DOCUMENT RESUME

ED 136 705	HE 008 764
AUTHOR	Render, Barry
TITLE	Public Higher Education Enrollment Forecasting in the State of Ohio.
SPONS AGENCY	Ohio Board of Regents, Columbus.
PUB DATE	Jun 76
NOTE	147p.; Not available in hard copy due to marginal legibility of original document.
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Enrollment Projections; Enrollment Trends; Governing Boards; *Higher Education; *Models; *Part Time Students; State Agencies; *Statewide Planning; *Systems Approach
IDENTIFIERS	*Ohio

ABSTRACT

With the growing concern for the development of good mathematical education planning models, few states have developed the type of enrollment projection systems that they would consider to be ideal. The primary objectives of this research project were to develop, construct, and document an enrollment forecasting system for use by the Ohio Board of Regents. In addition, an important part of the research deals with the subject of part-time student enrollments. A first step in the modeling process for forecasting part-time enrollments involved the identification and characterization of part-time student populations in each Ohio school and in the entire state system. (Author/MSE)

PUBLIC HIGHER EDUCATION ENROLLMENT FORECASTING IN THE STATE OF OHIO 1976-1980

Barry Render

This study has been funded by a grant from the Ohio Board of Regents

June, 1976

PUBLIC HIGHER EDUCATION ENROLLMENT FORECASTING IN THE STATE OF OHIO

by

Barry Render, Ph.D.

Senior Partner
Management Science Associates

and

Associate Director
Division of Business and Economic Research
University of New Orleans

This study has been funded by a grant from the Ohio Board of Regents.

June, 1976

Acknowledgments

Many people deserve acknowledgment for their contributions to this study. Mr. William B. Coulter, Vice-Chancellor of the Ohio Board of Regents, took a special interest in the development of enrollment projection models for the OBOR and provided support throughout. Mr. Lawrence J. O'Brien, OBOR Project Director for the study, spent hundreds of hours helping on all phases of this research. His suggestions and advice were invaluable and he has earned my highest respects.

Ms. Theresa A. Crafts did an excellent job as my graduate research assistant for the project. She conducted background literature work, helped with data collection, tabulation and analysis, and did much of the computerized statistical programming. Mr. Harris S. Segal served well as systems analyst and was responsible for all computer programming used in forecasting enrollments.

Finally, my thanks go to Dr. Gerald L. Shawhan and Professor C. Thomas Innis, both of the University of Cincinnati and both former members of my doctoral committee, for their years of encouragement and support of my research in the field of higher education.

Barry Render

Table of Contents

Table of Contents Con'td.

PUBLIC HIGHER EDUCATION ENROLLMENT FORECASTING IN THE STATE OF OHIO

INTRODUCTION

Unprecedented growth in the Ohio public higher educational system in the decade which followed the creation of the Ohio Board of Regents (OBOR) has magnified the importance of accurate planning for both primary and support programs. This planning, for the more than 60 universities, branches, technical, general and community colleges is, to a large extent, dependent on the projection of enrollments in these institutions. It may even be said that the effective governance of higher education is in part a function of reliable estimates of the future behavior of potential students. Budgeting for additional faculty members, library, physical plant, etc., is partially justified to the legislature by the flow of students projected in individual institutions and in the entire State system.

The Ohio Board of Regents has, throughout its existence, encouraged and on occasion funded research devoted to the improvement of enrollment projection methodologies and models. This report describes this author's research in the area of enrollment forecasting in the period 1973-1976, and details the results of the contractual work undertaken in October, 1975 for the OBOR.

OBJECTIVES

An increasing number of higher educational administrators governing or being governed by state planning bodies have, over the past years, become interested in the development of good mathematical educational planning models. The application of management science/operations research techniques to problems of higher education has not, however, kept pace with the use of those techniques and models in the military and business fields. Few states have developed the type of enrollment projection systems that they would consider to be ideal.

It is believed that a system useful to Ohio Board of Regents should meet the following requirements.

1. It must provide accurate and timely outputs of enrollment projections.

2. It must be easily updated by the OBOR and easily maintained by OBOR or by state data processing personnel.

3. It should make maximum use of the student inventory file of the Uniform Information System.

4. It should be capable of incorporating not only demographic and historical data but administrative data as well.

The primary objectives of this research project have been to develop, construct and document an enrollment forecasting system which meets these requirements.

In addition, an important part of the research described in this report deals with the subject of part-time student enrollments. This part-time market for higher educational services lies, even today, relatively untapped by colleges throughout the nation. A first step in the modeling process for forecasting part-time enrollments involved a further objective, namely, the identification and characterization of part-time student populations in each Ohio school and in the entire State system.

ENROLLMENT PROJECTION TECHNIQUES - BACKGROUND

Before attempting to develop a projection model for the State of Ohio, it is important to examine what has been done by other planners and researchers. This section, which begins with a discussion of general educational planning models, provides a detailed analysis of enrollment projection techniques. The most important methodologies are presented and then examined in the context of existing national, state, and institutional forecasting models.

Planning Models

Planning models in the literature solve a wide variety of institutional problems with varying quantitative techniques and varying success.

The ERIC Clearinghouse's (1970) bibliography outlines models applying linear programming, dynamic programming, operational gaming, program evaluation review technique (PERT), Markov chains, and queueing to all levels of educational systems. A few other specific examples of application are a linear programming model (Graves and Thomas, 1971) for geographically allocating planned classroom spaces of a new college campus, a regression model for forecasting academic success in college (Hoyt, 1968), and a Lagrangian model relating student achievement to allocation of resources in a school (Sinha, Gupta and Sisson, 1969).

An examination of a "comprehensive" approach to university planning models is performed by Casasco (1970) who espouses the importance of these models as an integrated effort combining administrative, facility, and academic planning. Outputs generally provide the total university systems costs in terms of dollars, personnel, equipment and physical facilities.

Some comprehensive models cost out specific curriculum plans and educational policy, space requirements, salary scales, levels of support and construction programs. Six of the more noted operational models are: (i) Weathersby's (1969) cost simulation model for the University of California at Berkeley, (ii) Koenig, Keeney and Zemach's (1968, 1969) resource allocation model, MSU, for cost accounting, decision making and simulation at Michigan State University, (iii) a management system for resource planning, called CAMPUS, developed by Judy and Levine (1965), originally for the University of Toronto, and since extended to many other colleges (such as Thomas More, which has applied CAMPUS VII - a version for smaller schools (Lombus, 1974)), (iv) Mason's (1968) program planning model at the University of Rochester, (v) Keane and Daniel's

(1970) system simulation model, SEARCH, for use by small colleges in a project designed to assist them in developing and updating long-range plans, and (vi) Lawrence's (1970) WICHE-NCHEMS (Western Interstate Commission on Higher Education - National Center for Higher Education Management Systems) management information systems program, for the use of any American college, as an aid in the development of improved resource allocation and management systems.

Because of the large scale nature of such comprehensive models, simplifications are a necessity at many stages. Enrollments, for example, are either provided as input to the system, or else estimated in an unsophisticated manner. Naturally, the whole system suffers if one input is unreliable - thus highlighting the importance of accurate enrollment forecasting. Thorough comparisons, which include critiques, of the comprehensive models mentioned above (as well as others) are given in recent papers by Colin Bell (1972) and Roger Schroeder (1973, 1974).

Purposes of Enrollment Studies

As Norris, Poulton and Seeley (1974) point out, enrollment studies may accomplish a wide variety of purposes. For example, enrollment studies provide information for resource allocation at the federal, state, and institutional levels. Studies of enrollment, attrition, graduation, and occupational demand are meshed for manpower planning purposes. Enrollment and persistence studies serve to monitor educational access and are utilized in social policy planning. For the institutional user, enrollment projections are critical for staff and facilities planning in order to anticipate and service the facilities needs of different numbers and types of learners. In addition, studies of enrollment are utilized in programmatic analysis and planning.

Enrollment Projection Methodologies

Five general categories of projection strategies are utilized in the majority of existing studies: trend analysis, ratio method, cohort survival method, regression analysis, and Markov chains. These five are by no means collectively exhaustive, for there is little doubt that many college forecasts are strictly judgemental-based on seat-of-the-pants methods of administrators "who bring their lifetime experience to bear in a subjective manner and pronounce opinion of the probable enrollment" (Planisek, Krampf & Heinlein, 1974). And, in addition, the techniques listed above may not be considered mutually exclusive, for all could conceivably be present in a given study. This will be seen when various national, statewide and institutional models are discussed in the next sections.

The most common of the methods employed in making enrollment projections is a simple trend analysis using various techniques of extrapolation. This curve-fitting method usually consists of determining a relationship between numerical observations of a particular variable, over time. It assumes that enrollment trends, based on historical enrollment data, will continue - that the influences of the past are indicative of the factors which will operate in the future. The enrollment of the past over time may take the form of one of many curves (e.g. linear, second degree, exponential, etc.).

The ratio method of enrollment analysis is also widely used because of its comprehensivility and simplicity. The term refers to a process whereby historical data are utilized to develop a time series of ratios between the total population of some age group and the number of students in that age group. The ratio method is found in work dealing primarily with enrollment projections of national scope, and particularly in higher education: the age group used is generally eighteen to twenty-one year olds. The ratio method is not actually a forecasting device, but rather a means of preparing data as input to one, such as trend analysis. Extrapolated values of the ratio are then applied to projections of the national populations eighteen to twenty-one year olds, yielding projected student populations.

The cohort survival technique is based upon the extent to which a group of individuals survives by grade from first grade through college (grade-succession) or upon the extent to which a group of individuals survives by year of age from birth through the age of college graduation (age-survival). In the ratio method, for each calendar year one ratio is computed between the college-age pool and the persons enrolled in college. In the cohort survival method, a system of ratios is set up to determine the college enrollment for each calendar year; for example, respective ratios of second grade to first grade, of third grade to second grade, etc., are computed. The cohort of a particular year is thus followed through grade succession until the senior year or graduate school. In effect, the cohort survival method is a subset of the more general ratio method and it, too, depends on an external extrapolation technique for forecasting future survival rates.

Regression and econometric models generally project the dependent variable of enrollments as a function of such explanatory variables as the eighteen to twenty one year old population, tuition, income, unemployment rates or other economic indices. In forecasting enrollments, values of independent variables are themselves projected, often by trend analysis or regression, and it is assumed that statistical correlations between variables remain fixed.

Finally, Markov models have been used extensively in predicting student flows within a system. In the Markov formulation, a state is usually the student's grade (freshman, sophomore, etc.) and perhaps his major. The number of students in each state then depends in a Markovian fashion on the numbers in the previous states, the transition rates and the new admissions. For example, beginning with a freshman class, 75% may be expected to move to the sophomore level, 20% may drop out of school permanently and 5% may drop out for a year. If similar transition probabilities are known for each level of instruction, it should be possible to predict graduations and flows through the system. Models of this type were first studied by Gani (1963) and have been employed in most of the comprehensive resource allocation models cited in the previous sections (e.g., CAMPUS, M.S.U., SEARCH). Because the Markov model is generally used internally to project departmental enrollments, it requires an estimate of the college's total student body. Wasik (1971), for example, in applying the model in community colleges, recommends the development of a regression equation for projecting total enrollment.

None of these five procedures is perfect - each may work well under certain conditions one year in one region and poorly under the same conditions at a different time and place. Trend projection, by far the most widely used enrollment prediction model, is totally backward looking in its approach and has no ability to predict turning points (it thus works well only when enrollment changes continue at a known rate). The ratio method works well only in dealing with aggregated data (total nation or state) and only if ratios are stable or fit a trend well. Cohort survival extrapolations are fairly reliable when applied to the aging of children from grades one through twelve and also to the aging of students through college years. But survival rates from twelfth grade of high school to freshman year of college are generally too unstable to permit use of the trend technique as a true projection, rather than "flow-through", model. Regression, with more than one explanatory variable, requires a close eye to problems such as multicollinearity and auto-correlation - and also demands reliable forecasts of explanatory variables. Lastly, available evidence seems to indicate that transition probabilities used in Markov models may be quite unstable (see Hill and Judd, 1972) so that a method for predicting changes in probabilities is needed.

A comparison of several national attendance projection models, in the following section, is followed by a discussion of those models constructed for use in individual states or universities.

National Models

The most encompassing projection of national educational data, based on reports from all American public and private schools, at all levels, is published annually by the U. S. Office of Education. This general planning study established regression equations for numerous categories of colleges, programs, and majors by fitting a straight line to a ratio (of enrollment to 18-21 year old population) as the dependent variable and time, in years, as the independent variable.

The U. S. Census Bureau (1972) occassionally outputs enrollment forecasts for purposes of demographic planning, the latest covering the period 1975-2000. Logarithmic extrapolation of enrollment rates by age and sex are applied to population projections to output a distribution at higher education levels.

Similarly, the Carnegie Commission (1971) study, used as background for a recommendation concerning the future of American colleges, projected enrollments to the year 2000. The research also employed an extrapolation of 18-21 year old undergraduate enrollment ratio, by sex, which was then applied to a projection of the 18-21 year old population.

Future faculty manpower needs were examined by Cartter and Farrell (1965), who designed five undergraduate enrollment ratio series and applied them to a projection of 18-21 year olds. The future professional manpower supply study of the Commission on Human Resources (1970) projected students and professionals, by sex and age, using an extrapolation of age group enrollment rates and continuation ratios.

Froomkin's (1970) study of latent demand and student aid needs included a detailed examination and projection of national attendance ratios by income and achievement quartile. Using 1960-1967 enrollments and data from Project Talent surveys, the model forecast enrollments to 1976 by: (i) projecting high school graduates, (ii) allocating them to ability and socio-economic quartiles, (iii) estimating probabilities of college entry from each of the cells, and (iv) applying differential survival rates to the enrollees. Graduate enrollments were then fitted exponentially as a function of total enrollment.

Koshal's (1973a) econometric model prepares fifteen year projections of total U.S. enrollments, by sex, as a function of (i) the 18-21 year old population, (ii) the median family income, and (iii) three selective service draft variables (Korean War, post-Korea, and Vietnam War).

Fox (1971) establishes a concept of "full-college-potential" and applies it to the data underlying the Office of Education projections mentioned earlier. He creates a new set of projections based not on enrollment trend extrapolation for the students who do enter college, but rather on the number of potentially successful students, and concludes that one million possible enrollments are lost.

State & University Enrollment Models

Rather than group the various models which are about to be presented by technique (such as Markov-type, etc.), it is convenient to discuss them state by state, since many studies involve the application and comparison of more than one method.

Zimmer's (1971) dissertation research, for example, adapted four enrollment projection techniques to the Minnesota State College system. His models, survival-growth ratio, polynomial curve fitting, multiple regression, and Markov chain were evaluated against each other with his conclusion that the polynominal model (fitting curves of degrees one through four to extrapolate enrollments) was inferior, but that selection of the best of the remaining methods was dependent on the desired length of forecast and the availability of accurate data.

Using a modification of the decision-theoretic approach of Pritzker (1965), Zimmer also translated an accuracy limitation on his projections into a monetary criterion, which was the amount of the contingency fund provided by the legislature for underprojection. This pragmatic approach holds that there exist quantifiable costs associated with major vs minor underprediction, and major vs minor overprediction: in the case of state-controlled institutions these costs are particularly a function of the attitude of the state legislature toward under and over prediction.

The New York state system was examined by Shea (1968) who projected enrollments by program level and by type of institution. The study involved a review of earlier historical trend projections, development of a growth factor projection, and creation of an index to account for increased in-migration of students. Shea also provided part-time figures, but with lesser claim of confidence.

Shortly thereafter, the state of New York contracted with the Rensselaer Research Corporation (1969) to construct a prototype planning simulation model for projecting college enrollments. The resultant on-line, Markov-type, computer program modeled students' movement through the college system, determined their distribution within the system, and described them by sex, age, residence, credit load, year, and major area. The procedure involved cycling the total educational population through a transition matrix to produce a vector of grouped students who remain in the system the next year. Input to the Markov model consisted, however, of an estimate of incoming freshmen based only on trend. The primary researchers, Baisuck and Wallace, concluded that the study "raised more questions than were answered...Concern was focused upon the structure, data requirements and simulative capabilities of the model rather than upon its accuracy as a predictor of future events" (Baisuck and Wallace, 1970).

A Markovian approach was also taken by Harden and Tcheng (1971) for the projection of enrollment distributions at Illinois State University. Their paper introduced a two-step Markovian model to resolve difficulties which arise when (1) the number of university departments (and consequent states) increase and (2) the projected enrollments of various fields exceed the maximum enrollments established by various departments. In effect, the second step simply redistributes to other fields those numbers of students exceeding the enrollment ceilings.

An examination of alternative projection models designed to predict enrollment in specific academic departments was conducted at Kansas State University by Orwig, Jones and Lenning (1971, 1972). Two of their four techniques, the "baseline" model (which assumes changes in enrollment occur only as a function of overall institutional growth) and the Markov model (employing the usual transition matrix to represent existing states in the system) are probabilistic in nature and by themselves did not provide a total enrollment figure. Their "trend line" model predicted enrollments for both the baseline and Markov models, based on a regression model's analysis of the trends in department enrollment figures over a period of years. The authors state of the trend model, however: "although this may be the most frequently used method to project total university enrollment, it is simplistic and ignores other factors that could be included" (1972).

Also attempting to make forecasts by academic department (as well as course and major), Planisek, Krampf and Heinlein (1974) applied a technique called exponential smoothing as "a fast, efficient and accurate method of making forecasts...in situations where there are a large number of courses or departments within the university". They found, however, that in most situations course enrollments were too volatile to model. Unable to obtain data at the departmental level, they decided to use business college enrollments as a "basis for illustrating the effectiveness of the proposed methodology". The resulting projections for one, two and three quarters (30 weeks) ahead were "reasonably accurate" (4.7% error for one quarter), but the authors did not even suggest going beyond such short term forecasts by attempting one year or two year projections.

The Missouri Commission on Higher Education (1970) found that three simple predictive techniques resulted in similar fifteen year enrollment projections at state public institutions. Enrollments were calculated as a function of (i) the number of 18-23 year old, (ii) the number of 18-21 year olds, and (iii) high school graduates and past college enrollments. Five year projections were also made for all four-year state colleges by county of origin (data were not available for two-year schools or private colleges), by applying a least squares line and a second degree parabolic trend curve to 1965-1969 data. The study assumed that trends established during the four-year base period (which was a time of constantly increasing enrollments) would continue. No statistical validation was reported.

The computer simulation model of Perkins and Paschke (1970, 1973) predicted enrollments (and also operating expenditures and construction costs) for all Indiana colleges, to 1985, by separating institutions into three categories. Public state universities and large (over 3,000 students) private schools were studied by using regression analysis to predict high and low freshmen enrollment estimates. The equation representing the low end of the "expected" range of enrollments was a function of tuition, number of 18 year olds, and the number of freshmen in the previous year. The high estimate was based on the number of 18 year olds, personal income, and a trend factor. A cohort survival rate was then applied to determine total enrollments. Estimates for regional campuses of the public state universities were constructed by state experts. Undergraduate enrollment at all other colleges in Indiana was predicted using trend analysis on historical data. Multiple regression was again applied to predict graduate enrollments at the larger schools as a function of: the number of freshmen (an indication of the number of assistantships available), the number of seniors the previous year, and a trend factor representing demand growth. Although Perkins and Paschke did not present actual university enrollment data in their article, they did report the application of goodness-of-fit tests in a validation attempt. Using actual 1968 enrollments as a test of the "future" (the study was conducted in 1968), they concluded only that: "the results tend to confirm the validity of the enrollment sub-models" (Perkins and Paschke, 1973).

Hoenack's (1967) dissertation research involved the construction of a cross-sectional multiple regression model for the behavior of California high school seniors in 1965. He applied the model not to project enrollments, but rather to examine the effects of variables on the demand for freshman attendance at the University of California. Nonetheless, in gathering data on 350 individual California high schools, and in considering the sensitivity of demand to several socio-economic variables, Hoenack brought empirical analysis to bear on the problem of allocation of subsidy to college students, and indirectly to the problem of enrollment forecasting. His jointly dependent variables were proportions of eligible Spring 1965 graduates who went on to attend individual campuses of the University of California. The independent variables were costs of attending each campus, including transportation costs, local unemployment and wage rates, and the incomes of families living in the (census tract) attendance zones of high schools. No enrollment findings were reported, but Hoenack presented results indicating that the cost of attending the University of California significantly affected the number of high school students who apply and enroll.

The models of Ronald Thompson use identical techniques in projecting enrollments at all public and private colleges and universities in Kentucky (Thompson, 1972) and in Ohio (Thompson, 1973). His models (the Ohio model was commissioned by the OBOR) examine the county distribution of each school's enrollment and, based on birth rates, predict increases or decreases. Wright State University at Dayton, for example, enrolled 16% of the potential college population of four nearby counties in 1972. Thompson presumes that those four counties will continue to contribute a major portion (90%) of Wright State's students, and projects enrollments primarily as a function of the four county future population. As conservative as this approach appears to be, some resultant projections were highly unrealistic and average errors for a one-year forecast into 1973 were 11.9% in Ohio. Shawhan (1972), in evaluating Thompson's Kentucky model for possible adoption in Ohio, indicates his reservations about such a technique based entirely on a pool of recent high school graduates. Commenting, for example, on the applicability of Thompson's use of 18-19 year old high school graduates as the base for projecting enrollments at two-year schools, Shawhan writes: "In Ohio...the 18-19 year old percentage has significantly decreased in six years from 43% in 1966 to 32% in 1971. Statistically speaking therefore, the 18-19 year old pool is the worst, the 18-21 year old pool better, and surprisingly the 18-24 year old pool the best of the three to use as a base". More directly, one might question the validity of assuming that the percent of the drawing region (16% in the Wright State example) - based only on a 1972 observation - will remain constant over Thompson's 16 year period of projection, much less a shorter term.

Another Ohio study (Battelle Memorial Institute, 1969) forecast enrollments at all public and private colleges in Ohio by rank, major field, sex and course load using a cross-sectional model based on 1967 data only. As in Hoenack's California study, it attempted to establish differing socio-economic patterns of behavior by grouping regions (counties) into four income levels. Variables such as accessibility to college, preference of public versus private schools, and costs were incorporated, by economic demand theory, into the model. A series of fifteen decision links, many of them variations of the constant ratio method, moved students through the educational system. The independent variables used in the model, however, did not explain enough variation to produce stable forecasts. The results were an average forecast error of more than twice the Thompson study and predictions such as 1972 enrollment for the University of Cincinnati equal to 57,000 students (actual enrollment was 36,000 - an error of 58%).

Both the studies of Thompson and Battelle, it should be noted, were able to forecast total Ohio enrollments within one percent one year later. Their weakness, as in the vast majority of other studies, was evidenced in disaggregated projections for individual two-year and four-year campuses.

Finally, two similar models for again forecasting total enrollments, for the state of Ohio, were constructed by Koshal (1973b) and Innis (1973). Koshal's econometric model was identical to the one he used to predict national college attendance and was based primarily on the 18-21 year old population. Innis' multiple regression model employed the independent variables of 18-24 year old population and the percent of high school graduates in Ohio who continue on to college the following academic year. Both reported high statistical correlations (R^2s between .97 and .99). It also appears that the key explanatory variable in each is population - a point that we will return to in the next section.

Summary of Problems with Existing Models: An Overall Critique

Some mention was made earlier of weaknesses inherent in the five common enrollment projection techniques. There is little that educational researchers can do to compensate for such limitations beyond carefully collecting and analyzing data, observing assumptions underlying the use of their models, and waiting for an advance in the state of the art. Nevertheless, there is room for much improvement in the quantitative analysis of the enrollment decision process. This section will attempt to point out weaknesses common to most models regardless of the statistical techniques utilized within the models. It is this first step - understanding the problems - which will lead to the improvement of existing models and the development and application of new or different operations research concepts.

Very simply stated, there are many problems within the models just discussed. Some are inherent in the process of creating a mathematical representation of human behavior. It is extremely difficult, for example, for anyone to predict when a war will end, when a birth rate will reverse, or that college attendance will fall out of vogue. Most projection studies have chosen to avoid the issue with an explicit assumption that trends in institutional and state enrollment counts will continue at their observed rates.

Also troubling is the broad-based use of (only) the 18-21 year old population as a basis for projecting a college's total enrollments. This appears to be a major weakness in Thompson's studies of Ohio and Kentucky colleges, Perkins and Paschke's Indiana study, and a great many of the other national, state and institutional models. Whether a broader cohort population will validly (in a statistical sense) reflect the lengthened period of education and the return to the classroom of older students is questionable. The 18-24 year old population has been attempted with little change in the output of the models (as seen by comparing Innis' and Koshal's Ohio models, using 18-24 population (Innis, 1973) and and 18-21 population (Koshal, 1973b), and the use, for example, of an 18-50 cohort population would lead to serious estimation problems. Shea's New York state study did recognize this problem. He considered potential enrollment to be a function of high school graduates and of the over 25 year old student population, and estimated (without validation) that in 1975 the latter group would comprise 33% of all enrollments (Shea, 1968).

