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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. TITLE/AUTHOR OF PROPOSAL

Course/Program Title: Revised BA/BS with 3 Tracks
Suggested 20 character course title: _____
Department: Computer Science
Contact Person: John Cross, X4478, Stright 319

II. If a course, is it being proposed for:

- Course Approval/Revision Only
 Course Approval/Revision and Liberal Studies Approval
 Liberal Studies Approval Only (course previously approved by Senate.)

III. APPROVALS

John A. Cross
Department Curriculum Committee

Gary L. Butabrygh
Department Chairperson

H. Katz
College Curriculum Committee

W. J. Cal
* College Dean

Director of Liberal Studies
(where applicable)

Provost (where applicable)

* EACH COLLEGE DEAN MUST CONSULT WITH THE PROVOST BEFORE APPROVING CURRICULUM CHANGES. APPROVAL BY COLLEGE DEAN INDICATES THE PROPOSED CHANGE IS CONSISTENT WITH LONG RANGE PLANNING DOCUMENTS, ALL REQUESTS FOR RESOURCES IN THE PROPOSAL CAN BE MET, AND THE PROPOSAL HAS THE SUPPORT OF THE UNIVERSITY ADMINISTRATION.

III. TIMETABLE

Date Submitted:
to LSC _____

Semester to be
implemented:

Date to be
published
in Catalog

to UWUCC _____

Fall 1992

Part I. Curriculum Proposal Cover Sheet (Attached Cover Sheet)

Part II. Description of Curriculum Change

1. Catalog description follows.
2. Rationale follows catalog description.

Part III. Course Proposals (none)

Part IV. Letters of Support (Letter from Mathematics attached)

Part V. Curricular Offering/Change Authorization Form does not appear to apply to this change. On the advice of the Chairman of the Senate Curriculum Committee, Gary Buterbaugh, I have not included it.

Revised BA/BS with 3 Tracks

May 29, 1991

B. A. in Computer Science

(35 -> 43 credits of Computer Science)

(10 -> 28 credits of Free Electives)

(Footnotes (*) are at end)

Liberal Studies: As stated in Liberal Studies Requirements with the following specifications:

(55-58 credits)

Mathematics: MA 121 or MA 123

Liberal Studies electives: MA 216 or MA 214 or MA 217; foreign language III and IV, if not waived.

Additional Writing: EN 322, Technical Writing

(3 credits)

Foreign Language III and IV

(0 credits) (1)

Mathematics:

(3-10 credits) (2)

MA 123 Calculus I for Physics and Chemistry

(MA 121 and MA 122 or MA 127 may be substituted)

MA 216 Probability and Statistics for Natural Sciences

(MA 363 and MA 364, MA 214 and MA 417, or MA 217 and MA 417 may be substituted.)

MA 219 Discrete Mathematics

Required Computer Science Courses

(20 credits)

CO 105 Fundamentals of Computer Science
CO 110 Problem Solving and Structured Programming
CO 220 Applied Computer Programming
CO 300 Assembly Language Programming
CO 310 Data Structures
CO 315 Large File Organization and Access
CO 380 Seminar on the Computer Profession
CO 480 Seminar on Technical Topics

Select at least 9 credits from the list of controlled electives and/or the list of upper level electives. Note: Only 4 credits of CO 493 may be counted toward these 9 credits. (9-17 credits)

Select at least two (2) additional courses, from at least two (2) different categories, from the list of upper level electives. (6 credits)

Controlled Electives

(3)

CO 250 Introduction to Numerical Methods
CO 319W Software Engineering Principles
CO 320 Software Engineering Practice
CO 345 Data Communications
CO 355 Computer Graphics
CO 360 IBM Job Control Language

- CO 362 UNIX and C
- CO 481 Special Topics in Computer Science
(only sections approved for majors)
- CO 485 Independent Study
- CO 493 Internship in Computer Science

Upper Level Electives by Categories

1. Computer Architecture
 - CO 410 Processor Architecture and Microprogramming
2. Theory of Languages
 - CO 419 Software Development with Ada
 - CO 420 Modern Programming Languages
 - CO 424 Compiler Construction
 - CO 460 Theory of Computation
3. Systems Programming
 - CO 430 Introduction to Systems Programming
 - CO 432 Introduction to Operating Systems
4. Numerical Methods
 - CO 450 Applied Numerical Methods
5. Artificial Intelligence
 - CO 405 Artificial Intelligence
6. Data Base Management
 - CO 441 Data Base Management

Suggested Course Ordering

<u>First Semester</u>	<u>Second Semester</u>	
CO 105 MA 123	CO 110 MA 216	First Year
CO 220 CO 300 MA 219	CO 315 CO 310	Second Year
CO YYY CO YYY	CO YYY	Third Year
CO ZZZ CO 380	CO ZZZ CO 480	Fourth Year

Notes: CO YYY represents a controlled elective or an upper-level elective. CO ZZZ represents an upper-level elective. If CO 493 (Internship) is elected, CO 380 should be taken in the immediately preceding semester. An upper-level elective is required after an Internship.

B. S. in Applied Computer Science

(38 -> 47 credits of Computer Science)

(6 -> 18 credits of an approved minor)

(0 -> 19 credits of Free Electives)

Liberal Studies: As stated in Liberal Studies Requirements with the following specifications:

Mathematics: MA 121 or MA 123 or MA 127

(55-58 credits)

Liberal Studies electives: MA 216 or MA 214 or MA 217; foreign language III and IV, if not waived.

