SIMON FRASER UNIVERSITY S.85-57

MEMORANDUM

To: Senate

From: Senate Committee on Undergraduate Studies

Subject: School of Computing Science - Curriculum Revisions

Date: November 13, 1985

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of November 12, 1985 gives rise to the following motions:

MOTION 1:

"That Senate approve and recommend approval to the Board of Governors, as set forth in S.85-57, that the regulations governing formal acceptance of transfer and second degree students into Computing Science programs be established as follows:

1. A transfer or second degree student who has completed at least 12 credits of computing-related courses (courses which can be used in calculation of the Computing-Related GPA Requirement for Declaration) at SFU will be considered for admission to a Computing Science program on the same basis as any other student (i.e. based on CGPA and Computing-Related GPA over courses taken at SFU).

2. A transfer or second degree student who has not completed at least 12 credits of computing-related courses, but who has at least 57 semester hours of credit and has credit for all the lower division course requirements of a Computing Science program may apply to the School for special admission consideration based on transcripts from other post-secondary institutions."

MOTION 2:

"That Senate approve and recommend approval to the Board of Governors, as set forth in S.85-57, the changes to lower division requirements."

MOTION 3:

"That Senate approve and recommend approval to the Board of Governors, as set forth in S.85-57, the new course proposals

Item referred back by Senate 2/12/85

CMPT 307-3 Data Structures and Algorithms
CMPT 309-3 Introduction to Formal Languages and Automata with Applications
CMPT 412-3 Computational Vision
CMPT 490-3 VLSI Systems Design"

MOTION 4:

"That Senate approve and recommend approval to the Board of Governors, as set forth in S.85-57, course changes as follows:

CMPT 101 as specific prerequisite
Changes to CMPT 362
Renumbering of CMPT 380
Changes to CMPT 404
Prerequisite change for CMPT 406
Operating Systems Courses
Prerequisite change for CMPT 410"

MOTION 5:

"That Senate approve and recommend approval to the Board of Governors, as set forth in S.85-57, the following changes

Upper Division Reorganization
Elimination of Key Courses
Computing Presentation Requirement
Special Topics Courses
Upper Division Degree Requirements for Majors
Changes to Minor Requirements
Upper Division Credit Requirement for Transfer Students
DSDP Changes

Item referred back by Senate 2/12/85

SIMON FRASER UNIVERSITY

MEMORANDUM

SCUS 85-32

To Mr. R. Heath, Registrar & Secretary to the Senate Committee on Undergraduate Studies.	**From** Janet Blanchet, Administrative Assistant, Faculty of Applied Sciences.
Subject Computing Science Curriculum Revisions (ASU. 85-5).	**Date** November 4/85.

At a meeting of the Faculty of Applied Sciences held on Tuesday, October 29, 1985 the attached curriculum revisions in Computing Science were approved.

Would you please place this item on the next agenda of the Senate Committee on Undergraduate Studies.

J. Blanchet.

jb

Enclosure.

SIMON FRASER UNIVERSITY

ASU. 85-5. (revised).

MEMORANDUM

To Janet Blanchet, Faculty of Applied Sciences	**From** R.D. Cameron, Director of Undergraduate Programs, Computing Science
Subject CMPT Curriculum Revisions	**Date** November 4, 1985

Attached is the complete package of Computing Science curriculum revisions to go forward to Senate Committee on Undergraduate Studies (CMPT-UGCC.85-3:15). The main body of this package consists of the curriculum revision motions recently approved by the Faculty of Applied Sciences Undergraduate Curriculum Committee, reorganized as suggested by Dr. Bhaktan to facilitate their consideration by SCUS. Various appendices have been attached to show how the curriculum revisions will be reflected in the SFU calendar.

In addition, the following revised motion should go forward to SCUS for their consideration.

Moved that the regulations governing formal acceptance of transfer and second degree students into Computing Science programs be established as follows.

1. A transfer or second degree student who has completed at least 12 credits of computing-related courses (courses which can be used in calculation of the Computing-Related GPA Requirement for Declaration) at SFU will be considered for admission to a Computing Science program on the same basis as any other student (i.e., based on CGPA and Computing-Related GPA over courses taken at SFU).

2. A transfer or second degree student who has not completed at least 12 credits of computing-related courses, but who has at least 57 semester hours of credit and has credit for all the lower division course requirements of a Computing Science program may apply to the School for special admission consideration based on transcripts from other post-secondary institutions.

The original motion was item #3 in the proposed new declaration requirements for Computing Science that went forward to SCUS as ASU 85-1. The revisions are in accordance with suggestions made at SCUS. The calendar wording reflecting this proposal is included in Appendix V of the attached document.

1. Changes to Lower Division Requirements

The following motions have been approved by the School of Computing Science and the Faculty of Applied Sciences as changes to the lower division requirements for Computing Science Major and Honors programs. The net effect of these changes is to increase the lower division requirements from 35 to 39 semester hours (due to elevation of PHIL 210-4 from recommended to required status). Appendix I contains comparative calendar descriptions for the current and proposed lower division requirements.

1.1. MATH 272 Required

Moved that MATH 272 (Introduction to Probability and Statistics I) become the required lower division statistics course for CMPT majors and honors students and for DSDP honors students. Presently, students may satisfy this requirement with any one of MATH 101 (Introduction to Statistics A), MATH 102 (Introduction to Statistics B) or MATH 272; the proposal would no longer allow MATH 101 or 102 as options.

Rationale

This change would provide CMPT students with a sounder background in probability and statistics as needed for several upper division CMPT courses, including CMPT 305, 371 and 404, in particular

This change introduces no change in lower division credit hour requirements. Although MATH 272 has MATH 152 (Calculus II) as a prerequisite (there is no corresponding prerequisite for MATH 101 or 102) MATH 152 is a required lower division course for CMPT students.

1.2. PHIL 210 required

Moved that PHIL 210 (Elementary Formal Logic I) become a required lower division course for CMPT majors and honors students and DSDP honors students and that a similar requirement be recommended for MACM joint honors students.

Rationale

This proposal strengthens the formal topics components of the CMPT lower division requirements with only a slight reduction of flexibility for students. Currently PHIL 210 is a recommended lower division course, but we cannot count on all students to take it. Because of the central importance of formal logic to computing, CMPT 205 (Introduction to Formal Topics in Computing Science) has thus had to include formal logic as a component of its curriculum. The requirement for PHIL 210, however, would both increase the amount of formal logic required of students in the lower division and also remove the necessity of including a logic component in CMPT 205. Treatment of other formal topics could thus also be strengthened.

As a recommended lower division course, PHIL 210 is already taken by many CMPT students, minimizing the effect of its addition as a requirement. In addition, PHIL 210 is a useful course for many areas of study and hence its requirement as a lower division CMPT course does not unduly restrict student flexibility in changing from a CMPT program to some other program of

study.

Furthermore, addition of PHIL 210 as a required course for CMPT allows the course overlap between CMPT 205 and PHIL 210 to be eliminated.

1.3. Linear Algebra and Numerical Computing Requirements

Moved that the following changes be made to linear algebra and numerical computing requirements.

1. MATH 232 (Elementary Linear Algebra) is added as a lower division requirement for CMPT Majors and Honors students.

2. The lower division requirement for MACM 216 (Introduction to Computational Methods) or MACM 316 (Numerical Analysis I) is eliminated for CMPT Majors and Honors

3. MACM 316 (Numerical Analysis I) is added as an upper division requirement for Computing Majors and Honors students pursuing a B.Sc. degree.

4. MACM 216 is eliminated as a lower division requirement for Digital Systems Design Honors students as it is redundant (MACM 316 is already required for such students)

Rationale

This change accomplishes several objectives. First of all, it adds a linear algebra component to the lower division requirements which is useful for several upper division courses. Secondly, it better prepares B.Sc. graduates for work in scienctific computing by providing them with a stronger course in numerical computing (i.e., MACM 316 in place of MACM 216). Thirdly, by avoiding additional lower division requirements, it preserves the flexibility of students who attempt to pursue a Computing degree, but later decide to change academic goals. Finally, it eliminates the numerical computing requirement for students pursuing a B.A., B.B.A. or B.Ed., recognizing that other material is more relevant for computing in arts, business and education.

2. New Course Proposals

The School of Computing Science and the Faculty of Applied Sciences have approved the introduction of new CMPT courses as follows. The new course proposal forms for these courses are contained in Appendix II. Appendix III contains calendar descriptions of existing courses that are changed due to the introduction of the new courses.

2.1. Introduction of CMPT 307

Moved that a new third year course be added into the standard theory sequence as follows.

1. A new course CMPT 307-3 Data Structures and Algorithms is added, replacing CMPT 405-3 as the key course for the Theoretical Computing Science area. See attached course proposal.

