0	0.0	2.00
6	CLASSICS DEPARTMENT	1.00	1.50	1.00	0.0	0.0	3.50
7	ECONOMICS DEPARTMENT	0.50	3.00	0.0	0.0	0.0	3.50
8	EDUCATION DEPARTMENT	0.0	1.50	3.00	3.00	1.00	0.0
9	ENGINEERING DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
10	ENGLISH DEPARTMENT	6.00	6.00	12.00	15.00	4.00	43.00
11	FRENCH DEPARTMENT	8.00	6.00	3.00	3.00	0.0	20.00
12	GERMAN DEPARTMENT	3.00	3.00	1.00	1.00	0.0	8.00
13	HISTORY DEPARTMENT	6.00	3.00	6.00	6.00	0.0	21.00
14	MATHEMATICS DEPARTMENT	0.50	0.0	0.0	0.0	0.0	0.50
15	PHILOSOPHY DEPARTMENT	1.00	2.00	2.00	2.00	0.0	7.00
16	PHYSICS DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
17	POLITICAL SCIENCE DEPT	0.0	1.00	0.0	0.0	0.0	1.00
18	PSYCHOLOGY DEPARTMENT	0.0	1.00	0.0	0.0	0.0	1.00
19	SOCIOLOGY DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
20	SPEECH DEPARTMENT	0.0	2.00	2.00	0.0	0.0	4.00
21	TOTAL	30.00	30.00	30.00	30.00	5.00	116.50
22	ENROLLMENT 1972-1973	130.00	115.00	100.00	101.00	20.00	0.0
23				STUDENT CREDIT HOURS			

Figure 27

EXAMPLE
I C L M

OVERVIEW LINES

CURRENT DATE

LINE NO.	PLANNING ITEM	FROSH	SOPH	JUNIOR	SENIOR	SPEC	TOTAL
24	ACCOUNTING DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
25	BIOLOGY DEPARTMENT	260.00	0.0	0.0	0.0	0.0	0.0
26	BUSINESS DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
27	CHEMISTRY DEPARTMENT	260.00	0.0	0.0	0.0	0.0	0.0
28	CLASSICS DEPARTMENT	130.00	172.50	100.00	0.0	0.0	0.0
29	ECONOMICS DEPARTMENT	65.00	345.00	0.0	0.0	0.0	0.0
30	EDUCATION DEPARTMENT	0.0	172.50	300.00	303.00	20.00	0.0
31	ENGINEERING DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
32	ENGLISH DEPARTMENT	780.00	690.00	1200.00	1515.00	80.00	0.0
33	FRENCH DEPARTMENT	1040.00	690.00	300.00	303.00	0.0	0.0
34	GERMAN DEPARTMENT	390.00	345.00	100.00	101.00	0.0	0.0
35	HISTORY DEPARTMENT	780.00	345.00	600.00	606.00	0.0	0.0
36	MATHEMATICS DEPARTMENT	65.00	0.0	0.0	0.0	0.0	0.0
37	PHILOSOPHY DEPARTMENT	130.00	230.00	200.00	202.00	0.0	0.0
38	PHYSICS DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
39	POLITICAL SCIENCES DEPT	0.0	115.00	0.0	0.0	0.0	0.0
40	PSYCHOLOGY DEPARTMENT	0.0	115.00	0.0	0.0	0.0	0.0
41	SOCIOLOGY DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
42	SPEECH DEPARTMENT	0.0	230.00	200.00	0.0	0.0	0.0
43	TOTAL	3900.00	3450.00	3000.00	3030.00	100.00	0.0
44	WORK	0.0	4.00	2.00	0.0	0.0	6.00
45	WORK LINE	0.0	0.0	0.0	0.0	0.0	0.0
46	WORK LINE	260.00	260.00	260.00	260.00	250.00	260.00

Figure 27 (Continued)

EXAMPLE
I C L M

OVERVIEW LINES

CURRENT LATE RUN

LINE NO.	PLANNING ITEM	FROSH	SOPH	JUNIOR	SENIOR	SPEC	TOTAL
47	WORK LINE	0.0	0.0	0.0	0.0	0.0	0.0
48	WORK LINE	260.00	260.00	260.00	260.00	260.00	260.00
49	WORK LINE	130.00	302.50	402.50	402.50	402.50	402.50
50	WORK LINE	65.00	410.00	410.00	410.00	410.00	410.00
51	WORK LINE	0.0	172.50	472.50	775.50	795.50	795.50
52	WORK LINE	0.0	0.0	0.0	0.0	0.0	0.0
53	WORK LINE	780.00	1470.00	2670.00	4185.00	4265.00	4265.00
54	WORK LINE	1040.00	1730.00	2030.00	2333.00	2333.00	2333.00
55	WORK LINE	390.00	735.00	835.00	936.00	936.00	936.00
56	WORK LINE	780.00	1125.00	1725.00	2331.00	2331.00	2331.00
57	WORK LINE	65.00	65.00	65.00	65.00	65.00	65.00
58	WORK LINE	130.00	360.00	560.00	762.00	762.00	762.00
59	WORK LINE	0.0	0.0	0.0	0.0	0.0	0.0
60	WORK LINE	0.0	115.00	115.00	115.00	115.00	115.00
61	WORK LINE	0.0	115.00	115.00	115.00	115.00	115.00
62	WORK LINE	0.0	0.0	0.0	0.0	0.0	0.0
63	WORK LINE	0.0	230.00	430.00	430.00	430.00	430.00
64	WORK LINE	3900.00	7350.00	10350.00	13380.00	13440.00	13480.00
65	ACCOUNTING DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
66	BIOLOGY DEPARTMENT	260.00	0.0	0.0	0.0	0.0	260.00
67	BUSINESS DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
68	CHEMISTRY DEPARTMENT	260.00	0.0	0.0	0.0	0.0	260.00
69	CLASSICS DEPARTMENT	130.00	172.50	100.00	0.0	0.0	402.50

Figure 27 (Continued)

EXAMPLE
I C L M

OVERVIEW LINES

CURRENT DATE

LINE NO.	PLANNING ITEM	FROSH	SOPH	JUNIOR	SENIOR	SPEC	TOTAL
70	ECONOMICS DEPARTMENT	65.00	345.00	0.0	0.0	0.0	410.00
71	EDUCATION DEPARTMENT	0.0	172.50	300.00	303.00	20.00	795.50
72	ENGINEERING DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
73	ENGLISH DEPARTMENT	780.00	690.00	1200.00	1515.00	80.00	4265.00
74	FRENCH DEPARTMENT	1040.00	690.00	300.00	303.00	0.0	2333.00
75	GERMAN DEPARTMENT	390.00	345.00	100.00	101.00	0.0	936.00
76	HISTORY DEPARTMENT	780.00	345.00	600.00	606.00	0.0	2331.00
77	MATHEMATICS DEPARTMENT	65.00	0.0	0.0	0.0	0.0	65.00
78	PHILOSOPHY DEPARTMENT	130.00	230.00	200.00	202.00	0.0	762.00
79	PHYSICS DEPARTMENT	0.0	0.0	0.0	0.0	0.0	0.0
80	POLITICAL SCI DEPT	0.0	115.00	0.0	0.0	0.0	115.00
81	PSYCHOLOGY DEPT	0.0	115.00	0.0	0.0	0.0	115.00
82	SOCIOLOGY DEPT	0.0	0.0	0.0	0.0	0.0	0.0
83	SPEECH DEPARTMENT	0.0	230.00	200.00	0.0	0.0	430.00
84	TOTAL	3900.00	3450.00	3000.00	3030.00	100.00	13480.00
85	MASK	0.0	0.0	0.0	0.0	0.0	1.00