Educationalist L. J. Lins, at the University of Wisconsin, also aware of the limiations of such narrow cohorts, states:

> It is often assumed in national projections, for example, that the undergraduate college age pool consists of individuals who are 18 through 21 years of age. Generally it is true that a greater proportion of college undergraduates are in this age range. It is questionable, however, that the enrollment in any undergraduate college...consists of an equal proportion of the youth at each of the ages 18 through 21.
>
> It is evident that education beyond high school encompasses a much wider range than the 4 year span immediately following high school graduation. The socio-economic change following World War II has varied the pattern of college attendance. Many persons older than the traditional college-age group are entering college for the first time or are returning to college for further education. (Lins, 1965)

Norris, Poulton and Seeley, at the University of Michigan concur and add: "The underlying assumptions in existing enrollment studies have been inadequate for projecting college enrollments...Broader cohort populations must be utilized in order to reflect the extension of the period of education and the participation of older learners." (Norris, Poulton & Seeley, 1974). The need for this realization is, of course, self-evident in the Ohio higher educational system. Close to 40% of the State's 340,000 students may be classified as part-timers, the average age of whom is 29 years.

A third criticism of most existing projection methodologies concerns the failure of their models to incorporate variables which are explanatory in nature. Information derived from even such demographic factors as county populations and birthrates or from high school graduation and college participation rates can be valuable in identifying changing trends. Rather than projecting enrollment trend lines, the concern should be with projecting those variables which cause the trends. This procedure provides <u>some</u> opportunity for recognizing turning points in enrollment patterns. More importantly though, it assists the educational policy maker in understanding the <u>whys</u> of enrollment changes - a first step in the development of a controllable system. Once a body of theory relating factors important in the student enrollment decision process is established, it will be possible for administrators to simulate the effect of various changes in explanatory variables upon the estimates. This is a maximization of the utility of enrollment forecasting models. Mangelson, analyzing national enrollment techniques, adds: "The incorporation of underlying factors into enrollment projections will improve the quality of actual enrollment projections" (Magelson, et. al., 1973).

It is important to recognize this inability of most existing models to operate as policy-aiding devices. Educational administrators are, like marketing planners, beginning to recognize the need and utility of mathematical models of student (or buyer) behavior. To attract a perhaps untapped market of potential students, or to adjust a school's direction or image, it is necessary to have a basis for comparison with other colleges.

A fourth criticism may be leveled at those models which approach institutional forecasting in a "micro-manner". Regression studies (such as Perkins and Paschke, 1973) which project each school's enrollments without considering its competition induce a "double-counting" bias. Such a problem seems to be inherent in the procedure of aggregating a set of unintegrated forecasts made independently by (or for) each college. A comprehensive treatment, viewing all schools as within one system competing for students may be a better approach, especially in terms of forecasting full-time enrollments.

THE OBOR DATA BASE

A workable, realistic mathematical model is directly the function of the availability and quality of timely data. The importance of data in the problem-solving orientation of this research suggests that a section be addressed to the topic.

The broadness of this study owes a great deal to the excellent Uniform Information System initiated in 1966 by the OBOR. Although early years of its collection were marred by occassional misreporting and exclusions, the quality of the data has since improved vastly. The lack of this type of complete data base, in other states, has no doubt hampered innovative enrollment modeling and restricted researchers to the simplest of techniques (which often rely on only highly aggregated inputs).

In addition to OBOR data collections dealing with students, staffing, space and finances published every year (OBOR, 1967-1975a, 1967-1975b, 1967-1975c), a vast wealth of unpublished information, in the form of files on magnetic tape, was made available for the enrollment study. The data needed here, from the Student Inventory File of the information system, is based on an inventory conducted every fall at each of the colleges in Ohio's public system. Each school reports data on its students to the Regents in standardized format on either punched cards or magnetic tape. These incoming data are then processed by the OBOR through the Ohio interagency state data processing center's IBM 370 computer.

Because of the difficulty in accessing reliable data in a compatible format prior to 1971, only 1971-1975 files were utilized in developing the projection models described in the following sections of this report. Detailed analyses were conducted of historical enrollments by institution, by county, by part-time versus full-time, by age, by rank, by day-evening status, etc. Data pertaining to out-of-state enrollments, graduate students, and professional students were also tabulated.

Exhibit I, which follows on the next five pages, details the structure of the Student Inventory File of the OBOR Uniform Information System. Definitions of terms used throughout this report are also provided.

Computer programs written in the MARK IV, COBOL, and FORTRAN languages which utilized this data base were run on computers of the Ohio State Data Processing Center in Columbus, the Southwestern Ohio Regional Computer Center in Cincinnati, and the Computer Research Center in New Orleans. Programs and documentation are being turned over to the OBOR upon completion of this project.

A MODEL FOR FULL-TIME ENROLLMENTS

The approach taken in this study was to separate full-time versus part-time students for purposes of analysis and modeling. (A full-time student is defined as one having registered for 12 or more credits in a school term.) These two groups of students, clearly non-homogeneous in age and goals (as will be detailed in later sections of this report), have seldom been successfully forecast when lumped into one group.

The following pages describe a system constructed for the projection of full-time students. A series of separate and distinct models which deal with the projection of part-time enrollments at each institution will be discussed shortly.

Figure 1 illustrates the structure of the full-time enrollment projection model. The system begins with the basic input, by county, of

DUE DATE - Annually on November 1.

PERIOD COVERED - Registration for fall term as of the 14th calendar day after the first day of classes.

FORM OF REPORT - Single punched card for each student, utilizing uniform card columns and data fields; or other automatic and compatible record form offering identical content and sequence.

CONTENT OF REPORT -

Card Column	Information	Code or Source of Code
1-2	Institution Number	Code List A
3-4	Branch or Academic Center Number	Code List B (see below)
5-13	Student Code Number	Institutions's Code
14	Enrollment Status	
	Day	1
	Evening	2
15	Year	Actual
16	Institutional Calendar	
	Semester	1
	Quarter	2
	Trimester	3
17-19	Credit Hours Attempted	Actual
20-23	Cumulative Credit Hours Achieved	Actual
24-25	Major Field of Study	Code List C
26-27	Student Rank	
	Freshman	01
	Sophomore	02
	Prejunior	03
	Junior	04
	Presenior	05
	Senior	06
	5th Year Undergraduate	07
	Unclassified Undergraduate	08
	Master's Student	09
	Doctoral Student	10
	Unclassified Graduate Student	11
	Professional	12
28	Sex	
	Male	1
	Female	2
29	Residency	
	Municipal or District Resident	0
	Ohio Resident	1
	Resident of another State	2
	Other Nationals	3
	Foreign	4

Card Column	Information	Code of Source of Code
30-31	State of Residency	Code List D
32-34	County of Residency	Code List E
35	Living Arrangements	
	Commuter	1
	Institutional Housing	2
	Institution-Related Housing	3
	Other	4
36-37	Year of Birth	Last two digits of Year of birth
38	Marital Status	
	Married	1
	Single	2
39-40	Institution from which transferred	Code List A
41-42	Branch from which transferred	Code List B
43	Race/Ethnic Category	
	Afro American	1
	American Indian	2
	Oriential American	3
	Spanish-Surnamed American	4
	Other American	5
	Foreign	6
79-80	Card Code	30

DEFINITIONS

Institution - The reporting institution.

Branch or Off-Campus Center - The off-campus center at which the subject student is enrolled. This field should be left blank if the student is enrolled and receiving instruction on the central campus of the institution.
For the purposes of Student Inventory reporting combine the "branch" and "off-campus: branch" into the single code "branch." For example, enrollment at the Ashtabula branch (01) and off-campus instruction extended from this branch (71) would all be reported as Ashtabula branch (01). In the same manner combine the off-campus instruction extended from the main campus other than Resident Credit Centers (codes 98 and 99) into code 98.

Student Code Number - A permanent number assigned by the institution, which distinguishes the subject student from all others enrolled by the institution.

Enrollment Status:

Day - A student who is primarily a day student, including students who may enroll in selected evening courses outside of a regularly organized evening division or who remain primarily day students in spite of some participation in a regularly organized evening division.

Evening - A student enrolled exclusively in courses beginning after 4:00 p.m.

Year - The last digit of the calendar year during which the academic period began.

Institutional Calendar - The calendar system currently in use by the institution, and indicating the credit values according to which Credit Hours Attempted and Cumulative Credit Hours Achieved are reported in card columns 17 through 23.

Credit Hours Attempted - Total credit hours for which the student is enrolled during the fall term being reported and as of the 14th calendar day after the first day of classes, expressed in tenths.

Cumulative Credit Hours Achieved - Total credit hours for which the student has been given credit toward the degree he seeks during all previous periods of enrollment, and including credits accepted by the institution through transfer from another college or university or credit awarded through advanced placement procedures, expressed in tenths.

Major Field of Study - The students' educational goal as expressed through reference to a program shown in Code List C. Students enrolled in a regularly organized program of general studies which precludes their selection of a major interest (a general or university college), or who for other reasons have not yet been required to define a major interest should be assigned the code (90) for General Education.

Student Rank:

Freshman - A student who has earned less than 25 percent of the total credit hours required for the baccalaureate he seeks and which normally requires four years of study, and a student who has earned less than 50% of the total credit hours required for the associate degree he seeks.

Sophomore - A student who has earned between 25 and 50 percent of the credit hours required for the baccalaureate he seeks and which normally requires four years of study, and a student who has earned 50% or more of the credit hours required for the associate degree he seeks.

Prejunior - A student enrolled in a 5-year cooperative program who has completed two full years of enrollment, but falls somewhat short of regular junior status in terms of academic course credits because of his alternating schedule of work and study.

Junior - A student who has earned between 50 and 75 percent of the credit hours required for the baccalaureate he seeks and which normally requires four years of study.

Presenior - A student enrolled in a 6-year cooperative program who has completed three full years of enrollment, but falls somewhat short of regular senior status in terms of academic course credits because of his alternating schedule of work and study.

Senior - A student who has earned between 75 and 100 percent of the credit hours required for the baccalaureate he seeks and which normally requires four years of study.

Fifth Year Undergraduate - A student enrolled in a baccalaureate program requiring five or more years of full-time study for completion, and who has advanced beyond that point of progress normally requiring four school years.

Unclassified Undergraduate - A student, regardless of his previous academic experience or achievement, who is enrolled for undergraduate course work but who has no immediate degree goal.

Master's Student - A student who, having earned a baccalaureate, has been formally admitted to the graduate school or college and who is engaged in work toward a Master's degree, or a doctoral student whose program excludes award of the Master's degree but whose progress has not yet passed that level at which the intermediate degree is typically awarded in the graduate college.

Doctoral Student - A student formally admitted to the graduate school or college who holds a Master's degree and is engaged in work toward a doctoral degree, or a doctoral student whose program does not encompass award of the Master's degree but whose progress has passed that level at which the intermediate degree is typically awarded in the graduate college.

Unclassified Graduate Student - A student who is permitted to enroll in graduate courses but who has no immediate degree goal.

Professional - A student enrolled in a school or college of medicine, dentistry, veterinary medicine, law, or optometry.

Sex - The sex of the student - male or female.

Residency:

Municipal or District Resident - A student classified as a resident of a municipality or district which gives tax support to the reporting institution.

Ohio Residents - A student, other than one classified above, who is an Ohio resident according to definitions established in Ohio Board of Regents' Rule No. 2 governing subsidy allocations.

Resident of another State - Any student maintaining another state as his residence.

Other Nationals - American citizens living abroad, including their children, who maintain no residency status in this country.

Foreign - Nationals of other countries.

State of Residency - State from which a student originally enrolls.

County of Residency - County from which an Ohio resident originally enrolls.

Living Arrangements:

Commuter - A student who lives in his permanent residence, within the meaning of Ohio Board of Regents' Rule No. 2, while attending school.

Institutional Housing - A housing facility owned and operated by the institution.

Institution Related Housing - A private housing facility designed and built for the housing of students and operated either under rules of the institution or in a manner similar to operation of an institutional housing facility (non-university owned fraternity houses, privately built but university-approved dormitories, etc.).

Other - Any other housing facility in which students live.

Year of Birth - Year in which student was born.

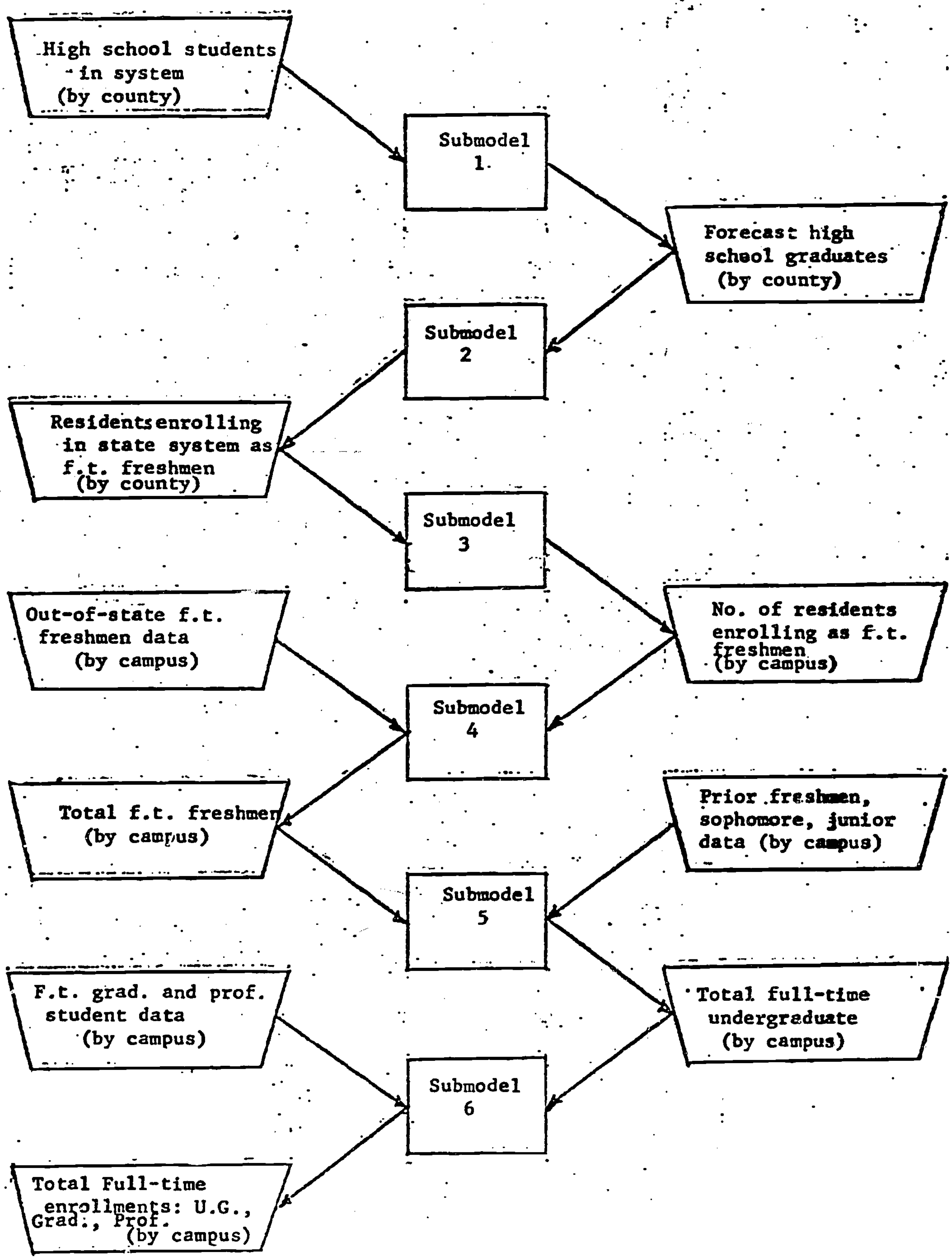
Marital Status - Current marital status (married or single) of the student.

Institution from which transferred - The institution last attended by an incoming transfer student before admission to the reporting institution. Applicable only to a transfer student during his first term of enrollment at the reporting institution.

Branch from which transferred - The branch or academic center of an Ohio state-assisted institution which constitutes the last center of attendance of an incoming transfer student. Applicable only to a transfer student during his first term of enrollment at the reporting institution.

Racial/Ethnic Category - It is our intention to use the prevailing categories and definitions as prescribed by the U.S. Department of Health, Education, and Welfare, Office of Civil Rights for compliance reporting.

Figure 1


High school students in system (by county)
Submodel 1
Forecast high school graduates (by county)
Submodel 2
Residents enrolling in state system as f.t. freshmen (by county)
Submodel 3
No. of residents enrolling as f.t. freshmen (by campus)
Out-of-state f.t. freshmen data (by campus)
Submodel 4
Total f.t. freshmen (by campus)
Prior freshmen, sophomore, junior data (by campus)
Submodel 5
F.t. grad. and prof. student data (by campus)
Total full-time undergraduate (by campus)
Submodel 6
Total Full-time enrollments: U.G., Grad., Prof. (by campus)

students currently in Ohio schools.[1] A certain percentage of these students are then upgraded and moved through the educational sequence all the way to graduate school. This approach differs from models which conduct institutional forecasting in a micro-manner, as mentioned earlier, by viewing all schools as within one competing system.

Forecasting High School Graduates: Submodel 1

Submodel 1, dealing with demographic projections, establishes cohort-survival and trend relationships on each Ohio county's elementary and secondary school graduates. It was found by Ronald Thompson (1973) that trend lines, relating the ratio of twelfth grade graduates to first grade enrollments 12 years earlier (the only 2 grades for which complete data were available), could be set for each county by examining a time series of the following term:

$$PC_i\ (t) = \frac{HSGRAD_i\ (t)}{FIRST_i\ \ (t-12)}$$

Where $PC_i(t)$ = percent of first grade enrollments in year (t-12) leaving the system 12 years later, in year t, in county i

$HSGRAD_i(t)$ = number of high school graduates in year t in county i

$FIRST_i(t-12)$ = number of 1st grade enrollments in year (t-12) in county i

Counties in Ohio tend to differ from one another considerably in survival rates, but are not generally unstable over time. Appendix B updates the Thompson forecasts of 1973 with the inclusion of 1974 and 1974 school data.

---

[1]The county is chosen as the basic unit of student origin for several reasons: Regents' data on individual student home are recorded by county; elementary and high school student data are tabulated annually by county; and student behavior patterns are expected to differ by county, thus suggesting that county by county modeling may be superior to an aggregate method.

Forecasting County Participation Rates: Submodel 2

The second submodel, in calculating a propensity-to-enroll factor, relates the number of high school graduates, in each county (from submodel 1), to that number of full-time freshmen from that county who are enrolled the following year in Ohio public colleges. The participation rate in each county reflects the level of interest in college education and the gradual shift in preference from private to public institutions of higher education.

Where trends existed in county level participation, they were forecast to continue, unless information was provided to indicate otherwise. In many cases, participation rose sharply in 1975, as compared to the 1971-1974 period. Administrative input was requested in these cases and the results are reflected in Appendix B's projections. Generally, it was assumed that 1976 rates would continue to reflect the economic conditions in the State responsible for the increase in 1975. As has been observed in the past, the introduction of a new school or expansion of existing facilities in a particular region causes several years of increased county level participation. This administrative input, too, was considered in the estimation of 1976-1980 rates.

In the annual updating of this submodel, it is recommended that the OBOR seek out county level inputs relating to college participation wherever possible.

The translation to a potential freshmen population in year t, in <u>origin</u> county i, call it $O_i(t)$, is found by multiplying the estimated year t participation rates, $RATE_i(t)$, by the projected number of high school graduates in year t, $HSGRAD_i(t)$, as follows:

$$O_i(t) = RATE_i(t) \times HSGRAD_i(t)$$

Allocating Full-time Freshmen Among Campuses: Submodel 3

In justifying the separation of part-time and full-time models, it seems evident that patterns of part-time attendance at public institutions are a function of factors dissimilar to those influencing full-time attendance. Students, for example, rarely travel long distances from home to register part-time at college. And in effect, schools do not "compete" statewide for part-time students in the same sense as they do in attempting to attract full-time Ohio students. It should be noted that "compete" may actually be the proper term, for state subsidies to public colleges in Ohio are proportional to the number of full-time Ohio residents attending that school. While some two-year campuses in the state system have a limited geographic appeal or drawing power, the dozen four-year universities and several of the two-year colleges do draw students from almost every county.

An historical data base of the share of the market (the market being, in this case, public college bound full-time freshmen in each county from submodel 2), which each of the public colleges in Ohio has drawn, was developed as a first step. It consists of a matrix of dimensions 88 (counties) x 70 (approximate number of schools) x 5 (years worth of information).

A regression formula was applied to each county-school combination (over 5,500 of them) to forecast the 1976-1980 market shares. The forecasts were then individually examined to insure their reasonableness.

These forecast market shares (or percents attending each school from each county) were multiplied by the potential freshman population in each county to determine the number of freshmen who will attend each school from that county. Mathematically,

$S_{ij}(t) = P_{ij}(t) \times O_i(t)$

Where $S_{ij}(t)$ = number of full-time freshmen attending school j from county i in year t

$P_{ij}(t)$ = percent (forecast) of market of students in county i who will attend school j in year t. Percentages were normalized to add to 100% in each year.

$O_i(t)$ = potential freshmen population in year t, in origin county i (from submodel 2).

The third submodel, in addition, sums the projected freshmen enrollment from each county to a particular institution to provide a figure for total full-time Ohio resident freshmen at each campus, namely,

$$S_{.j}(t) = \sum_{i=1}^{88} S_{ij}(t) \qquad (i = \text{county number})$$

Where $S_{.j}(t)$ = number of residents forecast to enroll as full-time freshmen at school j in year t.

Forecasting Out-of-State Freshmen: Submodel 4

The enrollment projection system described thus far has dealt exclusively with the class of students which are referred to as in-state residents. Ohio secondary school graduates (Submodel 1), Ohio county participation rates (Submodel 2), and Ohio freshmen populations by institution (Submodel 3) have been discussed. A certain percentage of students attending the majority of public colleges in the state are, however, non-Ohio residents.

Time series analysis or trend lines may be applied to forecast the percentage of non-Ohio freshmen to total freshmen. It should be noted that only one state institution (Central State University) draws more than twenty percent of its full-time freshmen from beyond Ohio borders. Many two-year branch campuses and technical colleges attract virtually all of their students from within the state.

An estimate of the number of out-of-state freshmen enrolling at each campus is found by multiplying a specific mathematical ratio (in brackets below) times the number of Ohio resident full-time freshmen, from submodel 3.

$$\text{Out-of-state fresh } (t)_j = \left[\frac{\text{Percent } (t)_j}{1 - \text{Percent } (t)_j}\right] \times \text{Ohio fresh } (t)_j$$

Where Percent $(t)_j$ = percent of out-of-state freshmen to total freshmen forecast for school j in year t.

The two freshmen classes are then summed to provide total freshmen estimates by public campus.

Cohort Survival Ratios for Sophomores, Juniors, and Seniors: Submodel 5

To complete the forecast of full-time undergraduate enrollments, the number of sophomores, juniors, and seniors must also be estimated. The cohort survival ratio is considered a reliable and efficient means of doing so. Although sometimes quite different among schools, the ratio, within an institution, of students at rank X in year t, to students at rank X + 1 in year t + 1, is considered stable from year to year (Innis, 1971).

The survival ratios to sophomores, juniors and seniors in year t at school j, for the previous year's freshmen, sophomores and juniors are given by

$$R_j^{Soph}(t) = \frac{Soph(t)_j}{Fresh(t-1)_j}$$

$$R_j^{Jun}(t) = \frac{Jun(t)_j}{Soph(t-1)_j}$$

$$R_j^{Sen}(t) = \frac{Sen(t)_j}{Jun(t-1)_j}$$

where R represents the rate of survival[2] in each case.

Estimates of survival rates at each institution over the period 1976-1980 are provided in Appendix A. It is suggested that, in the future updating of this model, institutional inputs be requested in verifying the accuracy of these estimates.

Graduate and Professional Students: Submodel 6

Forecasting full-time graduate and professional (e.g. Law, Medicine) enrollments, at the eleven state universities which offer post-baccalaureate degrees, is the final consideration in this system for full-time students. Other studies have tried to tie graduate enrollments to a university's freshmen population (Perkins and Paschke (1973)), but such a relationship is unstable when applied to Ohio schools. Instead, a relationship is

[2]Such survival rates take into account not only continuing students and dropouts, but also transfers and drop-ins. Thus, a large urban university, which receives a large influx of two-year college transfers, may easily maintain survival rates greater than 100% from the sophomore to junior year.

found to hold between graduate enrollments and total full-time undergraduate populations. A very smooth upward trend in the ratio of graduates to undergraduates is seen at several state universities. At the others, a stable relationship is in existence. As in the case of out-of-state freshmen (Submodel 4), the technique selected to forecast the relationship between graduate and undergraduate populations is the time-series, or trend line method.