2. CMPT 307-3 replaces CMPT 405-3 as a required course for CMPT majors.

3. The prerequisite for CMPT 405-3 is changed to be CMPT 307-3.

Rationale

This change solves the problems of CMPT 405 resulting from its dual role as a required theory course for Computing majors and as the honors theory course in algorithm design and analysis.

2.2. Integration of Automata Theory into CMPT Curriculum

Moved that classical computing science theory be integrated into the Computing Science curriculum as follows.

1. Space freed up by the removal of formal logic from CMPT 205 be used to introduce automata theory.

2 A new course CMPT 309-3 (Introduction to Formal Languages and Automata with Applications) is introduced in the area of Theoretical Computing Science. See attached course proposal.

3. MACM 306 (Introduction to Automata Theory), MACM 401 (Switching Theory and Logical Design) and MACM 402 (Automata and Formal Languages) are eliminated from the area of Theoretical Computing Science.

4. MACM 306 as a prerequisite to CMPT 483 (Parsing and Interpretation) is replaced by a requirement for either CMPT 309 or MACM 402.

These changes streamline the Theoretical Computing Science area by integrating classical theory with the standard theory sequence. The prerequisite change for CMPT 483 provides a strengthened background in formal languages as well as automata theory.

2.3. Introduction of CMPT 412

Moved that CMPT 411 (Artificial Intelligence Topics) be split into two separate courses as follows.

1. CMPT 411 is retitled "Knowledge Representation" and has its prerequisites changed to be either CMPT 384 (Symbolic Computing) or CMPT 410 (Artificial Intelligence Survey).

2. The calendar description for CMPT 411 is changed as follows.

> Formal and foundational issues dealing with the representation of knowledge in artificial intelligence systems are covered. Questions of semantics, incompleteness, nonmonotonicity and others will be examined. As well particular approaches, such as procedural or semantic network, may be discussed.

3. CMPT 412 (Computational Vision) is introduced as per the attached course proposal.

Rationale

CMPT 411 as currently described covers both the application of logic to problem solving and computational approaches to image understanding. It is very difficult to teach both of these topics in one course and do justice to either. The proposed change resolves these problems.

2.4. Introduction of CMPT 490

Moved that CMPT 490 (VLSI Systems Design) be added as a course in the Computer Design and Organization area and that CMPT 490 replace CMPT 483 (Parsing and Interpretation) as a requirement in the Digital System Design Honors program. See attached course proposal.

Rationale

The graduate VLSI design course (CMPT 852) has proven particularly useful to DSDP students. This change recognizes that fact allowing such students to take the course for undergraduate credit.

3. Course Changes

The School of Computing Science and the Faculty of Applied Sciences have approved the following changes to individual CMPT courses. Comparative calendar descriptions for all changed courses (including CMPT 405, 411 and 483 modified above) are presented in Appendix III.

3.1. CMPT 101 as Specific Prerequisite

Moved that the prerequisites for CMPT 201 (Data and Program Organization) and CMPT 205 (Introduction to Formal Topics in Computing Science) be modified to include an explicit requirement for CMPT 101 (Introduction to a High Level Programming Language A) or CMPT 104 (Introduction to a High Level Programming Language II).

Rationale

The above courses are already implicit prerequisites since CMPT 105 (Fundamental Concepts of Computing) is an explicit prerequisite to both courses and CMPT 101 or 104 is required as a corequisite for CMPT 105. The change is necessary, however, to ensure that students who take both CMPT 101 and 105 at the same time satisfactorily complete both courses before proceeding.

3.2. Changes to CMPT 362

Moved that the following changes be made to CMPT 362 (Educational Uses of Computers).

1. The course description is changed to the following.

   > Application of computing technology to education. Principles underlying the construction of software and hardware systems for computer-assisted education.

2. The course title is changed to "Computers in Education".

3. The course credit is reduced to 3 semester hours from 4.

4. The course prerequisite is changed from CMPT 105 and some course in Education to CMPT 201

Rationale

This reflects a change in use of the course to one which deals with computer-assisted learning from a technological perspective.

3.3. Renumbering of CMPT 380

Moved that CMPT 380 (Computational Linguistics) be renumbered as CMPT 413.

Rationale

This change brings this course together with the other Artificial Intelligence courses in the CMPT 41x numbering scheme and better reflects the level of the material involved.

3.4. Changes to CMPT 404

Moved that the prerequisites for CMPT 404 (Computer System Measurement and Evaluation) be changed from CMPT 305 (Computer Simulation and Modeling) and CMPT 400 (Hardware Architecture) to CMPT 305 and CMPT 401 (Operating Systems) and that the course credit be reduced from 4 to 3 semester hours.

Rationale

The performance of computer systems is fundamentally affected by the nature of the computer's operating system and hence the operating system background is necessary for the performance evaluation course. At the same time, the hardware background necessary for the course is met by CMPT 390 (Digital Circuits and Systems) which is prerequisite for CMPT 401.

The reduction from 4 to 3 credit hours brings this course in line with others and is reasonable given the added prerequisite in operating systems.

3.5. Prerequisite Change For CMPT 406

Moved that the prerequisites for CMPT 406 (Computational Geometry) be changed from "CMPT 405. MATH 194 is strongly recommended" to "CMPT 307".

Rationale

With the introduction of CMPT 307 as a prerequisite to CMPT 405 and the consequent strengthening of CMPT 405, that course becomes too strong a prerequisite for CMPT 406. The recommendation for MATH 194 is dropped as it has not proven useful for the course.

3.6. Operating Systems Courses

Moved that the following changes be made to the operating systems courses.

1. The prerequisite for CMPT 393 (Systems Software for Minicomputers and Microcomputers) is changed to be CMPT 401 (Operating Systems).

2. CMPT 393 is dropped as a recommended course for CMPT 401.

3. CMPT 393 is renumbered as CMPT 402, is retitled Operating Systems Software Laboratory and is changed to be a 3 credit course.

4. The calendar description of CMPT 402 is changed to be as follows.

> This course provides hands-on practical experience in minicomputer and microcomputer environments. Low level computer architecture and operating system features are discussed. Lecture topics include interrupt handling, CPU scheduling, memory management, process management, device drivers, network communication, bootstrapping and overall operating systems design. Case studies of UNIX-like operating systems are discussed. Laboratory work consists of implementing various components of an operating system.

Students with credit for CMPT 393 may not take CMPT 402 for further credit.

Rationale

This change allows the duplication of operating systems material between CMPT 393 and CMPT 401 to be eliminated. Currently, some operating systems material must be covered in CMPT

393 in order that lab work may be carried out. Unfortunately, there is not time for adequate academic treatment of the material in CMPT 393, and it must be repeated in CMPT 401. The change resolves this problem and gives an even better background in operating systems material to serve as the basis for systems software lab work.

3.7. Prerequisite Change for CMPT 410

Moved that CMPT 384 (Symbolic Computing) be added as a recommended course for CMPT 410 (Artificial Intelligence Survey).

Rationale

Artificial intelligence programming is fundamentally symbolic in nature. This change draws students attention to the usefulness of CMPT 384 to CMPT 410 while at the same time preserving flexibility for students who can handle CMPT 410 without a CMPT 384 prerequisite.

4. Changes in Upper Division Program Requirements

The School of Computing Science and the Faculty of Applied Sciences have approved the following changes to the upper division requirements of the CMPT Major, Honors and Minor programs and to the Digital Systems Design Honors Program. The effect of these changes are summarized through the comparison of current and proposed calendar descriptions in Appendix IV. Appendix V contains description of proposed changes in regulations, including changes previously approved.

4.1. Upper Division Reorganization

Moved that the upper division depth and breadth areas for CMPT honors and majors be reorganized as follows.

1. A new upper division area called "Computing Systems" is created comprising the following courses.

   a. CMPT 371-3 Data Communications and Networking

   b. CMPT 401-3 Operating Systems

   c. CMPT 402-3 Operating Systems Software Laboratory

   d. CMPT 404-4 Computer System Measurement and Evaluation

2. CMPT 401, CMPT 402 and CMPT 404 are removed from the "Software Systems and Programming" area, which is renamed as "Programming Languages and Software". CMPT 371 is removed from the "Information Systems" area.

3. The upper division areas of "Intensive Applications" and "Analytical Tools for Scientific Computation" are eliminated.