Figure 27 (Continued)

EXAMPLE I . . M — ENGLISH MAJOR ITEM — CURRENT DATE

LINE NO.	PLANNING ITEM	FRESH	SOPH	JUNIOR	SENIOR	SPEC	TOTAL
23			STUDENT CREDIT HOURS				
65	ACCOUNTING DEPARTMENT	0	0	0	0	0	0
66	BIOLOGY DEPARTMENT	260	0	0	0	0	260
67	BUSINESS DEPARTMENT	0	0	0	0	0	0
68	CHEMISTRY DEPARTMENT	260	0	0	0	0	260
69	CLASSICS DEPARTMENT	130	173	100	0	0	403
70	ECONOMICS DEPARTMENT	65	345	0	0	0	410
71	EDUCATION DEPARTMENT	0	173	300	303	21	79[illegible]
72	ENGINEERING DEPARTMENT	0	0	0	0	0	0
73	ENGLISH DEPARTMENT	780	690	1200	1515	80	4265
74	FRENCH DEPARTMENT	1040	690	300	303	0	2333
75	GERMAN DEPARTMENT	390	345	100	101	0	936
76	HISTORY DEPARTMENT	780	345	600	606	0	2331
77	MATHEMATICS DEPARTMENT	65	0	0	0	0	65
78	PHILOSOPHY DEPARTMENT	130	230	200	202	0	762
79	PHYSICS DEPARTMENT	0	0	0	0	0	0
80	POLITICAL SCI DEPT	0	115	0	0	0	115
81	PSYCHOLOGY DEPT	0	115	0	0	0	115
82	SOCIOLOGY DEPT	0	0	0	0	0	0
83	SPEECH DEPARTMENT	0	230	200	0	0	430
84	TOTAL	3900	3450	3000	[illegible]030	100	13480

Figure 27 (Concluded)

F. Data Collection

The critical problem with the use of the ICLM methodology is the development of the input data. This can be done in two ways. First, the planner can use the results of historical analysis. Second, he can develop estimates of the values by using documentary materials.

The historical analysis involves the analysis of the courses taken by all students over the time periods selected by the planner. In a time period (generally an academic year) the planner needs to view the record of each student, classify the student by year and major, and then tally the credit hours taken by department. The results are then totaled for the entire enrollment. The result of this is the total student credit hours by department taken by freshman majors in all fields, sophomore majors in all fields, and so on. The averages are then computed by dividing the total student credits by the number of students generating them. These averages become the coefficients used as inputs to the ICLM.

This type of analysis is generally feasible only if the size of the student body is very small or if a computer can be used to analyze the data. In either case the effort will involve considerable time before good data will be available. To proceed with planning while that effort is under way, the planner can make estimates of the coefficients.

Most colleges have degree requirements. The tighter the curriculum is structured (i.e., the fewer the options open to the students) the easier it will be to estimate the actual load of students. For example, if all history majors must take 6 hours of English in their freshman year, we can enter 6 for the appropriate coefficient. In most curricula there are a number of such requirements. Such catalog documentation should be used to develop the coefficients where possible. When electives are prescribed or where there are simply no requirements, the planner can make estimates using his own judgment and his knowledge of the institution.

After this type of estimate has been completed, the results should be reviewed with the principal advisor for each major. His more specific information about what students actually take or the direction in which he and other advisors steer students can be used to modify the values entered earlier. These are still estimates but they will tend to be fairly close to reality and can be used for projections.

Institution: ____________
Completed by: ____________
Date: ____________

DATA COLLECTION DOCUMENT
INDUCED COURSE LOAD MATRIX

Data to be used for projecting student credit demand for majors in ____________ during the ____________ academic year.

Average Credits per Student	Freshman	Sophomore	Junior	Senior	Total
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Department ____________	____	____	____	____	____
Total	____	____	____	____	____
Enrollment Projection	____	____	____	____	____

Figure 28

DATA COLLECTION DOCUMENT
INDUCED COURSE LOAD MATRIX
(Sample)

Data to be used for projecting student credit demand for majors in ENGLISH during the 71-72 academic year.

Average Credits per Student	Freshman	Sophomore	Junior	Senior
Department ACCOUNTING	-	-	-	-
Department BIOLOGY	2	-	-	-
Department CHEMISTRY	2	-	-	-
Department CLASSICS	1	1.5	1	-
Department ECONOMICS	.5	3	-	-
Department EDUCATION	-	1.5	3	3
Department ENGLISH	6	6	12	15
Department FRENCH	8	6	3	3
Department GERMAN	3	3	1	1
Department HISTORY	6	3	6	6
⋮	⋮	⋮	⋮	⋮
Total	30	30	30	30
Enrollment Projection	130	115	100	101

Figure 29

The ideal situation is to conduct a historical analysis over the past ten years to accurately determine what these averages have been. This time series can be reviewed to determine change and develop bases for future projections. If this type of information is available in a college, it should obviously be used. However if it is not available, the planner should use the best available data and use his own judgment to determine whether a large research project is justified.

Figure 28 presents a data collection document for the input to the model. The data may be generated in either of the ways discussed above. Figure 29 presents a sample data collection document filled in.

G. Model Adaptation

No matter how good the data and no matter how sophisticated and precise the statistical methodology, as planners and decision makers review the projection results they will suggest changes. These changes will reflect recognition of constraints, distrust of projected values, a sense that the projections are not reasonable, a curosity to see what would happen if...? All of these concerns are important to the planner and modeller.

The interest in assessing the impact of alternative futures should be encouraged by the planner. In the area of the ICLM, the obvious area of interest is the implication of changes in the curriculum. What would the instructional load be for each department if we required more English of some students, less of others, and kept some the same? Once an ICLM has been set up and tested, this kind of question can be easily accommodated.

Changes in the model can be of two basic types. The structure of the model itself can be changed to more closely approximate the real situation. For example, it may turn out that the planner needs to look at student credit hour production by level of course, i.e., lower division, upper division, etc. This would necessitate a basic structural change in the initial model presented here.

The second type of change is the result of the application of informed judgment. Running the ICLM which shows the student credit hour production of a department rising to a level which decision makers think impossible will necessitate some changes in the values of the coefficients used. Thus without modifying the structure of the model, the values of key elements are changed and the results presented to decision makers.

IV. Faculty Planning

A. Relation to Overall Planning

After the planner has projected the number of students and the instructional demand created by these students, he is in a position to project the number of faculty required to deliver these services and their costs. This is faculty planning. In simple terms it is the translation of students into faculty members and the associated salary costs.

Figure 30 again presents the position of faculty planning in the overall planning effort. This is the most critical decision area but often the one in which the administrator or other decision makers have the least latitude. Development of the number of faculty required is only half the problem. The other is putting a price on these services. In economic terms the value of a product or service is determined by the price paid. In the case of faculty, the price is the salary paid by the college. This price allows us to translate numbers of faculty into dollars, a common unit of measurement.

Since the administrator often has a dollar amount which is the maximum amount available for faculty, this planning step usually involves the matching of required resources with available resources. If the administration believes it should have 100 faculty members to provide the instructional services demanded by the projected number of students and if their cost will exceed the money available for this purpose, the administration will either have to scale down the number of faculty needed, reduce the cost of the same number of faculty, or increase the amount of money available for this purpose. What is most likely is that all three alternatives will be tried simultaneously. Such compromises result from reviewing the consequences of different staffing levels and salary scales. These are compared to the money available. If there is still a gap, new levels are specified and the model solved again. This cycle of review and analysis is graphically displayed in Figure 30.

