S 229

SIMON FRASER UNIVERSITY

MEMORANDUM

Curriculum Changes

To: Mr. H. M. Evans
Secretary of Senate

From: B. L. Funt
Dean of Science

Subject: Program Priorities

Date: February 19, 1969

At its meeting of February 17th, 1969, the Faculty of Science considered the recommendations on program priorities and agreed that these would be:

1. Computing Science
2. Biochemistry

In addition, strong support was expressed for the proposal for a summer program for teachers, but this proposal, which was before the Faculty, was not considered in sufficiently definitive form to be brought forward at this time.

It is essential that I make it clear to Senate that the description of course content in the programs is not final, but has been completed sufficiently to present a general perspective of the programs and their content sufficient to establish their priority positions.

If the programs are approved and further competent faculty members obtained, variation in general content of individual courses may be brought forward.

None of the courses recommended for the new programs in Computing Science and Biochemistry have been considered in detail by the Undergraduate Curriculum Committee of the Faculty of Science, and it is not intended to present such courses for individual detailed approval until approval for the program as a whole has been obtained.

On the other hand, the programs and their general delineation have been considered in detail by the Faculty and by appropriate committees of Faculty, and have been examined and debated extensively.

B. L. Funt

BLF/cj
Enclosure

S229a

SIMON FRASER UNIVERSITY

MEMORANDUM

Curriculum Changes

To Faculty of Science.	From B. L. Funt, Dean of Science.
Subject Proposal for a Program in Computing Science.	Date February 6, 1969

Computers and computer techniques are having profound impact on modern society. The have revolutionized the approach to a wide variety of disciplines; they have a profound sociological, economic and scientific implication. No branch of science and technology can be predicted to have a quicker growth rate or greater impact or a greater potential for the next decade.

These observations are not particularly novel. They are widely recognized by the community; they are widely appreciated by potential students. There is therefore a great demand for courses and programs in Computing Science.

There is a correspondingly rapid development in the sophistication of computer techniques and in the development of computing science as an established discipline with many broad ramifications, including such diverse topics as integrated information systems and artificial intelligence.

In terms of selecting a program for which there is a broad need within the university community and appreciation in external society and a real demand from students, computing science is probably the best choice and the most highly favoured selection.

Some courses in computing science are presently taught in the Department of Mathematics. The Department prepared a proposal for an expanded computing science program and this was discussed at Faculty and various recommendations regarding the structuring of the administrative portion of the program and the management of the Computer Centre were made and are in the process of implementation.

The Computing Science program in its academic form as prepared by the Department of Mathematics is based on the core program widely employed in both Canadian and American universities. There is little doubt that it will be essentially correct in its ramification. There is little doubt also that the senior academic appointment in Computing Science will provide leadership and professional competence and that the academic personnel in the computing group will polish the program in terms of academic refinement and actual course structure.

However, although the fine details of the academic program cannot and should not be specified at this time, the broad implications in terms of budgetary need, program priorities, and curriculum development must be viewed now.

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Curriculum Changes

IMPLEMENTATION

The general pattern of development can be viewed as proceeding in three phases:

PHASE I - initiation of 100 and 200 level courses in Computing Science.

PHASE II - initiation of 300 and 400 level courses.

PHASE III - initiation of a complete major program in Computing Science.

PHASE IV - the establishment of new branches and choices within the Computing Science elective and the establishment of choices in the graduate program.

The essential first three phases will probably have the following budgetary implications:

1969-70 - number of new faculty - 3; annual rate of salary - $45,000; actual salary commitment - $30,000; operating expense - $45,000.

1970-71 - number of new faculty - 2; annual rate of expenditure - $70,000; actual expenditure - $60,000; operating expense - $90,000.

1971-72 - number of new faculty - 3; annual rate of expenditure - $110,000; actual expenditure - $90,000; operating expense - $135,000.

The essential course outlines were already distributed at the Faculty meeting of October 24, 1968 as paper 17-F. At the present time, no change in these is put forward.