4. A new upper division area called "Artificial Intelligence" is created, comprising the following courses.

   a. CMPT 380-3 Computational Linguistics

   b. CMPT 410-3 Artificial Intelligence Survey

   c. CMPT 411-3 Knowledge Representation

   d. CMPT 412-3 Computational Vision

5. A new table called "Computing Science Electives" is introduced containing the following courses.

   a. CMPT 305-3 Computer Simulation and Modeling

   b. CMPT 340-3 Computers in Biomedicine

   c CMPT 351-3 Introduction to Computer Graphics

   d. CMPT 362-3 Computers in Education

   e. CMPT 392-3 Introduction to Digital Signal Processing

   f. CMPT 451-3 Interactive Graphics and Animation Systems

6. A second new table, called "Computing Mathematics Electives" is also added containing the following courses.

   a. MACM 306-3 Introduction to Automata Theory

   b. MATH 308-3 Linear Programming

   c. MATH 343-3 Combinatorial Aspects of Computing

   d. MACM 360-3 Computation for Statistical Data Processing

   e. MACM 401-3 Switching Theory and Logical Design

   f. MACM 402-3 Automata and Formal Languages

   g. MATH 408-3 Discrete Optimization

h. MATH 416-3 Numerical Analysis II

Rationale

These changes are intended both to more sharply focus and to modernize the Computing Science depth areas. Several specialty courses, which are not really appropriate for any particular depth area, have been eliminated from the depth areas and included in a table so that they may be included as part of elective requirements. The remaining courses have been organized into six well-focussed and currently relevant areas of Computing Science.

4.2. Elimination of Key Courses

Moved that courses used to fulfill Computing Science breadth requirements not be restricted to being key courses.

Rationale

This requirement has essentially become redundant with the increased focus of the Computing Science depth areas and the elimination of specialty courses therefrom. Elimination of the requirement provides more flexibility both for students in taking courses and for the School in offering them; it also eliminates extra administrative work in checking graduation requirements and handling exceptions.

4.3. Computing Presentation Requirement

Moved that the following changes be made to upper division Computing Presentation Requirements.

1. CMPT 428 (Practicum III) becomes an acceptable alternative to CMPT 493 (Computing Science Presentation Seminar I) for the upper division Computing Presentation Requirement for CMPT majors and honors students, DSDP honors students and MACM honors students.

2. CMPT 494 (Computing Science Presentation Seminar II) is eliminated.

3. The title of CMPT 493 is changed to "Computing Science Presentation Seminar".

4. The Computing Science Presentation Requirement is retained only for Majors and Honors students pursuing a B.Sc.; it is dropped for students pursuing a B.A., B.B.A. or B.Ed.

Rationale

These changes are a rationalization of the Computing Presentation Requirement to allow the School to reduce the resources it commits to this area while at the same ensuring that the basic requirement is met. In this regard, CMPT 494 is dropped as it is purely an optional course. Secondly, CMPT 428 is used as an alternative to CMPT 493, recognizing that CMPT Co-op

students gain experience equivalent to CMPT 493 by the end of their third Co-op semester. Thirdly, the requirement is dropped for students in degree programs which arguably meet the requirement in other ways.

4.4. Special Topics Courses

Moved that the following changes be made to upper division special topics courses.

1. CMPT 418-3 (Special Topics in Computing Science I) and CMPT 419-5 (Special Topics in Computing Science II) are eliminated.

2. CMPT 409-3 Special Topics in Theoretical Computing Science is introduced and included in the Theoretical Computing Science depth area. See attached course proposal.

3. CMPT 419-3 Special Topics in Artificial Intelligence is introduced and included in the Artificial Intelligence depth area. See attached course proposal.

4. CMPT ~~454~~ 459-3 Special Topics in Database Systems is introduced and included in the Information Systems depth area. See attached course proposal.

5. CMPT 479-3 Special Topics in Computing Systems is introduced and included in the Computing Systems depth area. . See attached course proposal.

6. CMPT 489-3 Special Topics in Programming Languages and Systems is introduced and included in the Programming Languages and Software depth area. See attached course proposal.

7. CMPT 499-3 Special Topics in Computer Hardware is introduced and included in the Computer Design and Organization depth area. See attached course proposal.

Rationale

These changes allow special topics courses to be easily identified with a given Computing Science depth area.

4.5. Upper Division Degree Requirements for Majors

Moved that the following changes be made to upper division requirements for a CMPT major for the B.A., B.Sc., B.B.A. and B.Ed. degree.

1. The Social Aspects of Computing requirement is dropped for B.A., B.B.A., and B.Ed. degrees.

2. Candidates for the B.A., B.B.A. and B.Ed. degrees must, in addition to satisfying

breadth and depth requirements, take one further course from the Computing Science depth areas or the list of Computing Science Electives to make up their total of 30 upper division CMPT credits.

3. The requirement for a concentration of 15 semester hours in another discipline is eliminated for the B.B.A., B.Ed. and B.Sc. degrees. The requirement is retained for the B.A. degree, in which case the department of concentration must be in the Faculty of Arts.

4. Candidates for the B.Sc. degree are required to take two further courses chosen the lists of Computing Science depth areas, Computing Science Electives or Computing Mathematics Electives, in addition to meeting depth and breadth requirements and completing MACM 316.

5. Candidates for the B.Sc. degree must additionally complete 9 credits of electives (at any level) from the Faculty of Arts.

Rationale

These changes strengthen the requirements for a B.Sc. degree in Computing Science, recognizing that the increasingly professional nature of the discipline places increasing requirements on the Computing background of graduates. The total number of required upper division credits has been raised to 39 from 36 (30 CMPT credits plus 6 upper division credits in a concentration).

At the same time, however, requirements for B.A., B.B.A. and B.Ed. are held to 30 upper division CMPT credits. The concentration of 15 credits outside of CMPT is dropped for B.B.A. and B.Ed. degree candidates as it is redundant in their case.

4.6. Changes to Minor Requirements

Moved that the requirements for a Minor in Computing Science be modified as follows.

1. The Minor requires 15 credit hours of courses selected from the Computing Science depth areas and from the Computing Science Electives.

2. At least 9 credits must be selected from the Computing Science depth areas.

Rationale

This change reflects the reorganization of the Computing Science depth areas and requires that at least 3 of the 5 upper division courses taken by Computing Minors are in the Computing Science core courses (depth areas).

4.7. Upper Division Credit Requirement for Transfer Students

Moved that the following minimum requirements on CMPT courses taken at SFU be established.

1. CMPT majors students must complete at least 24 of their required 30-40 upper division CMPT credits at Simon Fraser University.

2. CMPT honors students and DSDP honors students must complete at least 35 of their required 50 upper division CMPT credits at Simon Fraser University.

3. CMPT minors students must complete at least 12 credits of their required 15 upper division CMPT credits at SFU.

Rationale

This requirement is necessary for the School of Computing Science to be able to ensure that SFU graduates with Computing degrees meet the School's standards. This provision will also allow the School to entertain transfer credit requests to upper division CMPT courses.

4.8. DSDP Changes

Moved that the following changes be made to the Digital Systems Design Honors program.

1. MACM 306 (Introduction to Automata Theory) and MACM 401 (Switching Theory and Logical Design) are eliminated as required courses.

2. CMPT 309 (Computability Theory) is added as a required course.

Rationale

The replacement of MACM 306 and MACM 401 by CMPT 309 streamlines requirements somewhat, making room for the CMPT 307 course added above.

Appendix I
Current and Proposed Lower Division Calendar Descriptions

I.1. Major and Honors Programs

LOWER DIVISION COURSE REQUIREMENTS

Students who plan to undertake a Major, or Honors in Computing Science must obtain credit for the following lower division courses (or equivalents):

CMPT	101-4	Introduction to a High Level Programming Language A
	105-3	Fundamental Concepts of Computing
	201-4	Data and Program Organization
	205-3	Introduction to Formal Topics in Computing Science
	275-3	Software Engineering
	290-3	Introduction to Digital Systems
MATH	101-3	Introduction to Statistics A
(or	102-3	Introduction to Statistics B)
(or	272-3	Introduction to Probability and Statistics. (This course is a prerequisite for CMPT 305-3 Computer Simulation and Modeling)
	151-3	Calculus I
	152-3	Calculus II
MACM	216-3	Introduction to Computational Methods

*Any 100 level English course or PHIL 001-3.

MACM 316-3 may be used to satisfy the requirements of MACM 216-3.

MATH 232-3 is a prerequisite for CMPT 351-3.

PHYS 120-3 and 121-3, are prerequisites for CMPT 291-1.

In addition, PHIL 210-4 is recommended.

Approval of calculus courses in place of MATH 151 or MATH 152 will be based on corresponding approval within the Mathematics Department. It is recommended that students with normal entry take these courses in their first four semesters.

*A grade of C–, or better, is required for these courses.