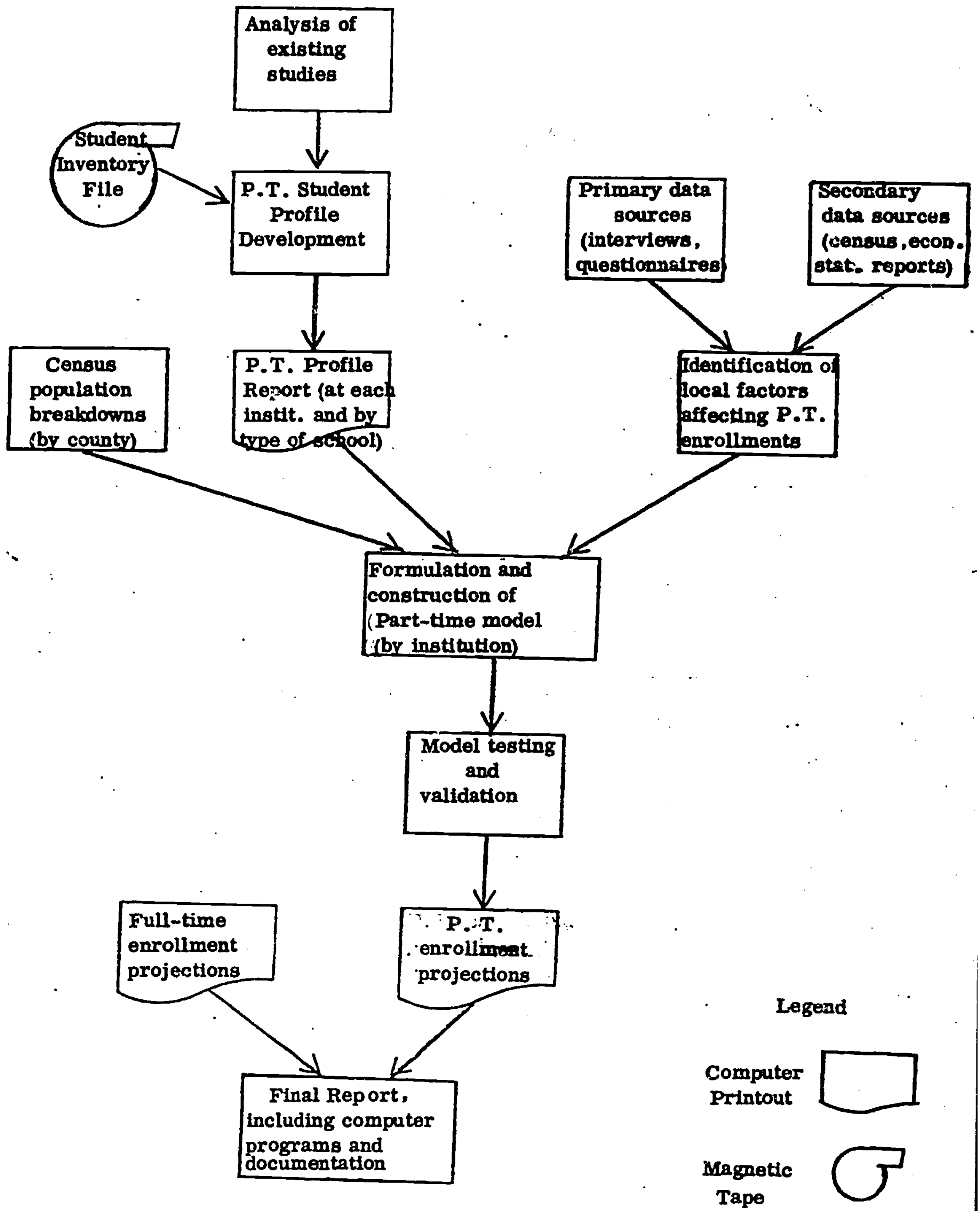
Professional enrollments are controlled in admissions at most universities. Administrative inputs were sought to update historical full-time counts.

THE STUDY OF PART-TIME STUDENTS

The next four sections of this report are addressed to the subject of part-time degree-credit enrollments. The first, a compilation and analysis of existing studies, involved a search of literature on adult and part-time student education. The second section deals with the creation of a profile of part-time students at each institution and in the entire Ohio system. The third section describes attempts to identify factors affecting part-time enrollments in various regions of the state. Finally, the methodology by which part-time enrollments are forecast is presented in the fourth section.

Figure 2 illustrates the step by step procedures followed in developing part-time projections. It should be noted that, for purposes of this study, part-time students are referred to in the traditional sense,

Figure 2
Study of Part-time Enrollments



as students enrolled in from one through eleven hours of degree-credit work. This complements the definition of a full-time student, adopted earlier, as a person registered for twelve or more hours of degree-credit work.[3]

THE PART-TIME STUDENT: A BRIEF LITERATURE SUMMARY

Over fifty-five references dealing with part-time and adult students in higher education are included in the bibliography at the end of this report. Their highlights are briefly discussed below.

Part-time Students - The Way Things Were

The subjects of part-time higher education, adult education, and continuing education have become the vogue or educational literature in the past four years. No institution, it now seems, is disinterested in the education of the nation's adults. Times have changed considerably since most educational administrators passed through college, however.

In years past, Dean Harold Glen Clark of Brigham Young University writes:

> The part-time student was as different from a full-time student as day is from night. We can still remember when special sessions...were devised to take care of this 'off beat' student. He was thought of as something less than the more respected regular student, ...as less serious in his intentions and not sharp enough to pursue the regular curriculum. (1974, p. 24)

[3]The definition does not, however, include another increasingly important category of student, namely, a person in non-credit continuing education programs. That topic is addressed in a later section of this report entitled "Further Work and Extensions."

Daniel H. Perlman, of Roosevelt University, echoes Clark's ideas:

> The graduate research university was the embodiment of the ideal: a place where research and scholarship could be carried on for its own sake...Students were young because higher education was something to be acquired before one began the business of life. Students were expected to be unmarried and unemployed. This view dominated American higher education for most of its three hundred year history, and is still the norm in many places.

Regarding adult education, Perlman adds:

> The activities, programs, faculty and students of this segment of higher education occupied a peripheral, second class status. These programs did not become part of the collective memory of higher education; they were generally not written about, widely referred to, or built upon. (1975, p. 323)

Some aspects of continuing adult education had been successful for many years, particularly in the area of professional extension programs.[4] But in the arena of credit and degree programs, offerings to part-time and evening students, and faculty interest in them, had generally been weak. It was estimated that "no more than 5 percent of part-time students studying for degrees ever achieve them." (Haygood, 1970, p. 201)

A dramatic change in higher education took place in about 1970. Suddenly, it became respectable to develop evening, off-campus and non-residential programs. As Perlman states:

> The higher education community was surprised to discover a 'new' market. It was learned that the country contained twelve million adults over age 25 who had had some college but had not graduated, and another 38 million who had completed high school but had not attended college. (1975, p. 324)

[4]In 1963, for example, the University of California enrolled in its professional programs: 1 out of every 3 lawyers in the state; 1 out of every 5 dentists; 1 out of every 6 doctors; 1 out of every 8 engineers; and 1 out of every 12 teachers in the state (Haygood, 1970, p. 203)

As projections showed that these numbers would reach 22 million and 59 million respectively by 1990, plans proliferated to tap the new market.

The New Majority

Although but a few significant studies have been conducted to analyze part-time or adult post-secondary education, several important facts do emerge. Since 1969, for example, more credit and non-credit students have participated in post-secondary education on a part-time basis (55%) than on a full-time basis (45%). In 1972 the participation rate was 57% vs. 43%. The rate of increase for part-time college students between 1969 and 1972 was 3.5 times faster than for full-time students. (Goerke, 1974; Clark, 1974; American Council on Education, 1974).

This breed of adult part-time students has been termed "the new majority" in post-secondary education. Junior colleges have lead the way in the rate of increase, but as was also pointed out in the American Council on Education's report, Financing of Higher Education for Adult Students, 63% of the students in graduate programs (in 1972) attended on a part-time basis.

The new majority, according to the A.C.E. paper, are also essentially different from full-time students. They are mostly employed, older, and seriously concerned with occupational needs and with family and home life. In particular, the report states that part-time students have four different types of motivations and behavioral patterns, only one of which they share with full-time students:

1) Some part-time students attend school for a variety of personal and family reasons, as do most full-time students;

2) Part-time students in occupational and professional groups continue their education because of salary incentives, peer group pressures or because of legal, relicensing or certification requirements;

3) Employees in organizations come back to school for programs usually designed by the organization to achieve its goals;

4) Others participate in federal or state public problem solving programs.

Two Year Colleges

While the part-time student phenomenon is characteristic of all post-secondary institutions, it is most pronounced in the two year colleges where, since 1969, the percentage of part-time students has risen from 49.4 to 56.0 in 1973. Table I illustrates this national trend for degree credit students. If non-credit students enrolled in various categories were included, the trend toward part-time enrollment in two year colleges would be even more pronounced.

Table II presents a list of states with sizable two year college enrollments and their 1973 percentage of part-time students. More than half of the states saw part-time figures exceed full-time figures in 1973. In addition, the number of women enrolled part-time in two-year colleges has increased significantly. According to the Chronicle of Higher Education (Dec. 16, 1974, p. 8) the part-time female enrollment jumped from 635,364 in 1972 to 732,914 in 1973 to 884,588 in 1974.

John Lombardi, of UCLA, sums up the two-year college situation:

> Part-time students are the new majority on the two-year campuses...By 1980, they will represent two-thirds of the student body in at least half the states,...the national figures for part-time students will be truly phenomenal. The total may very well approach 11 to 12 million. (1975, p. 25)

TABLE I

Full-Time and Part-Time Enrollments

in

Two Year Colleges

Fall 1969-1973

Fall	Full-Time	Part-Time	Percent of Part-Time
1969	1,062,000	1,038,000	49.4
1970	1,172,000	1,135,000	49.2
1971	1,276,000	1,271,000	49.9
1972	1,281,000	1,446,000	53.0
1973	1,297,000	1,670,000	56.3

Sources: 1970, 1971, 1972 Junior College Directories
1973, 1974 Community and Junior College Directories
1975 Community, Junior, and Technical College Directory

TABLE II

Full-Time and Part-Time Enrollments

17 States With Enrollments of More Than 40,000

Fall 1973

A. States with Part-Time Enrollments Exceeding 50 percent

	Full-Time	Part-Time	Percent Part-Time
Arizona	20,111	48,695	70.9
California	307,775	548,625	64.1
Illinois	73,463	133,889	64.6
Maryland	24,033	60,918	71.7
Michigan	48,759	147,626	75.2
Missouri	18,084	23,159	56.2
New Jersey	30,298	32,891	52.1
Ohio	38,111	44,665	54.0
Oregon	23,578	48,883	67.4
Pennsylvania	26,187	29,618	53.1
Texas	77,141	83,765	52.1
Virginia	24,523	30,285	55.3
Washington	46,876	56,896	54.8
Wisconsin	27,115	64,369	70.4

B. States With Full-Time Enrollments Exceeding 50 Percent

	Full-Time	Part-Time	Percent Part-Time
Florida	68,253	64,283	48.5
New York	129,188	103,608	45.5
North Carolina	36,063	29,967	45.4

Source: 1975 Community, Junior, and Technical College Directory, p. 92

Changing Age Patterns

Another important factor in the analysis of part-time students in higher education has been the changing age distribution. Studies in Ohio and nation-wide have for some time indicated the dwindling rate of the 18-21 year old and 18-24 year old populations from within the part-time ranks. A 1972 U.S. Office of Education (U.S.O.E.) Survey (see Table III) illustrates that 69.2% of all part-time two-year college students and 78.8% of all part-time four-year college students are over 24 years of age. Overall, 74% of the part-time students are 25 or older. (A.C.E., 1974, p. 25)

This study indicates that part-time students in Ohio public colleges are not as old as the national average. In 1971, only 55% of the part-time enrollments in Ohio were 25 years of age or older. By 1975, this figure had risen to 61%.[5]

Anne Young's article, entitled "Going Back to School at 35", also employed 1972 U.S.O.E. Survey data to make several strong points about the adult part-time student. One out of every 50 adults aged 35 years or older (1.5 million people) was said to be "going back to school." Of these, 780,000 were attending colleges or universities. 86% (i.e., 354,300) of the women and 80% (i.e., 293,300) of the men were registered part-time. 98% of the men and 75% of the women were in the labor force, and nearly all the women were married (1973, p. 39-40).

---

[5]It should be noted, however, that the U.S.O.E. Survey included both degree-credit and non-credit part-time college students in its study, whereas this study looks only at degree-credit students. It is likely that the inclusion of non-degree credit students. induces a bias toward an older average age.

TABLE III

Age Distribution

Part-Time Collegiate Students

Age	2 Year Coll/Tech	4 Year Coll/Univ
17-24	30.8%	22.2%
25-34	32.1	39.4
35-44	18.8	21.1
45-54	12.1	12.0
55-64	4.5	4.4
65+	1.7	1.0
Total Participants	2,561,000	3,367,000

Source: 1972 USOE Survey

The age factor is a major issue which will face all states in setting new policies for the financing of part-time students. Again quoting the American Council on Education report:

> It is a central premise of this report that all students in postsecondary institutions are adults with adult responsibilities both in terms of their roles in society and in the academic environment. As a consequence, past distinctions between regular full-time students who enter college after high school graduation and "adult" students (those who have graduated or who are over 21 and have never completed college) can no longer be sustained either for program or financing purposes. In 1972, for example, of the 782,000 veterans enrolled in collegiate education, those 22 years and older comprised 96.0 percent of vocational and technical school veterans' enrollments, 95.8 percent of community college veterans' enrollments, 97.7 percent of other undergraduate veterans' enrollments and 99.8 percent of graduate veterans' enrollments. Even among veteran freshmen, 80.6 percent of the enrollees were 22 and over. The average age of all Vietnam era veterans through June 1973 was 27 years. (1974, p. 23)

The question, according to the President of the National University Extension Association, is equitable funding of part-time students. Glenn Goerke states:

1. Our students must have the same access to loans and scholarships as do full-time students.
2. Tuition rates must be revised so that hourly rates charged part-time students do not average out to be greater than the rate charged full-time students.
3. State funding formuli and other budgeting devices must accept the responsibility for equal support of the part-time student. (1974, p. 6)

Steven Sample, Vice-President of the University of Nebraska system, adds:

> Encouraging part-time students through fair and equitable treatment takes us even more quickly into uncharted political waters, away from old attractive models of full-time kids in college. But in the final analysis, the part-time adult continuum is an exciting new market. (1974, p. 29)

Analyzing the "Exciting New Market"

The Carnegie Commission's extensive analysis of continuing education in New Students, New Places, and the data in the study lead Lyman Glenny to the conclusion that: "Higher education will no longer be a growth industry unless an entirely new constituency can be attracted to its institutions, and unless continuing education becomes an accepted pattern in our society." (1974, p. 6)

But as Richard Berendzen asks: "If older students are to partly save higher education, what do we actually know about them? The answer is not nearly enough." (1974, p. 123)

And if the question is rephrased as: What do we know about degree-credit part-time students in our colleges and universities, the answer, unfortunately, is even less.

As best as can be determined, no statewide or nationwide large scale study of degree-credit part-time higher education has been published to date. No enrollment projection studies delve deeply into the issue of part-time students; few institutions have gone beyond a simple survey of part-time or evening students in efforts to identify and profile them; and very few studies (Nolfi, 1973; Duggan, 1972) have attempted to correlate part-time attendance to socio-economic factors.

What is the Part-Time Potential?

Various studies mentioned earlier in this section lay claim to the enormous potential for the part-time segment of higher education enrollments. Including non-credit students, some researchers believe that more than 10 million part-time students may be counted by 1980. The National Center for

Education Statistics forecasts a 17% increase in degree-credit part-time students, to over 3.5 million, by 1980, (while estimating that full-time enrollments will be virtually unchanged at 5.7 million). (1975, p. 23)

But how can the potential for part-time enrollments in Ohio, particularly in the large cities, be measured? Is there such a thing as a level of potential which has not yet been reached in each community?

Table IV presents some thought provoking data pertaining to 1973 part-time degree credit enrollments at both public and private colleges in Ohio's four largest SMSA's. It is evident, given the population of potential students in the four areas, that certain cities have been much more successful in developing an atmosphere conducive to part-time higher education than others. The concept of "marketing the university" (see Berry and George, 1975) can no doubt have an impact on these and future figures.

PROFILE OF PART-TIME ENROLLMENTS

In order to not only forecast part-time enrollments, but to better understand who the part-time student is and to aid in creating educational programs for him, a five-year profile of part-time enrollments at each institution was developed. This process involved the writing of a series of computer programs designed to extract the type of information which might prove useful in analyzing patterns of part-time attendance.

Included in the profile of each institution were student counts broken down by: (1) day-evening status, (2) hours attempted, (3) rank, (4) age, (5) sex, and (6) home county, as well as cross tabulations and

TABLE IV

Part-Time Enrollments by SMSA - 1973

Area	Part-Time Total	Population	Percent Enrolled
Cincinnati SMSA	20,691	1,100,800	1.88%
Cleveland SMSA	24,364	2,004,000	1.22%
Columbus SMSA	10,343	1,055,900	0.98%
Dayton SMSA	14,064	845,300	1.66%

Cincinnati area schools included are: University of Cincinnati (13,326); OCAS (1,739); Walters (1,063); University College (166); Cincinnati Tech (82); Mt. St. Joseph (170); Edgecliff (126); Xavier University (4,019)

Cleveland area schools included are: Cleveland State (5,610); Cayahoga (14,641); Baldwin-Wallace (585); Case-Western (2,249); John Carroll (1,131); Ursuline (148)

Columbus area schools included are: Ohio State (6,368); Columbus Tech (676); Bliss (85); Capital (434); Franklin (2,372); Ohio Dominican (308); Ohio Institute (100)

Dayton area schools included are: Wright State (6,342); Sinclair (5,457); Dayton (2,073); Kettering (47); Miami-Jacobs (145)

Sources: Garland Parker's annual reports in Intellect and Census data.

related percentages for several of these variables. It is hoped that these data will be helpful in anticipating the market for future programs.

In addition to institutional profiles, a series of seven state level aggregate profiles was developed to present a better picture of the total scene. These seven categories are as follows: (1) urban universities, (2) non-urban universities,[6] (3) all universities, (4) community/general colleges, (5) technical colleges, (6) branch campuses, and (7) all state schools. As will be seen in later sections, enrollments forecasting was also conducted not only at the institutional level, but in each of these aggregate categories as well.

An attached printout contains the part-time enrollment profiles of individual schools. For purposes of illustration, the next seven pages contain the aggregate profiles just mentioned.

Many interesting patterns of change are evidenced in these statistical reports. For example, although student rank distributions (percentage-wise) remained relatively stable over the past five years, a steady increase is noted in the percentage of students enrolled in evening programs. Equally important, one observes an increase in female participation, not only in terms of greater numbers statewide, but in percent (from 41% in 1971 to 47% in 1975). Finally, an examination of the age distributions tells the same story that was mentioned earlier on the national level. Declining (relative) participation in the 18-24 year old age groupings is

---

[6]Urban universities include Cleveland State, Ohio State, Toledo, Akron, Cincinnati, Wright and Youngstown. Non-urban universities include Bowling Green, Kent, Miami, Ohio and Central State.

	STUDENTS	%	STUDENTS	%	STUDENTS	%	STUDENTS	%	STUDENTS	%
PART-TIME TOTAL	92569		97933		105898		117030		130234	
I. ENROLLMENT										
A. DAY	44738	48	52736	54	49793	47	52663	45	55415	43
B. EVENING	47829	52	45197	46	56005	53	64366	55	74819	57
II. HOURS ATTEMPTED										
A. 0-6 HOURS	58222	63	62544	64	69239	65	76936	66	84608	65
B. 7-11 HOURS	34347	37	35389	36	36651	35	40094	34	45626	35
III. HOURS ATTEMPTED &ENROLLMENT										
A. DAY 0-6 HRS.	23540	25	28747	29	27382	26	29159	25	28761	22
B. DAY 7-11 HRS.	21210	23	23989	24	22413	21	23505	20	26654	20
C. EVE 0-6 HRS.	34680	37	33797	35	41856	40	47777	41	55847	43
D. EVE 7-11 HRS.	13149	14	11400	12	14239	13	16589	14	18972	15
IV. RANK										
A. FRESH-SOPH	53023	57	55524	57	59471	56	65599	56	73963	57
B. JNR-SNR	19401	21	21459	22	23993	23	26643	23	29081	22
C. GRAD-PROF	20145	22	20950	21	22426	21	24788	21	27190	21
V. AGE										
A. 19 & UNDER	9013	10	9135	9	8981	8	9751	8	10609	8
(MALE, FEMALE)	4316 4697		4390 4745		4313 4668		4526 5225		4594 6015	
B. 20-21	11412	12	12307	13	12830	12	13702	12	14967	11
(MALE, FEMALE)	6369 5043		6785 5522		7120 5710		7394 6308		7801 7166	
C. 22-24	21235	23	20659	21	22153	21	24057	21	25622	20
(MALE, FEMALE)	13405 7830		12623 8046		13137 9016		13640 10417		14214 11408	
D. 25-29	21672	23	24098	25	27242	26	31068	27	35391	27
(MALE, FEMALE)	15395 6277		16401 7697		17684 9558		19354 11714		21300 14091	
E. 30-34	10648	12	11857	12	13331	13	14796	13	17175	13
(MALE, FEMALE)	6890 3758		7445 4412		7983 5348		8554 6242		9693 7482	
F. 35-39	6138	7	6522	7	7577	7	8383	7	9879	8
(MALE, FEMALE)	3196 2942		3334 3188		3777 3800		4001 4382		4619 5260	
G. 40-44	4478	5	4664	5	5106	5	5634	5	6295	5
(MALE, FEMALE)	1915 2563		1965 2699		2057 3049		2173 3461		2523 3772	
H. 45-49	3107	3	3271	3	3691	3	4092	3	4528	3
(MALE, FEMALE)	1127 1980		1247 2024		1377 2314		1402 2690		1514 3014	
I. 50 & OVER	4866	5	5410	6	4979	5	5547	5	5768	4
(MALE, FEMALE)	2315 2551		2400 3410		2312 2667		2474 3073		2313 3455	
J. MEAN AGE	28		28		29		29		29	
VI. SEX										
MALE	54928	59	56590	58	59760	56	63518	54	68571	53
FEMALE	37641	41	41343	42	46130	44	53512	46	61663	47

URBAN UNIVERSITIES	1971 STUDENTS	%	1972 STUDENTS	%	1973 STUDENTS	%	1974 STUDENTS	%	1975 STUDENTS	%
PART-TIME TOTAL	47597		50634		53354		58603		61271	
I. ENROLLMENT										
A. DAY	19399	41	23208	46	21903	41	23117	39	20755	34
B. EVENING	28194	59	27426	54	31451	59	35486	61	40516	66
II. HOURS ATTEMPTED										
A. 0-6 HOURS	29130	61	31340	62	33760	63	37329	64	38446	63
B. 7-11 HOURS	18463	39	19294	38	19594	37	21274	36	22825	37
III. HOURS ATTEMPTED &ENROLLMENT										
A. DAY 0-6 HRS.	9778	21	12111	24	11173	21	11699	20	8745	14
B. DAY 7-11 HRS.	9621	20	11097	22	10730	20	11418	19	12010	20
C. EVE 0-6 HRS.	19352	41	19229	38	22587	42	25630	44	29701	48
D. EVE 7-11 HRS.	8842	19	8197	16	8864	17	9856	17	10815	18
IV. RANK										
A. FRESH-SOPH	20576	43	20850	41	21065	39	22519	38	22634	37
B. JNR-SNR	13242	28	14569	29	16094	30	17732	30	19091	31
C. GRAD-PROF	13775	29	15215	30	16195	30	18352	31	19546	32
V. AGE										
A. 19 & UNDER	3516	7	3526	7	3150	6	3427	6	3415	6
(MALE, FEMALE)	1698 1818		1725 1801		1570 1580		1716 1711		1563 1852	
B. 20-21	5256	11	5713	11	5775	11	6099	10	6161	10
(MALE, FEMALE)	3083 2173		3386 2327		3480 2295		3567 2532		3471 2690	
C. 22-24	11847	25	11532	23	12403	23	13481	23	13715	22
(MALE, FEMALE)	7678 4169		7288 4244		7623 4780		7986 5495		7958 5757	
D. 25-29	12665	27	14307	28	15602	29	17437	30	18761	31
(MALE, FEMALE)	9323 3342		10079 4228		10449 5153		11147 6290		11708 7053	
E. 30-34	5926	12	6513	13	6986	13	7562	13	8294	14
(MALE, FEMALE)	4133 1793		4440 2073		4498 2488		4635 2927		5031 3263	
F. 35-39	3074	6	3345	7	3621	7	3964	7	4387	7
(MALE, FEMALE)	1816 1258		1887 1458		1946 1675		2052 1912		2219 2168	
G. 40-44	2181	5	2280	5	2303	4	2593	4	2614	4
(MALE, FEMALE)	1052 1129		1061 1219		988 1315		1059 1534		1130 1484	
H. 45-49	1455	3	1597	3	1692	3	1915	3	1910	3
(MALE, FEMALE)	589 866		670 927		670 1022		664 1251		697 1213	
I. 50 & OVER	1673	4	1821	4	1822	3	2125	4	2014	3
(MALE, FEMALE)	720 953		711 1110		785 1037		868 1257		726 1288	
J. MEAN AGE	28		28		28		29		28	
VI.										
A. MALE	30092	63	31247	62	32009	60	33694	57	34503	56
B. FEMALE	17501	37	19387	38	21345	40	24909	43	26768	44

