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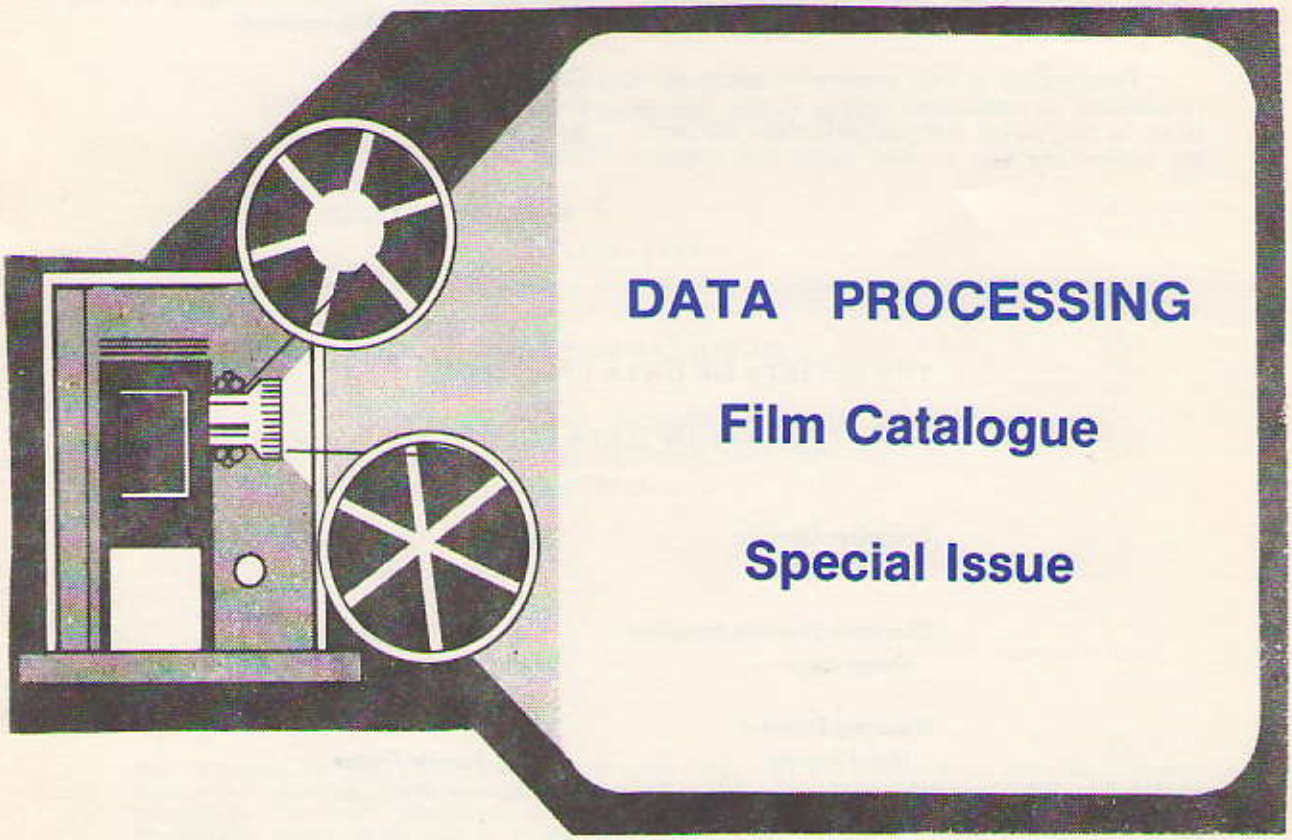

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A SURVEY OF COMPUTING IN PRIVATE LIBERAL ARTS COLLEGES

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INTRODUCTION

There have been several surveys of computing course offerings [6, 10, 12], including a recent one specifically of small liberal arts colleges [9]. One difficulty with these earlier surveys, however, is that the results are affected by the fact that data is included from only those institutions interested enough to respond to the request for information. The status of the unresponsive group is always left to speculation. For the present study, an attempt is made at a complete survey of one group of colleges. This is done by collecting data from college catalogs.

Chosen as the survey population was the set of private liberal arts colleges in the United States with enrollment less than 4,000. This group was chosen because these colleges have unique problems in implementing a computing curriculum, and many different approaches have been taken to solving these problems. A detailed discussion of these problems, which typically have to do with the smallness of the schools and their limited resources, is found elsewhere [7, 13].