Mathematics Department
Simon Fraser University

PROPOSED COMPUTER SCIENCE PROGRAM

Curriculum Changes

Ronald Harrop

July 30, 1968

Proposed Undergraduate Courses in Computing

Curriculum Reports

The following is the result of a study of a proposed introduction of serious computer science work into the undergraduate program of the University. It is envisaged that graduate work would start later.

As a starting point the recent (March 1968) proposals of the A.C.M.[1] were used, together with the older recommendations of the C.U.P.M.[2] It should be noted that the former document supercedes earlier ACM proposals and takes into account the CUPM document.

The next few pages show the ACM proposals in diagramatic form and the proposed action in respect of these proposals.

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1. Curriculum 68. Recommendations for Academic Programs in Computer Science. A report of the ACM Curriculum Committee on Computer Science.
Communications of the Association for Computing Machinery, 11 (1968) 151-196.

2. Recommendations on the Undergraduate Mathematics Program for Work in Computing. Committee on the Undergraduate Program in Mathematics, May, 1964.

Curriculum Changes

EQUIVALENCE OF CUPM COURSES AND PRESENT MATHEMATICS DEPARTMENT COURSES

The following table is an assessment in general terms of the equivalence of the CUPM courses quoted in the ACM Curriculum with present Mathematics Department courses. The CUPM courses are given in the publication: A General Curriculum in Mathematics for Colleges. A Report to The Mathematical Association of America. Committee on the Undergraduate Program in Mathematics, 1965. Naturally the equivalence is not exact.

CUPM	Math. Dept.
M1	113, 114
M2	213
M2P	483
M3	232
M4	214
M5	411, some 412
M6	432
M7	485

Note: M2, M4 are best considered as a unit.