LOWER DIVISION REQUIREMENTS

Students who plan to undertake a Major or Honors in Computing Science must obtain credit for the following lower division courses (or equivalents):

CMPT	101-4	Introduction to a High Level Programming Language A
	105-3	Fundamental Concepts of Computing
	201-4	Data and Program Organization
	205-3	Introduction to Formal Topics in Computing Science
	275-3	Software Engineering
	290-3	Introduction to Digital Systems
MATH	151-3	Calculus I
	152-3	Calculus II
	232-3	Elementary Linear Algebra
	272-3	Introduction to Probability and Statistics I
PHIL	001-3	Critical Thinking
	210-4	Elementary Formal Logic I

(39 semester hours)

Notes:

1. CMPT 104-1 (Introduction to a High Level Programming Language II) may be used to satisfy the requirement for CMPT 101-4.
2. Approval of calculus courses in place of MATH 151 or MATH 152 will be based on corresponding approval within the Mathematics department.
3. Any 100 level English course may alternatively be used to satisfy the requirement for PHIL 001-3. A grade of C- or better is required in PHIL 001-3 or its alternative.

The grade point average calculated over all the SFU courses used to fulfill the above requirements plus any other CMPT courses taken is called the Computing-Related GPA for Declaration of a Major or Honors in Computing Science and must be 2.5 or better for formal declaration in a Computing Science Major or Honors program.

It is recommended that students with normal entry complete the above courses within the first four semesters. In addition, students planning to take courses in the digital circuit and system design stream (CMPT 291-1, CMPT 391-3, CMPT 491-4) are advised to complete the prerequisite courses PHYS 120-3 (Physics I) and PHYS 121-3 (Physics II) during the first four semesters.

I.2. Digital Systems Design Honors Program

Digital Systems Design Honors Program

The design of digital systems, the application of new physical devices in the design of novel information processing systems, and the construction of special purpose digital systems for a wide variety of applications are among the most exciting (and already persistent) growth areas in applied physics, electrical engineering and computing science.

LOWER DIVISION COURSE REQUIREMENTS:

Students who plan to undertake an Honors Program in Digital Systems Design must obtain credit for the following lower division courses:

CMPT	101-4	Introduction to a High Level Programming Language A
	105-3	Fundamental Concepts of Computing
	201-4	Data and Program Organization
	205-3	Introduction to Formal Topics in Computing
	275-3	Software Engineering
	290-3	Introduction to Digital Systems
	291-1	Introduction to Digital Circuit Design
MATH	101-3	Introduction to Statistics A
(or	102-3	Introduction to Statistics B)
	151-3	Calculus I
	152-3	Calculus II
	232-3	Linear Algebra
	251-3	Calculus III
MACM	216-3	Introduction to Computational Methods
PHYS	120-3	Physics I
	121-3	Physics II
	131-2	General Physics Lab
	221-3	Intermediate Electricity and Magnetism
	233-2	Introduction to Physics Lab A

*Any 100-level English course or PHIL 001-3

MACM 316-3 may be used to satisfy the requirements of MACM 216-3.

MATH 272-3 may be used to satisfy the requirements of MATH 101-3.

*A grade of C– or better is required in these courses.

Digital Systems Design Honors Program

LOWER DIVISION REQUIREMENTS

Students who plan to undertake an Honors Program in Digital Systems Design must obtain credit for the following lower division courses (or equivalents):

CMPT	101-4	Introduction to a High Level Programming Language A
	105-3	Fundamental Concepts of Computing
	201-4	Data and Program Organization
	205-3	Introduction to Formal Topics in Computing Science
	275-3	Software Engineering
	290-3	Introduction to Digital Systems
	291-1	Introduction to Digital Circuit Design
MATH	151-3	Calculus I
	152-3	Calculus II
	232-3	Elementary Linear Algebra
	251-3	Calculus III
	272-3	Introduction to Probability and Statistics I
PHIL	001-3	Critical Thinking
	210-4	Elementary Formal Logic I
PHYS	120-3	Physics I
	121-3	Physics II
	131-2	General Physics Lab
	221-3	Intermediate Electricity and Magnetism
	233-2	Introduction to Physics Lab A

(56 semester ho

Notes:

1. CMPT 104-1 (Introduction to a High Level Programming Language II) may be used to satisfy the requirement for CMPT 101-4.
2. Any 100 level English course may alternatively be used to satisfy the requirement for PHIL 001-3. A grade of C- or better is required in PHIL 001-3 or its alternative.

Appendix II
New Course Proposal Forms

This appendix contains new course proposal forms for the four new regular courses (CMPT 307, CMPT 309, CMPT 412 and 490), as well as forms for the proposed special topics courses (CMPT 409, CMPT 419, CMPT 459, CMPT 479, CMPT 489, CMPT 499).

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **307** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Data Structures and Algorithms**

Calendar Description of Course:

Basic data structures and algorithms for lists, stacks, queues, trees and sets. Graphs and graph algorithms. Sorting. Algorithm design techniques.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 201, CMPT 205, MATH 152 and MATH 232.

What course (courses) if any, is being dropped from the calendar if this course is approved: **none; however CMPT 405 will be offered less frequently**

2. Scheduling

How frequently will the course be offered? **at least twice per year**

Semester in which the course will first be offered? **86-3**

Which of your present faculty would be available to make the proposed offering possible? **B. Bhattacharya, P. Hell, T. Kameda, A. Liestman, J. Peters**

3. Objectives of the Course

To provide Computing students with the fundamental tools and techniques necessary for the design and analysis of data structures and algorithms.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24

Department Chairman Dean Chairman, SCUS

CMPT 307 - Data Structures and Algorithms

Sample Course Outline

1. Basic Data Structures - lists, stacks, queues, trees, sets
2. Operations on sets. Hashing. Priority Queues
3. Trees - Binary search trees, balanced trees
4. Graphs - Single-source and all-pairs shortest paths, minimum-cost spanning trees, traversals
5. Sorting - simple sorting schemes, quicksort, heapsort, bin sorting, lower bound on comparison sorting
6. Algorithm Design Techniques - Divide-and-Conquer, Dynamic Programming, Greedy Algorithms, Backtracking, Local Search

Suggested Textbook

Data Structures and Algorithms.
A.V. Aho, J.E. Hopcroft, J.D. Ullman.
Addison-Wesley, 1983.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **309** Credit Hours: **3** Vector: **3-0-0**

Title of Course:

Introduction to Formal Languages and Automata with Applications

Calendar Description of Course:

Languages, grammars, automata and their applications. Turing machines. Computability and undecidability. Complexity theory.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 205.

What course (courses) if any, is being dropped from the calendar if this course is approved: **none**

2. Scheduling

How frequently will the course be offered? **once per year**

Semester in which the course will first be offered? **87-1**

Which of your present faculty would be available to make the proposed offering possible? **B. Hadley, R. Harrop, A. Liestman, J. Peters**

3. Objectives of the Course

To provide both a theoretical and an applied treatment of formal languages and automata.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24 1/11/85

W. S. Lulle

Department Chairman Dean Chairman, SCUS

CMPT 309 - Introduction to Formal Languages and Automata with Applications

Sample Course Outline

1. Chomsky Hierarchy - languages, grammars.
2. Regular and Context-Free Languages - grammars, finite and push-down automata.
3. Applications - text processing, artificial intelligence.
4. Deterministic Languages - LR(k) grammars, deterministic pushdown automata, application to compilers.
5. Turing Machines and Linear Bounded Automata - recursive, recursively enumerable and context-sensitive languages.
6. Computability and Complexity Theory - introduction to recursive function theory, time and space hierarchies, complexity measures.

Suggested Reference Book

Introduction to Automata Theory, Languages, and Computation.
J.E. Hopcroft, J.D. Ullman.
Addison-Wesley, 1979.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES
NEW COURSE PROPOSAL FORM

3 November 1985

1. Calendar Information

Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **412** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Computational Vision**

Calendar Description of Course:

Computational approaches to image understanding will be discussed in relation to theories about the operation of the human visual system and with respect to practical applications in robotics. Topics will include edge detection, shape from shading, stereopsis, optical flow, Fourier methods, gradient space, three-dimensional object representation and constraint satisfaction.

Nature of Course: **Lecture**

Prerequisites (or special instructions): **MATH 152 and CMPT(9) U.D. or permission of the instructor.**

What course (courses) if any, is being dropped from the calendar if this course is approved: **none; however CMPT 411 will be offered less frequently**

2. Scheduling

How frequently will the course be offered? **once per year**

Semester in which the course will first be offered? **87-1**

Which of your present faculty would be available to make the proposed offering possible? **B. Funt**

3. Objectives of the Course

To provide students with a solid understanding of the methods and problems in the computer analysis of images.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24

W. S. Luk
Department Chairman

Dean

Chairman, SCUS

CMPT 412 - Computational Vision

Sample Course Outline

1. Image Formation

    a. Image Models: reflectance, imaging geometry

    b. Spatial Properties: Fourier Transform

2. Low-Level Vision

    a. Edge Detection: gradient operators, zero-crossings and primal sketch

    b. Shape from Shading

    c. Shape from Stereo: matching, triangulation

    d. Shape from Motion: optical flow

    e. Shape from Texture

    f. Intrinsic Images and 2 1/2 D sketches

3. High-Level Vision

    a. Representation of 3D objects: generalized cylinders, surface patches, voxels

    b. Understanding line-drawings

    c. Top-down versus bottom-up processes

    d. Use of constraints

    e. Shape properties of 2D regions

    f. Matching

Suggested Textbook

Ballard, D.H., and Brown, C.M., COMPUTER VISION, Prentice-Hall, Englewood Cliffs, New Jersey, 1982.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **490** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **VLSI Systems Design**

Calendar Description of Course:

The theory and application of MOS field effect transistor technology. Special emphasis is placed upon the design and layout of very large scale integrated (VLSI) digital circuits.