This type of review is central to the budget process and will be present in all types of decisions not just those relating to faculty. This makes clear the necessity of having a means of rapidly and accurately looking at a number of different alternatives involving varying levels of several variables so that the best possible decision can be made. This, of course, is the essence and advantage of simulation. A model can help assess the financial impact of a number of alternatives before the resources are committed. The planner is able to increase his control of the future by testing it out beforehand.

PLAN REFINING CYCLE

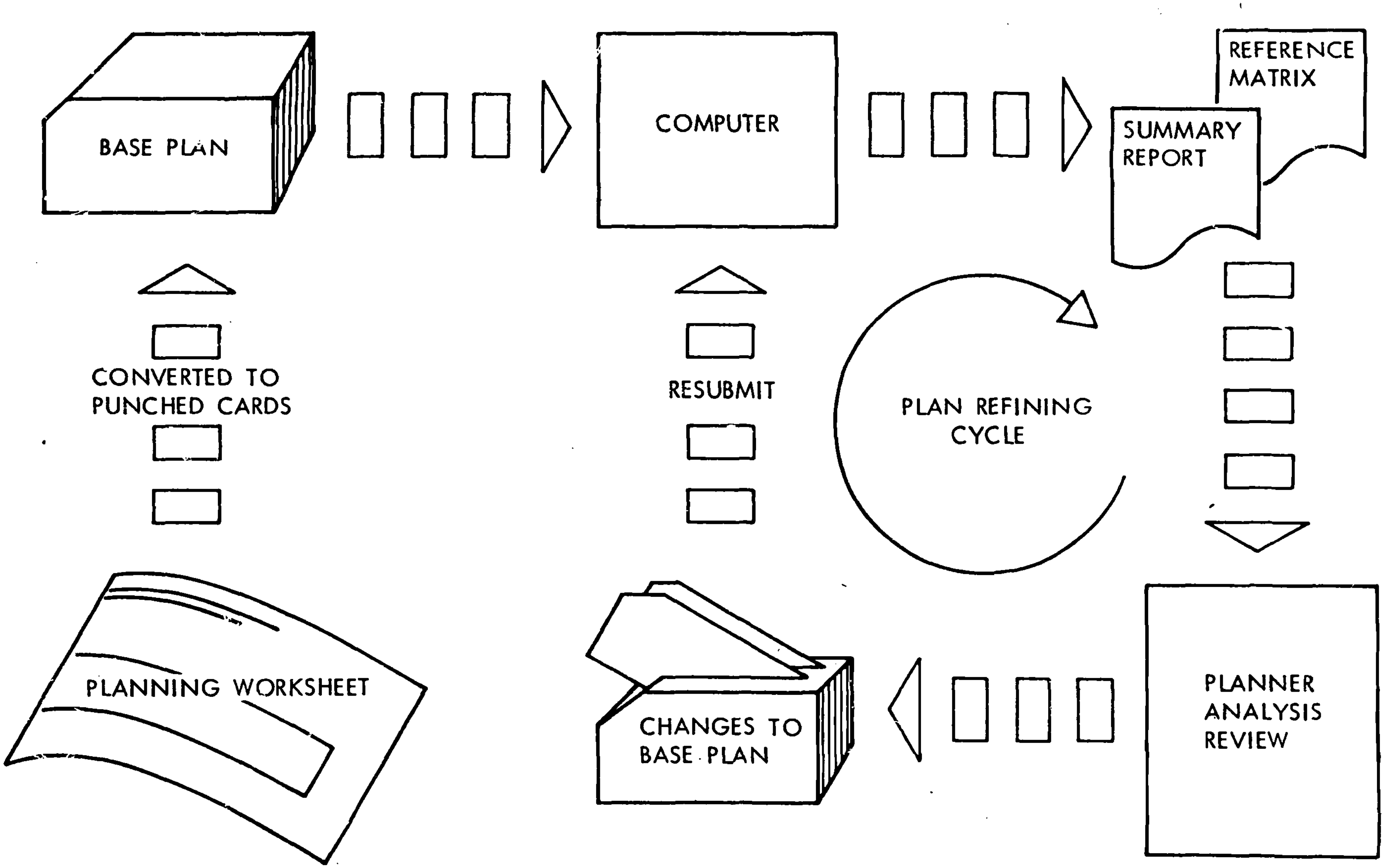

Figure 30

B. Theory of Faculty Planning

A college is a labor intensive enterprise. The biggest single expense item is salaries. Of this salary total, the largest single element and thus the one which has the largest impact on the total fiscal picture is instructional salaries. As a result, the method of determining the number of faculty is a highly sensitive variable. What appear to be small changes in the student-faculty ratio, for example, will have a significant impact on the total salary picture and the surplus-deficit.

The sensitivity of this variable underscores the importance of approaching staffing decisions in an organized, rational fashion. These decisions cannot be made in total isolation from their fiscal implications. If an administrator spends most of his time worrying about non-faculty costs and accepts the staffing decisions as given, he is devoting his energies to those items which have little impact and ignoring the decisions which significantly affect the overall fiscal condition of his institution.

In non-educational settings, salaries theoretically relate to productivity. As an individual produces more, he receives more compensation. This has not historically occurred in higher education. Over the last twenty years, there has been no significant change in the number of students instructed per faculty member. While there have been some qualitative changes, they are difficult to document and are not completely accepted even in theory.

At the same time that productivity has remained the same, faculty compensation has significantly increased. The resulting educational inflation has increased the cost of operation without reducing the unit cost. The solution has generally been to increase the total financing of the institution either by increasing charges to students or requesting increased funds from external sources or both.

There are constraints in dealing with faculty planning. The most visible is tenure. There are situations in which staff cannot be reduced even though analysis and reason indicate it should be. There are other less visible but almost equally strong constraints. The decision-making process of a college is not a simple one. Even though analysis and study indicate that staffing should be reduced, this cannot be implemented simply. Administrators find that the people to be eliminated have a voice in that very decision.

Standards set by external agencies are often constraints. These include the regional accrediting associations and the more narrow but often equally powerful discipline-oriented accrediting organizations. More general norms of academic respectability are also important. Of course, in the opposite direction, the amount of money available for salaries is also a constraint.

A theory of faculty planning must take into account these three factors. First, staffing is the critical input decision. Second, staffing should relate to productivity. Third, faculty planning must take constraints into account.

C. Techniques of Faculty Planning

Faculty planning is composed of two separate activities. First the planner needs to determine the number of faculty required to provide the educational services demanded by the projected enrollment. Second, the planner needs to determine the dollar cost of the staffing developed in step one. This section will briefly review some of the techniques for accomplishing both of these.