Curriculum Changes
ACM
PROGRAM

THE CORE COURSES OF THE PROPOSED UNDERGRADUATE PROGRAM

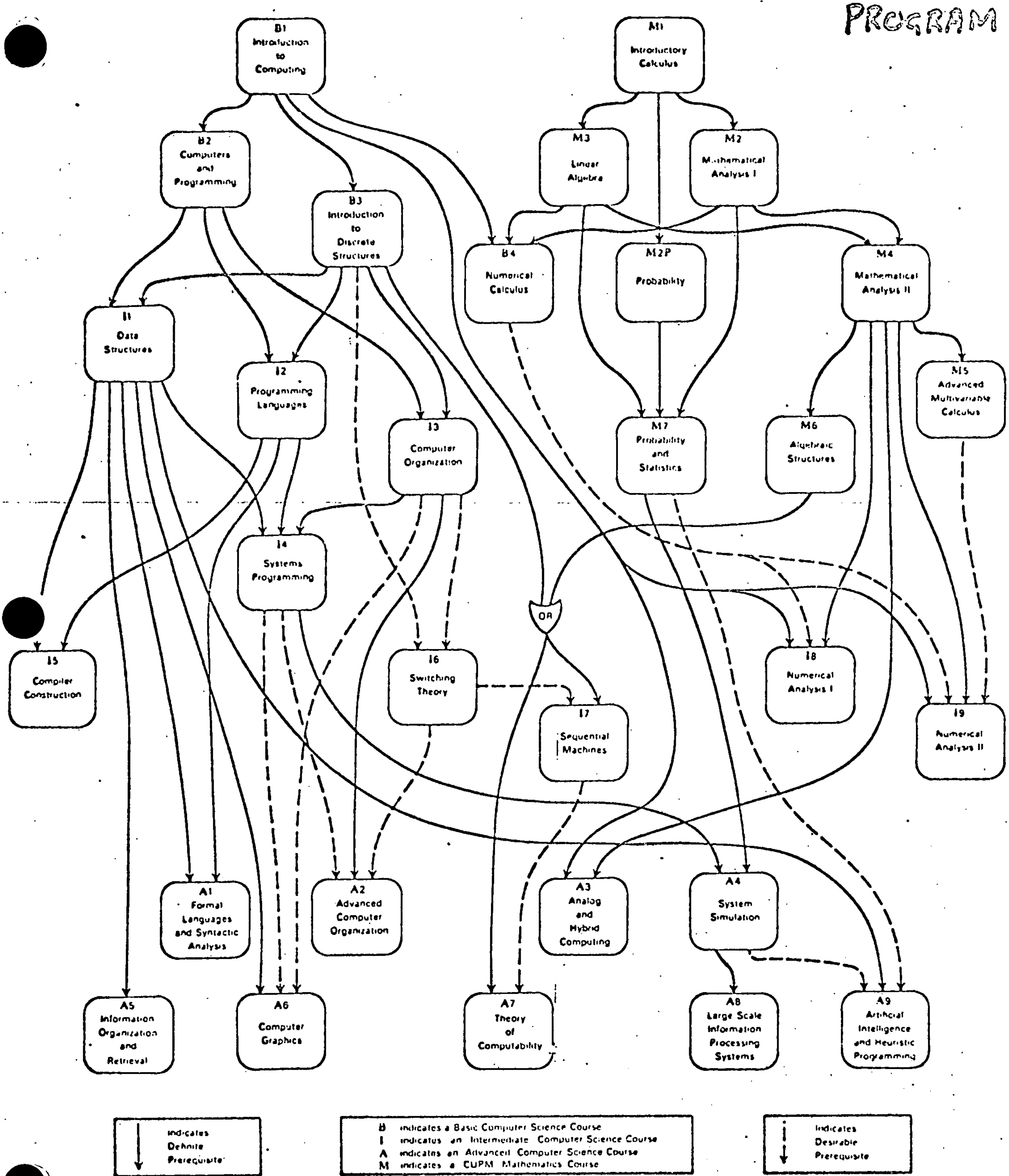


FIG. 1. Prerequisite structure of courses

Curriculum Changes A.C.M WITH PROPOSED MODIFICATIONS