Nature of Course: **Lecture/Laboratory**

Prerequisites (or special instructions):

CMPT 390 and CMPT 391.

What course (courses) if any, is being dropped from the calendar if this course is approved: **none; however the course will be offered jointly with CMPT 852**

2. Scheduling

How frequently will the course be offered? **once per year**

Semester in which the course will first be offered? **86-3**

Which of your present faculty would be available to make the proposed offering possible? **R.F. Hobson**

3. Objectives of the Course

To provide theory and training in an important technical area, especially for students of the Digital Systems Design Honors Program.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff **1/2 T.A.**

Library

Audio Visual

Space

Equipment **One more SUN color workstation, software**

5. Approval

Date: 85/10/24

W. S. Lule
Department Chairman

Dean

Chairman, SCUS

CMPT 490 - VLSI Systems Design

Sample Course Outline

1. Review of MOSFET Theory
2. Simulation of MOSFET Devices Using SPICE
3. Logic Simulation
4. NMOS Technology
5. CMOS Technology
6. Layout Rules
7. Combinational Logic: inverters, gates, PLAs
8. Sequential Logic: registers, stacks, FSMs
9. Procedural Layout
10. Hierarchical Systems Design
11. Design Verification and Testing
12. Silicon Compilation Techniques
13. Microprocessor Design
14. Introduction to Analog Design Techniques

Suggested Reference Books

- David Hodges and Horace Jackson. Analysis and Design of Digital Intregrated Circuits. McGraw-Hill, 1983.
- Carver Mead and Lynn Conway. Introduction to VLSI Systems. Addison-Wesley, 1980.
- Course notes by R.F. Hobson.
- Digital MOS Integrated Circuits. Edited by Mohamed I. Elmasry, IEEE Press, 1981.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **409** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Special Topics in Theoretical Computing Science**

Calendar Description of Course:

Current topics in theoretical computing science depending on faculty and student interest.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 307.

What course (courses) if any, is being dropped from the calendar if this course is approved: **CMPT 418, CMPT 419**

2. Scheduling

How frequently will the course be offered? **depending on faculty interest**

Semester in which the course will first be offered? **unknown**

Which of your present faculty would be available to make the proposed offering possible?

B. Bhattacharya, P. Hell, T. Kameda, A. Liestman, J. Peters

3. Objectives of the Course

To provide a special topics course which can be used as a depth course in theoretical computing science.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24 -1.1.05

W. S. Luk

Department Chairman Dean Chairman, SCUS

CMPT-UGCC.85-3:15

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **419** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Special Topics in Artificial Intelligence**

Calendar Description of Course:

Current topics in artifiicial intelligence depending on faculty and student interest.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 410.

What course (courses) if any, is being dropped from the calendar if this course is approved: **CMPT 418, CMPT 419**

2. Scheduling

How frequently will the course be offered? **depending on faculty interest**

Semester in which the course will first be offered? **unknown**

Which of your present faculty would be available to make the proposed offering possible?

N. Cercone, V. Dahl, J. Delgrande, B. Funt, B. Hadley

3. Objectives of the Course

To provide a special topics course which can be used as a depth course in artificial intelligence.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24

W. S. Luk
Department Chairman

Dean

Chairman, SCUS

SENATE COMMITTEE ON UNDERGRADUATE STUDIES
NEW COURSE PROPOSAL FORM

3 November 1985

1. Calendar Information

Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **459** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Special Topics in Database Systems**

Calendar Description of Course:

Current topics in database and information systems depending on faculty and student interest.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 354

What course (courses) if any, is being dropped from the calendar if this course is approved: **CMPT 418, CMPT 419**

2. Scheduling

How frequently will the course be offered? **depending on faculty interest**

Semester in which the course will first be offered? **unknown**

Which of your present faculty would be available to make the proposed offering possible?

W.S. Luk

3. Objectives of the Course

To provide a special topics course which can be used as a depth course in information systems.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24

W.S. Luk
Department Chairman

Dean

Chairman, SCUS

SENATE COMMITTEE ON UNDERGRADUATE STUDIES
NEW COURSE PROPOSAL FORM

3 November 1985

1. Calendar Information

Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **479** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Special Topics in Computing Systems**

Calendar Description of Course:

Current topics in computing systems depending on faculty and student interest.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 401

What course (courses) if any, is being dropped from the calendar if this course is approved: **CMPT 418, CMPT 419**

2. Scheduling

How frequently will the course be offered? **depending on faculty interest**

Semester in which the course will first be offered? **unknown**

Which of your present faculty would be available to make the proposed offering possible?

S. Atkins, T. Kameda

3. Objectives of the Course

To provide a special topics course which can be used as a depth course in computing systems.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24 11/11/85

W. S. Luk
Department Chairman

Dean

Chairman, SCUS

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **489** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Special Topics in Programming Languages**

Calendar Description of Course:

Current topics in programming languages depending on faculty and student interest.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 383

What course (courses) if any, is being dropped from the calendar if this course is approved: **CMPT 418, CMPT 419**

2. Scheduling

How frequently will the course be offered? **depending on faculty interest**

Semester in which the course will first be offered? **unknown**

Which of your present faculty would be available to make the proposed offering possible?

R. Cameron, J. Weinkam

3. Objectives of the Course

To provide a special topics course which can be used as a depth course in programming languages and software.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24

W.S. Luk
Department Chairman

Dean

Chairman, SCUS

SENATE COMMITTEE ON UNDERGRADUATE STUDIES 3 November 1985
NEW COURSE PROPOSAL FORM

1. Calendar Information Department: **School of Computing Science**

Abbreviation code: **CMPT** Course Number: **499** Credit Hours: **3** Vector: **3-0-0**

Title of Course: **Special Topics in Computer Hardware**

Calendar Description of Course:

Current topics in computer hardware depending on faculty and student interest.

Nature of Course: **Lecture**

Prerequisites (or special instructions):

CMPT 390

What course (courses) if any, is being dropped from the calendar if this course is approved: **CMPT 418, CMPT 419**

2. Scheduling

How frequently will the course be offered? **depending on faculty interest**

Semester in which the course will first be offered? **unknown**

Which of your present faculty would be available to make the proposed offering possible?

L.J. Hafer, R.F. Hobson

3. Objectives of the Course

To provide a special topics course which can be used as a depth course in computer design and organization.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty	**none**
Staff	**none**
Library	**none**
Audio Visual	**none**
Space	**none**
Equipment	**none**

5. Approval

Date: 85/10/24 1/11/85

W.S. Luk

Department Chairman Dean Chairman, SCUS

Appendix III
Current and Proposed Course Descriptions

CMPT 201-4 Data and Program Organization
Reviews the basic organization of programs, data and control languages and input/output routines. Advanced methods will be introduced for the design and implementation of large programs including the need for, type of, and implementation of modular design programs. (Lecture/Tutorial)
Prerequisites: CMPT 105, MATH 151.

CMPT 205-3 Introduction to Formal Topics in Computing Science
Provides an introduction to the theoretical aspects of computing, building on computational concepts encountered in CMPT 101-4, 103-4 and 105-3. Topics include discrete mathematical structures as they apply to computing science, and an introduction to the formal study of models of computation, formal languages and algorithms. This material is developed more extensively in subsequent upper level theory courses.
(Lecture/Tutorial)
Prerequisites: CMPT 105, MATH 151.

CMPT 362-3 Educational Uses of Computers
This course will be concerned with aspects of the teaching of computer-related topics and applications of computers at elementary and secondary school levels. There will be consideration, in the context of the availability of various general types of computer facility, of topics such as: the position and teaching of computer literacy and computing science in schools; applications of computers in other subject areas; computer-assisted learning; and aspects of the role of computing in educational administration. (Lecture/Tutorial)
Prerequisites: CMPT 105 and some course in Education or permission of the Department.

CMPT 380-3 Computational Linguistics
This course examines the theoretical and applied problems of constructing and modeling systems, which aim to extract and represent the meaning of natural language sentences or of whole discourses, but drawing on contributions from the fields of linguistics, cognitive psychology, artificial intelligence and computing science. (Lecture/Tutorial)
Prerequisites: CMPT 201 and 205, or, for non-Computing Majors, Minors, or Honors: CMPT 110 and LING 405 and 406.