1. Number of faculty: The basic technique of determining the number of faculty involves the use of "factors" or "ratios." These factors are applied to enrollment projections under a variety of constraints to produce the number of faculty required. The following will discuss a number of such ratio methods as well as one non-ratio method.

a. Student-Faculty ratio: This is probably the best known and most widely used factor. For every x number of students there will be one faculty member. A student-faculty ratio of 20:1 says that for every 20 students (FTE) there will be one full-time equivalent faculty member. To develop the total number of faculty needed, then, the planner will divide the total number of projected FTE students by 20. The result will be the number of faculty required under a 20:1 student-faculty ratio. This technique can be applied to total enrollment as well as smaller units, such as the department. To develop FTE students for a department, divide the total student credit hours produced by the normal full-time load. The institutional total would then be an aggregate of all departmental totals.

b. Teaching load and class size: This ratio method allows the planner to introduce additional variables which are really components of the student-faculty ratio. The formula used here is

$$F = \frac{SCH}{CS \times TL}$$

where F = number of faculty

SCH = student credit hours
CS = class size
TL = teaching load

Student credit hours is a measure of the number of students and the amount of educational service they require. Class size and teaching load are constraints on the number of faculty needed to provide the services required. For example, if a college projected a total instructional demand of 54,000 student credit hours, wished to maintain an average teaching load of 18 (two semesters), it would require 100 FTE faculty. The result is as follows:

$$F = \frac{54000}{30 \times 18} = \frac{54000}{540} = 100$$

This is equivalent to a student-faculty ratio of 22.5 assuming a full-time student carries 24 credits per year.

c. Student credit hours: The student credit hour ratio is really equivalent to the student-faculty ratio. Instead of viewing students in full-time equivalents, this method views them in terms of student credit hours. A ratio of student credit hours per FTE faculty member is used to develop the number of faculty required. The advantage of this method over the student-faculty ratio is that often the student credit hour statistic is available while the FTE students may not be. This is often true for departmental and subunit analysis.

d. Student contact hours: (SConH) This method is a further elaboration of the student credit hour ratio. Instead of SCH it uses student contact hours. A student contact hour is produced when one student has contact with a faculty member for one hour per week. For example, a class that meets three hours per week and enrolls 50 students will produce 150 student contact hours. The supporters of this approach claim that contact hours is a "fairer" measure of faculty effort because it more directly measures the delivery of educational services than does a student credit hour.

There are some disciplines where there is a significant difference between the two. These will be departments with laboratories and other types of activities where a credit hour is equal to more than one contact hour. This method requires a ratio of student contact hours to faculty. The total number of projected student contact hours is then divided by the ratio to produce the number of faculty.

e. Program: This is a non-ratio technique in which the number of faculty is not directly related to the number of students or the educational services provided but rather to the demands of the academic program. This method is often used in the smaller college.

The argument runs thus. "We have decided to offer a major in chemistry. In order to offer a good major in chemistry, we need four faculty members: one in organic chemistry, one in inorganic, one in analytical, and one in physical chemistry. These four are needed regardless of the number of students enrolled in the department. Whether there is one major or 15 makes no difference because the type of educational experience required for one is the same as for the 15." Above certain enrollment levels, there may be some relationship between the number of students and the number of faculty.

f. Combination: This is a combination of the ratio and programmatic methods. Some of a department members needed simply to supply the educational services for one student required. The remaining are needed to supply the same services to additional students. The first group of faculty is equivalent to fixed operating expenses and the other to the variable operating costs. The first is not affected by the number of students while the second is.

This combination method is also used to take constraints, such as tenure, into account. There are some faculty members who simply cannot be released. The number of faculty needed is figured by the ratio method does not come into the decision area of an administrator until it exceeds that fixed number of faculty. At that point he has the option of adding faculty or maintaining the fixed number. The number of faculty can be calculated by a ratio or other method.

g. Composition by rank: Since college faculty are arranged by ranks, it is possible to determine the number of faculty by ranks: instructor, assistant professor, associate professor, and professor. In large institutions with sizable graduate programs, graduate assistants may also be included in the distribution. Since salary scales are usually determined by faculty ranks, changing compositions of rank can have an impact on the total amount of salary required.

While composition plans can be applied to departments and subunits, they usually are applied to the total faculty. A typical set of parameters is: professors will not exceed 40 percent of the total faculty; associate professors not less than 10 percent; assistant professors not more than 35 percent. In this case instructors will be the fall-out item determined by the three parameters. This type of plan can be used with any of the methods described above.

2. Faculty salary: Once the number of faculty has been determined, the planner needs to develop the associated dollar cost. The following section will review four techniques for this.

a. Average salary: This is probably the most widely used technique for computing faculty cost. It uses the following formula: total salaries = average salary x number of faculty. This straightforward technique can be used at any level of disaggregation as long as an average salary and the number of faculty involved can be specified. For example, this analysis can be applied on a departmental basis if there are projections of faculty by department and of average faculty salary by department.

If the cost projections are to be by ranks, this technique can be used as long as the number of faculty by ranks and an average faculty salary by ranks are projected. Historical data for this approach are usually easily available because the American Association of University Professors use this analytical framework.

This approach allows the planner to change the average salary in accord with internal and external financial constraints. This change is usually specified in percentage terms.

b. Base salary: This technique allows the planner to adjust two variables related to salary paid to the projected number of faculty: the base salary and the percentage of the base to be paid. For example, an institution may set a base salary of $14,000. This base will be increasing at 4 percent per year. Further, the faculty of the biology department are earning salaries which are 60 percent, 80 percent, and 81 percent of the base respectively. In the future the first will stay at 60 percent of base, the second will increase 0.5 per year, and the third will increase 1 per year. Since both the base and the percent of base can be changed, the actual salaries can be the result of choosing between a number of alternative futures examined.

This method can also be applied at any level--college, division, department--as long as the number of faculty can be projected (and the percent of base at which they will be paid). This method can be combined with the average salary method by relating the average salary to a base so that both the base and the percent of the base appropriate to the average can change.

c. Merit and cost of living increases: This method distinguishes between those changes in salary which are required to maintain the real dollar value of salary and those which are used to reflect the quality of job performance. The first type of change simply reflects changes in the cost of living so that next year's salary will have the same buying power as this year's. The merit increases are in addition to these and reflect promotions, extra effort, increased efficiency, heightened effectiveness, etc. These changes tend to be made on an individual basis while the former are made across the board.

The bases for merit changes in salary range from rather subjective and off-hand evaluations to fairly rigid calculations of productivity.

D. Micro-Model

1. Faculty analysis: Figure 31 presents the worksheets for conducting an analysis of faculty staffing patterns. By inserting the input data items and performing the indicated calculations, a planner will have an analysis of historic faculty staffing arrangements. They will put him in a better position to select methods of projecting future faculty needs.

a. Input: The input elements are Lines 1, 2, 4, 7, 12, 15, 16, 20, and 25. A description of these data elements and their probable sources follows:

Line 1: Student credit hours: They are a measure of instructional activity calculated by multiplying the number of students in a course by the credits assigned to that course and totaling the courses. They will be available from the Registrar's Office.

Line 2: Full-time equivalent (FTE) faculty: This item consists of full-time plus part-time faculty expressed in equivalent terms. The traditional method for computing the full-time equivalents of part-time faculty is to divide the teaching load of a part-time faculty member by the "individual" full-time load. For example, a faculty member teaching 6 credit hours at an institution where the normal full-time load is 12 credits is described at 0.5 FTE faculty member. This information will usually be available from the Registrar or the Academic Dean.

FACULTY PLANNING
HISTORIC ANALYSIS
WORKSHEET

Department: ______________

No.	Item	Source	66	67	68	69	70	71	72
			Academic Year Beginning In:						
* 1	Student Credit Hours (SCH)	Input							
* 2	FTE Faculty	Input							
3	Ratio: SCH/FTE Faculty	Line 1 ÷ Line 2							
* 4	Time Periods	Input							
5	Accumulated Ratio	Accumulate Values in Line 3							
6	Ave Ratio: SCH/FTE Faculty	Line 5 ÷ Line 4							
* 7	Average Credits Per Full Time Student	Input							
8	FTE Students	Line 1 ÷ Line 7							
9	Student-Faculty Ratio	Line 8 ÷ Line 2							
10	Accumulate Student-Faculty Ratio	Accumulate Values in Line 9							
11	Ave Student-Faculty Ratio	Line 10 ÷ Line 4							
*12	Faculty Teaching Load	Input							
13	Accumulate Faculty Teaching Load	Accumulate Values in Line 12							
14	Average Teaching Load	Line 13 ÷ Line 4							
*15	Registrations	Input							
*16	Number of Sections	Input							
17	Average Section Size	Line 15 ÷ Line 16							
18	Accumulated Average Section Size	Accumulate Values in Line 17							

* Input items: See section IV. D. 1.