Curriculum recommendations in computing are generally aimed at the large universities and are often too ambitious and not responsive to the goals of the small liberal arts college. Because of this, several model curricula have been proposed specifically for this group of small colleges [3, 8]. One of the purposes of this survey is to determine how actual implementations of curricula in these small colleges correspond to the models that have been suggested.

A total of 724 colleges were identified as satisfying the requirements of being private, liberal arts colleges with enrollment less than 4,000. Of this group, recent college catalogs were located for 676. Of these, 72 percent included listings for the 1977-78 academic year, and 90 percent were listings for no earlier than the 1976-77 academic year. No college whose catalog listings were prior to 1975 was included.

Since the size of the school greatly affects the type of courses that it offers, the results of the survey are presented broken down by the size of the college. Four groupings are used for this distribution, and these are shown in Table 1, along with the frequency counts for each group.

CURRICULUM MODELS

In order to study the trends in offerings at the colleges in the survey, the offerings of each school were compared with various curriculum models. This was done in a manner that is similar to a technique used in [9]. Schools were classified as following a model if more than half of the courses offered were found in the model curriculum, if certain key courses from the model were offered, and if more courses from that model were in the curriculum than from any other model.

Of the thirteen models used, seven are published curriculum recommendations, and six are patterns of course offerings which do not match any of the published recommendations but which occur frequently in small colleges. These patterns are:

1. No courses in computing offered.
2. Introductory courses only offered.
3. Two courses only offered.
4. Language oriented curriculum.
5. Application oriented curriculum.
6. Data processing curriculum.

Schools were included in the "No courses" pattern if they had no courses for credit listed in their catalog. A school would be included under this pattern even if there was a numerical analysis course listed in the Mathematics Department. The "Introductory courses only" classification does not imply that only one course is offered at the school. In many cases several courses are offered, but all are at the introductory level. Schools of that type fit this pattern. Schools that offered just two computing courses in sequence were placed in the "Two courses only" category. These were not included among those following a curriculum model because two courses are not enough to establish a pattern.

The "Language oriented curriculum" is one whose course offerings are centered about various programming languages. The offering of such a school might include courses like "Introduction to FORTRAN," "Advance COBOL," or "APL Programming."

The fifth pattern is the "Application oriented curriculum." The courses in such a curriculum are generally tied to applications of the computer in some other area. Typical course titles for this pattern are "Business Application of Computers," "Scientific Programming," and "Social Science Computing."

The "Data processing" pattern of offerings begins with a course like "Introduction to Data Processing" and usually includes additional courses like "Management Information Systems" and "Systems Analysis." The courses in such a curriculum emphasize business applications and often include instruction in operations, unit-record equipment, and data center management.

The seven published models which were used are listed below with references.

Austing-Engel—A Computer Science Program for Small Colleges [3]

CUPM—Recommendations for an Undergraduate Program in Computational Mathematics [4]

ACM '68—Curriculum '68, Recommendations for Academic Programs in Computer Science, A Report of the ACM Curriculum Committee on Computer Science [1]

C^3S—Curriculum Recommendation for the Undergraduate Program in Computer Science, A Working Report of the ACM Committee on Curriculum in Computer Science [2]

Information Systems—Curriculum Recommendations for Undergraduate Programs in Information Systems [5]

Wheaton—Computer Science for Liberal Arts Colleges [8]

IEEE—A Curriculum in Computer Science and Engineering [11]

SUMMARY OF RESULTS

Tables 2 through 7 summarize the results of this study. A brief discussion of each table follows.

Table 2 gives the percentage of schools in each size classification offering each curriculum. As expected, the offerings at smaller schools are less developed since 19 percent of the schools with enrollments under 1,000 offer no courses, and over one-half of this group offer nothing beyond an introductory course. By contrast, 99 percent of the schools with 2,000 or more students offer at least one course in computing, and 95 percent of these larger schools offer courses beyond the introductory level.

The curriculum models that are the most frequently matched in the medium size institutions are ACM '68, C^3S, and Data Processing. The pattern of offering a sequence of language courses is also popular in this group.