CMPT 393-3 Systems Software for Minicomputers and Microcomputers
This course provides hands-on practical experience in minicomputer and microcomputer environments. Low level computer architecture features are discussed. Hardware components to be examined include central processors, the teletype, terminals, printers, tapes, and disks. Lecture topics include instruction sets, bootstrapping, stand-alone control, memory management, interrupts, debugging machine (assembler) and high level language code, device communication, multiprogramming, time-sharing, operating system control and operating system generation. Laboratory work includes device communication, interrupt handling, real-time multi-user applications, and operating system maintenance.
(Lecture/Laboratory)
Prerequisites: CMPT 290 or 291 and 201.
Students with credit for CMPT 293 may not take CMPT 393 for further credit.

CMPT 201-4 Data and Program Organization
Reviews the basic organization of programs, data and control languages and input/output routines. Advanced methods will be introduced for the design and implementation of large programs including the need for, type of, and implementation of modular design programs. (Lecture/Tutorial)
Prerequisites: CMPT 101 or 104, 105, MATH 151.

CMPT 205-3 Introduction to Formal Topics in Computing Science
Provides an introduction to the theoretical aspects of computing, building on computational concepts encountered in CMPT 101-4, 103-4 and 105-3. Topics include discrete mathematical structures as they apply to computing science, and an introduction to the formal study of models of computation, formal languages and algorithms. This material is developed more extensively in subsequent upper level theory courses. (Lecture/Tutorial)
Prerequisites: CMPT 101 or 104, 105, MATH 151.

CMPT 362-3 Computers in Education
Application of computing technology to education. Principles underlying the construction of software and hardware systems for computer-assisted education. (Lecture/Tutorial)
Prerequisites: CMPT 201.

CMPT 413-3 Computational Linguistics
This course examines the theoretical and applied problems of constructing and modeling systems, which aim to extract and represent the meaning of natural language sentences or of whole discourses, but drawing on contributions from the fields of linguistics, cognitive psychology, artificial intelligence and computing science. (Lecture/Tutorial)
Prerequisites: CMPT 201 and 205, or, for non-Computing Majors, Minors, or Honors: CMPT 110 and LING 405 and 406.

CMPT 402-3 Operating Systems Software Laboratory
This course provides hands-on practical experience in minicomputer and microcomputer environments. Low level computer architecture features are discussed. Lecture topics include interrupt handling, CPU scheduling, memory management, process management, device drivers, network communication, bootstrapping and overall operating systems design. Case studies of UNIX-like operating systems are discussed. Laboratory work consists of implementing various components of an operating system.
(Lecture/Laboratory)
Prerequisites: CMPT 401.
Students with credit for CMPT 393 may not take CMPT 402 for further credit.

CMPT 401-3 Operating Systems
Discusses important concepts in modern operating systems. Topics include multi-programming and multi-processing processes, semaphores and other synchronization primitives, memory management, process management, resource management, deadlocks, file systems. (Lecture)
Prerequisites: CMPT 201, 205, 390. CMPT 393 is recommended.

CMPT 404-3 Computer System Measurement and Evaluation
Introduces the major problems encountered and choice of available methods to evaluate suitability and performance of a computer system. Topics include evaluation of objectives, economics of computers, measurement of tools and techniques, analysis of performance, special problems. (Lecture/Tutorial)
Prerequisites: CMPT 305 and 400.

CMPT 405-3 Design and Analysis of Computing Algorithms
Models of computation; methods of algorithm design; complexity of algorithms; algorithms on graphs and integers, sorting and searching, NP-complete problems, applications in graphics and artificial intelligence. (Lecture)
Prerequisites: CMPT 201, MATH 152, and CMPT 205 or MATH 243, and MACM 216 or MATH 232.

CMPT 406-3 Computational Geometry
Mathematical preliminaries; convex hull algorithms; intersection problems; closest-point problems and their applications. (Lecture)
Prerequisite: CMPT 405. MATH 194 is strongly recommended.

CMPT 410-3 Artificial Intelligence Survey
Provides a unified discussion of the fundamental approaches to the problems in artificial intelligence. The topics considered are: representational typology and search methods; game playing, heuristic programming; pattern recognition and classification; theorem-proving; question-answering systems; natural language understanding; computer vision. (Lecture/Tutorial)
Prerequisites: CMPT 201 and 205.

CMPT 411-3 Artificial Intelligence Topics
This course investigates two topics of Artificial Intelligence (i) the application of logic to problem-solving and computer programming; and (ii) computational approaches to image understanding. (Lecture)
Prerequisites: CMPT 201 and 205. CMPT 410 is recommended.

CMPT 483-3 Parsing and Interpretation
Theoretical and practical aspects of parsing and interpreter implementation. Analysis of the structure of high level languages, lexical analysis, parsing, syntax error recovery, internal representation and environment for interpretation, interactive system requirements. (Lecture/Laboratory)
Prerequisites: CMPT 205, 275, 383, MACM 306.

CMPT 401-3 Operating Systems
Discusses important concepts in modern operating systems. Topics include multi-programming and multi-processing processes, semaphores and other synchronization primitives, memory management, process management, resource management, deadlocks, file systems. (Lecture)
Prerequisites: CMPT 201, 205, 390.

CMPT 404-3 Computer System Measurement and Evaluation
Introduces the major problems encountered and choice of available methods to evaluate suitability and performance of a computer system. Topics include evaluation of objectives, economics of computers, measurement of tools and techniques, analysis of performance, special problems. (Lecture/Tutorial)
Prerequisites: CMPT 305 and 401.

CMPT 405-3 Design and Analysis of Computing Algorithms
Models of computation; methods of algorithm design; complexity of algorithms; algorithms on graphs and integers, sorting and searching, NP-complete problems, applications in graphics and artificial intelligence. (Lecture)
Prerequisites: CMPT 307.

CMPT 406-3 Computational Geometry
Mathematical preliminaries; convex hull algorithms; intersection problems; closest-point problems and their applications. (Lecture)
Prerequisite: CMPT 307.

CMPT 410-3 Artificial Intelligence Survey
Provides a unified discussion of the fundamental approaches to the problems in artificial intelligence. The topics considered are: representational typology and search methods; game playing, heuristic programming; pattern recognition and classification; theorem-proving; question-answering systems; natural language understanding; computer vision. (Lecture/Tutorial)
Prerequisites: CMPT 201 and 205.

CMPT 411-3 Knowledge Representation
Formal and foundational issues dealing with the representation of knowledge in artificial intelligence systems are covered. Questions of semantics, incompleteness, nonmonotonicity and others will be examined. As well, particular approaches, such as procedural or semantic network, may be discussed. (Lecture/Tutorial)
Prerequisites: CMPT 384 or 410.

CMPT 483-3 Parsing and Interpretation
Theoretical and practical aspects of parsing and interpreter implementation. Analysis of the structure of high level languages, lexical analysis, parsing, syntax error recovery, internal representation and environment for interpretation, interactive system requirements. (Lecture/Laboratory)
Prerequisites: CMPT 205, 275, 383, and CMPT 309 or MACM 402.

Appendix IV
Current and Proposed Upper Division Calendar Descriptions

IV.1. Tables

UPPER DIVISION COURSE REQUIREMENTS

Attention is drawn to the lower division courses stated above. Majors and Honors students are required to consult an Adviser before commencing their upper division course requirements.

Requirements are structured according to the areas of concentration shown in Table 1. When a course is selected from an area to fulfil a breadth requirement, this course should normally be a key course for the area, as indicated in Table 2.

TABLE I

Area	Course		Title
Computer Design and Organization	CMPT	390-3	Digital Circuits & Systems
		391-3	Microcomputer Hardware Workshop
		400-3	Hardware Architecture
		491-4	Analogue and Digital Circuits
		495-3	Digital Systems Design & Specification Lab I
		496-3	Digital Systems Implementation Laboratory
Software Systems and Programming	CMPT	383-3	Comparative Programming Languages
		384-3	Symbolic Computing
		393-4	Systems Software for Minicomputers and Microcomputers
		401-3	Operating Systems
		404-4	Computer System Measurement & Evaluation
		483-3	Parsing and Interpretation
		484-3	Compiler Construction
Information Systems	CMPT	301-3	Information Systems Management
		302-3	System Development Projects
		354-3	File and Database Structures
		370-3	Information System Design
		371-3	Data Communications and Networking
Intensive Applications	CMPT	340-3	Computers in Biomedicine
		351-3	Introduction to Computer Graphics
		380-3	Computational Linguistics
		392-3	Introduction to Digital Signal Processing
	or	410-3	Artificial Intelligence Survey
		411-3	Artificial Intelligence Topics
		451-3	Interactive Graphics & Animation Systems
Theoretical Computing Science	CMPT	405-3	Design & Analysis of Algorithms
		406-3	Computational Geometry
	MACM	306-3	Introduction to Automata Theory
		401-3	Switching Theory & Logical Design
		402-3	Automata & Formal Languages
Analytical Tools for Scientific Computation	CMPT	305-3	Computer Simulation & Modeling
	MACM	360-3	Computation for Statistical Data Processing
	MACM	316-3	Numerical Analysis I

UPPER DIVISION REQUIREMENTS

The primary upper division requirements for a Major or Honors in Computing Science are structured according to the areas of concentration shown in Table I. Elective courses which may be used to fulfill further requirements are shown in tables II and III.