	1971 STUDENTS	%	1972 STUDENTS	%	1973 STUDENTS	%	1974 STUDENTS	%	1975 STUDENTS	%
PART-TIME TOTAL	9435		8370		8819		8844		9621	
I. ENROLLMENT										
A. DAY	9203	98	8151	97	8291	94	8174	92	9008	94
B. EVENING	231	2	219	3	526	6	670	8	613	6
II. HOURS ATTEMPTED										
A. 0-6 HOURS	5027	53	4700	56	5164	59	5227	59	5612	58
B. 7-11 HOURS	4408	47	3670	44	3655	41	3617	41	4009	42
III. HOURS ATTEMPTED &ENROLLMENT										
A. DAY 0-6 HRS.	4838	51	4520	54	4727	54	4651	53	5129	53
B. DAY 7-11 HRS.	4366	46	3631	43	3566	40	3523	40	3679	40
C. EVE 0-6 HRS.	188	2	180	2	436	5	576	7	483	5
D. EVE 7-11 HRS.	43	0	39	0	90	1	94	1	130	1
IV. RANK										
A. FRESH-SOPH	1868	20	1496	18	1382	16	1354	15	1664	17
B. JNR-SNR	2417	26	2284	27	2622	30	2650	30	2675	28
C. GRAD-PROF	5150	55	4590	55	4815	55	4840	55	5282	55
V. AGE										
A. 19 & UNDER	665	7	434	5	395	4	321	4	422	4
(MALE, FEMALE)	319 346		203 231		188 207		180 141		203 219	
B. 20-21	968	10	848	10	879	10	777	9	804	8
(MALE, FEMALE)	539 429		444 404		466 413		420 357		411 393	
C. 22-24	2724	29	2348	28	2398	27	2452	28	2464	26
(MALE, FEMALE)	1690 1034		1419 929		1384 1014		1332 1120		1319 1145	
D. 25-29	2348	25	2371	28	2527	29	2636	30	2944	31
(MALE, FEMALE)	1567 781		1554 817		1595 932		1571 1065		1678 1266	
E. 30-34	941	10	869	10	981	11	1060	12	1170	12
(MALE, FEMALE)	621 320		527 342		533 448		609 451		647 523	
F. 35-39	617	7	508	6	588	7	597	7	687	7
(MALE, FEMALE)	317 300		252 256		275 313		251 346		287 400	
G. 40-44	491	5	419	5	471	5	434	5	470	5
(MALE, FEMALE)	205 286		170 249		176 295		145 289		176 254	
H. 45-49	343	4	292	3	313	4	290	3	349	4
(MALE, FEMALE)	132 211		101 191		94 219		82 208		92 257	
I. 50 & OVER	338	4	281	3	267	3	277	3	311	3
(MALE, FEMALE)	132 206		76 205		77 190		71 206		87 224	
J. MEAN AGE	28		28		28		28		29	
VI. SEX										
MALE	5522	59	4746	57	4788	54	4661	53	4900	51
FEMALE	3913	41	3624	43	4031	46	4183	47	4721	49

PART-TIME TOTAL	STUDENTS 57032	%	STUDENTS 59004	%	STUDENTS 62173	%	STUDENTS 67447	%	STUDENTS 70892	%
I. ENROLLMENT										
A. DAY	28602	50	31359	53	30194	49	31291	46	29763	42
B. EVENING	28425	50	27645	47	31977	51	36156	54	41129	58
II. HOURS ATTEMPTED										
A. 0-6 HOURS	34157	60	36040	61	38924	63	42556	63	44058	62
B. 7-11 HOURS	22871	40	22964	39	23249	37	24891	37	26834	38
III. HOURS ATTEMPTED &ENROLLMENT										
A. DAY 0-6 HRS.	14616	26	16631	28	15900	26	16350	24	13874	20
B. DAY 7-11 HRS.	13987	25	14728	25	14296	23	14941	22	15889	22
C. EVE 0-6 HRS.	19540	34	19409	33	23023	37	26206	39	30184	43
D. EVE 7-11 HRS.	8885	16	8236	14	8954	14	9950	15	10945	15
IV. RANK										
A. FRESH-SOPH	22444	39	22346	38	22447	36	23873	35	24298	34
B. JNR-SNR	15659	27	16853	29	18716	30	20382	30	21766	31
C. GRAD-PROF	18925	33	19805	34	21010	34	23192	34	24828	35
V. AGE										
A. 19 & UNDER	4181	7	3960	7	3545	6	3748	6	3837	5
(MALE,FEMALE)	2017 2164		1928 2032		1758 1787		1896 1852		1766 2071	
B. 20-21	6224	11	6561	11	6654	11	6876	10	6965	10
(MALE,FEMALE)	3622 2602		3830 2731		3946 2708		3987 2889		3882 3083	
C. 22-24	14571	26	13880	24	14801	24	15933	24	16179	23
(MALE,FEMALE)	9368 5203		8707 5173		9007 5794		9318 6615		9277 6902	
D. 25-29	15013	26	16678	28	18129	29	20073	30	21705	31
(MALE,FEMALE)	10890 4123		11633 5045		12044 6085		12718 7355		13386 8319	
E. 30-34	6867	12	7382	13	7967	13	8622	13	9464	13
(MALE,FEMALE)	4754 2113		4967 2415		5031 2936		5244 3378		5678 3786	
F. 35-39	3691	6	3853	7	4209	7	4561	7	5074	7
(MALE,FEMALE)	2133 1558		2139 1714		2221 1988		2303 2258		2506 2568	
G. 40-44	2672	5	2699	5	2774	4	3027	4	3084	4
(MALE,FEMALE)	1257 1415		1231 1468		1164 1610		1204 1823		1306 1778	
H. 45-49	1798	3	1889	3	2005	3	2205	3	2259	3
(MALE,FEMALE)	721 1077		771 1118		764 1241		746 1459		789 1470	
I. 50 & OVER	2011	4	2102	4	2089	3	2402	4	2325	3
(MALE,FEMALE)	852 1159		787 1315		862 1227		939 1463		813 1512	
J. MEAN AGE	28		28		28		28		28	
VI. SEX										
A. MALE	35614	62	35993	61	36797	59	38355	57	39403	56
B. FEMALE	21414	38	23011	39	25376	41	29092	43	31489	44

COMMUNITY/GEN COLL	1971 STUDENTS	%	1972 STUDENTS	%	1973 STUDENTS	%	1974 STUDENTS	%	1975 STUDENTS	%
PART-TIME TOTAL	18914		22459		25698		29057		34277	
I. ENROLLMENT										
A. DAY	8628	46	10825	48	10811	42	12119	42	14597	43
B. EVENING	10286	54	11634	52	14887	58	16938	58	19680	57
II. HOURS ATTEMPTED										
A. 0-6 HOURS	13261	70	15600	69	18270	71	20664	71	23581	69
B. 7-11 HOURS	5653	30	6859	31	7428	29	8393	29	10696	31
III. HOURS ATTEMPTED & ENROLLMENT										
A. DAY 0-6 HRS.	4499	24	5775	26	6384	25	7353	25	8375	24
B. DAY 7-11 HRS.	4129	22	5050	22	4427	17	4766	16	6222	18
C. EVE 0-6 HRS.	8762	46	9825	44	11886	46	13311	46	15206	44
D. EVE 7-11 HRS.	1524	8	1809	8	3001	12	3627	12	4474	13
IV. RANK										
A. FRESH-SOPH	18887	100	22436	100	25678	100	28737	99	33744	98
B. JUN-SEN	27	0	23	0	20	0	320	1	533	2
C. GRAD-PROF	0	0	0	0	0	0	0	0	0	0
V. AGE										
A. 19 & UNDER	2476	13	2752	12	2917	11	3247	11	3706	11
(MALE, FEMALE)	1008 1468		1176 1576		1234 1683		1322 1925		1449 2257	
B. 20-21	2829	15	3175	14	3441	13	3893	13	4527	13
(MALE, FEMALE)	1387 1442		1492 1683		1685 1756		1823 2070		2084 2443	
C. 22-24	3478	18	3851	17	4202	16	4649	16	5520	16
(MALE, FEMALE)	2071 1407		2135 1716		2259 1943		2322 2327		2768 2752	
D. 25-29	3494	18	4222	19	5471	21	6613	23	8083	24
(MALE, FEMALE)	2327 1167		2660 1562		3295 2176		3854 2759		4569 3514	
E. 30-34	2035	11	2672	12	3256	13	3706	13	4630	14
(MALE, FEMALE)	1218 817		1516 1156		1800 1456		1961 1745		2439 2190	
F. 35-39	1237	7	1514	7	1985	8	2262	8	2714	8
(MALE, FEMALE)	567 670		687 827		923 1062		1000 1262		1198 1516	
G. 40-44	930	5	1103	5	1358	5	1490	5	1796	5
(MALE, FEMALE)	379 551		434 669		520 838		549 941		695 1101	
H. 45-49	704	4	835	4	1010	4	1133	4	1280	4
(MALE, FEMALE)	239 465		301 534		372 638		398 735		407 873	
I. 50 & OVER	1731	9	2335	10	2058	8	2064	7	2013	6
(MALE, FEMALE)	937 794		1221 1114		1106 952		1093 971		960 1053	
J. MEAN AGE	29		29		29		29		29	
VI. SEX										
A. MALE	10133	54	11622	52	13194	51	14322	49	16560	48
B. FEMALE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	STUDENTS	%	STUDENTS	%	STUDENTS	%	STUDENTS	%	STUDENTS	%
PART-TIME TOTAL	13126		11719		12383		12728		15241	
I. ENROLLMENT										
A. DAY	6206	47	8171	70	6284	51	5916	46	7076	46
B. EVENING	6920	53	3548	30	6099	49	6812	54	8165	54
II. HOURS ATTEMPTED										
A. 0-6 HOURS	8420	64	7822	67	8499	69	8914	70	10975	72
B. 7-11 HOURS	4706	36	3897	33	3884	31	3814	30	4266	28
III. HOURS ATTEMPTED & ENROLLMENT										
A. DAY 0-6 HRS.	3570	27	5094	43	3674	30	3628	29	4457	29
B. DAY 7-11 HRS.	2636	20	3077	26	2610	21	2288	18	2619	17
C. EVE 0-6 HRS.	4850	37	2728	23	4825	39	5286	42	6518	43
D. EVE 7-11 HRS.	2070	16	820	7	1274	10	1526	12	1647	11
IV. RANK										
A. FRESH-SOPH	8226	63	6073	52	6060	49	5738	45	6772	44
B. JUR-SUR	3680	28	4501	38	5040	41	5394	42	6107	40
C. GRAD-PROF	1220	9	1145	10	1283	10	1596	13	2362	15
V. AGE										
A. 19 & UNDER	1671	13	1502	13	1539	12	1558	12	1593	10
(MALE, FEMALE)	838 833		736 766		714 825		661 897		647 946	
B. 20-21	1881	14	1838	16	1850	15	1738	14	1955	13
(MALE, FEMALE)	1014 867		996 842		949 901		877 861		953 1002	
C. 22-24	2681	20	2237	19	2220	18	2210	17	2453	16
(MALE, FEMALE)	1594 1087		1277 960		1252 968		1214 996		1247 1206	
D. 25-29	2611	20	2330	20	2525	20	2747	22	3468	23
(MALE, FEMALE)	1737 874		1438 892		1514 1011		1608 1139		1886 1582	
E. 30-34	1459	11	1311	11	1455	12	1560	12	1894	12
(MALE, FEMALE)	707 752		637 674		713 742		734 826		849 1045	
F. 35-39	1011	8	880	8	1012	8	1055	8	1347	9
(MALE, FEMALE)	384 627		342 538		411 601		383 672		489 858	
G. 40-44	721	5	644	5	712	6	726	6	951	6
(MALE, FEMALE)	193 528		195 449		241 471		206 520		283 668	
H. 45-49	491	4	405	3	496	4	499	4	698	5
(MALE, FEMALE)	[illegible] 363		116 289		157 339		138 361		202 496	
I. 50 & OVER	600	5	572	5	574	5	635	5	882	6
(MALE, FEMALE)	146 454		168 404		206 368		217 418		294 588	
J. MEAN AGE	29		28		28		29		29	
VI. SEX										
MALE	6721	51	5905	50	6157	50	6038	47	6850	45
FEMALE	6405	49	5814	50	6226	50	6690	53	8391	55

	STUDENTS	%	STUDENTS	%	STUDENTS	%	STUDENTS	%	STUDENTS	%
PART-TIME TOTAL	3501		4751		5636		7798		9824	
I. ENROLLMENT										
A. DAY	1302	37	2381	50	2504	44	3337	43	3979	41
B. EVENING	2198	63	2370	50	3132	56	4460	57	5845	59
II. HOURS ATTEMPTED										
A. 0-6 HOURS	2384	68	3082	65	3546	63	4802	62	5994	61
B. 7-11 HOURS	1117	32	1669	35	2090	37	2996	38	3830	39
III. HOURS ATTEMPTED &ENROLLMENT										
A. DAY 0-6 HRS.	855	24	1247	26	1424	25	1828	23	2055	21
B. DAY 7-11 HRS.	448	13	1134	24	1080	19	1510	19	1924	20
C. EVE 0-6 HRS.	1528	44	1835	39	2122	38	2974	38	3939	40
D. EVE 7-11 HRS.	670	19	535	11	1010	18	1486	19	1906	19
IV. RANK										
A. FRESH-SOPH	3466	99	4669	98	5286	94	7251	93	9149	93
B. JNR-SNR	35	1	82	2	217	4	547	7	675	7
C. GRAD-PROF	0	0	0	0	133	2	0	0	0	0
V. AGE										
A. 19 & UNDER	685	20	921	19	980	17	1198	15	1473	15
(MALE,FEMALE)	453 232		550 371		607 373		647 551		732 741	
B. 20-21	478	14	733	15	885	16	1195	15	1520	15
(MALE,FEMALE)	346 132		467 266		540 345		707 488		882 638	
C. 22-24	505	14	701	15	930	17	1265	16	1470	15
(MALE,FEMALE)	372 133		504 197		619 311		786 479		922 548	
D. 25-29	554	16	868	18	1117	20	1635	21	2135	22
(MALE,FEMALE)	441 113		670 198		831 286		1174 461		1459 676	
E. 30-34	287	8	492	10	653	12	908	12	1179	12
(MALE,FEMALE)	211 76		325 167		439 214		615 293		727 452	
F. 35-39	199	6	275	6	371	7	505	6	744	8
(MALE,FEMALE)	112 87		166 109		222 149		315 190		426 318	
G. 40-44	155	4	218	5	262	5	391	5	464	5
(MALE,FEMALE)	86 69		105 113		132 130		214 177		239 225	
H. 45-49	114	3	142	3	180	3	255	3	291	3
(MALE,FEMALE)	59 55		59 83		84 96		120 135		116 175	
I. 50 & OVER	524	15	401	8	258	5	446	6	548	6
(MALE,FEMALE)	380 144		224 177		138 120		225 221		246 302	
J. MEAN AGE	30		28		27		28		28	
VI. SEX										
A. MALE	2460	70	3070	65	3612	64	4803	62	5749	59
B. FEMALE	1041	30	1681	35	2024	36	2995	38	4075	41

coupled with a strong increase in the 25-29 year old group and moderate percentage increases in older categories.

Of course, it is also evident that, statewide, part-time enrollment has grown dramatically - from 92,569 in 1971 to 130,234 in 1975. Figure 3 and Table V illustrate the relationship between part-time and total Ohio enrollments.

Table V

PART-TIME VS. TOTAL ENROLLMENTS

	1971	1972	1973	1974	1975
Total	290,537	292,938	298,098	309,428	339,692
Part-time	92,569	97,933	105,890	117,030	130,234
Full-time	197,968	195,005	192,208	192,398	209,458
Part-time as % of Total	31.9%	33.4%	35.5%	37.8%	38.3%

It is estimated that part-time students will continue to increase as a percent of total enrollments, and by 1980 will comprise over 45% of statewide headcounts.

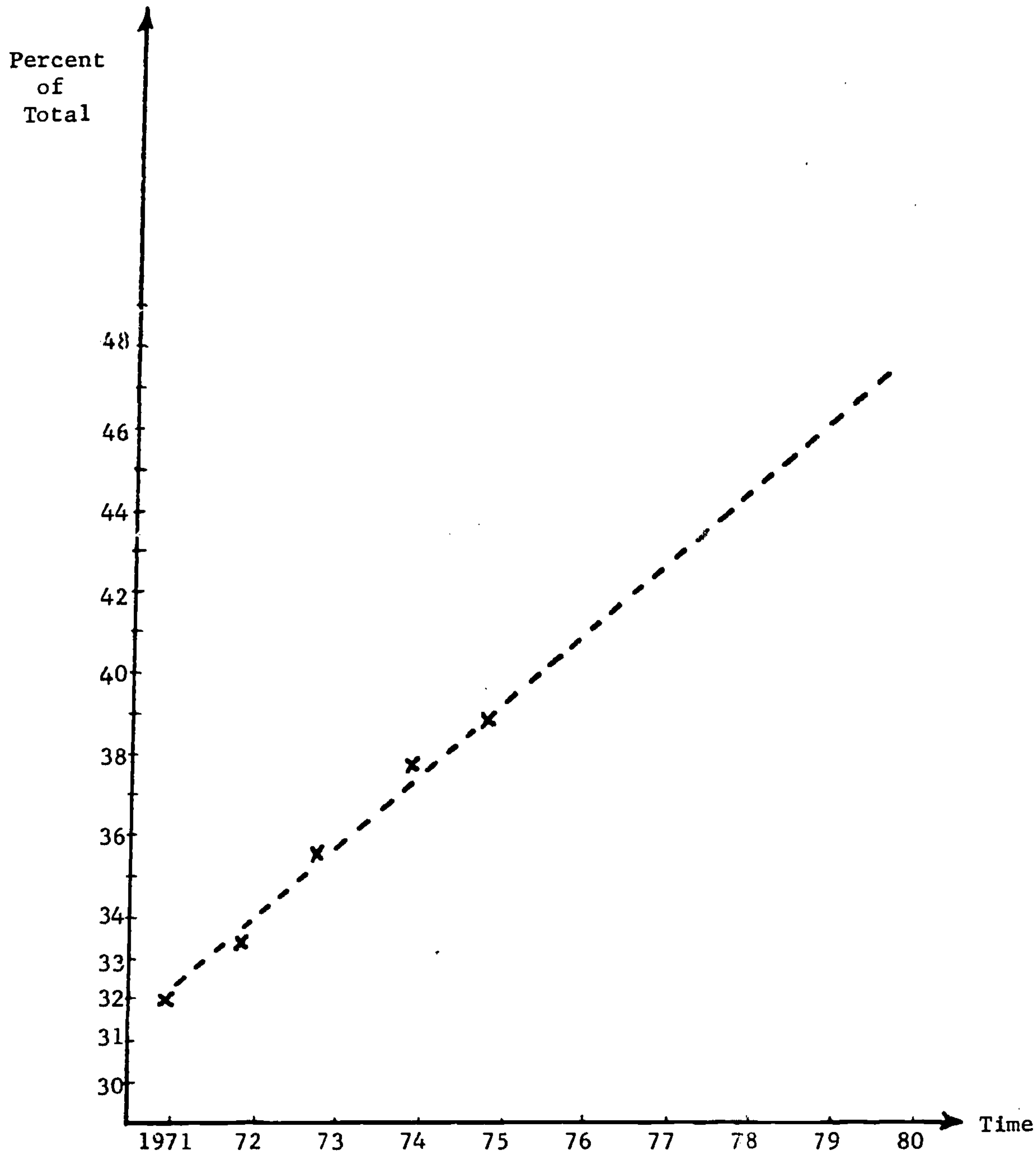
FACTORS AFFECTING PART-TIME ENROLLMENTS

Few studies of higher education have focused on the identification and quantification of factors critical to the forecasting of part-time student enrollments. One of the objectives of this project has been to attempt to formulate a model which establishes such predictive factors. This section describes some exploratory research involving two stages. First, a questionnaire was designed and distributed to all state insti-

Figure 3

Part-time Enrollments as a Percent of

Total State Enrollments



tutions with the goal of soliciting administrative inputs and regional insights regarding patterns of part-time enrollment. A second stage was directed to the gathering of demographic and economic indicator data and experimenting with a step-wise linear regression statistical model.

Questionnaire Results

The questionnaire exhibited on the next two pages of this report was mailed to the president of each state institution of higher education in Ohio. Accompanied by a cover letter from OBOR Chancellor Norton and computer generated profiles of part-time enrollments, the questionnaire was intended to assist in understanding and planning for the role of part-time students at the State and local levels. Actual enrollment projections were sought, as were factors which administrators considered to influence future part-time participation.

The fourth question responded to dealt with the identification of those factors. Table VI summarizes the comments provided by institutions of five different categories. Internal factors are controllable, to a great extent, by the college. External factors are often suggested to be a function of society and the economy.

Regression Analysis

Since so many questionnaire responses pointed to the economy as a major external factor influencing enrollments, a great deal of time was spent gathering income, sales, unemployment, and other indicators reflective of economic trends. Although five years of data is not an extensive time series which permits sophisticated statistical analysis,

QUESTIONNAIRE

Part-Time Degree Credit Enrollments

The enclosed computer printout profiles the part-time degree credit student population at your institution over the past five years. Your policy changes and many local factors may well have a strong impact on the part-time degree credit student situation in the near future. Your analysis of the data enclosed and the answers to the following questions will assist us in understanding and planning for the role of the part-time degree credit student in the State of Ohio in the coming years.

(1) To what extent do you believe that past trends shown on your computer profile will reflect the future part-time degree credit student enrollment at your institution? For example, do you perceive trends (either growth or decline) which will continue? Will they be even more pronounced?

(2) Do you have definite plans to increase offerings to attract part-time degree credit students next year? If so, please describe these in detail.

(3) Is it possible for students attending only on a part-time basis to earn a degree at your school? If so, approximately how many different degree programs, undergraduate and graduate, are available to the part-time student?

(4) What factors do you think will most influence part-time degree credit enrollments at your institution for the next five years?

(5) What projections, if any, have you made for part-time enrollments for the next five years at your campus, either in actual numbers or percentage changes.

How would you rate the following at your campus?

a. The level of support in local industry or government, today, for part-time programs at your school. They are

_____vitally interested _____concerned _____not interested.

b. The level of support you anticipate from industry and government in the next five years:

_____the same level _____increased support _____less support.

c. The registration process for part-time or evening students: (check as many as appropriate)

_____available by phone or mail _____available in the evening _____available on Saturdays _____same as for full-time

d. The advertising budget for part-time programs and students

_____large _____sufficient _____small _____none

e. The parking for part-time or evening students is

_____very accessible _____accessible _____difficult

f. The safety of campus after dark

_____very safe _____adequate _____could be improved _____could be improved significantly

Table VI

FACTORS THOUGHT TO INFLUENCE
DEGREE CREDIT PART-TIME ENROLLMENTS

	Internal Factors*	External Factors
Urban Universities	Off-campus offerings (2) Adult/career studies Evening/weekend classes Faculty interest Variety of credit cont. educ. programs More convenient to register/attend	Economy Inflation Job scarcity Societal/community attitudes towards higher education (4) Backlog of 25-34 year olds Influx from community/technical colleges (2)
Non-urban Universities	Continuing Educ. programs Class times Off-campus offerings Recruitment	More assoc. degree graduates Economy Job advancement Consortium
Community/ General Colleges	Expanded facilities More convenient (3) Variety of courses (3) Flexible scheduling	Economy (4) Financial Aid (3) Low tuition (3) Job market (2) Industrial expansion Laison program with industry
Technical Colleges	Flexible, wide ranged offerings (3) Off-campus programs (2) Evening courses/scheduling (3) Mini programs Promotion of courses (3) Accessibility	Economy (6) Employment and job training emphasis (6) Low tuition Financial aid (3) Lifestyle changes - women's lib Industry support Older students Public awareness (2)
Branch Campuses	Evening classes (2) Broad selection of courses (4) New programs (6) Job-related courses Convenient times Promotion of courses (2) Counseling of students	Economy (10) Job market - need to upgrade employee skills (5) Low cost programs (6) Industrial support Public awareness (2) Financial aid (2) Area population growth Social trends - women's lib

* Numbers in ( ) indicate the number of schools which responded with that particular answer.

the available indicators were tested, one at a time, for correlation with part-time enrollments. State level data were inserted when examining the aggregate groups of urban universities, non-urban universities, community/general colleges, technical colleges, and branch campuses. SMSA level data were employed in testing the model on sample schools in various regions.

The results, surprisingly, indicated that despite the inclusion of several varied indicators, the simple variable of "time" yielded the best statistical relations in over 75 percent of the cases. In some institutions with stable part-time enrollments (such as Cuyahoga-Metro), unemployment rates produced the best combination of coefficients of determination (R^2) and level of significance (F value). But because part-time headcounts at so many schools (and statewide) have exhibited a steady positive growth, time-series analysis may be considered as attractive a statistical model as a regression with more complex independent variables. Of the state level models, only non-urban universities and branch campuses did not yield significant correlations with the variable "time."

Table VII contains a technical summary of the state level models and a sample of three institutional models (Cleveland State, Sinclair, and Columb[illegible]ch).

