"Identified with Kansas State University

- Machine Languages--Language processors, conversational languages, extensible languages
- Computer Design and Architecture--Computer logic, switching theory
- Programming Systems
- Biological and Ecological Systems Simulation
- Data Organization and Manipulation--File management and data processing, information storage and retrieval, text processing

Areas of Current and Essential Interest to Both Campuses

- Numerical Analysis
- Artificial Intelligence

Identified with the University of Kansas

- Formal Language Theory--Theory of grammars, formal languages, formal semantics
- Natural Languages and Symbol Systems--Computational linguistics, pattern generation in the humanities and fine arts, sound synthesis and analysis
- Automata and Mathematical Logic--Theory of automata, computability, recursive function theory
- Machine Systems
- Information Systems Theory and Design--Analysis of information networks, information acquisition, social implications of information systems"

Currently, the department is formulating the exact requirements for this degree under the general requirements of the Graduate School along with any additional constraints imposed by the joint program. A tentative Ph.D. examination program is currently under development within the department and preliminary conclusions are shown in Appendix IV-A.

In developing courses in this department, as in all other departments the faculty is primarily concerned with development of a coherent curriculum as well as achievement of social awareness. Course offerings (see Appendix IV-B) at all levels are constantly reviewed and changed as situations demand (Appendices IV-C and IV-D outline the undergraduate requirements for a computer science major). One of the most significant forces for change is the change in numbers and interests by people taking courses. The following table presents the enrollments in computing courses through the past 7 school years and projects enrollment for the current year.

Table 1. Enrollment in Computing Courses 1963-1971

| Year | 63-64 | 64-65 | 65-66 | 66-67 | 67-68 | 68-69 | 69-70 | Estimated 70-71 |
|---|---|---|---|---|---|---|---|---|
| Under-graduate | 111 | 214 | 367 | 443 | 507 | 831 | 1424 | 1800 |
| Graduate | 0 | 0 | 0 | 8 | 81 | 165 | 360 | 420 |

From this table we view not an unnatural phenomenon, but one which brings an even wider spectrum of requirements and backgrounds to the classes. As a result of increasing enrollment, the department has been able to subdivide the sections of the introductory course with emphasis in science, general and business. Periodically we discuss with other department faculties, using both questionnaires and meetings, the relevancy of our courses to their offerings. Sometimes, however, this has been difficult since such areas as numerical analysis are clearly not assignable to a particular department; even more fundamental is the question of who should teach introductory computer courses, particularly as such courses spread throughout the entire undergraduate student body as envisaged in our projections.

Course modifications, deletions and additions are a natural consequence of faculty growth. In the department, any changes recommended for existing courses

are first carefully examined by a faculty subcommittee. The subcommittee's recommendations are then made to the entire department faculty from which any formal changes are forwarded to the administration. Suggestions for new courses are also passed upon by the subcommittee and the department faculty, after which if the majority are in agreement, the course will be offered first semester under a general number. Once the course has been taught in this manner, it is evaluated by the entire departmental faculty and considered for permanent addition as a new course under its own number.

In addition to this review procedure, if the course is proposed at the Ph.D. level then it is also subject to the review of the joint steering committee made up of three members of our faculty and three members of the corresponding department at the University of Kansas. In this way we prevent duplication of effort between the two departments.

In order to recognize and reward excellence in teaching, the Computer Science Department makes available a "Rating Sheet" to every student in every class taught by the department every semester. Each student is asked to rate his instructor on many items using a graduated 5-point scale. In addition, other information pertaining to mannerisms and habits of presentation which may distract from the total teaching environment is requested. These ratings are collected and tallied by the department secretary (without regard to students' names) and are made available to the individual instructors. Currently no overt public recognition of any instructor or instructors based on this rating is made; each instructor interprets and uses (or discards) the results as he desires. As familiarity with the evaluation process grows, we expect to standardize the evaluation and interpretation of the results. In addition, the Rating Sheets will be updated periodically to to reflect changing conditions in the department and in the curriculum. A sample copy of the rating questionnaire is included in Appendix III-A.