TABLE I
Computing Science Concentrations

Computer Design and Organization	CMPT	390-3	Digital Circuits and Systems
		391-3	Microcomputer Hardware Workshop
		400-3	Hardware Architecture
		490-3	VLSI Systems Design
		491-4	Analogue and Digital Circuits
		495-3	Digital Systems Design and Specification Lab I
		496-3	Digital Systems Implementation Laboratory
		499-3	Special Topics in Computer Hardware
Computing Systems	CMPT	371-3	Data Communications and Networking
		401-3	Operating Systems
		402-3	Operating Systems Software Laboratory
		404-3	Computer System Measurement and Evaluation
		479-3	Special Topics in Computing Systems
Programming Languages and Software	CMPT	383-3	Comparative Programming Languages
		384-3	Symbolic Computing
		483-3	Parsing and Interpretation
		484-3	Compiler Construction
		489-3	Special Topics in Programming Languages
Information Systems	CMPT	301-3	Information Systems Management
		302-3	System Development Projects
		354-3	File and Database Structures
		370-3	Information System Design
		459-3	Special Topics in Database Systems
Artificial Intelligence	CMPT	410-3	Artificial Intelligence Survey
		411-3	Knowledge Representation
		412-3	Computational Vision
		413-3	Computational Linguistics
		419-3	Special Topics in Artificial Intelligence
Theoretical Computing Science	CMPT	307-3	Data Structures and Algorithms
		309-3	Introduction to Formal Languages and Automata with Applications
		405-3	Design and Analysis of Algorithms
		406-3	Computational Geometry
		409-3	Special Topics in Theoretical Computing Science

TABLE II

Area	Key Course(s)
Computer Design and Organization	CMPT 390-3
Software Systems and Programming	CMPT 401-3 or 383-3
Information Systems	CMPT 354-3
Intensive Applications	CMPT 410-3 or 351-3
Theoretical Computing Science	CMPT 405-3
Analytical Tools for Scientific Computation	CMPT 305-3

TABLE II
Intensive Application Courses

CMPT	305-3	Computer Simulation and Modeling
	340-3	Computers in Biomedicine
	351-3	Introduction to Computer Graphics
	362-3	Computers in Education
	392-3	Introduction to Digital Signal Processing
	451-3	Interactive Graphics and Animation Systems

TABLE III
Computing Mathematics Courses

MACM	306-3	Introduction to Automata Theory
	316-3	Numerical Analysis I
	401-3	Switching Theory and Logical Design
	402-3	Automata and Formal Languages
MATH	308-3	Linear Programming
	343-3	Combinatorial Aspects of Computing
	408-3	Discrete Optimization
	416-3	Numerical Analysis II

IV.2. Major Program

Specific Requirements for a Major in Computing Science

Attention is drawn to Lower Division Course Requirements, as prerequisites, as described in the preceding sections.

a) For a Major in Computing Science, students must complete:

30 hours of upper division Computing Science courses including CMPT 354-3 File and Database Structures, CMPT 405-3 Design and Analysis of Computing Algorithms, and CMPT 493-1 Computing Science Presentation Seminar I. The 30 hours of Computing Science courses must satisfy the following distribution requirements:
A minimum GPA of 2.0 is required on these 30 upper division credits.

i) **Depth Requirement:**

Concentrations consisting of **three** courses from each of two areas shown in Table 1.
Theoretical Computing Science and Analytical Tools for Scientific Computation may not both be counted as Depth Areas.

NOTE: In exceptional circumstances, different depth areas may be considered and sanctioned with the approval of a faculty sponsor and the Curriculum Committee.

ii) **Breadth Requirement:**

Three different courses from distinct areas selected from the remaining areas (each course should normally be a key course in the area as indicated in Table 2).

iii) **Social Aspects of Computing Requirement:**
One of CMPT 320 or CMPT 350.

iv) Any other upper division Computing Science courses to bring the total upper division hours to at least 30.

b) In addition, for the degree, students must include a concentration in a discipline (department) other than Computing Science, approved by the program adviser, consisting of at least 15 semester hours, and including at least 6 hours of upper division credit.

c) For a degree with a Major in Computing Science, a student must complete 120 semester hours, with an overall minimum of 45 hours of upper division credit.

Students are advised to consult the *General Regulations* of the University and the regulations of the Faculty governing graduation requirements.

DEGREE

Students may obtain a B.Sc. or a B.A. depending on the direction of their concentration and content of their overall program. The degree awarded will be determined in consultation with a faculty adviser.

Upper Division Requirements for a Major in Computing Science

For a Major in Computing Science, students must satisfy the following requirements.

1. **Depth Requirement**
Concentrations consisting of three courses from each of two areas shown in Table I must be completed. (18 semester hours)

2. **Breadth Requirement**
One course each in three additional areas of Table I must be completed. (9 semester hours)

3. CMPT 307-3 (Data Structures and Algorithms) and CMPT 354-3 (File and Database Structures) must be included within the the courses used to satisfy depth and breadth requirements.

4. Further course requirements for a Major in Computing Science depend on the degree sought, as follows.

   a. For a Major in Computing Science in conjunction with a B.B.A. program as offered by the Faculty of Business Administration or in conjunction with a B.Ed. program as offered by the Faculty of Education, one additional CMPT course chosen from Table I or Table II must be completed, bringing the total upper division semester hours in CMPT courses to at least 30.

   b. For a B.A. degree with a Major in Computing Science, the following additional requirements must be met.

      i. One additional CMPT course chosen from Table I or Table II must be completed bringing the total upper division semester hours in CMPT courses to at least 30.

      ii. A concentration of 15 semester hours in a discipline (department) within the Faculty of Arts must be completed. This concentration must include at least 6 semester hours of upper division credit.

   c. For a B.Sc. degree with a Major in Computing Science, the following additional requirements must be met.

      i. Three additional courses chosen from Tables I, II or III must be completed. These courses must include MACM 316-3 (Numerical Analysis I). (9 semester hours)

      ii. **Social Aspects of Computing Requirement**
      One of CMPT 320-3 (Social Implications of a Computerized Society) or CMPT 350 (Information and Public Policy) must be completed. (3 semester hours)

      iii. **Computing Presentation Requirement**
      One of CMPT 428-0 (Practicum III) or CMPT 493-1 (Computing Science Presentation Seminar) must be completed.

      iv. **Faculty of Arts Electives**
      At least 9 semester hours of courses (at any level) from the Faculty of Arts must be completed, excluding those used to satisfy Computing Science lower division course requirements.

5. For all Major programs in Computing Science, a grade point average of 2.0 must be obtained on the 30 to 40 semester hours of upper division CMPT/MACM/MATH courses used to fulfill the above requirements.

6. For all Major programs in Computing Science, at least 24 semester hours of the required CMPT courses must be taken at Simon Fraser University.

7. For a degree with a Major in Computing Science, 120 semester hours must be completed, with an overall minimum of 45 semester hours of upper division credit.

For all Major programs in Computing Science, at least 30 semester hours of upper division CMPT courses must be counted towards the CMPT Major and cannot at the same time be counted towards the credit hour requirements of any other program.

Students are advised to consult the *General Regulations* section of this calendar governing University graduation requirements.

IV.3. Honors Program

Specific Requirements for Honors in Computing Science

Attention is drawn to Lower Division Course Requirements, as prerequisites, as described in the preceding sections.

a) For Honors in Computing Science, students must complete:

50 hours of upper division Computing Science courses including CMPT 354-3 File and Database Structures, CMPT 405-3 Design and Analysis of Computing Algorithms, and CMPT 493-1 Computing Science Presentation Seminar I. The 50 hours of Computing Science courses must satisfy the following distribution requirements:

i) **Depth Requirement:**

Concentrations consisting of **four** courses in one of the areas shown in Table 1, and 3 courses in each of two other areas. One of the three areas chosen must be Theoretical Computing Science.