Schools with 2,000 or more students show a greater tendency to favor the C^3S model. Since this model was not published until 1977, and since even then it appeared in a working form, it has not been adopted because the schools wished to follow the recommendations. The situation appears to be that the thinking of the faculty at these schools was similar to that of the C^3S Committee and their recommendations had, in fact, already been implemented at many schools. Specific courses from the C^3S report which are offered in many institutions are Computer Programming II, Assembly Language Programming, and Computer Organization.

Another interesting figure among the largest groups of schools is the percentage following the Information Systems model. This model appears to be growing in popularity, especially among schools which offer a computing course sequence within the Department of Business.

The breakdown of departments offering computing courses is given in Table 3. Some schools offer computing courses in more than one department. When this is the case, the department with the most extensive offerings is recorded as the department for that school.

Twenty percent of the total sample have a department of computer science, but this factor is highly dependent on the size of the school. About 15 percent of the schools in the sample offer their computing courses within the business department. This percentage seems to be independent of the size of institution.

The language taught in the first course is the subject of Table 4. Note that all of these percentages total to more than one hundred because some schools teach more than one language in the introductory course. Also note that this tabulates use in the first course and does not include any other course in the curriculum. This data was available only for those schools which name the language taught in the catalog description of their introductory course. This includes about half of the schools sampled. This table shows only negligible use of languages other than FORTRAN and BASIC in the first course, with FORTRAN clearly dominating.

In Table 5, the distribution of concentrations is given. Three classes of concentrations are used. The first, the major, includes those programs which allow a student to graduate with some form of computing as the principal major subject. The category minor includes those schools which allow a secondary

concentration in computing. The joint major differs from the minor in that it is a special form of a major in some given area which includes a heavy component of computing courses. These programs have names like "major in mathematics with emphasis in computer science," "major in physics/computer science," and "major in business administration with data processing concentration."

While only 3 percent of the schools with enrollments under 1,000 offer a major, almost one-fourth of those over 2,000 do. Note that only one type of concentration was recorded for each school, so the listing of minors means a minor is offered but no major.

Table 6 indicates that the C^3S and the ACM '68 curricula are the dominant models in use at schools which offer concentrations in computing. Over half of all majors and joint majors are classified as one of these two models. Another interesting entry in this table is the large percentage of minor programs which follow the "Language" pattern. This indicates that these schools are unlikely to move on to a major unless a change of direction occurs in their curriculum.

The distribution of courses offered by type of concentration is given in Table 7. Only those courses offered by more than 20 percent of the schools which have concentrations were listed in this table. Here again the tendency of schools, which grant only a minor, to offer language oriented courses is evident. A number of courses are listed in Table 7 which are not included in any curriculum recommendations but which are nevertheless popular offerings. These are COBOL Programming, FORTRAN Programming, and Data Processing.

CONCLUSIONS

Although there are some differences in the population sampled, this survey can best be compared with the recent survey of Lopez, Raymond, and Tardiff [9]. They sampled small liberal arts colleges but included public, as well as private institutions. They included schools with enrollments between 1,000 and 3,000. A comparison can still be made to reach some conclusions as to how their self-selecting sample (selection by returning the survey form) with response rate of 39 percent relates to the present study.

Surprisingly, the percentage of schools offering no program is almost identical in the two surveys. This indicates that there might not be as much bias in the sample toward schools with programs as is generally believed.

Although the C^3S model was not available at the time of the Lopez, Raymond, and Tardiff survey, it was included in an earlier form as one of their Almost twice as many schools are following this model in the present survey as in the earlier one. This may indicate a shift that has occurred in the one year between surveys and reflect the difference between the C^3S Report and its earlier version.

The present survey indicates that there are many computing curricula being offered in private liberal arts colleges and that these take many different forms. Over half of these schools still offer computing courses in the Mathematics Department, but this number is being diminished by the growing number of Computer Science Departments (20%). There also is a significant number (16%) of schools which offer computing courses primarily in the Business Department. Major programs and other concentrations are offered at a significant number of institutions, but these programs tend to be more language and application oriented than their counterparts at larger universities.

The offerings sampled in this survey are rapidly changing, and a repeat of this survey in two years would no doubt yield very different results. The number of major programs is rapidly changing and the recent publication of new curriculum recommendations [2, 11] will no doubt have a significant impact.

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Table 1

DISTRIBUTION OF SIZE OF SCHOOLS
IN THE SAMPLE

Enrollment	Number	Percentage
0-999	308	46
1000-1499	186	28
1500-1999	93	14
2000-3999	89	13