INDICATED [PRE-REQUISITES NOT NECESSARILY CORRECT] 5

THE CORE COURSES OF THE PROPOSED UNDERGRADUATE PROGRAM

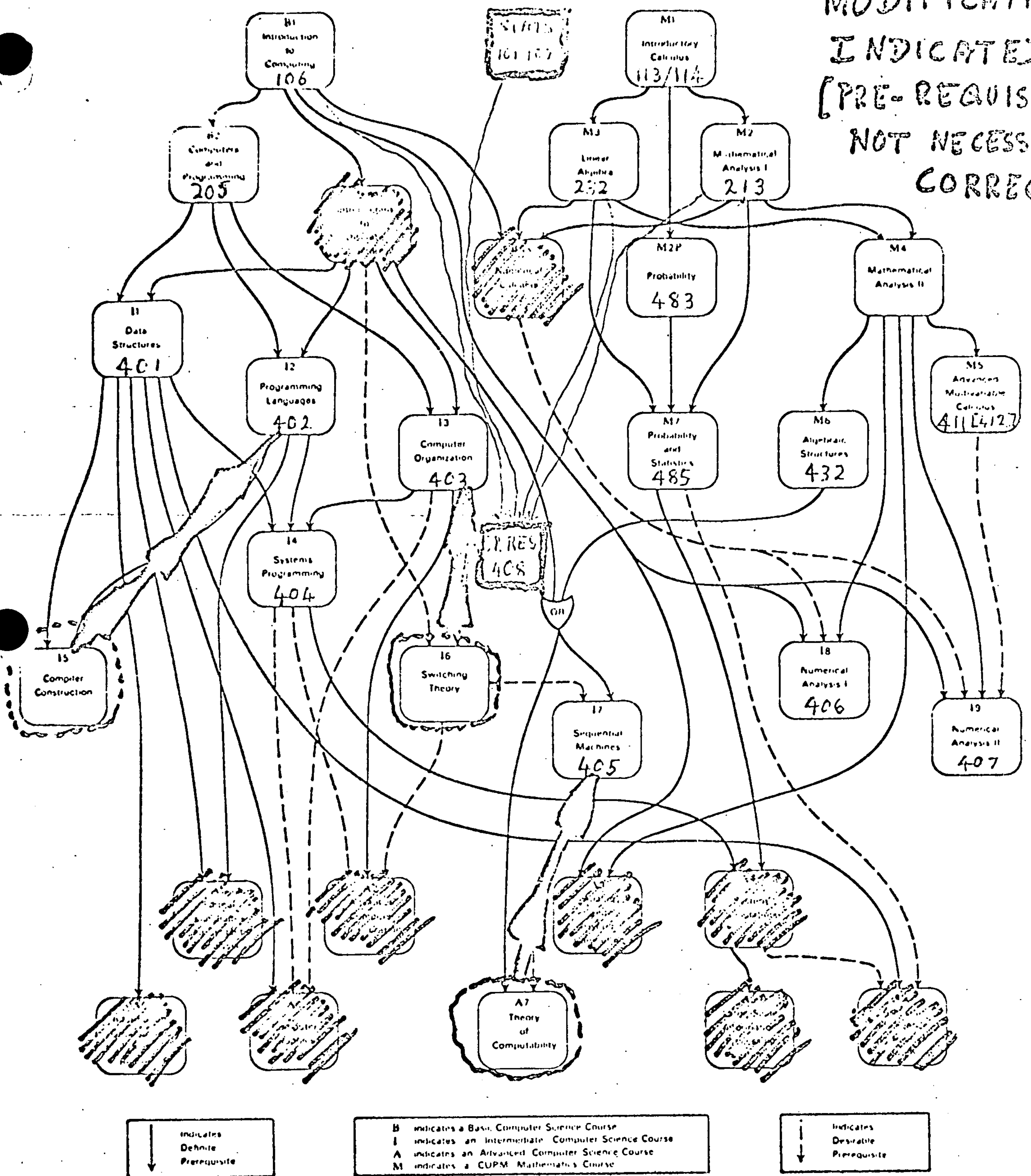


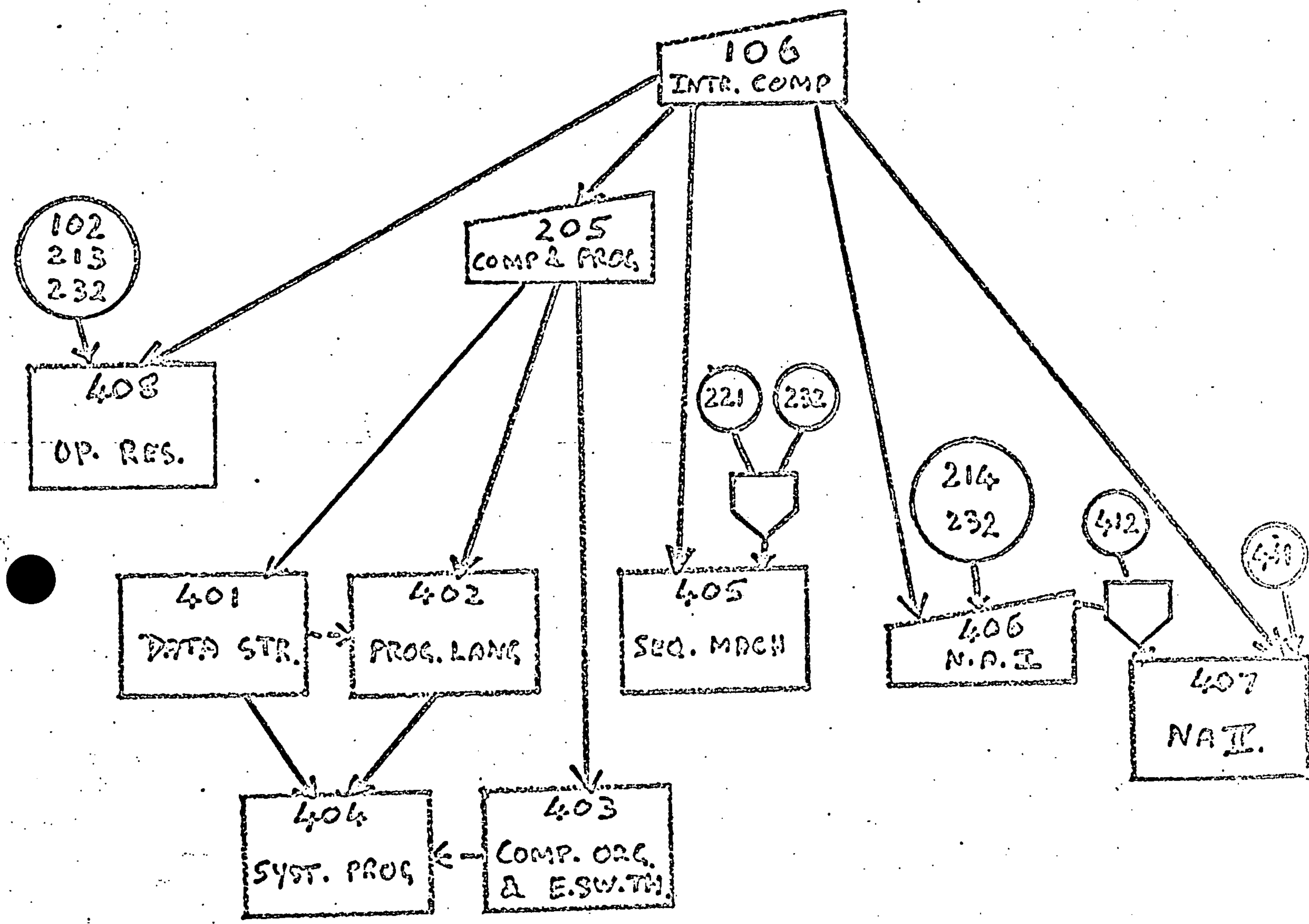
FIG. 1. Prerequisite structure of courses