NOTE: In exceptional circumstances, different depth areas may be considered and sanctioned with the approval of a faculty sponsor and the Curriculum Committee.

ii) **Breadth Requirement:**

Three different courses consisting of one course from **each** of the remaining areas (each course should normally be a key course in the area as indicated in Table 2).

iii) **Social Aspects of Computing Requirement:**
One of CMPT 320 or CMPT 350.

iv) Any other Computing Science courses to bring the total upper division hours to at least 50.

b) In addition, for the Honors degree, students must include a concentration in a discipline (department) other than Computing Science, approved by the program adviser, consisting of at least 15 semester hours, and including at least 6 hours of upper division credit.

c) For a degree with Honors in Computing Science, a student must complete 132 semester hours with an overall minimum of at least 60 hours of upper division credit.

Students are advised to consult the *General Regulations* of the University and the regulations of the Faculty from which they are seeking their degree, governing graduation requirements.

DEGREE

Students may obtain a B.Sc. or a B.A. depending on the direction of their concentration and content of their overall program. The degree awarded will be determined in consultation with a faculty adviser.

Upper Division Requirements for Honors in Computing Science

For Honors in Computing Science, students must satisfy the following requirements.

1. **Depth Requirement**
Concentrations consisting of four courses in one of the areas shown in Table I and three courses from each of two other such areas must be completed. One of the areas must be Theoretical Computing Science. (30 semester hours)

2. **Breadth Requirement**
One course each in the three remaining areas of Table I must be completed. (9 semester hours)

3. **Social Aspects of Computing Requirement**
One of CMPT 320-3 (Social Implications of a Computerized Society) or CMPT 350 (Information and Public Policy) must be completed.

4. **Computing Presentation Requirement**
One of CMPT 428-0 (Practicum III) or CMPT 493-1 (Computing Science Presentation Seminar) must be completed.

5. **Credit Hour Requirement**
Additional Computing Science courses must be completed to bring the total upper division credit hours in CMPT/MACM to at least 50.

6. CMPT 307-3 (Data Structures and Algorithms), CMPT 354-3 (File and Database Structures), CMPT 405-3 (Design and Analysis of Algorithms), and MACM 316-3 (Numerical Analysis I) must be included within the the courses used to satisfy the depth, breadth and credit hour requirements above.

7. For a B.A. degree with Honors in Computing Science, a concentration of 15 semester hours in a discipline (department) within the Faculty of Arts must be completed. Similarly, for a B.Sc.. degree with Honors in Computing Science, a concentration of 15 semester hours in a discipline (department) within the Faculty of Science must be completed. In both cases, the concentration must include at least 6 semester hours of upper division credit.

8. In addition, a minimum of 60 semester hours of upper division credit and an overall total of 132 semester hours of credit is required for the degree, together with a Graduation Grade Point Average of at least 3.00 as described in the *General Regulations* section of this calendar.

IV.4. Digital Systems Design Honors Program

UPPER DIVISION COURSE REQUIREMENTS:

To obtain the degree a student must, in addition to satisfying the general requirements of the University and Faculty complete 132 semester hours including the following courses:

CMPT	351-3	Introduction to Computer Graphics
or	410-3	Artificial Intelligence Surveys
	354-3	File and Database Structures
	383-3	Comparative Programming Languages
	390-3	Digital Circuits and Systems
	391-3	Microcomputer Hardware Workshop
	392-3	Introduction to Digital Signal Processing
	393-4	Systems Software for Minicomputers and Microcomputers
	400-3	Hardware Architecture
	401-3	Operating Systems
	405-3	Design and Analysis of Computer Algorithms
	483-3	Compiler Construction
	491-3	Analogue and Digital Circuits
	493-1	Computing Science Presentation Seminar I
	495-3	Digital Systems Design and Specification Laboratory
	496-3	Digital Systems Implementation Laboratory
MACM	306-3	Introduction to Automata Theory
	401-3	Switching Theory and Logical Design
	316-3	Numerical Analysis I
MATH	310-3	Introduction to Ordinary Differential Equations
PHYS	326-3	Electronics and Instrumentation
	331-3	Electronics Laboratory

Social Aspects of Computing Requirement:

In addition, one of the following courses must be taken: CMPT 320 or CMPT 350.

UPPER DIVISION REQUIREMENTS

For an Honors degree in Digital Systems Design, the following requirements must be met.

1. The following courses must be completed.

CMPT	307-3	Data Structures and Algorithms
	309-3	Introduction to Formal Languages and Automata with Applications
	351-3	Introduction to Computer Graphics
or	410-3	Artificial Intelligence Survey
	354-3	File and Database Structures
	390-3	Digital Circuits and Systems
	391-3	Microcomputer Hardware Workshop
	392-3	Introduction to Digital Signal Processing
	400-3	Hardware Architecture
	401-3	Operating Systems
	402-3	Operating Systems Software Laboratory
	405-3	Design and Analysis of Computer Algorithms
	490-3	VLSI Systems Design
	491-4	Analogue and Digital Circuits
	495-3	Digital Systems Design and Specification Laboratory
	496-3	Digital Systems Implementation Laboratory
MACM	316-3	Numerical Analysis I
MATH	310-3	Introduction to Ordinary Differential Equations
PHYS	326-3	Electronics and Instrumentation
	331-3	Electronics Laboratory

(58 semester hours)

2. **Social Aspects of Computing Requirement**
One of CMPT 320-3 (Social Implications of a Computerized Society) or CMPT 350 (Information and Public Policy) must be completed.

3. **Computing Presentation Requirement**
One of CMPT 428-0 (Practicum III) or CMPT 493-1 (Computing Science Presentation Seminar) must be completed.

Computing Science Minor Program

UPPER DIVISION COURSE REQUIREMENTS

Students minoring in Computing Science must complete at least 15 credits of upper division Computing Science (CMPT or MACM) courses shown in Table I, of which no more than 9 credits can be from any one area. Normally at least 12 of these credits will be in CMPT courses.

UPPER DIVISION REQUIREMENTS

For a Minor in Computing Science students must complete the following requirements.

1. Three courses chosen from the Computing Science Upper Division Core Courses listed in Table I must be completed. (9 semester hours)
2. Two additional CMPT courses chosen from Table I or Table II must be completed. (6 semester hours)
3. No more than three courses from any one area of Table I may be counted towards the above 15 semester hours of credit.
4. At least 12 semester hours of these courses must be completed at Simon Fraser University.

Appendix V
Current and Proposed Calendar Regulations

Restrictions on entry to and continuation in Minor, Major and Honors Programs and to Upper Division Courses in Computing Science and to Related Joint Programs or Courses

A student desiring to take a MINOR/MAJOR/HONORS Program in Computing Science, or a combined MAJOR or HONORS program in Computing Science may continue to indicate on registration forms the INTENDED program as under current regulations and practice.

For formal declaration and formal acceptance into any one of these programs involving Computing Science, a student must normally have completed the 57th credit hour. Prior to each Fall semester the School of Computing Science will establish the minimum Cumulative Grade Point Average level required for acceptance into its upper division courses for the academic year — Fall, Spring, Summer. Students having a CGPA of 2.6 or higher will be accepted into the School's programs regardless of the total number of applications; students below 2.25 will not be accepted under any circumstances. To remain in a program in Computing Science a student will be expected to maintain at least the minimum CGPA of 2.25.

Enrolment Limitations

The School of Computing Science limits admission to the upper division of its Major, Minor and Honors programs and to related joint programs. Space in upper division Computing Science courses are primarily reserved for students who have been formally accepted into such a program; only such students will be generally able to obtain the upper division courses necessary to complete the program.

Acceptance of a student into any Computing Science program will be based both on overall academic performance as measured by the Cumulative Grade Point Average (CGPA) and on specific academic performance in computing-related material as measured by the Computing-Related Grade Point Average for Declaration in the given program. The CGPA is calculated based on all course work completed at SFU as described in the *General Regulations* section of this calendar. The Computing-Related GPA for a given program is the grade point average calculated over all courses **used** to satisfy the lower division course requirements of that program and any other Computing Science courses **taken**. Only courses taken at SFU are used in these calculations.

A student may apply for formal acceptance as a declared student in any one of these programs involving Computing Science upon completion of 57 semester hours including the lower division course requirements for the program. For direct admission based on CGPA and on Computing-Related GPA the student must have completed at least 12 semester hours of the computing-related courses at SFU. Students having both a CGPA and a Computing-Related GPA of 2.5 or higher will be accepted into the School's programs regardless of the total number of applications; students below 2.25 will not be accepted under any circumstances.

A transfer or second-degree student who has not completed at least 12 credits of computing-related courses for a program, but who has at least 57 semester hours of overall credit and has the credit for all the lower division requirements of a program may apply to the School for special admission consideration based on transcripts from other post-secondary institutions.

To remain in a program in Computing Science a student will be expected to maintain at least the minimum CGPA of 2.25.