FORECASTING PART-TIME ENROLLMENTS

Results of the analysis of linear regression models suggest that forecasts of part-time enrollments may be considered to be a function of historical attendance. Regression models with time as the independent

Table VII

***** MULTIPLE LINEAR REGRESSION *****

SAMPLE SIZE 5
DEPENDENT VARIABLE: CODE1 URBAN UNIVERSITIES
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.98698
MULTIPLE CORR COEFF. 0.99347

ESTIMATED CONSTANT TERM 43696.700
STANDARD ERROR OF ESTIMATE 740.68951

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.124729E+09	.124729E+09	227.4	0.0006
RESIDUALS	3	0.164586E+07	548621.		
TOTAL	4	0.126375E+09			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CODE1
TIME	3531.700	234.2	227.4	0.0006	0.9935

SAMPLE SIZE 5
DEPENDENT VARIABLE: CODE2 NON_URBAN UNIVERSITIES
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.06967
MULTIPLE CORR COEFF. 0.26395

ESTIMATED CONSTANT TERM 8764.0000
STANDARD ERROR OF ESTIMATE 564.41959

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	71571.6	71571.6	.2247	0.6679
RESIDUALS	3	955708.	318569.		
TOTAL	4	0.102728E+07			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR. COEF. WITH CODE2
TIME	84.60000	178.5	.2247	0.6679	0.2640

SAMPLE SIZE 5
DEPENDENT VARIABLE: CODE3 ALL UNIVERSITIES
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.97704
MULTIPLE CORR COEFF. 0.98845

ESTIMATED CONSTANT TERM 52460.700
STANDARD ERROR OF ESTIMATE 1012.1334

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.130776E+09	.130776E+09	127.7	0.0015
RESIDUALS	3	0.307324E+07	.102441E+07		
TOTAL	4	0.133849E+09			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CODE3
TIME	3616.300	320.1	127.7	0.0015	0.9885

SAMPLE SIZE 5 COMMUNITY/GENERAL COLLEGES
DEPENDENT VARIABLE: CODE4
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.99037
MULTIPLE CORR COEFF. 0.99517

ESTIMATED CONSTANT TERM 14883.800
STANDARD ERROR OF ESTIMATE 671.90715

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.139308E+09	.139308E+09	308.6	0.0004
RESIDUALS	3	0.135438E+07	451459.		
TOTAL	4	0.140662E+09			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CODE4
TIME	3732.400	212.5	308.6	0.0004	0.9952

SAMPLE SIZE 5 TECHNICAL COLLEGES
DEPENDENT VARIABLE: CODE5
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.97197
MULTIPLE CORR COEFF. 0.98588

ESTIMATED CONSTANT TERM 1594.1000
STANDARD ERROR OF ESTIMATE 486.56307

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.246270E+08	.246270E+08	104.0	0.0020
RESIDUALS	3	710231.	236744.		
TOTAL	4	0.253373E+08			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CODE5
TIME	1569.300	153.9	104.0	0.0020	0.9859

SAMPLE SIZE 5
DEPENDENT VARIABLE: CODE6 BRANCH CAMPUSES
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.38518
MULTIPLE CORR COEFF. 0.62063

ESTIMATED CONSTANT TERM 11467.700
STANDARD ERROR OF ESTIMATE 1208.4606

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.274471E+07	.274471E+07	1.879	0.2640
RESIDUALS	3	0.438113E+07	.146038E+07		
TOTAL	4	0.712584E+07			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CODE6
TIME	523.9000	382.1	1.879	0.2640	0.6206

SAMPLE SIZE 5 ALL STATE SCHOOLS
DEPENDENT VARIABLE: CODE7
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.97221
MULTIPLE CORR COEFF. 0.98601

ESTIMATED CONSTANT TERM 80403.100
STANDARD ERROR OF ESTIMATE 2914.6427

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.891646E+09	.891646E+09	105.0	0.0020
RESIDUALS	3	0.254854E+08	.849514E+07		
TOTAL	4	0.917131E+09			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CODE7
TIME	9442.700	921.7	105.0	0.0020	0.9860

SAMPLE SIZE 5 SINCLAIR COMMUNITY COLLEGE
DEPENDENT VARIABLE: SINCL
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.99638
MULTIPLE CORR COEFF. 0.99819

ESTIMATED CONSTANT TERM 1887.1000
STANDARD ERROR OF ESTIMATE 122.49409

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.123988E+08	.123988E+08	826.3	0.0001
RESIDUALS	3	45014.4	15004.8		
TOTAL	4	0.124438E+08			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH SINCL
TIME	1113.500	38.74	826.3	0.0001	0.9982

SAMPLE SIZE 5 CLEVELAND STATE UNIV.
DEPENDENT VARIABLE: CLEVE
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.99268
MULTIPLE CORR COEFF. 0.99633

ESTIMATED CONSTANT TERM 4806.1000
STANDARD ERROR OF ESTIMATE 63.853826

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	0.165893E+07	.165893E+07	406.9	0.0003
RESIDUALS	3	12231.9	4077.31		
TOTAL	4	0.167116E+07			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH CLEVE
TIME	407.3000	20.19	406.9	0.0003	0.9963

COLUMBUS TECH.
SAMPLE SIZE 5
DEPENDENT VARIABLE: COLUM
INDEPENDENT VARIABLES: TIME

COEFFICIENT OF DETERMINATION 0.95621
MULTIPLE CORR COEFF. 0.97786

ESTIMATED CONSTANT TERM 357.30000
STANDARD ERROR OF ESTIMATE 70.760400

ANALYSIS OF VARIANCE
FOR THE REGRESSION

SOURCE OF VARIATION	DF	S. SQ.	M.S.	F	PROB
REGRESSION	1	327972.	327972.	65.50	0.0039
RESIDUALS	3	15021.1	5007.03		
TOTAL	4	342993.			

VAR.	REGRESSION COEFFICIENT	S. E. OF REG. COEF.	F-VALUE (DF 1, 3)	PROB	CORR.COEF. WITH COLUM
TIME	181.1000	22.38	65.50	0.0039	0.9779

variable are not, however, necessarily the best technique for prediction. Exponential smoothing is another process which utilizes historical data. It obtains a smoothed value for the time-series of observations which becomes the forecast for some future period.

Exponential smoothing may be considered an appropriate forecasting device because of three properties : (a) it is easy to understand; (b) it is quickly executable; and (c) it is efficient. Research on sales and enrollment data suggest that the method produces generally lower forecast errors than many other techniques (Adam, 1973; Groff, 1973; Planisek, 1974).

Exponential smoothing assumes that the most recent observations contain the most information about what will happen in the future and they therefore should be given relatively more weight than older observations. Hence, it is a weighting scheme that applies the most weight to the most recent observed values and decreasing weights to the older values. A double exponential smoothing model, the procedure utilized in this research, is able to incorporate any trends that are present in the enrollments.

Exponential smoothing was believed to be a rational planning device which would produce less error than such other mathematical models as moving averages or regression. If a moving average or regression technique were employed, all past data would be considered equally relevant, whereas, the exponential smoothing model weights past data incrementally. That is, data which are in excess of four or five years could be considered irrelevant because of the changing conditions within the present higher education system. On the other hand, it is not always possible to rely merely on last year's data since it is subject to random error and would not be a stable basis upon which to project the data for the next time period. Hence, because exponential smoothing can assume that data are constant or that there is in fact a trend present and at the same time weights the most recently observed data more heavily, it was selected as the technique to utilize for forecasting purposes.

The Exponential Smoothing Models

The basic smoothing equation may be stated as:

$$\hat{R}(t+1) = AR(t) + A(1-A)R(t-1) + A(1-A)^2R(t-2) +\ldots+ A(1-A)^nR(t-n) +\ldots+ (1-A)^tR(0),$$

where $\hat{R}(t+1)$ is the enrollment projected for next year for a particular institution. Each R( ) represents the part-time enrollment over successive years and the "A" is a constant which is determined empirically or subjectively. (Shell and Render, 1975)

The following is an example of a simple exponential smoothing model:

$$\hat{R}(t+1) = AR(t) + (1-A)\hat{R}(t)$$

where $\hat{R}(t+1)$ is the part-time enrollment being predicted, A is the smoothing constant between zero and one, R(t) is the most recently observed enrollment, $\hat{R}(t)$ is the enrollment predicted the period before, and t is measured in years. In the above equations the sum of the weights is equal to one.

The simple exponential smoothing model is most appropriate if the enrollments are approximately constant. However, if a time series of enrollments portrays a trend, a double exponential smoothing model is more appropriate. That is, besides smoothing the actual enrollments, the slope of the line joining these figures is also smoothed and incorporated into the model. Two smoothing operations are therefore taking place simultaneously, one on the actual enrollments and one on the changes in enrollment. The following equation pertains:

$$\hat{B}(t) = A[\hat{R}(t)-\hat{R}(t-1 \text{ [illegible] } -A)\hat{B}(t-1)$$

where $\hat{B}(t)$ is the trend being estim[illegible](t)-$\hat{R}(t-1)$ is the apparent trend, $\hat{B}(t-1)$ is the trend previously estimated, and t is the time in years.

Both of these smoothed values are combined in developing the following model:

$$\hat{V}(t) = R(t) + [(1-A)/A]\hat{B}(t)$$

where $\hat{V}(t)$ is the estimated starting enrollment. The final prediction is obtained from:

$$\hat{F}(t+L) = \hat{V}(t) + L\hat{B}(t)$$

where L is the projected period 1, 2, 3, and $\hat{F}$ is the enrollment forecasted.

The above equation represents the model employed in this study for forecasting part-time enrollments. Values for the smoothing constant, A, were selected for each institution based on responses to the questionnaire distributed to administrators.

CONTROL TOTALS FOR ENROLLMENT FORECASTS

Part-time and full-time enrollment projections follow in the next section of this report. As will be seen, institutional projections are aggregated to provide a state level enrollment forecast of higher education in Ohio. To insure the reasonableness of the final part-time and full-time aggregate figures, the concept of "control totals" was employed.

Basically, this means that other techniques of forecasting aggregate enrollments were used to develop independent estimates, or control totals. In general, planners may feel more confident in the outputs of one mathematical model if they are corroborated by the results of other approaches.

One method of forecasting both part-time and full-time statewide enrollments is through analysis of percentage participation of the population in public higher education, by age and sex groupings. For example, if the participation of 25-29 year old males in part-time higher education is known historically, it may be possible to forecast the future participation of males in that age group. Coupled with population projections for the 25-29 year old Ohio male population, for the period 1976-1980, it is possible to forecast the part-time enrollments for that cohort of the population. The sum of all male and female part-time forecasts, for each age group, provides an aggregate control total for part-time Ohio enrollments.

This procedure was followed for the part-time and full-time sectors independently. Table VIII illustrates the data used for constructing part-time estimates. The "bottom line" of that table is a control total for part-time enrollments in 1976-1980. It was used as one measure of the credibility of the forecasts derived through institutional estimates. The differences are depicted below in Table IX.

TABLE VIII

PART-TIME ENROLLMENTS

BY AGE AND SEX

					Actual	Forecast				
Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
18 - 19										
Total	9013	9135	8981	9751	10609	10804	10800	11159	11134	11215
Male	4316	4390	4313	4526	4594	4578	4365	4360	4138	4068
Percent	2.2	2.2	2.1	2.1	2.1	2.1	2.0	2.0	1.9	1.9
Female	4697	4745	4668	5225	6015	6226	6435	6799	6996	7147
Percent	2.3	2.4	2.3	2.5	2.8	2.9	3.0	3.2	3.3	3.4
20 - 21										
Total	11412	12307	12830	13702	14967	15746	16307	17057	17302	17427
Male	6369	6785	7120	7394	7801	7989	8100	8286	8321	8317
Percent	4.0	3.9	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9
Female	5043	5522	5710	6308	7166	7757	[illegible]	8771	8981	9110
Percent	2.6	2.8	2.9	3.2	3.5	3.7	[illegible]	4.1	4.2	4.3
22 - 24										
Total	21235	20669	22153	24057	25622	27185	28394	29808	31237	32454
Male	13405	12623	13137	13640	14214	15054	15485	16057	16645	17054
Percent	5.9	6.2	6.6	6.3	5.9	5.8	5.7	5.7	5.7	5.7
Female	7830	8046	9016	10417	11408	12131	12909	13751	14592	15400
Percent	2.7	2.8	3.1	3.5	3.8	4.0	4.2	4.4	4.6	4.8

TABLE VIII

PART-TIME ENROLLMENTS

BY AGE AND SEX

					Actual	Forecast				
Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
25 - 29										
Total	21672	24098	27242	31068	35391	38506	40923	44101	48505	53535
Male	15395	16401	17684	19354	21300	22061	22758	24351	27064	30345
Percent	4.5	4.6	5.1	5.7	6.5	6.7	6.9	7.1	7.3	7.5
Female	6277	7697	9558	11714	14091	16445	18165	19750	21441	23190
Percent	1.7	1.9	2.3	2.6	3.0	3.3	3.6	3.9	4.2	4.5
30 - 34										
Total	10648	11857	13331	14796	17175	18501	20539	22037	23427	25083
Male	6890	7445	7983	8554	9693	9976	10593	10745	10644	10583
Percent	2.2	2.3	2.3	2.4	2.6	2.7	2.8	2.9	3.0	3.1
Female	3758	4412	5348	6242	7482	8525	9946	11292	12783	14500
Percent	1.1	1.3	1.5	1.7	2.0	2.2	2.4	2.6	2.8	3.0
35 - 39										
Total	6138	6522	7577	8383	9879	11231	12428	14225	15510	16642
Male	3196	3334	3777	4001	4619	5269	5864	6553	7131	7627
Percent	1.1	1.2	1.3	1.3	1.5	1.6	1.7	1.8	1.9	2.0
Female	2942	3188	3800	4382	5260	5962	6564	7672	8379	9015
Percent	1.0	1.1	1.3	1.5	1.7	1.9	2.0	2.2	2.3	2.4

TABLE VIII

PART-TIME ENROLLMENTS

BY AGE AND SEX

	ACTUAL					FORECAST				
Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
40 - 44										
Total	4478	4664	5106	5634	5295	7106	7693	8126	9289	9880
Male	1915	1965	2057	2173	2523	2736	3050	3136	3579	3725
Percent	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.2
Female	2563	2699	3049	3461	3772	4370	4543	4990	5710	6155
Percent	0.8	0.9	1.0	1.2	1.4	1.6	1.7	1.8	2.0	2.1
45 - 49										
Total	3107	3271	3691	4092	4528	4749	5172	5278	5383	5519
Male	1127	1247	1377	1402	1514	1460	1702	1652	1875	1840
Percent	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7
Female	1980	2024	2314	2690	3014	3289	3470	3626	3508	3679
Percent	0.6	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.3	1.4
50+										
Total	4866	5410	4979	5547	5768	5043	5076	5113	5120	5126
Male	2315	2400	2312	2474	2313	2434	2450	2466	2468	2470
Percent	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Female	2551	3010	2667	3073	3455	2609	2626	2647	2652	2656
Percent	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3
Total	92569	97933	105890	117029	130234	138871	147332	156904	166907	176881

Table IX

PART-TIME FORECASTS AND CONTROLS

	1976	1977	1978	1979	1980
Institutional Aggregate*	139,453	148,765	157,068	165,369	174,017
Control Total**	138,871	147,332	156,904	166,907	176,881
Percent Difference	0.4%	1.0%	0.1%	0.9%	1.6%

* From projections presented in the next section.
** From Table VIII

ENROLLMENT PROJECTIONS - 1976-1980

The pages that follow contain enrollment projections for each category of public institution of higher education in Ohio. Individual school estimates are provided in Appendix D of this report. The projections are but one set of numbers which result from the assumptions set forth earlier regarding demographics, participation rates, cohort-survival ratios, and other given relationships. The forecasts are provided as "most-likely" estimates of the future, given the knowledge available to the research team and OBOR administrators today. If any assumptions are modified, the resultant projections will, of course, also change.

The purpose of the development of an enrollment projection system is to permit such changes and modifications to be made. Administrators should have the flexibility to adjust data inputs based on the most recent and most accurate information available, and then to rerun the computer programs and produce updated projections. In this situation, "what if" questions can be answered readily by an objective forecasting methodology.

The set of enrollment projections provided in this report are detailed, but self-explanatory. The next seven pages, which illustrate the seven aggregate categories of institutions, deal with the future of public higher education in the State of Ohio and merit close analysis.

FURTHER WORK AND EXTENSIONS

This study has but scratched the surface in terms of providing for the planning needs of the Ohio Board of Regents. It is, however, a significant step in the direction of better administrative planning and control.

Still, much work remains. The model described in this report, if it is to be accepted as a viable planning tool, will require fine-tuning, periodic updating, and constant monitoring and critical analysis. It is recommended that both qualitative and quantitative data at the state, county, and institutional levels be continuously sought and recognized as legitimate inputs. It is also to be recognized that outputs should not be accepted without question because they appear on computer-generated reports. As most managers are aware, programmers, systems analysts, and even computers, make occassional errors.

Non-Credit Continuing Education

The study of part-time and full-time degree credit student enrollments has been a challenging and interesting topic for research. Equally as exciting, and equally as difficult, is the relatively new subject on non-credit continuing education.

Within the next fifteen years, before the 18-21 year old population is decreased by 25 or 30 percent, colleges and universities must interest themselves in alternative forms of education. The 25-40 age and the

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

ALL STATE SCHOOLS

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	80326	92039	94761	93761	92271	90767	86653
FULL-TIME SOPHOMORES	40654	43459	47646	48976	48247	47245	46269
FULL-TIME JUNIORS	30279	30783	31612	32481	33554	32545	31311
FULL-TIME SENIORS	24889	26542	25425	26120	26925	27782	26952
TOTAL FULL-TIME UNDERGRADUATES	176148	192783	199446	201339	200099	198340	191187
FULL-TIME GRADUATE STUDENTS	10943	11097	11313	11424	11345	11147	10712
FULL-TIME PROFESSIONAL STUDNTS	5006	5134	5230	5362	5427	5501	5600
TOTAL FULL-TIME STUDENTS	192097	209014	215989	218126	217772	214989	207500
TOTAL PART-TIME STUDENTS	116604	130112	139453	148765	157068	165369	174017
GRAND TOTAL	308701	339126	355442	366891	374840	380358	381517

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

ALL UNIVERSITIES

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	56183	58895	60807	58927	56744	54480	51151
FULL-TIME SOPHOMORES	31261	32608	33652	34767	33711	32454	31182
FULL-TIME JUNIORS	29187	29638	30436	31277	32377	31402	30205
FULL-TIME SENIORS	24313	25876	24830	25470	26277	27150	26342
TOTAL FULL-TIME UNDERGRADUATES	140944	147017	149727	150442	149110	145488	138881
FULL-TIME GRADUATE STUDENTS	10698	10949	11203	11318	11249	11054	10625
FULL-TIME PROFFESIONAL STUDNTS	5006	5133	5230	5362	5427	5501	5600
TOTAL FULL-TIME STUDENTS	156648	163099	166160	167123	165786	162044	155106
TOTAL PART-TIME STUDENTS	67447	70892	74088	77575	80682	83534	86346
GRAND TOTAL	224095	233991	240248	244698	246468	245578	241452

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

NON-URBAN U'S (BOWLING GREEN, CENTRAL, KENT, MIAMI, OHIO U.)

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	18935	19713	20205	19578	18821	18291	17127
FULL-TIME SOPHOMORES	11273	11495	12091	12361	11980	11518	11199
FULL-TIME JUNIORS	11194	11060	10915	11460	11719	11355	10915
FULL-TIME SENIORS	9902	10378	9627	9513	10015	10232	9922
TOTAL FULL-TIME UNDERGRADUATES	51304	52646	52838	52913	52537	51398	49165
FULL-TIME GRADUATE STUDENTS	3556	3680	3672	3608	3678	3608	3466
FULL-TIME PROFESSIONAL STUDNTS	0	0	24	48	84	120	144
TOTAL FULL-TIME STUDENTS	54860	56326	56535	56650	56300	55126	52776
TOTAL PART-TIME STUDENTS	8844	9621	10335	10951	11276	11457	11687
GRAND TOTAL	63704	65947	66870	67601	67526	66583	64463

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

URBAN UNIVERSITIES (CLEVELAND, OHIO STATE, TOLEDO, AKRON, CINCIN, YOUNGSTOWN, WRIGHT)

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	37248	39182	40602	39349	37922	36189	34024
FULL-TIME SOPHOMORES	19488	21113	21561	22405	21730	22935	19983
FULL-TIME JUNIORS	17993	18578	19521	19816	20657	20046	19289
FULL-TIME SENIORS	14411	15498	15203	15956	16261	16918	16419
TOTAL FULL-TIME UNDERGRADUATES	89640	94371	96888	97528	96572	94090	89716
FULL-TIME GRADUATE STUDENTS	7142	7269	7530	7629	7570	7446	7158
FULL-TIME PROFESSIONAL STUDNTS	5006	5133	5206	5314	5343	5381	5456
TOTAL FULL-TIME STUDENTS	101788	106773	109625	110472	109486	106918	102330
TOTAL PART-TIME STUDENTS	58603	61271	63753	66624	69456	72077	74659
GRAND TOTAL	160391	168044	173378	177096	178942	178995	176989

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

BRANCH CAMPUSES

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	7470	9283	8240	8044	7848	7744	7113
FULL-TIME SOPHOMORES	2891	3328	3476	3484	3406	3333	3297
FULL-TIME JUNIORS	1092	1141	1175	1204	1176	1142	1106
FULL-TIME SENIORS	576	626	595	650	648	631	610
TOTAL FULL-TIME UNDERGRADUATES	12029	13378	13487	13383	13080	12851	12126
FULL-TIME GRADUATE STUDENTS	245	148	110	105	96	92	87
FULL-TIME PROFESSIONAL STUDNTS	0	1	0	0	0	0	0
TOTAL FULL-TIME STUDENTS	12274	13527	13597	13488	13177	12944	12214
TOTAL PART-TIME STUDENTS	12302	15119	15730	16466	17301	18039	18796
GRAND TOTAL	24576	28646	29327	29954	30478	30983	31010

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

COMMUNITY/GEN COLL.

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	10012	15052	15633	16207	16701	17271	17103
FULL-TIME SOPHOMORES	3977	4504	6225	6391	6614	6784	7005
FULL-TIME JUNIORS	0	0	0	0	0	0	0
FULL-TIME SENIORS	0	0	0	0	0	0	0
TOTAL FULL-TIME UNDERGRADUATES	13989	19556	21859	22598	23316	24055	24109
TOTAL PART-TIME STUDENTS	29057	34277	38116	41438	44554	47638	51113
GRAND TOTAL	43046	53833	59975	64036	67870	71693	75222

OHIO BOARD OF REGENTS

ENROLLMENT PROJECTIONS 1976-1980

TECHNICAL COLLEGES

	1974	1975	1976	1977	1978	1979	1980
FULL-TIME FRESHMEN	6661	9809	10080	10582	10977	11270	11284
FULL-TIME SOPHOMORES	2525	3023	4292	4333	4514	4673	4785
FULL-TIME JUNIORS	0	0	0	0	0	0	0
FULL-TIME SENIORS	0	0	0	0	0	0	0
TOTAL FULL-TIME UNDERGRADUATES	9186	12832	14372	14916	15492	15944	16070
TOTAL PART-TIME STUDENTS	7798	9824	11519	13286	14531	16158	17762
GRAND TOTAL	16984	22656	25891	28202	30023	32102	33832

college graduate populations will increase accordingly and provide a tremendous market for continuing education programs.

As in other states, such as Georgia, the OBOR will eventually need to consider funding under alternative subsidy models, which take into account continuing education units (CEU's). But unlike the case of degree credit students, data pertaining to continuing education students are few and non-uniform.

Since the 1967 H.E.W. nationwide study of non-credit activities in institutions of higher education, literally thousands of articles and reports have been written on the subject of continuing education. Journals such as Adult Education, Adult Leadership, Journal of Continuing Education and Training, Studies in Adult Education, and Journal of Research and Development in Education regularly publish numerous articles on adult education programs.

Yet few large scale empirical studies have been conducted at the state level. It will be increasingly important to understand the potential market and to identify the interests and needs of citizens in Ohio, as elsewhere. Adults seeking convenience in registration, scheduling and parking, low fees, relevant and useful subjects, etc., may attend short courses, workshops, discussions, seminars, and classes, even if they do not consider degree credit programs. The final recommendation of this report is that an extensive study of the demand, existence, and marketability of continuing education in the State of Ohio be conducted.

REFERENCES

Adams, Velma A. "Adult Education: Where the Bread and Action Are." College Management, April, 1973, pp. 9-14.

Alfred, Richard L. 1971 - 1972 Student Attrition: Antecedent and Consequent Factors. Kansas City, Mo.: Metropolitan Junior College District, 1972. ERIC, #ED 070 435.

Alworth, Robert M., and Judee Freed. 1974-75 Fall Enrollment Analysis. Research Report No. 74-08. Los Angeles: Los Angeles Community College District, Division of Educational Planning and Development, 1974. ERIC #ED 100 443.

American Council on Education. Financing Part-Time Students: The New Majority in Postsecondary Education. Washington, D.C., 1974.

Association for Institutional Research. Proceedings of the Fifth Annual National Institutional Research Forum. Stoney Brook, N.Y., 1965.

Association for Institutional Research. Proceedings of the Eleventh Annual Forum of the Association for Institutional Research, Denver, 1971.

Baird, Leonard L. Patterns of Educational Aspiration. ACT Research Report No. 32, Iowa City: American College Testing Program, 1969.

Baisuck, Allen, and Wallace, William A. "A Computer Simulation Approach to Enrollment Projection in Higher Education." Socio-Economic Planning Sciences, IV (September, 1970), 365-81.