The department has no formal procedure for orienting new faculty. However, since the department itself is new (as of July 1971), perhaps this oversight can be excused. In future years we plan to at least provide a small packet of information and a sheet of check-off items to guide the efforts of new members in becoming acquainted with the department, the university, and the myriad rules, regulations, rights, and responsibilities appertaining to joining the faculty.

The members of the Computer Science Department are always on the lookout for people who, because of emminence in their field or other appropriate qualifications, would be an asset to the Department. Actual recruitment, of course, is based on the availability of funds for such an appointment. Recognizing the importance of Computer Science to the University, we anticipate great needs for additional faculty in both the immediate and intermediate futures and will do our best to meet these needs with new faculty of worthy report.

In general, insofar as appointment, retention, and promotion of faculty is concerned, the department follows the policy and procedures established for the University as stated in the Faculty Handbook, Paragraphs III-A through -D, pp. 11-14, (1968 edition).

The role of the faculty in the department is threefold:

1. He should engage in research and investigations which will enhance his own effectiveness as an educator and an authority in his chosen field(s), as evidenced by continuing publication and presentations of the results of his work.

2. He should be successful in imparting his knowledge to students who come to him, and

3. He should participate in university and departmental committees where such participation is beneficial to his own interests and to the interests of the University.

Graduate Teaching Assistants and Graduate Research Assistants are almost indispensable in the Computer Science Department (which has the charter of providing basic instruction and education in the art of computer usage for the entire University campus) in that they shoulder much of the responsibility of providing meaningful instruction and interaction with students that would not be possible for the numerically smaller, higher-rank faculty to provide by itself. Through a designated faculty coordinator, we try to provide guidance and assistance sufficient to ensure continuing high quality of instruction and yet exercise restraint in order that the personality of the individual instructor or graduate assistant not be overshadowed. Periodic meetings are conducted for those instructors teaching different sections of the same course, for example, to ensure that essentially the same material is being covered in all groups, but the method of presentation, etc., is left to the imagination and ingenuity of the individual instructor.

PROFESSIONAL GROWTH

The Computer Science Department feels that ongoing professional growth and development of each faculty member is absolutely necessary if we are to acquire and retain the expertise and knowledge needed to fulfill our responsibilities as educators. To this end, we hope to make provisions for attendance at professional meetings and conferences throughout the year. The local chapter of the ACM, for example, attempts to provide a highly qualified technical speaker at each of its meetings. As Kansas is the heart of the United States, many opportunities for attendance at conferences, etc., are made available each year; we hope to provide (subject to the budget, of course) some funds for such travel.

The course load per faculty member is adjustable to some extent. An individual who prefers teaching above research can assume more than the two courses

per semester norm, while one who is heavily engaged in research, especially if partially or fully supported by grants, can arrange to teach fewer than the norm. The basic criteria to be followed in adjusting the teaching/research ratio is usefulness to the university and the department goals.

## TEN-YEAR PLAN FOR CURRICULUM

Our ten-year plan for the curriculum in computer science is composed of the following major items:

1. By 1976, all KSU undergraduates should have some exposure to computing. To achieve this, new and improved introductory courses will be developed in our curriculum to meet diversified student needs.

2. Computer science is probably the most rapidly changing scientific field. To keep abreast of the field, the entire curriculum will be subject to continual modification to reflect the current and projected state of the art. In particular, the ACM Curriculum '68 is already obsolete for KSU planning and will be updated in 1972.

3. In the future, various other disciplines will rely more and more on computers and related technology. To satisfy the needs of people in these areas, it is essential for us to develop and offer inter-disciplinary service courses in computer science. The first of these courses will appear in 1972.

4. The success of the joint Ph.D. program with the University of Kansas should be realized by 1975 with the graduation of our first Ph.D.'s. To successfully implement this program we need to establish the requirements for the Ph.D., develop graduate level courses in the above designated areas, and formulate innovative policies on the operation of the joint program.