Figure 31

FACULTY PLANNING HISTORIC ANALYSIS WORKSHEET (CONT'D)

No.	Item	Source	Academic Year Beginning In: 66	67	68	69	70	71	72
19	Mean Average Section Size	Line 18 ÷ Line 4	___	___	___	___	___	___	___
*20	Student Contact Hours	Input	___	___	___	___	___	___	___
21	Ratio: Student Contact Hours To Student Credit Hours	Line 20 ÷ Line 1	___	___	___	___	___	___	___
22	Accumulate Ratio	Accumulate Values in Line 21	___	___	___	___	___	___	___
23	Average Ratio: Student Contact Hours to Student Credit Hours	Line 22 ÷ Line 4	___	___	___	___	___	___	___
24	Ratio: Student Contact Hours to FTE Faculty	Line 20 ÷ Line 12	___	___	___	___	___	___	___
*25	Total Salaries	Input	___	___	___	___	___	___	___
26	Average Salary	Line 25 ÷ Line 2	___	___	___	___	___	___	___
27	Last Year's Ave Salary	Shift Values in Line 26 to the Right 1 Year	___	___	___	___	___	___	___
28	Pct Change in Average	(Line 26 - Line 27) Line 27	___	___	___	___	___	___	___
29	Accumulate Pct Change	Accumulate Values in Line 28	___	___	___	___	___	___	___
30	Ave Pct Change in Average Salary	Line 29 ÷ Line 31	___	___	___	___	___	___	___
*31	Time Periods	Input	___	___	___	___	___	___	___

* Input Items: see section IV. 1. [illegible]

Figure 31 (Concluded)

Line 4: Time periods: These are used to compute the moving averages and will correspond to the extent of the time period being analyzed.

Line 7: Average credits per full-time student: This statistic is used to convert student credit hours into FTE students. It is the average number of credits taken by full-time students. It will be available from the Registrar's Office.

Line 12: Faculty teaching load: This is the average number of credits taught by full-time faculty members. Most colleges have a published policy on teaching load. In some institutions this published standard is larger than the actual average teaching load. The actual rather than the published standard should be used. This information should be available either from the Registrar or the Academic Dean's Office.

Line 15: Registrations: This item consists of the total duplicated number of students enrolled in courses. For example, if a department offered four courses, the registrations would be equal to the total number of students enrolled in the four courses. This information is obtained from the Registrar.

Line 16: Number of sections: This is the total number of of credit sections. It should not be confused with courses. A course which is offered in four sections will be counted as four. This information is available from the Registrar.

Line 20: Student contact hours: They are a measure of the number of hours per week a student has scheduled contact with a faculty member. A course which enrolls 40 students and which is scheduled to meet four clock hours per week will produce 160 student contact hours. Notice that this is different from student credit hours which depend upon the number of credits carried by the course.

Line 25: Total salaries: This item consists of the total amount paid to the academic staff at the level of the department being analyzed. This information will usually be available from the business office.

Line 31: Time periods: These are used to compute the moving averages and will correspond to the extent of the time period being analyzed.

b. Output: The output of this faculty analysis will provide the planner with information on the following items in Figure 31.

Ratio of student credit hours to FTE faculty: Line 3 displays this ratio for each of the periods under analysis. Line 6 provides a running average of this item through time. The final entry in Line 6 is the average ratio over all the time periods.

Full-time equivalent students: Line 8 provides the number of full time equivalent students receiving instruction in the unit under consideration.

Student-faculty ratio: Line 9 displays the student-faculty ratio for each period. The average ratio for all the time periods is the last entry in Line 11.

Average faculty teaching load: The final value in Line 14 is the average teaching load over all the time periods.

Average section size: Line 17 displays the calculated average section size for each time period. The final value in Line 19 is the mean average section size for all time periods.

Ratio of student contact hours to student credit hours: Line 21 presents this ratio for each time period, and Line 23 presents the running average ratio. This is useful in estimating the student contact hours given the student credit hours.

Ratio of student contact hours to FTE faculty: Line 24 presents this ratio for each time period.

Average faculty salary: Line 26 displays the average faculty salary for each time period. Line 28 represents the annual percentage change in the average salary and Line 30 presents the running average of that percentage change.

2. Faculty planning projection: Figure 32 presents a framework for projecting the number and cost of faculty. There are five input items.

a. Input:

Student credit hours: This item comes from the enrollment projection and the induced course load matrix analysis. It can also be projected independently especially if a planner wants to investigate the impact of various levels of instructional activity.

Average credits per full-time student: This item comes from the analysis illustrated in figure 31. Again the planner can use the factors developed in that analysis or change the average to assess the impacts of changes.

Student-faculty ratio: The planner inserts the student-faculty ratio and his estimates of its future behavior. Typically the first estimates will be based on the analysis of historic information.

FTE faculty-base: This is the minimum number of faculty required for this department. This requirement may relate to programmatic issues, tenure, or other constraints.

Average faculty salary: On the basis of historic analysis and policy constraints, the planner enters this variable across the planning horizon.

b. Output: There are four major results of the analysis suggested in Figure 32.

FTE students: This calculation translates the student credit hour load in the department into FTE students.

FTE faculty-calculated: This is the number of faculty developed from applying the student-faculty ratio to the FTE students in the department.

FTE faculty-actual: This is the maximum of the calculated FTE faculty and the base faculty.

FACULTY PLANNING
PROJECTION

Department: ____________

No.	Item	Source	Academic Year Beginning In: 72	73	74	75	76	77	78
* 1	Student Credit Hours	Change By ____	____	____	____	____	____	____	____
* 2	Ave Credits Per Full Time Student	Change By ____	____	____	____	____	____	____	____
3	FTE Students	Line 1 ÷ Line 2	____	____	____	____	____	____	____
* 4	Student-Faculty Ratio	Change By ____	____	____	____	____	____	____	____
5	FTE Faculty-Calculated	Line 3 ÷ Line 4	____	____	____	____	____	____	____
* 6	FTE Faculty-Base	Change By ____	____	____	____	____	____	____	____
7	FTE Faculty-Actual	Maximum of Values in Lines 5 and 6	____	____	____	____	____	____	____
* 8	Ave Faculty Salary	Change By ____	____	____	____	____	____	____	____
9	Faculty Salaries	Line 7 x Line 8	____	____	____	____	____	____	____

* Input item: See section IV. D. 2.

Figure 32

Faculty salaries: This is the dollar cost developed by applying the average faculty salary to the actual number of FTE Faculty.

By repeating this projection procedure for each department in the college and then adding the results of Line 7 (FTE Actual) and Line 9 (Faculty Salaries) the planner will develop the number of faculty and their cost for the entire institution. Using appropriate subtotals, he may also show the totals for intermediate subdivisions of the institution.

E. Case Study

The techniques just discussed have been applied to a set of data. This application could have been done manually using the worksheets and directions given in Section D. The same analysis and projection, however, can be accomplished in the PLANTRAN system. The computer not only increases the speed and accuracy of the calculations but, with the PLANTRAN system, also permits easy moficiation of structure and assumptions.