COMPUTER SCIENCE COURSES

Curriculum Changes

SHOWING PREREQUISITES

BASED ON PRESENT MATH PROGRAM



NOTES: (1) 106, 205, 406 replace 105, 487, 488 resp.

(2) Some changes in prerequisites will occur with

Curriculum Changes

FACULTY REQUIREMENTS ETC.

In order to implement the suggested programs with normal trimester operation and with enrollments as specified for courses offered in the Fall Semester and approximately one-half enrollment in Summer Semester, it will be necessary to have about 8 members of faculty, 5 one-semester teaching assistants, 1 programmer, 1 key punch operator, and a clerk typist. We have at present 2 members of faculty and about 3 one-semester teaching assistants engaged in the program and some programmer help. The justification for these figures is as follows:

Course	Units	Times/Yr.	Enrollment (Fall&Sp.)	Lectures*	Fac.Tut.*	T.A.Tut.*
106	3	3	150	9		15
205	3	3	90	9		9
401	4	1½	45	6	4½	
402	4	1½	45	6	4½	
403	4	1½	45	6	4½	
404	4	1½	30	6	3	
405	4	1½	45	6	4½	
406	3	1½	45	4½	4½	
407	3	1½	30	4½	3	
408	3	1½	45	4½	4½	
				61	33	24

Total faculty load 94½ hrs. 12 faculty

Total T.A. load 24 hours 5 T.A.'s

* These are faculty or T.A. weekly semester contact hours per year.

Curriculum Change

[ACM Course B1]

106-3 Introduction to Computing

Introduction to the concepts of algorithm and flowchart. Their relation to the structure of a computer. Use of a high level programming language for elementary problem solving.

(3-1-0)

Note: This course follows in rough outlines the ideas covered in B1. It replaces our course Mathematics 105-2. The high level language used will probably at the present time be FØRTRAN though PL I may be introduced at some later stage. Items 8 and 10 in B1 will receive less detailed attention than is suggested. More attention will be paid to flowcharting and problem analysis.