Baker, Curtis O. and Anthony D. Knerr. "Continuing Education: A Key Bay State Study." Planning for Higher Education, December, 1973.

Barton, John C. and Allen B. Moore. "Cooperative Adult Career Education Programs." Business Education World, November-December, 1974, p. 27.

Battelle Memorial Institute. Enrollment Forecasts for Higher Education in Ohio. Columbus: Battelle Memorial Institute, 1969.

Bell, Colin. "Can Mathematical Models Contribute to Efficiency in Higher Education?" Papers on Efficiency in the Management of Higher Education. Berkeley: The Carnegie Commission on Higher Education, 1972.

Belle, Robert L., et al. "Surveying and Serving the Non-Degree-Oriented University Student." College and University, Spring, 1974, pp. 207-221.

Berendzen, Richard. "Population Changes and Higher Education." Educational Record, Spring, 1974, pp. 115-125.

Berry, Leonard L., and William R. George. "Marketing the University: Opportunity in an Era of Crisis." Atlanta Economic Review, July-August, 1975, pp. 5-8.

Campbell, Duncan D. "University Continuing Education: Shaping the Future." Journal of Educational Thought, December, 1974, pp. 126-134.

Carlson, Daryl E,; Farmer, James; and Weathersby, George B. A Framework for Analyzing Postsecondary Education Financing Policies. Staff Report. The National Commission on the Financing of Postsecondary Education, Washington, D.C., May, 1974.

Carnegie Commission on Higher Education. New Students and New Places. New York: McGraw-Hill, 1971.

Cartter, Allan M., and Farrell, R. "Higher Education in the Last Third of the Century." Educational Record, XLVI (Spring, 1965), 119-28.

Casasco, Juan A. Planning Techniques for University Management. Washington, D.C.: American Council on Education, 1970.

Chandler, Marjorie O., and Rice, Mabel C. Opening Fall Enrollments in Higher Education. OE-54003, Washington, D.C.: U.S. Office of Education, 1967.

Clark, Harold Glen. "The American Council on Education Report of Financing of Higher Education for Adult Students." NUEA Spectator, December, 1974, pp. 24-28.

Commission on Human Resources. Human Resources and Higher Education. New York: Russell Sage, 1970.

Corrazzini, A. J., et. al. "Determinants and Distributional Effect of Enrollment in U.S. Higher Education." Journal of Human Resources, Winter, 1972, pp. 39-59.

Degree Programs for the Part-Time Student: A Proposal. Berkeley: California University, 1971. ERIC #ED 057 725.

Dickson, Susan J. A Demographic Study of the State of Ohio for Technical Educational Planning. Prepared for the Shawnee Conference, Shawnee State Park, Ohio, May 20, 1974.

Dowling, William D., and Raymond Taylor. "Planning and the Adult Student in Non-Traditional Degree Programs." Adult Leadership, February, 1974, pp. 272-275.

Duggan, Michael J. Evening College Enrollments: Past, Present, Future. Institutional Studies Research Report No. 53, Cincinnati: University of Cincinnati, 1972.

ERIC Clearinghouse on Educational Administration. Models for Planning. Eugene, Oregon: University of Oregon, 1970.

Fay, Francis A. "Adult Education and Public Policy." Adult Education, Winter, 1972, pp. 150-157.

Feldman, Kenneth A., and Newcomb, Theodore M. The Impact of College on Students. San Francisco: Josey-Bass, Inc., 1969.

Fox, Thomas G. "Long Run Planning for Undergraduate - Higher Education Capacity Needs". Socio-Economic Planning Sciences, V (February 1971), 1-24.

Froomkin, Joseph. Aspirations, Enrollments and Resources. Washington, D.C.: U.S. Office of Education, 1969.

Gani, J. "Formulae for Projecting Enrollment and Degrees Awarded in Universities". Journal of the Royal Statistical Society, CXXVIA (1963), 400-9

Giles, Wayne E. "The Adult Student in Higher Education." Adult Leadership, June, 1973, pp. 50-54.

Glen, Davis B. "Zero Population Growth: Effect on Adult Education." Adult Leadership, January, 1974, pp. 245-246.

Glenny, Lyman A. "Comprehensive Planning for Higher Education: Focus on New Priorities." Public Affairs Report, February, 1973, pp. 1-5.

Glenny, Lyman A. :Pressures on Higher Education." College and University Journal, September, 1973, pp. 5-9.

Goerke, Glenn A. "Our Time has Come." NUEA Spectator, June, 1974, pp. 4-7.

Graves, Robert J., and Thomas, Warren H. "A Classroom Location - Allocation Model for Campus Planning." Socio-Economic Planning Sciences, V (June, 1971), 191-204.

Greive, Donald E. A Study of Part-Time Students Enrolled in Cuyahoga Community College, Fall, 1968. Cleveland: Cuyahoga Community College, 1969.

Haggstrom, Gus W. The Growth of Higher Education in the United States. Berkeley, California: Carnegie Commission on Higher Education, 1971, ERIC, #ED 977 474.

Harden, Warren R., and Tcheng, Mike T. "Projection of Enrollment Distribution with Enrollment Ceilings by Markov Processes". Socio-Economic Planning Sciences, V (October, 1971), 467-73.

Haygood, Kenneth. "Colleges and Universities." Handbook of Adult Education. Smith, Robert M., et. al, eds. New York: Macmillan Company, 1970, pp. 191-212.

Higher Education and the Adult Student. Washington, D.C.: American Council on Education, 1972. ERIC, #ED 069 238.

Hill, A. and Judd, R. C. Findings Analytical Meaning in Enrollment Matrices. Office of Institutional Research Report, Toledo, Ohio: University of Toledo, 1972.

Hoenack, R. and Weiler, W. Cost Related Tuition Policies and University Enrollments. Management Information Division, Office of Management Planning and Information Services, Minneapolis: University of Minnesota, 1973.

Hoenack, Steven A. Private Demand for Higher Education in California. Office of Analytical Studies Report No. 85, Berkeley: University of California.

Hoyt, Donald P. Forecasting Academic Success in Specific Colleges. ACT Research Report No. 27, Iowa City: American College Testing Program, 1968.

Huckfeldt, Vaughn E. A Forecast of Changes in Postsecondary Education. Boulder: National Center for Higher Education Management Systems, 1972. ERIC, #ED 074 919.

Hunter, Ruth. "Adult Education is Irrelevant." Adult Leadership, March. 1971, pp. 305.

Innis, C. Thomas. Higher Education Enrollment Projections for the State of Ohio 1973-1988. Institutional Studies Office Report, Cincinnati: University of Cincinnati, 1973.

Innis, C. Thomas. Enrollment Projections. Department of Institutional Studies Report, Cincinnati: University of Cincinnati, 1971.

Judy, Richard W., et.al. Comprehensive Analytical Methods for Planning in University Systems (CAMPUS). Toronto, Ontario: University of Toronto, 1965.

Keane, G. F., and Daniel, James N. Systems for Exploring Alternative Resource Commitments in Higher Education (SEARCH). Peat, Marwick, Mitchell and Co., 1970.

Koenig, Herman E.; Keeney, M. G.; and Zemach R. A System Model for Management, Planning and Resource Allocation in Institutions of Higher Education. East Lansing, Mich.: Michigan State University, 1968.

Koenig, Herman E. "A Systems Model for Management, Planning and Resource Allocation in Institutions of Higher Education". Journal of Engineering Education, LIX (April, 1969) 963-66.

Koshal, Rajindar K. The Future of Higher Education in the U.S.: An Econometric Approach. Research Paper No. 1967, Athens, Ohio: Department of Economics, Ohio University, 1973a.

Koshal, Rajindar K. The Future of Higher Education in the State of Ohio: An Econometric Approach. Athens, Ohio: Department of Economics, Ohio University, 1973b.

Koshal, Rajindar; Shukla, Vishwa; and Buckley, Jerry. Long Run Demand for Higher Education: Some Experience of the State of Ohio. Research Paper No. 172, Athens, Ohio: Department of Economics, Ohio University 1974.

Kramer, Lawrence F. "Lifelong Learning Comes of Age." Planning for Higher Education, February, 1974.

Lawrence, Ben; Weathersby, George B.; and Patterson, Virginia. The Outputs of Higher Education. Boulder, Col.: NCHEMS, 1970.

Li, Pei-Chao. "Evening Students--Their Employment Patterns." Journal of College Placement, December-January, 1972, pp. 71-73.

Lombardi, John. Riding the Wave of New Enrollments. Topical Paper No. 50. Los Angeles: California University, 1975. ERIC, #ED 107 326.

Lombus, William. "Planning at a Small College with a CAMPUS Simulation Model". Paper presented at the New Approaches to Planning in Higher Education Conference, Kent, Ohio, May, 1974.

Lykins, Ronald G. Enrollment and Faculty Trends for Four Year Colleges and Universities in Ohio: 1967-68 through 1972-73. Prepared for the Citizens' Task Force on Higher Education. Columbus, Ohio: OBOR, 1974.

McNamara, James F. Applications of Mathematical Programming Models in Educational Planning. Exchange Bibliography No. 271, Monticello, Ill.: Council of Planning Librarians, 1972.

Mangelson, Wayne L., et. al. Projecting College and University Enrollments. Ann Arbor, Mich.: Center for Study of Higher Education, The University of Michigan, 1973.

Mason, Thomas R. Planning for the Development of the University of Rochester Campus. Rochester, N.Y.: Office of Planning and Institutional Studies, University of Rochester, 1968.

Mathematica, Inc. Enrollment and Financial Aid Models for Higher Education. Princeton, N.J., August, 1971.

Missouri Commission on Higher Education. Missouri Enrollment Projections 1970-1985. Missouri: Missouri Commission on Higher Education, 1970.

Nolfi, George J., and Valerie I. Nelson. Strengthening the Alternative Postsecondary Education System: Continuing and Part-Time Study in Massachusetts. Boston: Massachusetts Advisory Council on Education, 1973. ERIC, #ED 095 732.

Norris, Donald M.; Poulton, Nick L.; and Seeley, John A. "National Enrollment Projection and Decision Making". Paper presented at the New Approaches to Planning in Higher Education Conference, Kent, Ohio, May, 1974.

Ohio Board of Regents. Annual Report for the Fiscal Year. Columbus: Ohio Board of Regents, 1967 through 1975.

Ohio Board of Regents. Future Programs for Two-Year Institutions. Columbus: Ohio Board of Regents, 1973.

Ohio Board of Regents. New Directions in Higher Education in Ohio. Columbus: Ohio Board of Regents, 1974.

Ohio Board of Regents. Ohio Higher Education Basic Data Series. Columbus: Ohio Board of Regents, 1967 through 1975.

Ohio Board of Regents. Student Inventory Data: Uniform Information System. Columbus: Ohio Board of Regents, 1966 through 1975.

Ohio Board of Regents. The Two-Year College System in Ohio: A Planning Report. Columbus: Ohio Board of Regents, 1975.

Olson, Russel F. "Adult Education and the Urban Crisis." Today's Education, February, 1971, pp. 24-26.

Orwig, M. D.; Jones, Paul K.; and Lenning, Oscar T. "Projecting Freshman Enrollment in Specific Academic Departments". Proceedings of the Eleventh Annual Forum of the Association for Institutional Research, XI (1971), 123-7.

Orwig, M. D.; Jones, Paul K.; and Lenning, Oscar T. Enrollment Projection Models for Institutional Planning. ACT Research Report No. 48, Iowa City: American College Testing Program, 1972.

Parker, Garland G. "College and University Enrollments in America 1973-74; Statistics, Interpretation, and Trends." Intellect, February, 1974, pp. 319-336.

Parker, Garland G. College and University Enrollments in the U.S. American College Testing Special Report Eight, Iowa City: American College Testing Program, 1973a.

Paschke, P. E., and Perkins, W. C. A Simulation Analysis of the Higher Education System of the State of Indiana. Report to the Indiana Advisory Commission on Academic Facilities, Bloomington, Ind., 1970.

Perkins, William C., and Paschke, Paul E. "A Simulation Model of the Higher Education System of a State". Decision Sciences, IV (1973), 194-215.

Perlman, Daniel H. Planning for Adult Students in Higher Education, Lincoln, NB: ACE-AAIP Alumni Seminar, 1974. ERIC, #ED 100 239.

Peterson, Richard E. American College and University Enrollment Trends in 1971. Berkeley, Calif.: The Carnegie Commission on Higher Education, 1972.

Planisek, R. J.; Krampf, Robert F.; and Heinlein, Albert C. "An Evaluation of College and University Forecasting Methods". Paper presented at the New Approaches to Planning in Higher Education Conference, Kent, Ohio, May, 1974.

Pritsker, Alan A. B. "A Decision Theory Approach to Enrollment Prediction". Journal of Industrial Engineering, XVI (May, 1965), 164-70.

Render, Barry, and Shawhan, Gerald L. "Statewide Enrollment Prediction Models: A Review and a New Approach". Paper presented at the New Approaches to Planning in Higher Education Conference, Kent, Ohio, May, 1974.

Rensselaer Research Corporation. Construction and Analysis of a Prototype Planning Simulation for Projecting College Enrollments. Troy, N.Y.: Rensselaer Research Corporation, 1969.

Richards, J. M., Jr. A Factor Analysis of Student "Explanations" of Their Choice of College. ACT Research Report No. 8, Iowa City: American College Testing Program, 1965.

Sample, Steven B. "A Response: Implications of the ACE Report." NUEA Spectator, December, 1974, p. 29.

Schroeder, Roger G. "A Survey of Management Sciences in University Operations". Management Science, IXX (April, 1973), 895-906.

Schroeder, Roger G. "Overview of Decision Science Techniques in Academic Administration". Paper presented at the New Approaches to Planning in Higher Education Conference, Kent, Ohio, May 1974.

Shawhan, Gerald L. "Enrollment Projections". Memorandum to William Coulter of the Ohio Board of Regents, Columbus, Ohio, September 25, 1972.

Shawhan, Gerald L. College Enrollment-A Quick Look at Ohio and Ohio Students. Prepared for the Citizens' Task Force on Higher Education. Columbus, Ohio: OBOR, 1974.

Shea, Thomas H. Enrollment Projections 1968-80, NYS Higher Education. Office of Planning in Higher Education Report, New York: The State Education Department, 1968.

Shell, Richard and Render, Barry. "Forecasting Techniques for Production Planning and Control". Proceedings of the AIIE 26th Annual Institute Conference (1975).

Simon, Kenneth A., and Grant, W. Vance. Digest of Educational Statistics. 1970 ed. OE-10024, Washington, D.C.: U.S Office of Education, 1970.

Simon, Kenneth A. and Martin M. Frankel. Projections of Educational Statistics to 1983-84. Washington, D.C.: U.S. Department of Health, Education, and Welfare, 1975.

Sinha, Bani K.; Gupta, Shiv K.; and Sisson, Rogger L. "Towards Aggregate Models of Educational Systems." Socio-Economic Planning Sciences, III (June, 1969), 25-36.

Smith, Robert M., George F. Aker, and J. R. Kidd, eds. Handbook of Adult Education. New York: Macmillan Company, 1970.

Snyder, Fred A., and Clyde E. Blocker. The Adult Student Population. Harrisburg, Pa.: Harrisburg Area Community College, 1971. ERIC, #ED 047 689.

Tallman, B. M. and Newton, R. D. A Student Flow Model for Projection of Enrollment in a Multi-Campus University. Office of Budget and Planning Report, University Park, Penn.: The Pennsylvania State University, 1973.

Tanner, C. Kenneth. Designs for Educational Planning: A Systematic Approach. Lexington, Mass.: D. C. Heath and Company, 1971.

Technical Report on Adult and Continuing Education. Technical Group Report No. 2. Helena: Montana Commission on Post-Secondary Education, 1974. ERIC, #ED 099 489.

The Importance of Service: Federal Support for Continuing Education. Eighth Annual Report. Washington, D.C.: National Advisory Council on Extension and Continuing Education, 1974. ERIC, #ED 097 827.

They Come Part-Time: A Study of the Part-Time and Extension Student Population of Fall 1973. Trenton: Mercer County Community College, 1974.

Thompson, Ronald B. Projected Enrollments, Colleges and Universities, Commonwealth of Kentucky 1972-1985. Frankfort, Ky.: Commission on Higher Education, 1972.

Thompson, Ronald B. Projected Enrollments Institutions of Higher Education, State of Ohio, 1973-1989. Columbus, Ohio: Ohio Board of Regents, 1973.

U.S. Bureau of the Census, Current Population Reports, Series P-26, No. 122, "Estimates of the Population of Ohio Counties and Metropolitan Areas: July 1, 1973 and 1974," U.S. Government Printing Office, Washington, D.C., 1975.

U.S. Bureau of the Census. Projections of School and College Enrollment: 1971-2000. Washington, D.C.: U.S. Bureau of the Census, 1972.

Ward, Wilfred A. An Enrollment Forecasting Model. OIR Paper-P1, Hamilton, Ontario: Office of Institutional Research, McMaster University, 1972.

Wasik, J. L. "The Development of a Mathematical Model to Project Enrollments in a Community College System". Paper presented at the annual meeting of the American Education Research Association, New York, March, 1971.

Weathersby, George B., and Deanna Nash, eds. A Context for Policy Research in Financing Postsecondary Education, 1974. ERIC, #ED 098 859.

Weathersby, George B. The Development and Applications of a University Cost Simulation Model. Berkeley: Office of Analytical Studies, University of California, 1967.

Weathersby, George B. "Policy Issues in Adult Demand for Postsecondary Education". Paper presented at the New Approaches to Planning in Higher Education Conference, Kent, Ohio, May,1974

Wells, Jean A. Continuing Education for Women: Current Developments. Washington, D.C.: Employment Standards Administration, Women's Bureau, 1974. ERIC, #ED 099 622.

Western Interstate Commission on Higher Education (WICHE). Compatible Management Information Systems. Boulder, Col.: WICHE, 1969.

Wharton, Clifton R., Jr. "A New Emphasis on Lifelong Education." Technical Education Reporter, July-August, 1974, pp. 80-83.

Williams, David Carlton. "Adult Needs Today: The Fruits of Neglect." Adult Education, Fall, 1971, pp. 57-60.

Wing, Paul. Higher Education Enrollment Forecasting: A Manual for State-Level Agencies. Boulder: National Center for Higher Education Management Systems, 1974.

Winters, Peter R. "Forecasting Sales by Exponentially Weighted Moving Averages". Management Science, VI (1960), 324-342.

Wolfe, Gary K., and Carol Traynor Williams, "All Education is 'Adult Education': Some Observations on Curriculum and Profession in the Seventies." AAUP Bulletin, September, 1974, pp. 1-3.

Yocum, James C. "Population Changes in Two Decades." Bulletin of Business Research, September, 1971, pp. 1-3.

Young, Anne M. "Going Back to School at 35." Monthly Labor Review, October, 1973, pp. 39-42.

Youse, Clifford F. "Promotion and Recruitment of Part-Time Students." Adult Leadership, February, 1973, pp. 246-249.

Zelan, Joseph and David P. Gardner. "Alternatives in Higher Education--Who Wants What?" Higher Education, April, 1975, pp. 317-333.

Zimmer, John F. "Projecting Enrollment in a State College System". Proceedings of the Eleventh Annual Forum of the Association for Institutional Research, XI (1971), 134-9.

APPENDIX A

DOCUMENTATION OF COMPUTER PROGRAMS

This Appendix consists of four elements. (1) Computer programs used in analyzing and forecasting full-time and part-time enrollments are verbally documented. (2) System Flowcharts of forecasting programs are provided. (3) Layout forms are included which identify input and output formats for programs. (4) Finally, an actual listing of each computer program written for this project is provided.

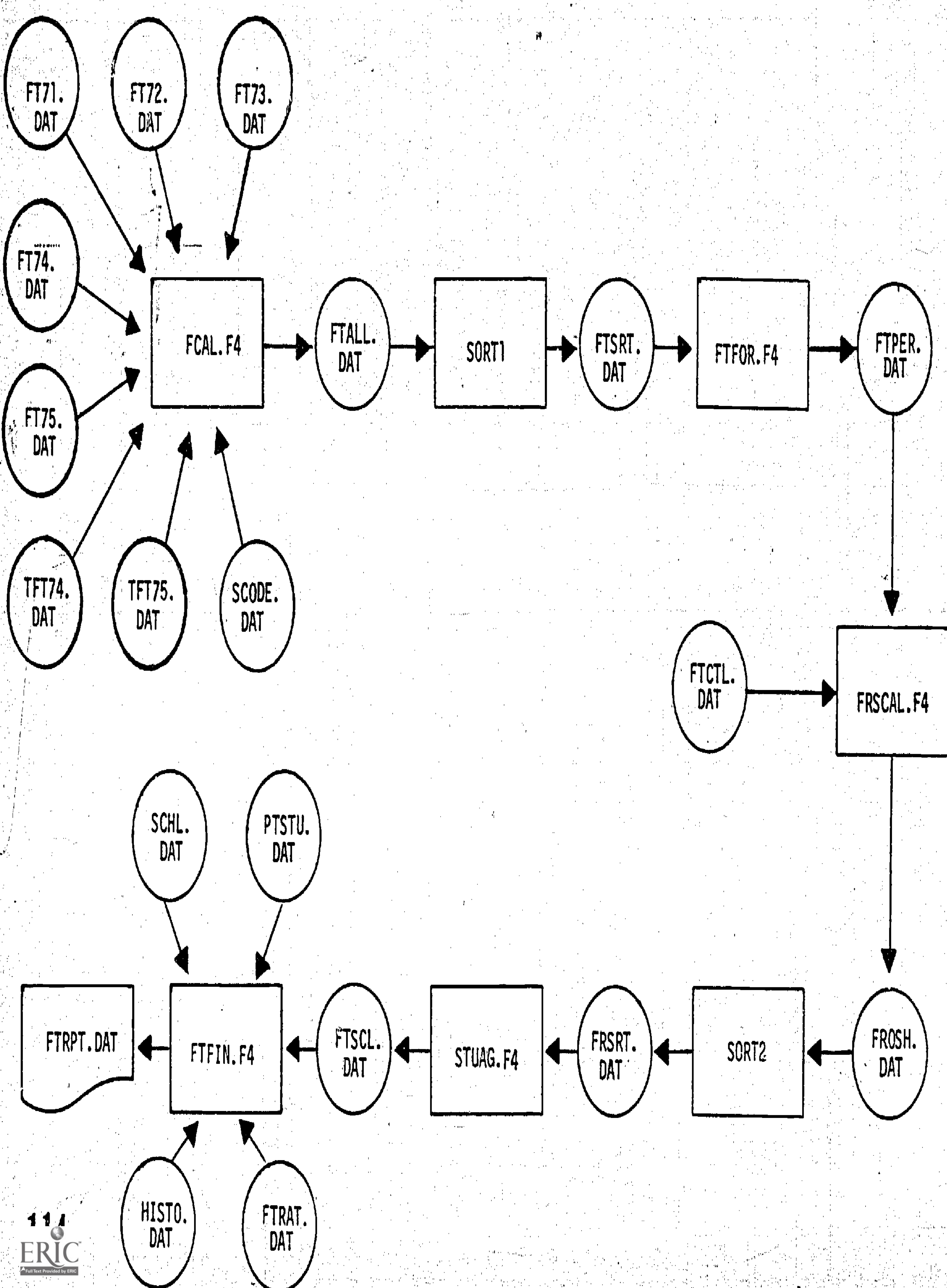
DESCRIPTION OF COMPUTER PROGRAMS FOR FULL-TIME STUDENTS

The first step in the process of forecasting full-time enrollments is the consolidation of the data into a single format within a single file. The data for the years 1971 through 1973 was available on computer cards from research conducted in 1974 by Dr. Render. This data was in a format that included a county code, a school code, and a number that represented the percentage of total freshman originating from that county going to that school. These files are identified as FT71.DAT, FT72.DAT and FT73.DAT on the accompanying flow chart. The file SCODE.DAT is the list of codes used to identify the schools as labeled in previous work and convert those codes to the standard 4 digit OBOR codes.

The 1974 and 1975 data were received from the OBOR in a different format. The detail files FT74.DAT and FT75.DAT included the codes identifying the county of origin, the school attended and the number of freshmen. The county totals were available from two additional files, TFT74.DAT and TFT75.DAT. After processing 1971-73 data, the program input, the 1974 and 1975 data, computes the percentage figure and outputs all the relevant data to the file FTALL.DAT.

The logical record in the file FTALL.DAT consists of the percentage of freshmen going from 1 county to 1 school in 1 year. Before further processing this file was sorted by county, school and year and renamed FTSRT.DAT.

SYSTEM FLOW CHART OF PROGRAMS FOR FULL-TIME ENROLLMENTS



FTSRT.DAT was used as input to FTFOR.F4. This program read the percentages going from one county to one school for all the available years, and using forecasting techniques set forth in the body of the final report, projected the percentages for the years 1976 through 1980. Both the historical and forecasted percentages are output to the data file FTPER.DAT.

The program FRSCAL.F4 read in FTPER.DAT and another data file FTCTL.DAT. The latter file consisted of 1 record per county. This record included the forecasted total number of freshmen that would originate from the county in each of the five forecast years. The program FSHCAL.F4 read in the forecasted percentages to all schools from each county one at a time. The percentages were first normalized (forced to add to one), for each year and then applied to the forecasted county control totals (FTCTL.DAT) in order to arrive at a forecast of in-state freshmen originating from that county going to each school for each year. This data was output to the file FROSH.DAT.