1. Faculty planning analysis: Figure 33 shows the PLANTRAN system input required to conduct the analysis. Figure 34 presents the "Analysis of Planning Matrix." Figure 35 shows the summary report output.

2. Faculty planning projection: Figure 36 shows the system input required to conduct the projection described in Section D. Figure 37 presents the "Analysis of Planning Matrix." Figure 38 shows the summary report output.

While the example deals with only one department, the basic framework can be applied to all departments and the results aggregated for institutional totals.

PLANTRAN II DATA SHEET

NAME ____________ PAGE 1 OF 2 MRI

IDENTIFICATION

ORGANIZATION	MODEL DESCRIPTION	DATE	BASE PERIOD	T	H	R		RUN NO.
EXAMPLE	FACULTY ANALYSIS	CURRENT DATE	1966	T			T - TIME PERIOD H - HEADING R - REPLACEMENT	

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	PERIOD 5	PERIOD 6	PERIOD 7	PERIOD 8	PERIOD 9	PERIOD 10	PERIOD 11	PERIOD 12

MODEL SPECIFICATION

LINE NO.	PLANNING ITEM	BASE LEVEL	FREEFORM METHOD OF COMPUTATION
1	STUDENT CREDIT HOURS	6974	DATA 7401, 7216, 7240, 7304, 7319, 7240
2	FTE FACULTY	10	DATA 12, 12, 11, 11, 12, 12
3	RATIO SCH TO FTE FACULTY	697	EQUATION: L1/L2
4	AVE RATIO SCH / FTE FAC		AVERAGE LINE 3
5	AVE CREDITS / F-T STUDENT	30	DATA 29.8, 30.6, 30.2, 30, 30, 30.2
6	FTE STUDENTS	232	EQUATION: L1/L5
7	STUDENT-FACULTY RATIO	23.2	EQUATION: L6/L2
8	AVE STUDENT-FACULTY RAT		AVERAGE OF LINE 7
9	FACULTY TEACHING LOAD	22	DATA 21.8, 22.4, 22, 22.2, 21, 20.6
10	AVERAGE TEACHING LOAD		AVERAGE OF LINE 9
11	REGISTRATIONS	2327	DATA 2700, 2405, 2415, 2435, 2440, 2413
12	NUMBER OF SECTIONS	58	DATA 63, 62, 62, 63, 64, 64
13	AVERAGE SECTION SIZE		EQUATION: L11/L12
14	MEAN AVE SECTION SIZE		AVERAGE LINE 13
15	STUDENT CONTACT HOURS	6974	DATA 7401, 7216, 7240, 7304, 7319, 7240
16	RATIO SCONH/SCH (X100)		EQUATION: 45/L1 * 100
17	AVERAGE RATIO SCONH/SCH		AVERAGE LINE 16
18	RATIO SCONH / FTE FACULTY		EQUATION: L15/ L2

SUMMARY REPORTS

REPORT TITLE	FREEFORM REPORT LINES

Figure 33

NAME ______

PLANTRAN II DATA SHEET

PAGE 2 OF 2 MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T (61)	H (63)	R (65)	T - TIME PERIOD H - HEADING R - REPLACEMENT	RUN NO. (78–80)

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
19	TOTAL SALARIES	84690	DATA 110380, 115600, 108400, 114630, 123680, c 133700
20	AVERAGE SALARY	8469	EQUATION: L19/L2
21	LAST YEARS AVE SALARY		SHIFT L20
22	PCT CHANGE IN SALARY		EQUATION: (L20-L21)/L21*100
23	AVE PCT CHANGE IN SALARY		AVERAGE L22
24			

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)
OVERVIEW LINE ANALYSIS	1-24
FACULTY ANALYSIS	1-4, 6-20, 22, 23

Figure 33 (Concluded)

EXAMPLE
FACULTY ANALYSIS
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1966

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
1	STUDENT CREDIT HOURS	6974	DATA7401,7216,7240,7304,7319,7240
2	FTE FACULTY	10	DATA12,12,11,11,12,12
3	RATIO SCH TO FTE FACULTY	697	EQUATION: L1 / L2
4	AVE RATIO SCH/FTE FAC		AVERAGE LINE 3
5	AVE CREDITS/F-T STUDENT	30	DATA29.8,30.6,30.2,30,30,30.2
6	FTE STUDENTS	232	EQUATION: L1 / L5
7	STUDENT-FACULTY RATIO	23.2	EQUATION: L6 / L2
8	AVE STUDENT-FACULTY RAT		AVERAGE OF LINE 7
9	FACULTY TEACHING LOAD	22	DATA 21.8,22.4,22,22.2,21,20.6
10	AVERAGE TEACHING LOAD		AVERAGE OF LINE 9
11	REGISTRATIONS	2327	DATA2700,2405,2415,2435,2440,2413
12	NUMBER OF SECTIONS	58	DATA63,62,62,63,64,64
13	AVERAGE SECTION SIZE		EQUATION: L11 / L12
14	MEAN AVE SECTION SIZE		AVERAGE LINE 13
15	STUDENT CONTACT HOURS	6974	DATA7401,7216,7240,7304,7319,7240
16	RATIO SCONH/SCH(X100)		EQUATION: L15 / L1 * 100
17	AVERAGE RATIO SCONH/SCH		AVERAGE LINE 16
18	RATIO SCONH/FTE FACULTY		EQUATION: L15 / L2
19	TOTAL SALARIES	84690	DATA110380,115600,108400,114630,123680,C

Figure 34

EXAMPLE
FACULTY ANALYSIS
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1966

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION 133700
20	AVERAGE SALARY	8469	EQUATION: L19 / L2
21	LAST YEARS AVE SALARY		SHIFT L20
22	PCT CHANGE IN SALARY		EQUATION: (L20 - L21) / L21 * 100
23	AVE PCT CHANGE IN SALARY		AVERAGE L22
24			

Figure 34 (Continued)

```
THE FOLLOWING REPORTS ARE REQUESTED
OVERVIEW LINE ANALYSIS        1-24
FACULTY ANALYSIS              1-4,6-20,22,23
```

Figure 34 (Concluded)

EXAMPLE
FACULTY ANALYSIS

OVERVIEW LINE ANALYSIS

CURRENT DATE

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
1	STUDENT CREDIT HOURS	7401.00	7216.00	7240.00	7304.00	7319.00	7240.00
2	FTE FACULTY	12.00	12.00	11.00	11.00	12.00	12.00
3	RATIO SCH TO FTE FACULTY	616.75	601.33	658.18	664.00	609.92	603.33
4	AVE RATIO SCH/FTE FAC	656.88	638.36	643.32	647.45	641.20	635.79
5	AVE CREDITS/F-T STUDENT	29.80	30.60	30.20	30.00	30.00	30.20
6	FTE STUDENTS	248.36	235.82	239.74	243.47	243.97	239.74
7	STUDENT-FACULTY RATIO	20.70	19.65	21.79	22.13	20.33	19.96
8	AVE STUDENT-FACULTY RAT	21.95	21.18	21.34	21.50	21.39	21.11
9	FACULTY TEACHING LOAD	21.80	22.40	22.00	22.20	21.00	20.60
10	AVERAGE TEACHING LOAD	21.90	22.07	22.05	22.06	21.90	21.71
11	REGISTRATIONS	2700.00	2405.00	2415.00	2435.00	2440.00	2413.00
12	NUMBER OF SECTIONS	63.00	62.00	62.00	63.00	64.00	64.00
13	AVERAGE SECTION SIZE	42.86	38.79	38.95	38.65	38.13	37.70
14	MEAN AVE SECTION SIZE	42.86	40.82	40.20	39.81	39.47	39.18
15	STUDENT CONTACT HOURS	7401.00	7216.00	7240.00	7304.00	7319.00	7240.00
16	RATIO SCONH/SCH(X100)	100.00	100.00	100.00	100.00	100.00	100.00
17	AVERAGE RATIO SCONH/SCH	100.00	100.00	100.00	100.00	100.00	100.00
18	RATIO SCONH/FTE FACULTY	616.75	601.33	658.18	664.00	609.92	603.33
19	TOTAL SALARIES	110380.00	115600.00	108400.00	114630.00	123680.00	133700.00
20	AVERAGE SALARY	9198.33	9633.33	9854.54	10420.91	10306.66	11141.66
21	LAST YEARS AVE SALARY	8469.00	9198.33	9633.33	9854.54	10420.91	10306.66
22	PCT CHANGE IN SALARY	8.61	4.73	2.30	5.75	-1.10	8.10
23	AVE PCT CHANGE IN SALARY	8.61	6.67	5.21	5.35	4.06	4.73