5. Good teaching and relevant courses will continue to be emphasized and improvement encouraged. To recognize and reinforce good teaching, improved and standardized rating questionnaires will be filled out by students. The curriculum will be systematically evaluated together with teaching style and course organization. Longitudinal trend lines will be established by 1981.

6. By 1981, the KSU curriculum in Computer Science will have undergone sufficient evolutionary change to meet the challenge of mass computer utilities for hardware, software, telecommunications, systems management, and diversified information services for specialized users and the general public.

## V. STUDENT ACHIEVEMENT

### 1. Undergraduate Academic Progress

"a. General Service Courses of the Department. Computer science offers three service courses: 1) Introduction to Computer Programming, 2) Introduction to Algorithmic Processes and 3) COBOL.

The beginning course, Introduction to Computer Programming (315), is required of all computer science majors, but it can be seen by our Fall, 1971 enrollment that this course serves a far broader segment of the student body than is represented by computer science majors. More than 40 percent of the students are business majors, who take it because it is required of all business majors. Of the remainder, about half are physical science majors (including mathematics, computer science, and engineering) and half are considered general students from all other disciplines.

The second course, an Introduction to Algorithmic Processes (400), is a second level course which has a number of non-majors who want to learn computer science, but these non-majors are from various disciplines. The third course, COBOL (410) appeals to business majors because it is the language most businesses use for data processing."

A recent effort to redistribute the students in the beginning course according to interest area, using the three divisions of business, scientific and general, has met with considerable success. Although students sign up for one course and are originally assigned sections without any distinction, we have arranged to offer multiple sections at most times of the day when the course is offered. The availability of special sections is then announced and students are urged (not required) to attend the section most appropriate to their interest area. All sections are assumed to teach the same basic material, the major

difference being in the nature of the assignments, which are flavored according to the type of section. Thus most problems in the business section represent accounting and business transactions. The science sections use mathematical and other scientifically oriented assignments. A somewhat greater emphasis upon text processing is found in the general sections.

Rather than present an exhaustive discussion of each service course, we will give some information on a single one. This is the introductory course, numbered 315. Our records show the following enrollment and breakdown by grades:

Table 1

| Year | Total Students | A | B | C | D | F | WD | INC | CR | NCR |
|---|---|---|---|---|---|---|---|---|---|---|
| 1970-71 | 849 | 194 | 200 | 224 | 73 | 43 | 80 | 15 | 19 | 1 |
| 1969-70 | 867 | 245 | 227 | 200 | 49 | 39 | 102 | 4 | 1 | - |

These figures are for two semesters each of this course. In the Fall of 1970 a breakdown study was done by major area for students enrolled in CS 315. This showed the following:

Table 2

| Student's Area of Interest | Number Enrolled in CS 315 | |
|---|---|---|
| Agriculture | 21 | (6%) |
| Architecture & Design | 13 | (4%) |
| Arts and Sciences (except CS majors) | 84 | (26%) |
| Arts and Sciences (CS majors) | 29 | (9%) |
| Business Administration | 135 | (41%) |
| Education | 5 | (2%) |
| Engineering | 34 | (10%) |
| Home Economics | 5 | (2%) |
| Veterinary Medicine | none | |

Several notes might be appended to this data. The high proportion of business majors is attributable to the fact that this course is required for students in all parts of the business curriculum. Indeed, the subsectioning effort mentioned earlier is in large part a response to the special needs of this large group of consumers of this course. The low number of students from engineering is due to the fact that the College of Engineering still maintains a duplicate faculty and course offering in this area. In fact, this duplicate course is required by number in many of the departments of the College of Engineering. It is expected that this situation will be corrected in the not too distant future.

Since an exposition of the grade distributions for courses given by the department is deemed desirable, these are presented below in graphic form. These distributions are all for recent offerings of these courses. Many of these courses have only recently been added to the curriculum. The others, primarily service courses, have inadequate records available due to the recent major transitions which have taken place in the department and the computer science program.

With the exceptions which were noted specifically, the majority of the courses offered by computer science have no appreciable service aspect at this time. There is a small but growing trend, perhaps represented best by two groups, physics majors and electrical engineers, in the direction of taking more courses in computer science

Table 3, indicates the grades given in the undergraduate courses the last two years.