FROSH.DAT was then sorted on school and given the name FRSRT.DAT which is input to the program STVAG.F4. This program simply adds up the forecasts from each county by school. The output file FTSCL.DAT is now a file consisting of 1 record for each school. The record includes the total number of in-state freshmen for each of the five forecasted years. This file, along with three additional files (so far exogenous to the system) make up the input data to the final forecasting program.

The final forecasting program is named FTFIN.F4. Along with FTSCH.DAT, described above, it inputs SCHL.DAT, PTSTV.DAT and FTRAT.DAT.

SCHL.DAT is simply a file of school names used to convert the numerical school code to an alphabetical name for purposes of final output. PTSTV.DAT is an independent forecast of the part-time students at each school for the five forecast years. The file FTRAT.DAT is another independently produced file that includes the 1975 freshmen, sophomore and junior enrollment for each school, the freshmen to sophomore, sophomore to junior, and junior to senior survival rates for each school, and a forecast of the percentage of out of state freshmen, the percentage of graduate students and the number of professional students for each year 1976 through 1980. The program FTFIN.F4 simply reads the number of in-state freshmen for each year. Using the percentage of out-of-state freshmen the total number of freshmen for each year is computed. Using the survival rates and the 1975 number of sophomores and juniors the remaining values (sophomore, juniors, and seniors 1976-1980) are calculated. Total undergraduates are simply the sum of the four classes for each year. The percentage of graduate students is then used to calculate the number of graduate students. The professional students are then added to the graduates and undergraduates to arrive at total full-time enrollment. The part-time students are added in to determine the forecast for total enrollment.

At the direction of the OBOR a last minute change was made to the above described program. Another data file was created (HISTO.DAT) this file included the historical enrollment data for each school for 1974 and 1975 by class. This data was read in by the program FTFIN.F4 so that it could be printed out in the final report.

DESCRIPTION OF COMPUTER PROGRAMS
FOR PART-TIME STUDENTS

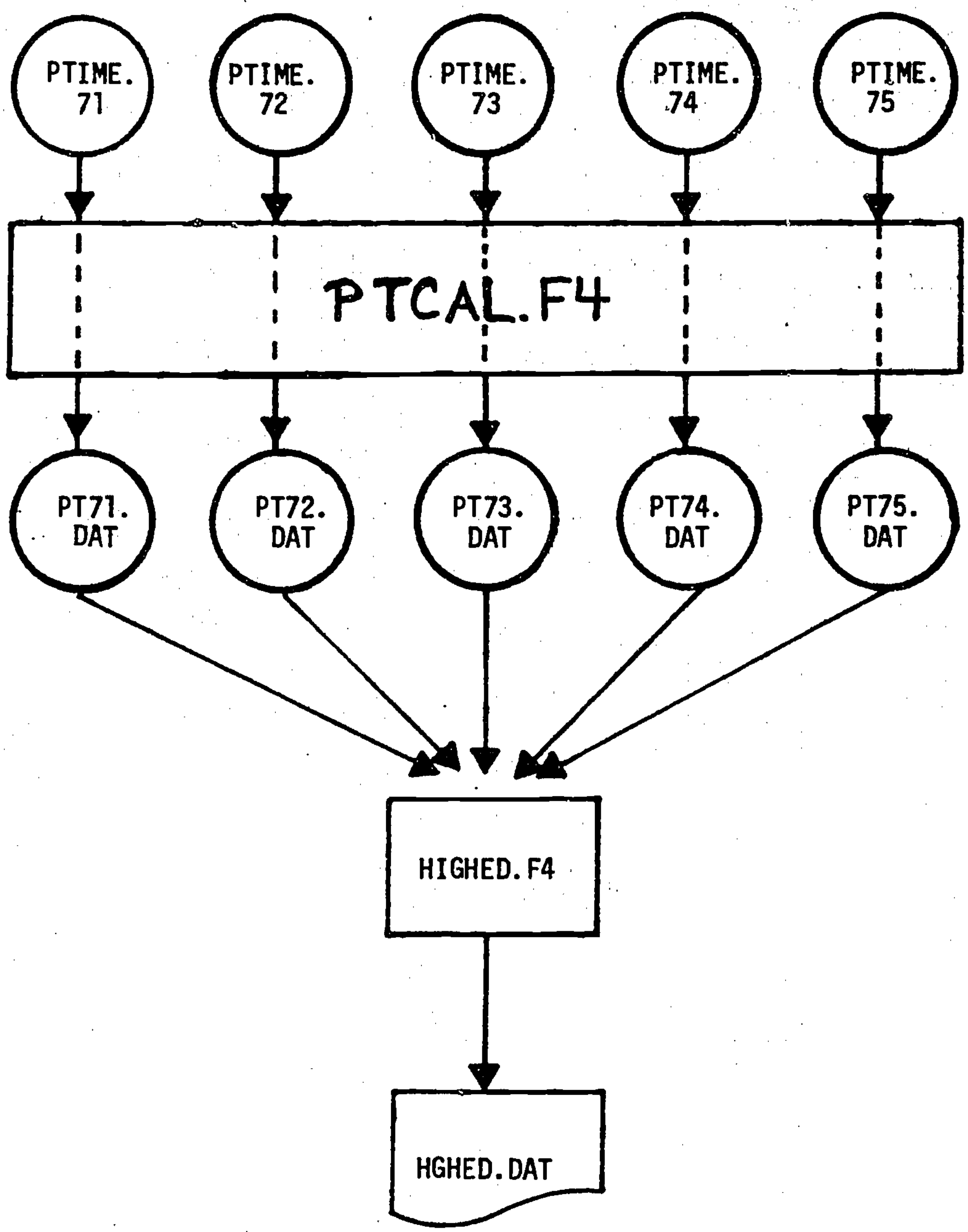
The five files of part-time students received from the Ohio Board of Regents were given the names PTIME.71 through PTIME.75, respectively. One at a time, these files were input to the program PTCAL.F4. This program assumes the input file to be sorted by school. It simply reads records one a time, increments the appropriate accumulators based on the information within the input record, and continues doing this until it determines a change in school.* At this point certain evaluations and determinations are made, the proper group accumulators are incremented, and a single school record is output to a data file named PTDSK.DAT, which is later given the name PT71.DAT to PT75.DAT depending on the year of the file being processed. After outputing a school record the school accumulators are zeroed and the process begins for the next school.

After all the schools have been processed, the groups are treated as if they were individual schools. The group accumulators are output in a manner identical to the individual school data.

The five data files that are output by PTCAL.F4 are input to another program. HIGHED.F4 which simply reads the five files simultaneously, determines that it is processing one school or one group at a time, and outputs the data in an easy to read format. This program also performs one calculation, that of mean age. The formatted file is output under the name HGHED.DAT.

---

* Some branch campuses were combined or ignored at the suggestion of the OBOR.



SYSTEM FLOW CHART OF

PROGRAMS FOR PART-TIME ENROLLMENTS

EXPONENTIAL SMOOTHING PROGRAM

The program on this page, PROCVS.F4, serves to forecast part-time enrollments at each institution. The input to it is a five year historical file of part-time enrollments (1971-1975) at each school. The program also requests an "alpha" weighting factor as input and then outputs a five year forecast of students. In addition to printing the exponentially smoothed forecast, a regression forecast (with time as the independent variable) is automatically output also. This provides a basis for comparison of the two methodologies.

```
        DIMENSION NS(10),SP(10),SPP(10),NX(10),X(10)
        CALL IFILE(21,'STUFF')
 80     READ(21,30)K,(X(I),I=1,5)
        IF(X(1).EQ.0.0.AND.X(5).EQ.0.0) GO TO 18
        WRITE(5,17)K
        GO TO 32
 18     WRITE(5,19)K
 19     FORMAT(' SCHOOL',I5,' NO FORECAST')
 17     FORMAT(' SCHOOL',I5)
        GO TO 80
 30     FORMAT(I5,5F6.0)
 32     TYPE 40
 40     FORMAT (' INPUT ALPHA'/)
        ACCEPT 45,ALPHA
        IF(ALPHA.EQ.0.0)GO TO 76
 45     FORMAT(1F)
        BETA=1.-ALPHA
        SP(2)=X(1)
        SPP(2)=X(1)
        DO 10 J=3,6
        SP(J)=ALPHA*X(J-1)+BETA*SP(J-1)
        SPP(J)=ALPHA*SP(J)+BETA*SPP(J-1)
        A=2.*SP(J-1) - SPP(J-1)
        B=ALPHA/BETA *(SP(J-1) - SPP(J-1))
 10     CONTINUE
        DO 20 J=2,6
 20     NS(J)=A + B*J
        NX(1)=.8*X(5)+.5*X(4)+.2*X(3)-.1*X(2)-.4*X(1)
        NX(2)=X(5)+.6*X(4)+.2*X(3)-.2*X(2)-.6*X(1)
        NX(3)=1.2*X(5)+.7*X(4)+.2*X(3)-.3*X(2)-.8*X(1)
        NX(4)=1.4*X(5)+.8*X(4)+.2*X(3)-.4*X(2)-X(1)
        NX(5)=1.6*X(5)+.9*X(4)+.2*X(3)-.5*X(2)-1.2*X(1)
        WRITE(5,70)K,(X(I),I=1,5),(NS(J),J=2,6)
 70     FORMAT(I6,5F6.0,5I6)
        WRITE(5,75)(NX(J),J=1,5)
 75     FORMAT(35X,5I6)
        GO TO 32
 76     IF(K.EQ.4000)GO TO 90
        GO TO 80
 90     CALL EXIT
        END
```

WHEN ORDERING NEW OR REVISED CARD FORM COMPOSITION.

INTERNATIONAL BUSINESS MACHINES CORPORATION

IBM

INFORMATION RECORDS DIVISION
MULTIPLE-CARD LAYOUT FORM

Form X24-6599
Printed in U.S.A.

Company ______

Application PART-TIME by HARRIS SEGAL Date ______ Job No. PART-TIME Sheet No. 1

PTIME.71 – 75 (INPUT to PTCAL.F4)

INST CODE	MAJOR	ENRL ST	YR	HRS ATT	HRS ACH	RANK	SEX	RESID	STATE	RES	CTY RES	LVG ARR	YR BRTH	MS	FILLER

9 9 9 9 … (columns 1–80)

PT71 – 75. DAT

THE FIVE FILES OUTPUT BY PTCAL.F4 HAVE VARIABLE FORMATS DEPENDING ON THE PARTICULAR RECORD BEING OUTPUT. THE PROGRAM HIGHED.F4 INPUTS THIS VARIABLE

9 9 9 9 … (columns 1–80)

FORMAT DATA FILE AND OUTPUTS THE FINAL FORMATED REPORT.

9 9 9 9 … (columns 1–80)

9 9 9 9 … (columns 1–80)

9 9 9 9 … (columns 1–80)

9 9 9 9 … (columns 1–80)

104

WHEN ORDERING NEW OR REVISED CARD FORM COMPOSITION.

INTERNATIONAL BUSINESS MACHINES CORPORATION

IBM

INFORMATION RECORDS DIVISION
MULTIPLE-CARD LAYOUT FORM

Form X24-6599-1
Printed in U.S.A.

Company ______

Application: FCAL.F4 by: HARRIS SEGAL Date: ______ Job No: FULL-TIME Sheet No: 2

Card 1: INST CODE (cols 7–10) | INST # (cols 13–14) — SCODE.DAT (INPUT)

Card 2: CTY CDE (1–2) | INST # (3–4) | PER CENT (5–9) | CTY CDE (10–11) | INST # (13–14) | PER CENT (15–19) | CTY CDE (20–22) | INST # (23–24) | PER CENT (25–29) — [redacted] REPEATED 8 10 CHARACTER RECORDS PER CARD — FT71.DAT, FT72.DAT, FT73.DAT (INPUT)

Card 3: CTY CDE (9–10) | INST. CODE (17–20) | NUMB. OF STUDENTS (26–30) — FT74.DAT, FT75.DAT (INPUT)

Card 4: CTY CDE (9–10) | TOTAL COUNTY STUDENTS (16–20) — TFT74.DAT, TFT75.DAT (INPUT)

Card 5: (blank)

123

Card 6: INST. CODE | CTY CDE | YR | PER CENT — FTALL.DAT (OUTPUT), FTSRT.DAT

124

WHEN ORDERING NEW OR REVISED
CARD FORM COMPOSITION.

INTERNATIONAL BUSINESS MACHINES CORPORATION

IBM

INFORMATION RECORDS DIVISION
MULTIPLE-CARD LAYOUT FORM

Form X24-6599-
Printed in U.S.A.

Company ____________

Application FTFOR.F4, FRSCAL.F4, STUAG.F4 by HARRIS SEGAL Date ______ Job No. FULL-TIME Sheet No. 3

FTSRT.DAT (INPUT to FTFOR.F4) SAME AS FTALL.DAT (OUTPUT of FCAL.F4)

1–2	CTY CODE
3–8	INST CODE
9–14	1971 PER CENT
15–20	1972 PER CENT
21–27	1973
28–34	1974
35–41	1975
42–48	1976
49–55	1977
56–62	1978
63–69	1979
70–76	1980

FTPER.DAT (OUTPUT of FTFOR.F4; INPUT to FRSCAL.F4)

1–2	CTY CODE
3–8	1976 # FRESHMEN
9–14	1977 FRESHMEN
15–20	1978
21–26	1979
27–32	1980

FTCTL.DAT (INPUT to FRSCAL.F4)

1–2	CTY CODE
3–8	INST CODE
9–16	1976 FRESHMEN
17–23	1977 FRESHMEN
24–30	1978
31–37	1979
38–44	1980

FROSH.DAT (OUTPUT of FRSCAL.F4)
FRSRT.DAT (INPUT to STUAG.F4)

125

126

106

WHEN ORDERING NEW OR REVISED CARD FORM COMPOSITION.

IBM

INTERNATIONAL BUSINESS MACHINES CORPORATION

INFORMATION RECORDS DIVISION
MULTIPLE-CARD LAYOUT FORM

Form X24-6599
Printed in U.S.A.

Company: ______

Application: STUAG.F4, FTFIN.F4 by HARRIS SEGAL Date ______ Job No. FULL-TIME Sheet No. 4

FTSCL.DAT (OUTPUT of STUAG.F4, INPUT to FTFIN.F4)

INST CODE	1–5
1976 IN-STATE FRESHMEN	7–13
1977	14–20
1978	21–27
1979	28–34
1980	35–41
(blank)	42–80

FTRAT.DAT (INPUT to FTFIN.F4)

INST CODE	1–4
GROUP	5
1975 FRESHMEN	6–10
1975 SOPH	11–15
1976 JUN.	16–20
SURVIVAL RATES F-S	21–23
SURVIVAL RATES S-J	24–26
SURVIVAL RATES J-S	27–29
% OUT-OF-STATE FRESHMEN 76	30–32
% OUT-OF-STATE FRESHMEN 77	33–35
% OUT-OF-STATE FRESHMEN 78	36–38
% OUT-OF-STATE FRESHMEN 79	39–41
% OUT-OF-STATE FRESHMEN 80	42–44
% GRADUATE STUDENTS 76	45–47
% GRADUATE STUDENTS 77	48–50
% GRADUATE STUDENTS 78	51–53
% GRADUATE STUDENTS 79	54–56
% GRADUATE STUDENTS 80	57–59
NO. PROFESSIONAL STUDENTS 76	60–63
NO. PROFESSIONAL STUDENTS 77	64–67
NO. PROFESSIONAL STUDENTS 78	68–71
NO. PROFESSIONAL STUDENTS 79	72–75
NO. PROFESSIONAL STUDENTS 80	76–79

PTSTU.DAT (INPUT to FTFIN.F4)

INST CODE	1–5
1976 PART-TIME STUDENTS	6–12
1977	13–19
1978	20–26
1979	27–33
1980	34–40
(blank)	41–80

SCHL.DAT (INPUT to FTFIN.F4)

INST CODE	1–5
INSTITUTION NAME	6–25
(blank)	26–80

HISTO.DAT (INPUT to FTFIN.F4)

INST CODE	1–4
1974 & 1975 FRESH	5–9
1974 & 1975 SOPH	10–14
JUN.	15–19
SEN	20–24
TOTAL UNDER.	25–29
GRAD	30–34
PROF	35–39
TOTAL FULL-TIME	40–44
PART-TIME	45–49
TOTAL	50–54
(blank)	55–80

FTFIN.F4 outputs FINAL FORMATED REPORT

127 128

```
      DIMENSION S(5),ACC(5)
      CALL IFILE (21,'FRSRT')
      CALL OFILE (22,'FTSCL')
10    FORMAT(1X,2X,1X,I4,1X,5F7.0)
20    FORMAT(1X,I4,1X,5F7.0)
      IHLD=100
40    READ(21,10,END=90)ISCL,(S(I),I=1,5)
      IF(ISCL.NE.IHLD)GO TO 100
50    IHLD=ISCL
      DO 60 J=1,5
60    ACC(J)=ACC(J)+S(J)
      GO TO 40
90    ISW=1
100   WRITE(22,20)IHLD,(ACC(J),J=1,5)
      IF(ISW.NE.0)GO TO 200
      DO 110 J=1,5
110   ACC(J)=0.0
      GO TO 50
200   CALL EXIT
      END
```

STVAG.F4

FRSCAL.F

```
      DIMENSION ISCHL(60),P(60,5),ACC(5),LTOTE(5),S(60,5)
      CALL IFILE(21,'FTPER')
      CALL IFILE(22,'FTCTL')
      CALL OFILE(23,'FROSH')
10    FORMAT(1X,I2,1X,I4,1X,35X,5(F5.4,2X))
20    FORMAT(I2,5I6)
30    FORMAT(1X,I2,1X,I4,1X,5F7.0)
      IHLD=1
      K=0
40    K=K+1
      READ(21,10,END=90)I,ISCHL(K),(P(K,J),J=1,5)
      IF(I.NE.IHLD)GO TO 100
50    IHLD=I
      DO 60 J=1,5
60    ACC(J)=ACC(J)+P(K,J)
      GO TO 40
90    ISW=1
100   READ(22,20,END=800)L,(LTOTE(J),J=1,5)
      IF(L.NE.IHLD)GO TO 850
      N=K-1
      DO 160 K=1,N
      DO 150 J=1,5
      P(K,J)=P(K,J)/ACC(J)
150   S(K,J)=P(K,J)*LTOTE(J)
160   WRITE(23,30)IHLD,ISCHL(K),(S(K,J),J=1,5)
      DO 170 J=1,5
      P(1,J)=P(N+1,J)
170   ACC(J)=0.0
      IF(ISW.NE.0)GO TO 900
      ISCHL(1)=ISCHL(N+1)
      K=1
      GO TO 50
800   TYPE 810
810   FORMAT(' READ EOF ON CONTROL FILE--N.G.')
      GO TO 900
850   TYPE 860, IHLD,L
860   FORMAT(' DETAIL COUNTY',I3,' DONT MATCH CTL CNTY',I3)
900   CALL EXIT
      END
```