Curriculum Changes

[ACM Course B2]

205-3 Computers and Programming

Internal structure of a computer system and machine-oriented programming. Theory of selected programming techniques. Introduction to theorem of advanced software and advanced hardware. (3-1-0)

Prerequisite - Mathematics 106-3.

Note: This course follows in general outline course B2 with additional emphasis on the use of assembler language. The danger that the last part of the B2 course could be handwaving is to be avoided.

[ACM Course B3] Curriculum Changes.

Comments on ACM Course B3 <u>Introduction to Discrete Structures</u>.

There is perhaps no need to introduce this course at the moment, but it, or something like it, may be found to be essential later, dependent on the mathematical background of the students we get. There are many topics of interest and of importance here for science students and for some arts students. In particular this relates to the graph theory work. It will be noticed that the course includes computer applications of the topics covered and not just their theory.

The omission of the course will mean that we will have to introduce any of the topics that should have been covered there when they are needed in later courses. This is not a particularly satisfactory position but is perhaps sensible at the moment if University expansion is limited.

Some of the theoretical work of B3 is covered in the new Pure Maths I course.

We would naturally consider mounting the course on request if special funds were provided.

[ACM Course B4]

Curriculum Changes

Comments on ACM Course B4 Numerical Calculus.

A good course for people going no further in computing science but one which for budgetary reasons we would possibly have to leave out at present. Material in it could be omitted or covered in I8/9. (Numerical Analysis I,II).

Curriculum Changes

[ACM Course I1]

401-4 Data Structures

Concepts of data. Theory and applications of several data organizations. Storage systems and structures.

(4-1-0)

Prerequisite Mathematics 205-3.

Note: This course follows essentially Course I1 of the ACM curriculum. It has been upgraded to a 4 credit course so that the graph theory part of the omitted course, B3, could be included. This could appropriately be done in part 4 of the syllabus. The course content is stated to be more than could be normally given in a one-semester course. This is another reason for upgrading to 4 units. In this course, as in many others of the proposed 400 level courses, the eventual content will to some extent have to be determined by experience. The ACM statement that: the instructor should carefully select material which gives the student a broad introduction to the subject but which fits together pedagogically · seems significant since there is a real danger that the course could develop into being a catalogue type collection of facts. If, however, this danger is borne in mind, the course could form and should form an essential introduction to later work.

[ACM Course I2 (see also I5)] Curriculum Changes

402-4 Programming Languages

Systematic approach to the study of programming languages. Introduction to assembler and translating systems.

(4-1-0)

Prerequisite - Mathematics 205-3. It is desirable, though not essential, that Mathematics 401-4 be taken prior to or concurrent with Mathematics 402-4.

Note: This course essentially follows I2, but has part of I5 added into it. It is not considered appropriate at this stage to recommend the introduction on a full course of compiler construction. The other courses being suggested are considered to be more important in the first instance. It may well happen that in the future this course is split along the lines suggested by ACM. We feel, however, that this would best be done in the light of experience gained here and not done immediately. The co-requisite 401-4 has been added partly because of the complete omission of B3, but more because it is felt that a detailed knowledge of data structures, while not essential for a full study of programming languages, is nevertheless a help. It becomes particularly desirable if we go far into the compiler construction aspect of the course. The course is essentially an extension of the software aspects of the course 205-3.

Curriculum Changes

[ACM Course I3 (see also I6)]

403-4 Computer Organization and Elementary Switching Theory

Hardware organization of computer systems. Logical design and elements of digital computer systems. Theoretical foundations and mathematical techniques concerned with the design of logical circuits. (4-1-0)

Prerequisite - Mathematics 205-3.

Note: In the same way as 402-4 is an extension of the software part of 205-3, the present course is an extension of the hardware part of that course. It is considered as a combination of I3 with parts of I6. It is not proposed at this time to give I6 in full.

[ACM Course I4]

Curriculum Changes

404-4 Systems Programming

Software organization of computer systems. Multiprogramming and multiprocessing systems. A particular system is shown for central study. (4-1-0)

Prerequisite - Mathematics 401-4 and 402-4. It is recommended that a student take Mathematics 403-4 prior to or concurrent with this course.