2. Program for Undergraduate Majors

The undergraduate major in Computer Science has existed at Kansas State University for three years. During this period, the program existed under

Table 3

UNDERGRADUATE COURSES

| Year | Course | Title | # Student | A | B | C | D | F | WD | INC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1970-71 | 286 400 | INT ALG PRO | 152 | 54 | 46 | 16 | - | 6 | 22 | 8 |
| 69-70 | " | " | 141 | 42 | 36 | 32 | 4 | 12 | 12 | 3 |
| 1970-71 | 286 410 | COBOL | 63 | 14 | 13 | 10 | 1 | 6 | 13 | 6 |
| 69-70 | " | " | 85 | 35 | 19 | 12 | 2 | 5 | 12 | - |
| 1970-71 | 286 425 | COMP ORG PRO | 98 | 17 | 18 | 39 | 8 | 4 | 12 | - |
| 69-70 | " | " | 92 | 62 | 10 | 3 | - | 11 | 6 | - |
| 1970-71 | 286 505 | MATH COMP I | 49 | 17 | 15 | 10 | 3 | - | 2 | 2 |
| 1970-71 | 286 506 | MATH COMP II | 38 | 7 | 8 | 17 | 4 | 2 | - | - |
| 1970-71 | 286 525 | INT INF STRN | 60 | 18 | 14 | 21 | 2 | 1 | 5 | 2 |
| 69-70 | " | " | 49 | 41 | 7 | - | - | 1 | - | - |
| 1970-71 | 286 600 | DISC STRUCT | 9 | 5 | 3 | 1 | - | - | - | - |
| 1969-70 | 286 610 | LIST PRO LAN | 15 | 5 | 4 | 2 | 2 | - | 2 | - |
| 1970-71 | 286 615 | COMP LOGIC | 6 | 1 | 3 | 2 | - | - | - | - |
| 69-70 | " | " | 14 | 4 | 2 | 6 | 1 | 1 | - | - |
| 1970-71 | 286 620 | PROG SYST | 16 | 4 | 3 | 1 | - | - | 3 | 5 |
| 69-70 | " | " | 8 | 7 | - | - | - | 1 | - | - |
| 1969-70 | 286 635 | NON-NUM PROG | 10 | - | 3 | 5 | 1 | - | - | 1 |
| 1970-71 | 286 640 | PROG LANG | 5 | 2 | 1 | - | - | - | 2 | - |
| 69-70 | " | " | 5 | - | 2 | 2 | - | 1 | - | - |
| 1970-71 | 286 798 | TOPICS CSCI | 13 | 10 | 1 | - | - | - | - | 2 |
| 69-70 | " | " | 8 | 7 | - | - | - | - | - | 1 |

the aegis of the Department of Statistics, then known as the Department of Statistics and Computer Science. On July 1, 1971, the Department of Computer Science became a separate operating unit in the university structure. Because of this very special situation, very few records are complete enough to yield accurate and useful statistics concerning the development and achievement of students enrolled in the university as computer science majors. Hence the discussion on these subjects will be highly qualitative in nature.

The growth of the undergraduate major program during these three years has been a satisfying demonstration of the need within the university for such an offering. Table 4 shows the population figures for undergraduate majors in computer science by classification and as a whole.

Table 4

| | Freshman | Sophomore | Junior | Senior | Total |
|---|---|---|---|---|---|
| 1970-71 | 30 | 29 | 43 | 43 | 145 |
| 1969-70 | 29 | 19 | 27 | 17 | 92 |
| 1968-69 | 17 | 15 | 20 | 8 | 60 |

(Some of the information in this table is from departmental advising records.)

The data for the academic year 1968-69 is from counseling records in the main office of the College of Arts and Sciences. It is thought that the figures for all three years are taken from major declarations by students during enrollment for the spring semester. These figures are more accurate than data from the fall registration.