FTFOR.F4

```
      DIMENSION P(10)
      CALL IFILE (21,'FTSHT')
      CALL OFILE (22,'FTPFP')
10    FORMAT(1X,I4,1X,I2,1X,I1,1X,F5.4)
20    FORMAT(1X,I2,1X,I4,1X,10(F5.4,2X))
      IHLD1=200
      IHLD2=1
40    READ(21,10,END=90)ISCHL,ICNTY,IYR,PHLD
      IF(ISCHL.NE.IHLD1)GO TO 100
      IF(ICNTY.NE.IHLD2)GO TO 450
50    IHLD1=ISCHL
      IHLD2=ICNTY
      P(IYR)=PHLD
      GO TO 40
90    ISW=1
100   IF(IHLD1.EQ.2202)GO TO 115
      IF(IHLD1.EQ.2701.OR.IHLD1.EQ.2702)GO TO 112
      IF(IHLD1.EQ.3898.OR.IHLD1.EQ.3599)GO TO 112
      IF(IHLD1.EQ.298.OR.IHLD1.EQ.299)GO TO 112
      IF(IHLD1.EQ.798)GO TO 112
      P(6)=1.0*P(5)+0.5*P(4)+0.0*P(3)-0.5*P(2)-0.0*P(1)
      P(7)=1.3*P(5)+0.6*P(4)-0.1*P(3)-0.8*P(2)-0.0*P(1)
      P(8)=1.6*P(5)+0.7*P(4)-0.2*P(3)-1.1*P(2)-0.0*P(1)
      P(9)=1.9*P(5)+0.8*P(4)-0.3*P(3)-1.4*P(2)-0.0*P(1)
      P(10)=2.2*P(5)+0.9*P(4)-0.4*P(3)-1.7*P(2)-0.0*P(1)
      DO 110 I=1,10
110   IF(P(I).LT.0.0)P(I)=0.0
      PAVER=0.4*P(4)+0.6*P(5)
      IF(PAVER.EQ.0.0)GO TO 113
      PDIF=P(6)-PAVER
      PFRAC=PDIF/PAVER
      IF(PFRAC.LT.0.2.AND.PFRAC.GT.-0.2)GO TO 113
      IF(PDIF.LT.0.0)GO TO 111
      P(6)=1.10*PAVER
      P(7)=1.15*PAVER
      P(8)=1.2*PAVER
      P(9)=1.25*PAVER
      P(10)=1.3*PAVER
      GO TO 113
111   P(6)=0.90*PAVER
      P(7)=0.85*PAVER
      P(8)=0.80*PAVER
      P(9)=0.75*PAVER
      P(10)=0.70*PAVER
      GO TO 113
112   P(6)=1.2*P(5)
      P(7)=1.3*P(5)
      P(8)=1.4*P(5)
      P(9)=1.45*P(5)
      P(10)=1.5*P(5)
113   DO 114 J=6,10
114   IF(P(J).GT.0.90)P(J)=0.90
115   WRITE(22,20)IHLD2,IHLD1,(P(I),I=1,10)
      DO 120 I=1,10
120   P(I)=0.0
      IF(ISW.EQ.1)GO TO 500
      GO TO 50
450   TYPE 460, ICNTY,IHLD2,ISCHL
460   FORMAT(' COUNTY CHG WO/SCHL CHG.',3I5)
500   CALL EXIT
```

```
      DOUBLE PRECISION TOTYR
      DIMENSION ISTUD(42,5),IPER(42,5),IORGN(1Ø,5),SCHL(4)
      DIMENSION ICALL(4),ISW(5),IYR(5),IFOR(6),IFOR2(5),IPRNT(5)
      DIMENSION ITOT(5),IMNAG(5),COUNTY(98,2),IPER2(1Ø,5),IFOR1(5)
      DIMENSION IFOR5(4),IFOR6(5)
      DIMENSION IFOR3(5),HEAD(42,4),ICNTY(1Ø,5),ICOD(5)
      DATA (HEAD(1,I),I=1,4)/2ØH PART-TIME TOTAL     /
      DATA (HEAD(2,I),I=1,4)/2ØHØI.ENROLLMENT       /
      DATA (HEAD(3,I),I=1,4)/2ØH       STATUS       /
      DATA (HEAD(4,I),I=1,4)/2ØH      A. DAY        /
      DATA (HEAD(5,I),I=1,4)/2ØH      B. EVENING    /
      DATA (HEAD(6,I),I=1,4)/2ØHØII.HOURS ATTEMPTED /
      DATA (HEAD(7,I),I=1,4)/2ØH      A. Ø-6 HOURS  /
      DATA (HEAD(8,I),I=1,4)/2ØH      B. 7-11 HOURS /
      DATA (HEAD(9,I),I=1,4)/2ØHØIII.HOURS ATTEMPTED/
      DATA (HEAD(1Ø,I),I=1,4)/2ØH      &ENROLLMENT  /
      DATA (HEAD(11,I),I=1,4)/2ØH          STATUS   /
      DATA (HEAD(12,I),I=1,4)/2ØH     A.DAY Ø-6  HRS./
      DATA (HEAD(13,I),I=1,4)/2ØH     B.DAY 7-11 HRS./
      DATA (HEAD(14,I),I=1,4)/2ØH     C.EVE Ø-6  HRS./
      DATA (HEAD(15,I),I=1,4)/2ØH     D.EVE 7-11 HRS./
      DATA (HEAD(16,I),I=1,4)/2ØHØIV.RANK           /
      DATA (HEAD(17,I),I=1,4)/2ØH     A.FRESH-SOPH  /
      DATA (HEAD(18,I),I=1,4)/19H     B.JNR-SNR     /
      DATA (HEAD(19,I),I=1,4)/2ØH     C.GRAD-PROF   /
      DATA (HEAD(2Ø,I),I=1,4)/2ØHØV.AGE             /
      DATA (HEAD(21,I),I=1,4)/2ØH      (MALE,FEMALE)/
      DATA  (HEAD(22,I),I=1,4)/2ØH     A. 19 & UNDER /
      DATA (HEAD(23,I),I=1,4)/2ØH     B. 2Ø-21      /
      DATA (HEAD(24,I),I=1,4)/2ØH     C. 22-24      /
      DATA (HEAD(25,I),I=1,4)/2ØH     D. 25-29      /
      DATA (HEAD(26,I),I=1,4)/2ØH     E. 3Ø-34      /
      DATA (HEAD(27,I),I=1,4)/2ØH     F. 35-39      /
      DATA (HEAD(28,I),I=1,4)/2ØH     G. 4Ø-44      /
      DATA (HEAD(29,I),I=1,4)/2ØH     H. 45-49      /
      DATA (HEAD(3Ø,I),I=1,4)/2ØH     I. 5Ø & OVER  /
      DATA (HEAD(31,I),I=1,4)/2ØH     J. MEAN AGE   /
      DATA (HEAD(32,I),I=1,4)/2ØHØVI. SEX           /
      DATA (HEAD(33,I),I=1,4)/2ØH     A. MALE       /
      DATA (HEAD(34,I),I=1,4)/2ØH     B. FEMALE     /
      DATA (HEAD(35,I),I=1,4)/2ØHØVII. COUNTY OF    /
      DATA (HEAD(36,I),I=1,4)/2ØH          ORIGIN   /
      DATA (HEAD(37,I),I=1,4)/2ØH      OUT OF STATE /
      TYPE 1Ø
1Ø    FORMAT (' HOW MANY FILES DO YOU WISH TO SELECT?')
      ACCEPT 2Ø,ICOL
2Ø    FORMAT (I)
      DO 25 I=1,ICOL
      TYPE 21
21    FORMAT (' WHAT FILE (ONE FILE NAME)?')
      ACCEPT 22,IFIL
      TYPE 11
      ACCEPT 2Ø,IYR(I)
11    FORMAT (' WHAT YEAR IS THIS FILE (2 DIGITS) ?')
22    FORMAT (A4)
      IDEV = 2Ø+I
C     ENCODE (21,23,ICALL) IDEV,IFIL
C23   FORMAT (11HCALL IFILE(,I2,2H,',A4,2H'))
      CALL IFILE(IDEV,IFIL)
      CALL IFILE (27,'SCHL')
```

```
      CALL IFILE (28,'COUNY')
25    CONTINUE
      CALL OFILE (26,'HGHED')
      DO 110 K=1,ICOL
110   IF (TYP(K).EQ.75) KPRIM = K
      TYPE 20,KPRIM
      DO 30 I=1,ICOL
30    ISW(I)=0
      DO 31 K2=0,10
32    READ (28,33) ((COUNTY(8*K2+K3,J),J=1,2),K3=1,8)
33    FORMAT (8(2A5))
31    CONTINUE
35    IF (ISW(1).EQ.1) GO TO 41
      DO 36 I=0,1
36    READ (21,42,END=1500) ICOD(1),(ISTUD(I*2+J,1),J=1,2),
     1(IPER(I*2+J,1),J=1,2)
      READ (21,43,END=1500) (ISTUD (I,1),I=5,8),(IPER(I,1),I=5,8)
      DO 37 I=0,9
37    READ (21,44) (ISTUD(8+I*3+J,1),J=1,3),(IPER(8+I*3+J,1),J=1,3)
      DO 38 I=0,1
38    READ (21,45) (ISTUD(38+I*2+J,1),J=1,2),(IPER(38+I*2+J,1),J=1,2)
      IF (ICOD(1).GE.1.AND.ICOD(1).LE.7) GO TO 40
      READ (21,46,END=1500) (ICNTY(I,1),IORGN(I,1),IPER2(I,1),I=1,10)
40    READ (21,47) ITOT(1)
41    IF (ICOL.LT.2) GO TO 100
      IF (ISW(2).EQ.1) GO TO 51
      DO 136 I=0,1
136   READ (22,42) ICOD(2),(ISTUD(I*2+J,2),J=1,2),
     1(IPER(I*2+J,2),J=1,2)
      READ (22,43) (ISTUD (I,2),I=5,8),(IPER(I,2),I=5,8)
      DO 137 I=0,9
137   READ (22,44) (ISTUD(8+I*3+J,2),J=1,3),(IPER(8+I*3+J,2),J=1,3)
      DO 138 I=0,1
138   READ (22,45) (ISTUD(38+I*2+J,2),J=1,2),(IPER(38+I*2+J,2),J=1,2)
      IF (ICOD(2).GE.1.AND.ICOD(2).LE.7) GO TO 50
      READ(22,46,END=1500)(ICNTY(I,2),IORGN(I,2),IPER2(I,2),I=1,10)
50    READ (22,47) ITOT(2)
51    IF (ICOL.LT.3) GO TO 100
      IF (ISW(3).EQ.1) GO TO 61
      DO 236 I=0,1
236   READ (23,42,END=1500) ICOD(3),(ISTUD(I*2+J,3),J=1,2),
     1(IPER(I*2+J,3),J=1,2)
      READ (23,43) (ISTUD (I,3),I=5,8),(IPER(I,3),I=5,8)
      DO 237 I=0,9
237   READ (23,44) (ISTUD(8+I*3+J,3),J=1,3),(IPER(8+I*3+J,3),J=1,3)
      DO 238 I=0,1
238   READ (23,45) (ISTUD(38+I*2+J,3),J=1,2),(IPER(38+I*2+J,3),J=1,2)
      IF (ICOD(3).GE.1.AND.ICOD(3).LE.7) GO TO 60
      READ (23,46,END=1500) (ICNTY(I,3),IORGN(I,3),IPER2(I,3),I=1,10)
60    READ (23,47) ITOT(3)
61    IF (ICOL.LT.4) GO TO 100
      IF (ISW(4).EQ.1) GO TO 71
      DO 336 I=0,1
336   READ (24,42,END=1500) ICOD(4),(ISTUD(I*2+J,4),J=1,2),
     1(IPER(I*2+J,4),J=1,2)
      READ (24,43) (ISTUD (I,4),I=5,8),(IPER(I,4),I=5,8)
      DO 337 I=0,9
337   READ (24,44) (ISTUD(8+I*3+J,4),J=1,3),(IPER(8+I*3+J,4),J=1,3)
      DO 338 I=0,1
338   READ (24,45) (ISTUD(38+I*2+J,4),J=1,2),(IPER(38+I*2+J,4),J=1,2)
```

```
     1(IPER2(I2,IPRNT(I3)))
        IF (I3.EQ.1) GO TO 1980
        ENCODE (25,1985,IFOR6)I4
 1985   FORMAT (9H(1H+,23X,I1,15H(16X),I6,3X,I3))
        WRITE (26,IFOR6)(IORGN(I2,IPRNT(I3))),(IPER2(I2,IPRNT(I3)))
 1980   CONTINUE
 1990   CONTINUE
        IF (ISWPT.EQ.1) WRITE (26,1250)(COUNTY(I,I5),I5=1,2)
 1250   FORMAT (1H+,3X,2A5,/1H )
 2000   CONTINUE
 300    WRITE (26,301)
 301    FORMAT (1H1)
        IMIN=ICOD(1)
        DO 320 I=1,ICOL
        ISW(I)=0
 320    IF (ICOD(I).LT.IMIN) IMIN=ICOD(I)
        DO 330 I=1,ICOL
 330    IF (ICOD(I).GT.IMIN) ISW(I)=1
        GO TO 35
 1499   TYPE 1498, ICOD(KPRIM),ICOD2
 1498   FORMAT (1X,2I5)
 1500   CALL EXIT
        END
 111
```

PT CAL. F4

```
      DIMENSION A(15,4),PER(15,4),ORIG(0/99),GCOUNT(7)
      DIMENSION IORIGN(0/10),IORNUM(0/10),IGRP(7,15,4)
      DIMENSION IORPER(0/80)
      INTEGER A,PER
      CALL IFILE (21,'PTIME')
      CALL OFILE (22,'PTDSK')
      TYPE 5
5     FORMAT(' ENTER YEAR OF DATA FILE BEING PROCESSED-2 DIGITS')
      ACCEPT 7,NYR
9     FORMAT(1X,2I4)
7     FORMAT(I2)
10    FORMAT (2I2,4X,I1,1X,I3,4X,I2,I1,4X,I2,1X,I2,I1,2X)
20    FORMAT(1X,I4,2(1X,I6),1X,2(1X,I3))
30    FORMAT(1X,I4,3(1X,I6),1X,3(1X,I3))
40    FORMAT(1X,I4,4(1X,I6),1X,4(1X,I3))
50    FORMAT(1X,I4,1X,10(1X,I2,I5,I3))
60    FORMAT(1X,I4,1X,I6)
80    READ (21,10,END=199),INO1,INO2,IDAY,IHRS,IRNK,ISEX,ICTY,IYR,IMRG
      IF(INO1.EQ.8.OR.INO1.EQ.10)GO TO 80
      INUMB=100*INO1+INO2
      IF (INUMB.EQ.198.OR.INUMB.EQ.199)INUMB=106
      IF (INUMB.GE.202.AND.INUMB.LE.299)INUMB=203
      IF (INUMB.GE.708.AND.INUMB.LE.798)INUMB=707
      IF (INUMB.EQ.3599) INUMB=3500
      IF (INUMB.EQ.3898) INUMB=3800
      IF (INUMB.EQ.4898) INUMB=4800
      IF (INUMB.EQ.100) GO TO 90
      IF (INUMB.NE.INOLD) GO TO 200
90    INOLD=INUMB
      INOLD1=INO1
      INOLD2=INO2
      COUNT=COUNT+1
      GCOUNT(7)=GCOUNT(7)+1
      A(1,IDAY)=A(1,IDAY)+1
      J=1
      IF(IHRS.GT.65) J=2
      A(2,J)=A(2,J)+1
      IF(IDAY.EQ.1) K=J
      IF(IDAY.EQ.2) K=J+2
      A(3,K)=A(3,K)+1
      L=2
      IF(IRNK.LT.3)L=1
      IF(IRNK.GT.8)L=3
      A(4,L)=A(4,L)+1
      IAGE=NYR-IYR
      IF(IAGE.LE.0)M=13
      IF(IAGE.GT.0)M=5
      IF(IAGE.GT.19)M=6
      IF(IAGE.GT.21)M=7
      IF(IAGE.GT.24)M=8
      IF(IAGE.GT.29)M=9
      IF(IAGE.GT.34)M=10
      IF(IAGE.GT.39)M=11
      IF(IAGE.GT.44)M=12
      IF(IAGE.GT.49)M=13
      A(M,3)=A(M,3)+1
      A(M,ISEX)=A(M,ISEX)+1
      A(14,ISEX)=A(14,ISEX)+1
      A(15,IMRG)=A(15,IMRG)+1
      ORIG(ICTY)=ORIG(ICTY)+1
```

```
      GO TO 80
199   ISWEND=1
200   DO 220 I=1,15
      DO 220 J=1,4
220   PER(I,J)=(A(I,J)/COUNT)*100+.5
      JCTY=0
      IORIGN(0)=0
      IORNUM(0)=ORIG(0)
      IORPER(0)=(ORIG(0)/COUNT)*100+0.5
      DO 250 I=1,88
      CTYCHK=(ORIG(I)/COUNT)*100+0.5
      IF(CTYCHK.LT.7.0) GO TO 250
      JCTY=JCTY+1
      IORIGN(JCTY)=I
      IORNUM(JCTY)=ORIG(I)
      IORPER(JCTY)=CTYCHK
250   CONTINUE
      DO 270 I=1,2
270   WRITE (22,20)INOLD,(A(I,J),J=1,2),(PER(I,J),J=1,2)
      WRITE (22,40)INOLD,(A(3,J),J=1,4) ,(PER(3,J),J=1,4)
      DO 280 I=4,13
280   WRITE (22,30)INOLD,(A(I,J),J=1,3),(PER(I,J),J=1,3)
      DO 290 I=14,15
290   WRITE (22,20) INOLD,(A(I,J),J=1,2),(PER(I,J),J=1,2)
      WRITE (22,50) INOLD,(IORIGN(J),IORNUM(J),
     1 IORPER(J),J=0,9)
      ICOUNT=COUNT
      WRITE(22,60) INOLD,ICOUNT
300   IF(INOLD1.GE.21.AND.INOLD1.LE.24) IG=1
      IF(INOLD1.EQ.3.OR.INOLD1.EQ.6.OR.INOLD1.EQ.9) IG=1
      IF(INOLD1.LE.2.OR.INOLD1.EQ.4.OR.INOLD1.EQ.5) IG=2
      IF(INOLD1.EQ.7) IG=2
      IF(INOLD1.GE.25.AND.INOLD1.LE.35) IG=4
      IF(INOLD1.GE.36.OR.INOLD1.EQ.29.OR.INOLD1.EQ.30) IG=5
      IF(INOLD2.GT.0) IG=6
      IF(INOLD.EQ.3500) IG=4
      IF (INOLD.EQ.3800) IG=5
      IF (INOLD.EQ.4800) IG=5
      IF(INOLD1.EQ.27) IG=4
      IF(INOLD.GE.3101.AND.INOLD.LE.3103) IG=4
      GCOUNT(IG)=GCOUNT(IG)+COUNT
      DO 400 I=1,15
      DO 400 J=1,4
      IGRP(IG,I,J)=IGRP(IG,I,J)+A(I,J)
      IGRP(7,I,J)=IGRP(7,I,J)+A(I,J)
      IGRP(3,I,J)=IGRP(1,I,J)+IGRP(2,I,J)
400   A(I,J)=0
      DO 410 I=0,88
410   ORIG(I)=0
      DO 420 I=0,9
      IORIGN(I)=0
      IORNUM(I)=0
420   IORPER(I)=0
      COUNT=0
      TYPE 8,INOLD,IG
      IF(ISWEND.EQ.1)GO TO 500
      GO TO 90
500   IG=0
      GCOUNT(3)=GCOUNT(1)+GCOUNT(2)
510   IG=IG+1
```

```
      DO 520 I=1,15
      DO 520 J=1,4
520   PER(I,J)=(IGRP(IG,I,J)/GCOUNT(IG))*100+0.5
      DO 570 I=1,2
570   WRITE (22,20)IG,(IGRP(IG,I,J),J=1,2),(PER(I,J),J=1,2)
      WRITE (22,40)IG,(IGRP(IG,3,J),J=1,4),(PER(3,J),J=1,4)
      DO 580 I=4, 13
580   WRITE (22,30) IG, (IGRP(IG,I,J),J=1,3),(PER(I,J),J=1,3)
      DO 590 I=14,15
590   WRITE (22,20)IG,(IGRP(IG,I,J),J=1,2),(PER(I,J),J=1,2)
      ICOUNT=GCOUNT(IG)
      WRITE(22,60) IG,ICOUNT
      IF(IG.EQ.7)GO TO 600
      GO TO 510
600   CALL EXIT
      END
```

```
. TY FCAL.F4
        DIMENSION ICODE(88),ICNTY(8),IHLD(8),PER(8),ITOTE(88)
        CALL IFILE(21,'SCODE')
10      FORMAT(2I)
15      FORMAT(1X,I4,1X,I2,1X,I1,1X,F5.4)
        CALL OFILE(22,'FTALL')
20      READ(21,10,END=30)J,I
        ICODE(I)=J
        GO TO 20
30      END FILE 21
        CALL IFILE(21,'FT71')
40      FORMAT(8(I2,I2,F5.4,1X))
        IYR=1
50      READ(21,40,END=70)(ICNTY(J),IHLD(J),PER(J),J=1,8)
        DO 60 J=1,8
        JCNTY=ICNTY(J)
        I=IHLD(J)
        XPER=PER(J)
60      WRITE(22,15)ICODE(I),JCNTY,IYR,XPER
        GO TO 50
70      END FILE 21
        GO TO (80,90,100)IYR
80      CALL IFILE(21,'FT72')
        IYR=2
        GO TO 50
90      CALL IFILE(21,'FT73')
        IYR=3
        GO TO 50
100     CALL IFILE(21,'TFT74')
        CALL IFILE(23,'FT74')
120     FORMAT(8X,I2,5X,I5)
130     FORMAT(8X,I2,6X,I4,5X,I5)
140     IYR=IYR+1
150     READ(21,120,END=160)I,ITOTE(I)
        GO TO 150
160     READ(23,130,END=170)JCNTY,ISCHL,NUMB
        XNUMB=NUMB
        XPER=XNUMB/ITOTE(JCNTY)
        WRITE(22,15)ISCHL,JCNTY,IYR,XPER
        GO TO 160
170     END FILE 21
        END FILE 23
        IF(IYR.EQ.5)GO TO 200
        CALL IFILE(21,'TFT75')
        CALL IFILE(23,'FT75')
        GO TO 140
200     CALL EXIT
        END
```

FTFIN.F4

```
      DIMENSION F1(5),ENR(10,0/8),SRATE(3),FRN(5),GR(5)
      DIMENSION ACC(7,10,7),SNAME(4),INR(10,7)
      CALL IFILE(21,'FTSCL')
      CALL IFILE(22,'FTRAT')
      CALL IFILE(23,'FTSTU')
      CALL IFILE(24,'SCHL')
      CALL IFILE(26,'HTSTO')
      CALL OFILE(25,'FTRPT')
10    FORMAT(1X,I4,1X,5F7.0)
20    FORMAT(I4,I1,3F5.0,3F3.2,10F3.3,5F4.0)
30    FORMAT(1X,I4,5F7.0)
40    FORMAT(1X,I4,4A5)
50    FORMAT(I4,10F5.0)
70    READ(21,10,END=500)ISCL,(F1(I),I=1,5)
      READ(22,20,END=990)JSCL,IG,(ENR(J,0),J=1,3),
     1 (SRATE(K),K=1,3),(FRN(L),L=1,5),(GR(L),L=1,5),
     2 (ENR(7,L),L=1,5)
      READ(23,30,END=993),KSCL,(ENR(9,K),K=1,5)
80    READ(24,40,END=996),LSCL,(SNAME(I),I=1,4)
      IF(LSCL.LT.ISCL)GO TO 80
      READ(26,50)MSCL,(ENR(M,6),M=1,10)
      READ(26,50)NSCL,(ENR(N,7),N=1,10)
      IF(ISCL.NE.JSCL.OR.ISCL.NE.KSCL.OR.ISCL.NE.LSCL)GO TO 980
      IF(ISCL.NE.MSCL.OR.ISCL.NE.NSCL)GO TO 980
      DO 100 I=1,5
      ENR(1,I)=F1(I)/(1.0-FRN(I))
      ENR(2,I)=ENR(1,I-1)*SRATE(1)
      ENR(3,I)=ENR(2,I-1)*SRATE(2)
      ENR(4,I)=ENR(3,I-1)*SRATE(3)
      DO 90 J=1,4
90    ENR(5,I)=ENR(5,I)+ENR(J,I)
      ENR(6,I)=ENR(5,I)*GR(I)
      ENR(8,I)=ENR(5,I)+ENR(6,I)+ENR(7,I)
100   ENR(10,I)=ENR(8,I)+ENR(9,I)
      DO 140 I=1,7
      DO 140 J=1,10
      ACC(7,J,I)=ACC(7,J,I)+ENR(J,I)
      INR(J,I)=ENR(J,I)
140   ACC(IG,J,I)=ACC(IG,J,I)+ENR(J,I)
169   WRITE(25,170)
170   FORMAT(1H1,33X,'OHIO BOARD OF REGENTS')
      WRITE(25,180)
180   FORMAT(1H0,28X,'ENROLLMENT PROJECTIONS 1976-1980')
199   WRITE(25,200)(SNAME(I),I=1,4)
200   FORMAT(1H-,4A5)
      WRITE(25,210)
210   FORMAT(1H-,30X,4X,4H1974,4X,4H1975,4X,4H1976,4X,4H1977,4X
     1 4H1978,4X,4H1979,4X,4H1980)
      WRITE(25,220)(INR(1,I),I=6,7),(INR(1,I),I=1,5)
220   FORMAT(31H0FULL-TIME FRESHMEN            ,7I8)
      WRITE(25,221)(INR(2,I),I=6,7),(INR(2,I),I=1,5)
221   FORMAT(31H FULL-TIME SOPHOMORES          ,7I8)
      WRITE(25,222)(INR(3,I),I=6,7),(INR(3,I),I=1,5)
222   FORMAT(31H FULL-TIME JUNIORS             ,7I8)
      WRITE(25,223)(INR(4,I),I=6,7),(INR(4,I),I=1,5)
223   FORMAT(31H FULL-TIME SENIORS             ,7I8)
      WRITE(25,224)(INR(5,I),I=6,7),(INR(5,I),I=1,5)
224   FORMAT(31H TOTAL FULL-TIME UNDERGRADUATES,7I8)
      IF(ISW.EQ.1.AND.IG.EQ.6)GO TO 233
      IF(ISCL.EQ.104)GO TO 233
```

```
      IF(IG.NE.1.AND.IG.NE.2.AND.IG.NE.3.AND.IG.NE.7)GO TO 230
233   WRITE(25,225)(INR(6,I),I=6,7),(INR(6,I),I=1,5)
225   FORMAT(31H FULL-TIME GRADUATE STUDENTS    ,7I8)
      WRITE(25,226)(INR(7,I),I=6,7),(INR(7,I),I=1,5)
226   FORMAT(31H FULL-TIME PROFESSIONAL STUDNTS,7I8)
      WRITE(25,227)(INR(8,I),I=6,7),(INR(8,I),I=1,5)
227   FORMAT(31H TOTAL FULL-TIME STUDENTS       ,7I8)
230   WRITE(25,231)(INR(9,I),I=6,7),(INR(9,I),I=1,5)
231   FORMAT(31H0TOTAL PART-TIME STUDENTS       ,7I8)
      WRITE(25,232)(INR(10,I),I=6,7),(INR(10,I),I=1,5)
232   FORMAT(31H-GRAND TOTAL                    ,7I8)
      DO 240 I=1,5
240   ENR(5,I)=0.0
      IF(ISW.EQ.1)GO TO 510
      GO TO 70
500   IG=0
      DO 505 I=1,7
      DO 505 J=1,10
505   ACC(3,J,I)=ACC(1,J,I)+ACC(2,J,I)
510   IG=IG+1
      IF(IG.GT.7)GO TO 1000
      DO 550 I=1,7
      DO 550 J=1,10
550   INR(J,I)=ACC(IG,J,I)
      READ(24,40,END=996)LSCL,(SNAME(I),I=1,4)
      IF(LSCL.NE.IG)GO TO 980
      ISW=1
      GO TO 169
980   TYPE 981, ISCL,JSCL,KSCL,LSCL
981   FORMAT(' FILES MISMATCH ',4I5)
      GO TO 1000
990   TYPE 991, ISCL,JSCL,KSCL,LSCL
991   FORMAT(' READ EOF ON FILE 2 ',4I5)
      GO TO 1000
993   TYPE 994, ISCL,JSCL,KSCL,LSCL
994   FORMAT(' READ EOF ON FILE 3 ',4I5)
      GO TO 1000
996   TYPE 997, ISCL,JSCL,KSCL,LSCL
997   FORMAT(' READ EOF ON FILE 4 ',4I5)
1000  CALL EXIT
      END
```

```
STMT LEVEL NEST
  1                     SELCT: PROCEDURE OPTIONS(MAIN);
  2     1                  1 BOREIN STATIC,
  3     1                   2 BR_CD CHAR(4),
  4     1                   2 FILL1 CHAR(48),
  5     1                   2 HRS CHAR(3),
  6     1                   2 FILL2 CHAR(19),
  7     1                   2 FILL3 CHAR(6);
  8     1                 DCL
                          1 BOREOUT STATIC,
                           2 OUT_CD CHAR(4),
                           2 FILL5 CHAR(6),
                           2 HRS_CDE CHAR(3),
                           2 FILL4 CHAR(19);
  9     1                 DCL
                          RECIN FIXED(9,0) INIT(0),
                          RECOT FIXED(9,0) INIT(0);
 10     1                 DCL
                          TAPEIN FILE RECORD INPUT,
                          FILEOUT FILE RECORD OUTPUT;
 11     1                 OPEN FILE(TAPEIN), FILE(FILEOUT);
 12     1                 ON ENDFILE(TAPEIN) GO TO WRAP_UP;
 14     1               READ_TP:
                          READ FILE(TAPEIN) INTO(BOREIN);
 15     1                 RECIN = RECIN + 1;
 16     1                 IF HRS < '120' THEN DO;
 18     1     1              RECOT = RECOT + 1;
 19     1     1              OUT_CD = BR_CD;
 20     1     1           FILL5 = SUBSTR(FILL1,43,6);
 21     1     1              HRS_CDE = HRS;
 22     1     1              FILL4 = FILL2;
 23     1     1              WRITE FILE(FILEOUT) FROM(BOREOUT);
 24     1     1            END;
 25     1                 GO TO READ_TP;
 26     1               WRAP_UP:
                          PUT DATA(RECIN,RECOT);
 27     1                 CLOSE FILE(TAPEIN), FILE(FILEOUT);
 28     1                 END SELCT;
```

PROGRAM TO CREATE TAPE CONTAINING ONLY PART-TIME STUDENTS

APPENDIX B

FULL-TIME ENROLLMENT DATA

BY INSTITUTION

Appendix B data are included only in copies of this report provided to the Ohio Board of Regents

APPENDIX C

COUNTY DATA UTILIZED IN FULL-TIME ENROLLMENT PROJECTION MODEL

Appendix C data are included only in copies of this report provided to the Ohio Board of Regents.

APPENDIX D

INSTITUTIONAL ENROLLMENT

PROJECTIONS

1976-1980

Appendix D data data are included only in copies of this report provided to the Ohio Board of Regents.