Figure 35

EXAMPLE
FACULTY ANALYSIS

FACULTY ANALYSIS

CURRENT DATE

LINE NO.	PLANNING ITEM	1967	1968	1969	1970	1971	1972
1	STUDENT CREDIT HOURS	7401.00	7216.00	7240.00	7304.00	7319.00	7240.00
2	FTE FACULTY	12.00	12.00	11.00	11.00	12.00	12.00
3	RATIO SCH TO FTE FACULTY	616.75	601.33	658.18	664.00	609.92	603.33
4	AVE RATIO SCH/FTE FAC	656.88	638.36	643.32	647.45	641.29	635.79
6	FTE STUDENTS	248.36	235.82	239.74	243.47	243.97	239.74
7	STUDENT-FACULTY RATIO	20.70	19.65	21.79	22.13	20.33	19.98
8	AVE STUDENT-FACULTY RAT	[illegible]	21.18	21.34	21.50	21.30	21.11
9	FACULTY TEACHING LOAD	21.80	22.40	22.00	22.20	21.00	20.80
10	AVERAGE TEACHING LOAD	21.90	22.07	22.05	22.08	21.99	21.71
11	REGISTRATIONS	2700.00	2405.00	2415.00	2435.00	2440.00	2413.00
12	NUMBER OF SECTIONS	63.00	62.00	62.00	63.00	64.00	64.00
13	AVERAGE SECTION SIZE	42.86	38.79	38.95	38.65	38.13	37.70
14	MEAN AVE SECTION SIZE	42.86	40.82	40.20	39.81	39.47	39.18
15	STUDENT CONTACT HOURS	7401.00	7216.00	7240.00	7304.00	7319.00	7240.00
16	RATIO SCONH/SCH(X100)	100.00	100.00	100.00	100.00	100.00	100.00
17	AVERAGE RATIO SCONH/SCH	100.00	100.00	100.00	100.00	100.00	100.00
18	RATIO SCONH/FTE FACULTY	616.75	601.33	658.18	664.00	609.92	603.33
19	TOTAL SALARIES	110380.00	115600.00	108400.00	114630.00	123680.00	133700.00
20	AVERAGE SALARY	9198.33	9633.33	9854.54	10420.91	10306.66	11141.66
22	PCT CHANGE IN SALARY	8.61	4.73	2.30	5.75	-1.10	8.10
23	AVE PCT CHANGE IN SALARY	8.61	6.67	5.21	5.35	4.06	4.73

Figure 35 (Concluded)

NAME ____________

PLANTRAN II DATA SHEET

PAGE 1 OF 1 MRI

IDENTIFICATION

ORGANIZATION (1–24)	MODEL DESCRIPTION (25–40)	DATE (41–56)	BASE PERIOD (57–60)	T H R (61–65)		RUN NO (78–80)
EXAMPLE	FACULTY PLAN	CURRENT DATE	1972	T	T - TIME PERIOD H - HEADING R - REPLACEMENT	

COLUMNAR HEADINGS - OPTIONAL

PERIOD 1 (1–6)	PERIOD 2 (7–12)	PERIOD 3 (13–18)	PERIOD 4 (19–24)	PERIOD 5 (25–30)	PERIOD 6 (31–36)	PERIOD 7 (37–42)	PERIOD 8 (43–48)	PERIOD 9 (49–54)	PERIOD 10 (55–60)	PERIOD 11 (61–66)	PERIOD 12 (67–72)

MODEL SPECIFICATION

LINE NO. (1–4)	PLANNING ITEM (5–28)	BASE LEVEL (29–40)	FREEFORM METHOD OF COMPUTATION (41–80)
1	STUDENT CREDIT HOURS	7240	DATA 7320, 7305, 7200, 7328, 7400, 7629
2	AVE CREDITS PER FULL-T	30	CONSTANT
3	FTE STUDENTS	241	EQUATION: L1/L2
4	STUDENT FACULTY RATIO	20	GOAL OF 24 IN PERIOD 4
5	FTE FACULTY (CALCULATED)	12	EQUATION: L3/L4
6	FTE FACULTY (BASE)	12	DATA 13, 13, 14, 12, 12, 12
7	FTE FACULTY (ACTUAL)	12	MAXIMUM OF L5, L6
8	AVE FACULTY SALARY	11141	PERCENT INCREASE OF 4
9	FACULTY SALARIES	133700	EQUATION: L7*L8
10			

SUMMARY REPORTS

REPORT TITLE (1–24)	FREEFORM REPORT LINES (25–80)
ENGLISH FACULTY	1, 3, 4, 10, 5-7, 10, 8, 9

Figure 36

EXAMPLE
FACULTY PLAN
RUN

ANALYSIS OF MATRIX
FOR A
6 PERIOD FORECAST

CURRENT DATE

BASE YR. 1972

LINE	DESCRIPTION	BASE	METHOD OF COMPUTATION
1	STUDENT CREDIT HOURS	7240	DATA 7320,7305,7200,7328,7400,7629
2	AVE CREDITS PER FULL-T	30	CONSTANT
3	FTE STUDENTS	241	EQUATION: L1 / L2
4	STUDENT-FACULTY RATIO	20	GOAL OF 24 IN PERIOD 4
5	FTE FACULTY(CALCULATED)	12	EQUATION: L3 / L4
6	FTE FACULTY(BASE)	12	DATA 13,13,14,12,12,12
7	FTE FACULTY(ACTUAL)	12	MAXIMUM OF L5,L6
8	AVE FACULTY SALARY	11141	PERCENT INCREASE OF 4
9	FACULTY SALARIES	133700	EQUATION: L7 * L8
10			

Figure 37

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THE FOLLOWING REPORTS ARE REQUESTED
ENGLISH FACULTY                    1,3,4,10,5-7,10,8,9
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Figure 37 (Concluded)

EXAMPLE
FACULTY PLAN

ENGLISH FACULTY

CURRENT DATE
RUN

LINE NO.	PLANNING ITEM	1973	1974	1975	1976	1977	1978
1	STUDENT CREDIT HOURS	7320.00	7305.00	7200.00	7328.00	7400.00	7629.00
3	FTE STUDENTS	244.00	243.50	240.00	244.27	246.67	254.30
4	STUDENT-FACULTY RATIO	21.00	22.00	23.00	24.00	24.00	24.00
10							
5	FTE FACULTY(CALCULATED)	11.62	11.07	10.43	10.18	10.28	10.60
6	FTE FACULTY(BASE)	13.00	13.00	14.00	12.00	12.00	12.00
7	FTE FACULTY(ACTUAL)	13.00	13.00	14.00	12.00	12.00	12.00
10							
8	AVE FACULTY SALARY	11586.64	12050.11	12532.11	13033.39	13554.73	14096.92
9	FACULTY SALARIES	150626.25	156651.31	175449.50	156400.69	162656.69	169163.00

Figure 38

F. Data Collection

Figure 39 is a copy of a data collection document for the historic analysis of faculty staffing patterns. Figure 40 is a sample of a completed data collection document which conforms to the data used in the case study. The planner should review section IV. D. 1 carefully before completing the document.