One apsect of the change in the computer science program, as reflected in our students, is that many poor engineering students have turned to computer science as a field that appealed to their basic interests, fit in with their

capabilities, and seemed less demanding. The same has perhaps been true of students in other fields, such as mathematics and physics. Casual observation of student records will show that in the past more students transferred into computer science with poor records than with good records. Since undergraduates may choose a major field without consultation with the department concerned, we are as helpless to prevent such a flow of students as the university as a whole is helpless in preventing poor but technically qualified (a diploma from a Kansas high school) students from entering. Our answer, and one which is showing increasing effectiveness, is the same as the university's. By maintaining high enough standards to assure a good education, we can match the influx with an outflow of students, who either fail and are dismissed or gravitate to fields more suited to their abilities. Recent marked upgradings of our courses are accomplishing this goal.

A major and intensive area of concern among the faculty in this department has been to provide adequate professional guidance for its undergraduate majors. Implementation of this goal takes several forms. First, emphasis in courses is placed wherever possible on developing good habits, in the sense of practices which are favored in a commercial environment, among students. Of particular importance here is the documentation of programs and of pre-program systems analysis work. To this end an informal committee of three faculty members has been working on a set of documentation standards which, it is hoped, will be adopted throughout the departmental course offerings. Second, members of the department maintain active contact with the non-university community of computer science workers and users by means of individual professional and consulting contacts and by talking with employment interviewers visiting the campus. This is done in order to ascertain on a continuing basis the employment needs of this non-university group in the area of computer science. It is the

intention of the department to remain sensitive to these needs and consider them in our continuing efforts to improve the undergraduate curriculum. That we have been initially successful is indicated by the apparent ability of our new Bachelor's degree holders to obtain jobs in computing or related areas. While no exact statistics are available, data obtained by interviewing faculty members seems to indicate a placement success rate of about 80 to 90 percent.

3. Undergraduate Non-Academic Performance

There can be little doubt that the computer science students themselves are enthusiastic about the program. In the spring of 1971 a student chapter of the Association for Computing Machinery was formed at Kansas State University. At this time, which is before the expected influx of memberships for the fall semester, the chapter contains about 20 members, about one-half of whom are undergraduates, with a high percentage of these being active and contributing to the growth and goals of the chapter. In the few short months of its existence the chapter has accomplished the following.

- Organized a highly productive meeting between students and faculty in the department for the purpose of discussing goals and means of obtaining them, settling grievances, and generally establishing paths of communication between these groups. More of these meetings are contemplated in the future.
- Sponsored a series of faculty and student talks on topics of professional interest at their monthly meetings. These have been well attended.
- Drawn an ACM national lecturer to the campus. The Association for Computing Machinery each year supports a group of men with national reputations in some area of interest to computing so that they may tour the country discussing recent advances in their area of competence.

Thus obtaining the services of one of these speakers is equivalent to obtaining a small grant.

- Also started a strong effort to attract more membership. Members of the chapter maintained a booth at the Fall Student Activities Carnival this year which featured one of the school's time-sharing terminals and arranged to have it used by the general public. The Activities Carnival is an event held early each academic year to apprise persons new to the campus of the various club and other extracurricular activities open to them.

Undergraduate computer science majors also have a normal interest in extracurricular activities, and through this, contribute their share to an important part of the university community. The undergraduates of this department are active in fraternity and sorority organizations, work in campus theatre productions, and participate in intramural sports. Some of them contribute along more professional lines by tutoring, both with and without pay, in computer science areas, and by holding computer science related jobs on campus.

"Thus there are many indications that the undergraduate major programs in computer science at Kansas State University are successful. Our students are vigorous and viable, in both the commercial and scholastic sense. Furthermore the present faculty is dedicated to maintaining this success, and to improving the program to the limit of our resources."

4. Graduate Academic Achievement

At present, the Department of Computer Science has 27 graduate students, two of whom have attained the Master's degree in computer science and 25 who are working toward that degree. Many of these students are seeking admission

into the Ph.D. program. Since the program was granted to the department in July of this year, the department has yet to formalize the candidacy requirements and therefore has not formally accepted any students as candidates.