Note: This course is intended as being essentially based on Course I4 of the ACM proposals. This means that with 401, 402 and 403 it forms the main "computer science" part of the computer science option. The problems which arrive in multi-accessing, multiprogramming and multiprocessing are emphasized in the course which should be a serious one. It will be noticed that in the ACM description it states that: here is considerably more material listed than can normally be covered in one semester so that careful selection of topics should be made or the course extended to two semesters. This is the justification for making the course 4 credit rather than 3.

Curriculum Changes

Comments on ACM Course I5 <u>Compiler Construction</u>

It is proposed that this course be omitted in the first instance, primarily for budget reasons. It is suggested that part of the course be included with I2 and this has been taken into account in the description of 402-4 and the comments on that course.

[ACM Course I6]

Curriculum Changes

Comments on ACM Course I6 <u>Switching Theory</u>

This course has certain aspects which might be more appropriate to study in physics. Whether it could be offered will to some extent depend on the qualifications of persons recruited into the computer science section of the Department. At this stage we feel that it would be best if part of the course were taken into I3 and the remainder omitted. We would still retain the flexibility to introduce the remainder of the course if it were found necessary or desirable at a later stage. These facts have been taken into account in the description of and comments on 403-4.

[ACM I7 (see also A7)]

Curriculum Changes

405-4 Sequential Machines

Theory of finite automata and sequential machines with extension to an introduction to the study of recursive (computable) functions. (4-1-0)

Prerequisite - Mathematics 106-3 and at least one of Mathematics 231-2 or 232-3.

Note: This course has been upgraded to a 4 unit course for a specific reason. The Mathematics Department has an active group in mathematical logic and it would be appropriate both from the computer science and the mathematical logic points of view if advantage was taken of that fact. Accordingly the elementary part of the graduate course A7, namely the introduction of the subject of computability using Turing machines and similar methods has been added to Course I7. The complete course (405-4) is essentially of pure mathematics type and could draw as its audience pure mathematicians with an interest in logic as well as persons whose primary interest is in computer science.

[ACM Course I8] Curriculum Changes

406-3 Numerical Analysis I

Theoretical and practical study of numerical methods appropriate for high speed digital computer solution of a variety of mathematical problems. This study will include ones taken from the following general areas: solution of linear equations, interpolation and approximation theory, ordinary differential equations. (3-1-0)

Prerequisite - Mathematics 106-3, 214-3 and 232-3.

Note: This course and 407-3 correspond to Courses I8 and I9 respectively of the ACM curriculum. They also correspond to Courses 6 and 7 respectively of the CUPM curriculum. Detailed prerequisite requirements and course content may need some modification as implications of the intermeshing of the courses with the methods and differential equations courses become apparent. At present it would, however, seem that the courses could be essentially independent as far as duplicate credit is concerned and rather in fact they are complementary to each other.

[ACM Course I9]

Curriculum Ch...

407-3 Numerical Analysis II

Similar to Numerical Analysis I with particular reference to topics arising in the study of linear algebra and of ordinary and partial differential equations.

(3-1-0)

Prerequisite - Mathematics 106-3, 411-4 and at least one of 406-3 or 412-4.

Note: See Note on 406-3.

[Not in ACM Recommendation] Curriculum Changes

408-3 Operations Research

Mathematical theory of optimization methods used in operations research. Illustrative examples. (3-1-0)

Prerequisites Mathematics 102-3, 106-3, 213-3, and 232-3.

Note: Prerequisites to this course will probably be varied with the implementation of changes in the statistics courses. The course is intended to cover mathematical aspects of operations research. It is realized that there is an operations research course within the Economics Department. On the other hand as is the case with statistics, there is work here which should be dealt with by mathematicians. It would be intended that the course, as with other computer science courses, would make use of the computer. I see no reason why the course should be 5 units as is the case with the economics course. If it were to be a 5-unit course it would be quite out of line with the other courses offered by the Mathematics Department.