No single data collection document, just as no single model, will be appropriate for every institution. Planners should modify the data collection specifications rather than modify the data to fit the document or not collect data at all. To the greatest extent possible input and output from the model should resemble the operational data of the institution with which the decision makers are familiar.

G. Model Adaptation

No matter how good the data and no matter how sophisticated and precise the statistical methodology, as planners and decision makers review the projected results they will suggest changes. Some will be changes that reflect a distrust of the projected values; others will constitute inputs of experience and judgment which were not included earlier; still others will simply be expressions of interest in what would happen if....? All of these concerns are important to the model builder.

He should be particularly interested in the third type of response. The decision maker who wants to investigate a number of alternatives--just to see what would happen--knows how to use a simulation technique. The chart in Figure 41 graphically represents this plan refining cycle which is the hallmark of a successful simulation effort.

Changes in the model can be of two types. The structure of the model itself can be changed in order to more closely approximate the real world situation. For example it may turn out that the student-faculty ratio is just not a good way to project faculty needs. In that case the structure of the model needs to be changed.

The second type of change is the result of the application of informed judgment. Projections which seem unrealistic to the decision makers will often need to be adjusted so that they more realistically reflect the actual or implied policy constraints.

Institution: ____________
Completed By: ____________
Date: ____________

FACULTY PLANNING
DATA COLLECTION DOCUMENT

Department: ____________

No.	Item	Academic Year Beginning In: 66	67	68	69	70	71	72
1	Student Credit Hours	___	___	___	___	___	___	___
2	Student Contact Hours	___	___	___	___	___	___	___
3	FTE Faculty	___	___	___	___	___	___	___
4	Faculty Teaching Load	___	___	___	___	___	___	___
5	Registrations	___	___	___	___	___	___	___
6	Number of Sections	___	___	___	___	___	___	___
7	Total Faculty Salaries	___	___	___	___	___	___	___
8	Average Credits Per Fulltime Student (institution-wide basis)	___	___	___	___	___	___	___

Figure 39

FACULTY PLANNING
DATA COLLECTION DOCUMENT
(Sample)

Institution: EXAMPLE
Completed By: Bill Pickett
Date: NOVEMBER 5, 1971

Department: ENGLISH

No.	Item	Academic Year Beginning In: 66	67	68	69	70	71	72
1	Student Credit Hours	6974	7401	7216	7240	7304	7319	7240
2	Student Contact Hours	6974	7401	7216	7240	7304	7319	7240
3	FTE Faculty	10	12	12	11	11	12	12
4	Faculty Teaching Load	22.	21.8	22.4	22	22.2	21	20.6
5	Registrations	2327	2700	2405	2415	2435	2440	2413
6	Number of Sections	58	63	62	62	63	64	64
7	Total Faculty Salaries	84690	110380	115600	108400	114630	123680	133700
8	Average Credits Per Fulltime Student (institution-wide basis)	30	29.8	30.6	30.2	30	30	30.2

Figure 40

PLAN REFINING CYCLE

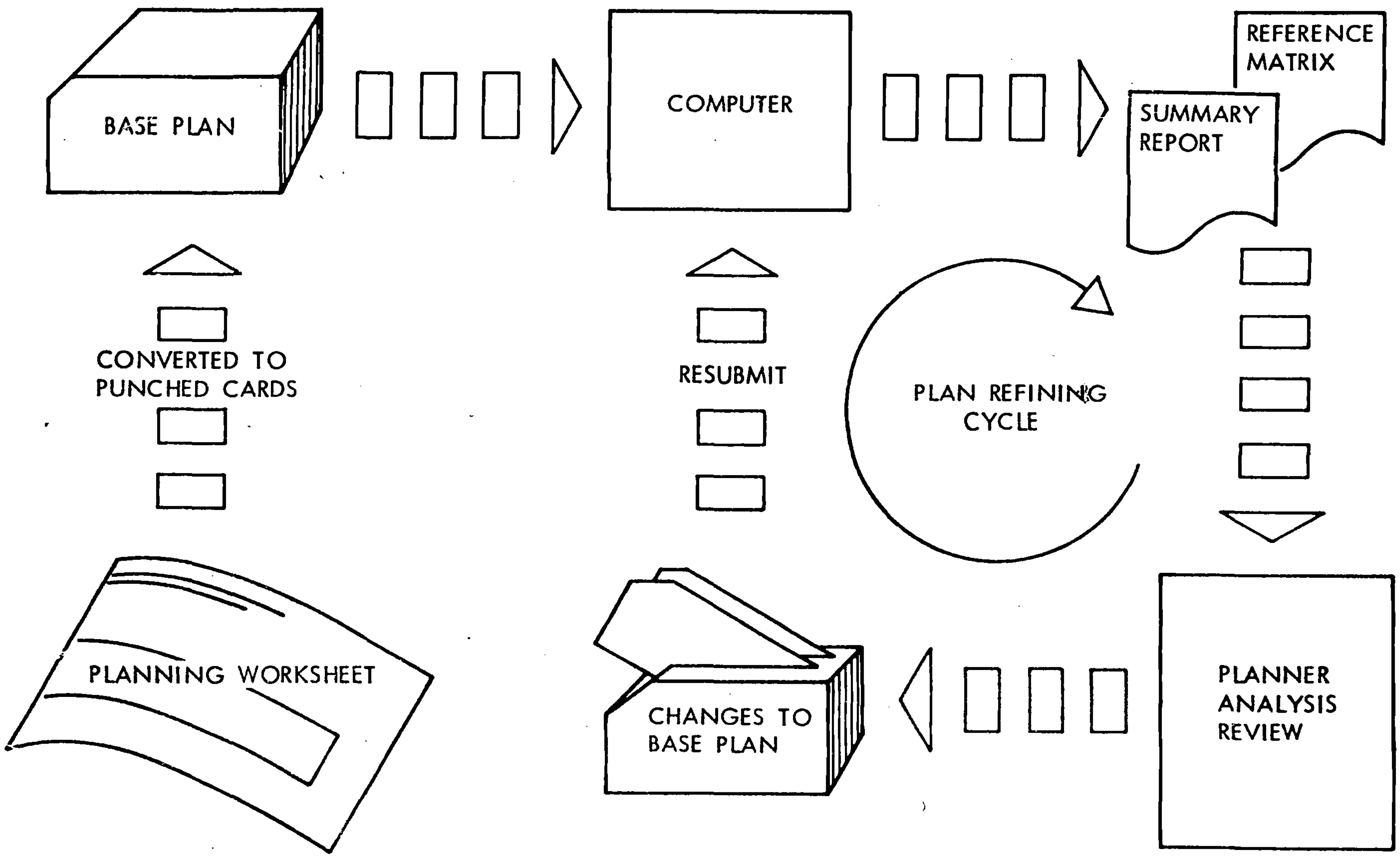

Figure 41