Currently seven graduate students hold graduate teaching assistantships in the department. One student holds a graduate research assistantship in another department doing computer research. Five graduate students hold computer related jobs with the University, most of them at the Computing Center. Four others are supporting themselves in graduate school with computer-related part-time jobs.

Table 5 indicates the graduate grade distribution in computer science courses for the last two years except in those cases in which the course was not offered both years.

5. Graduate Professional Achievement

As has been mentioned, seven graduate students are presently engaged in teaching computer science courses as graduate teaching assistants. Five are teaching two sections each (3 hours of lecture per week per section) of the introductory programming course and one graduate student is teaching one section of the introductory course and the one section of COBOL, a second level course. One student is teaching two sections (3 hours each) of the third level course, Computer Organization and Programming (425). In all cases the instructors are given considerable freedom to organize and handle the course as they see fit with a minimum of direction. Coordination through group meetings, directed by one of the faculty, is achieved with decisions made by the group. We feel that these students are gaining invaluable training and job experience that will help them in determining their careers. Academically the experience promotes better work habits on the part of the instructors due to the emphasis they must place on certain types of performance in their students.

Table 5

GRADUATE COURSES

| Year | Course | Title | # Student | A | B | C | D | F | WD | INC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1970-71 | 286 400 | INT ALG PRO | 2 | 2 | - | - | - | - | - | - |
| 1970-71 | 286 410 | COBOL | 3 | 1 | 2 | - | - | - | - | - |
| 69-70 | " | " | 6 | 4 | 1 | 1 | - | - | - | - |
| 1970-71 | 286 425 | COMP ORG PRO | 12 | 4 | 4 | 3 | - | - | - | 1 |
| 69-70 | " | " | 8 | 3 | 3 | 1 | - | - | 1 | - |
| 1970-71 | 286 506 | MATH COMP II | 3 | 2 | - | 1 | - | - | - | - |
| 1970-71 | 286 525 | INT INF STRN | 4 | 2 | 1 | 1 | - | - | - | - |
| 69-70 | " | " | 4 | 3 | 1 | - | - | - | - | - |
| 1970-71 | 286 600 | DISC STRUCT | 11 | 6 | 2 | 2 | - | - | - | 1 |
| 1969-70 | 286 610 | LIST PRO LAN | 10 | 7 | 3 | - | - | - | - | - |
| 1970-71 | 286 615 | COMP LOGIC | 13 | 8 | 2 | 3 | - | - | - | - |
| 69-70 | " | " | 6 | 5 | 1 | - | - | - | - | - |
| 1970-71 | 286 620 | PROG SYST | 12 | 4 | - | - | - | - | 2 | 6 |
| 69-70 | " | " | 6 | 6 | - | - | - | - | - | - |
| 1969-70 | 286 635 | NON-NUM PROG | 7 | 5 | 2 | - | - | - | - | - |
| 1970-71 | 286 640 | PROG LANG | 10 | 5 | 2 | - | - | - | 1 | 2 |
| 69-70 | " | " | 11 | 4 | 3 | - | - | 1 | 1 | 2 |
| 1970-71 | 286 810 | COMP SIM | 15 | 15 | - | - | - | - | - | - |
| 1970-71 | 286 811 | SIMULATION | 8 | 6 | 1 | - | - | - | - | 1 |
| 1970-71 | 286 815 | SP TOP CS | 2 | 1 | - | - | - | - | - | 1 |

5. Graduate Alumni Performance

The first Master of Science degree in Computer Science was awarded in 1969. Since then, fifteen additional Master of Science degrees have been awarded. The feedback received from the alumni indicates that they all found employment in the area of computer science without difficulty.

Approximately 80 percent of the alumni referred to above are presently employed by industrial organizations and the Federal Government. These include aerospace, defense and business. The remaining graduates are working toward the Ph.D. degree in Computer Science.

6. Student Achievement: The Next Decade

During the ten-year span from 1971 to 1981, the department will grow considerably both in the number of computer science majors and in the number of students taking the service courses but not majoring in computer science. Figure 1 shows the anticipated growth of the major groups. Furthermore, the range of backgrounds of the students taking service courses will come from a broader range of backgrounds.

Comprehensive and centralized records of the students in computer science are, for some categories of students, lacking. More complete individual records plus certain summaries or profiles will be kept and updated at regular intervals. Along with this move for more formalized record keeping, a more uniform and thorough acceptance procedure, preferably using such standard information as the graduate record exam, will be instituted for graduate school admissions. Figure 2 shows the anticipated timetable for the achievement of these goals.

For all students, the Computer Science Department objectives divide into four main areas: get good students initially; keep them once we have them; produce a high quality product in the end, and finally, aid the student in

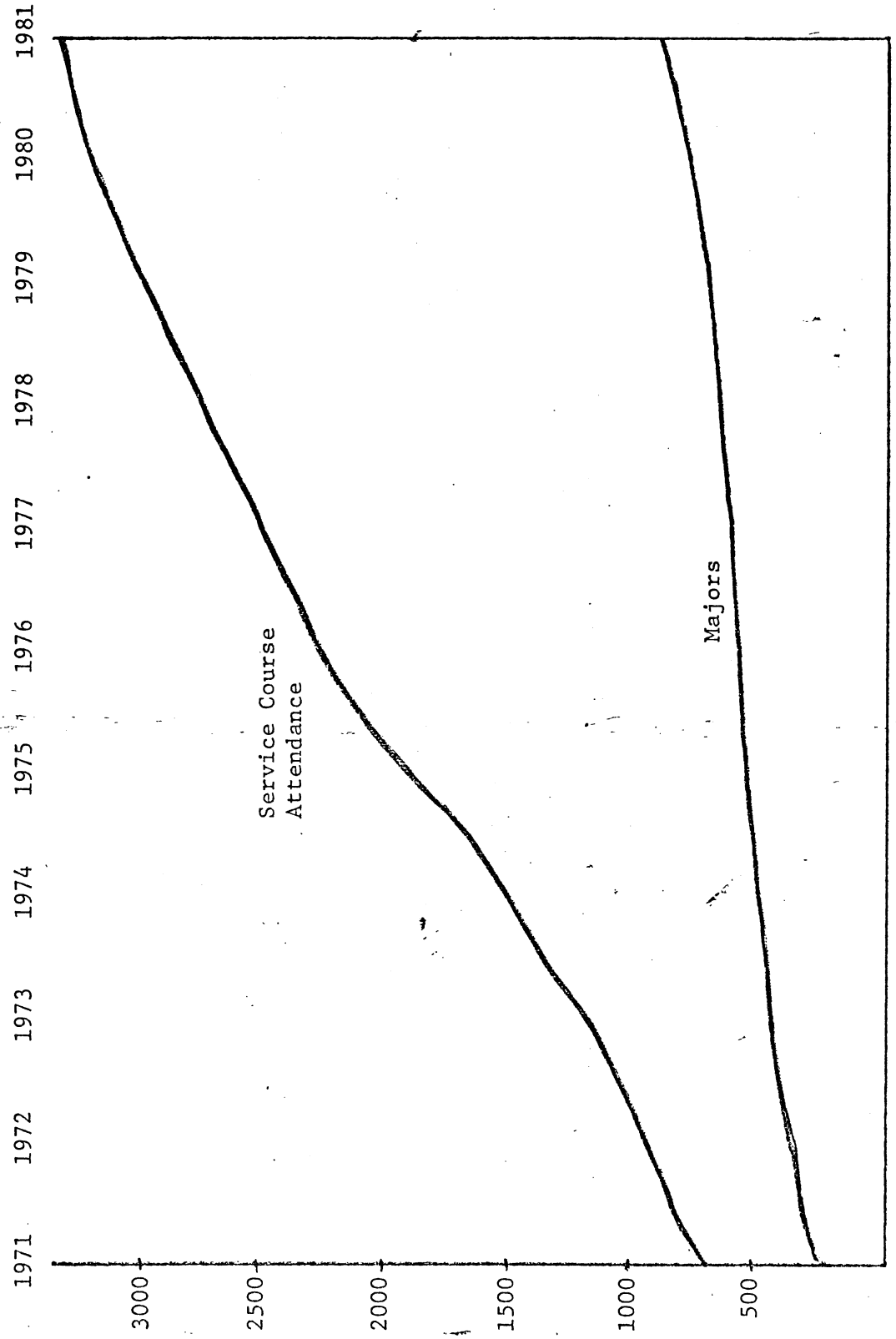


Figure 1. Anticipated Enrollment Changes

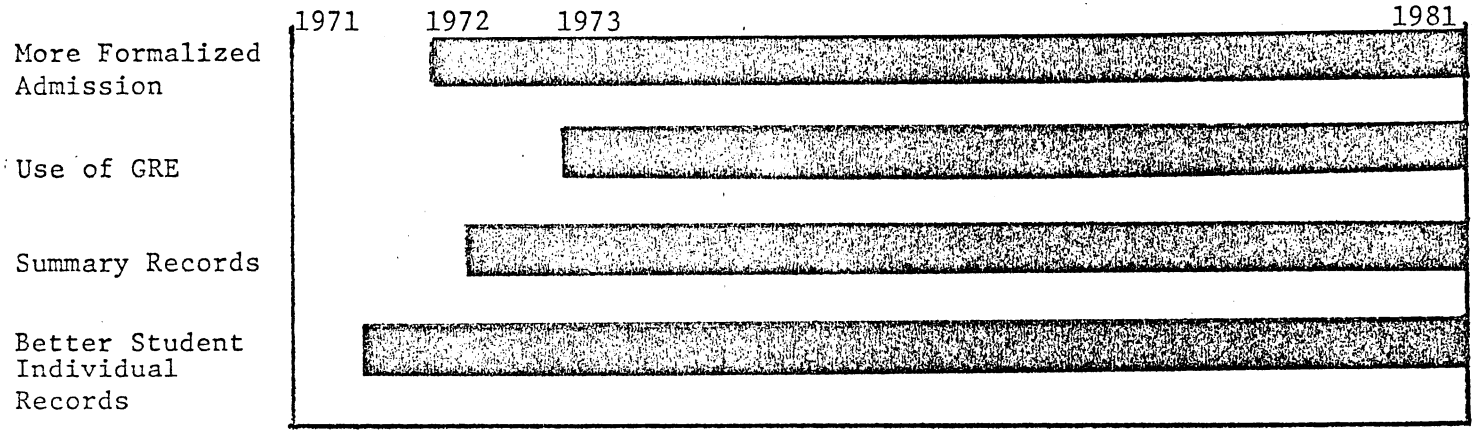


Figure 2. Chronology of Record Keeping Improvements

placement into a good job or into a good graduate school as he finishes his work at Kansas State University.

Attracting good undergraduates seems to be a difficult proposition. Traditionally, few academic departments make any effort to recruit undergraduate majors. The liberal admissions policy necessitated by this University's position at a state school means that many of our incoming students are academically poor. Perhaps the best way to ensure that the undergraduate program has a high percentage of quality students is through rigorous grading.

The implementation required to keep a good student and that required to turn a good student into a good computer scientist are very similar. It is much easier to learn in a course that is relevant, well taught, and part of a cohesive body of instruction. A student who learns, provided he learns the right material, is in the process of becoming an outstanding graduate. He should have available special projects on a resident mini-computer, which would be relatively inexpensive to establish and maintain. The other major effort toward these goals should be a continued insistence by the whole department upon good teaching by both faculty and graduate teaching assistants (see Part III, Faculty and Resources.

Just as there was a strong overlap between the second and third main objectives, there is one between the third and fourth. Since we want to maintain the relevance of courses to the outside world, we should communicate as much as possible with computer science users in industry and government, and students should be encouraged to seek summer positions outside the university.

Not only their temporary jobs, but also their permanent jobs after leaving our department, are indicators of our program's success. We will ask alumni how well our program has prepared them to achieve job success and job satisfaction.