Additional Writing: EN 322, Technical Writing

(3 credits)

Foreign Language III and IV

(0 credits) (1)

Mathematics:

(3-10 credits) (2)

MA 123 Calculus I for Physics and Chemistry

(MA 121 and MA 122 or MA 127 may be substituted)

MA 216 Probability and Statistics for Natural Sciences

(MA 363 and MA 364, MA 214 and MA 417, or MA 217 and MA 417 may be substituted.)

MA 219 Discrete Mathematics

Required Computer Science Courses

(26 credits)

CO 105 Fundamentals of Computer Science

CO 110 Problem Solving and Structured Programming

CO 220 Applied Computer Programming

CO 300 Assembly Language Programming

CO 310 Data Structures

CO 315 Large File Organization and Access

CO 319W Software Engineering Principles

CO 380 Seminar on the Computer Profession

CO 441 Data Base Management

CO 480 Seminar on Technical Topics

Select one (1) of the following two (2) courses.

(3-12 credits)

CO 320 Software Engineering Practice (3 credits)

CO 493 Internship in Computer Science (12 credits)

Select at least 6 credits from the list of controlled electives and/or the list of upper level electives.

(6 credits)

Select at least one (1) additional course from the list of upper level electives.

(3 credits)

Complete a minor from one of the following areas.

(6-18 credits)

- a.) From any department in the College of Natural Sciences and Mathematics (6-18 credits)
- b.) From designated Business courses (18 credits)
- c.) From designated Economics courses (15 credits)
- d.) From designated Geography courses (15 credits)

Controlled Electives

- CO 250 Introduction to Numerical Methods
- CO 345 Data Communications
- CO 355 Computer Graphics
- CO 360 IBM Job Control Language
- CO 362 Unix and C
- CO 481 Special Topics in Computer Science
(only sections approved for majors)
- CO 485 Independent Study

Upper Level Electives by Categories

- 1. Computer Architecture
 - CO 410 Processor Architecture and Microprogramming
- 2. Theory of Languages
 - CO 419 Software Development with Ada
 - CO 420 Modern Programming Languages
 - CO 424 Compiler Construction
 - CO 460 Theory of Computation
- 3. Systems Programming
 - CO 430 Introduction to Systems Programming
 - CO 432 Introduction to Operating Systems
- 4. Numerical Methods
 - CO 450 Applied Numerical Methods
- 5. Artificial Intelligence
 - CO 405 Artificial Intelligence

Suggested Course Ordering

<u>First Semester</u>	<u>Second Semester</u>	
CO 105 MA 123	CO 110 MA 216	First Year
CO 220 CO 300 MA 219	CO 315 CO 310	Second Year
CO 319W	CO YYY	Third Year

CO 441	* CO 320 or CO 380 and CO ZZZ	
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* CO ZZZ or CO 493	CO YYY CO ZZZ CO 480	Fourth Year
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*Notes: CO493 may be selected in either the Second Semester of the Junior year or the First Semester of the Senior year. If CO 493 is selected and approved, CO 380 may be taken in the immediately preceding semester and CO 320 may not be taken.

B. S. in Computer Science

(41 --> 49 credits of Computer Science)
(2 --> 14 credits of Free Electives)

Liberal Studies: As stated in Liberal Studies Requirements with the following specifications: (56-58 credits)

Mathematics: MA 123

Liberal Studies electives: MA 216; foreign language III and IV, if not waived.

Additional Writing: EN 322, Technical Writing (3 credits)

College Requirement: Foreign Language III and IV (0 credits) (1)

Mathematics: A minor in mathematics including the following courses (10-12 credits)

MA 123	Calculus I for Physics and Chemistry (MA 127 may be substituted)
MA 124	Calculus II for Physics and Chemistry (MA 128 may be substituted)
MA 171	Introduction to Linear Algebra
MA 216	Probability and Statistics for Natural Sciences (MA 363 and MA 364 may be substituted)
MA 219	Discrete Mathematics

Required Computer Science Courses (32 credits)

CO 105	Fundamentals of Computer Science
CO 110	Problem Solving and Structured Programming
CO 220	Applied Computer Programming
CO 300	Assembly Language Programming
CO 310	Data Structures
CO 315	Large File Organization and Access
CO 319W	Software Engineering Principles
CO 380	Seminar on the Computer Profession
CO 410	Processor Architecture and Micro Programming
CO 420	Modern Programming Languages
CO 432	Introduction to Operating Systems
CO 480	Seminar on Technical Topics

Select at least 9 credits from the following list of controlled electives. Note: Only 4 credits of CO 493 may be counted toward these 9 credits. (9 --> 17 credits)

Controlled Electives

CO 250	Introduction to Numerical Methods
CO 320	Software Engineering Practice
CO 345	Data Communications
CO 355	Computer Graphics
CO 360	IBM Job Control Language
CO 362	Unix and C
CO 405	Artificial Intelligence
CO 419	Software Development and Ada
CO 424	Compiler Construction
CO 430	Introduction to Systems Programming
CO 441	Data Base Management
CO 450	Applied Numerical Methods
CO 460	Theory of Computation
CO 481	Special Topics in Computer Science (only sections approved for majors)
CO 485	Independent Study
CO 493	Internship in Computer Science

Suggested Course Ordering

<u>First Semester</u>	<u>Second Semester</u>	
CO 105 MA 123	CO 110 MA 124	First Year
CO 220 CO 300 MA 216	CO 315 CO 310 MA 219	Second Year
CO 319W CO 410 MA 171	MA 219 CO 420 CO YYY	Third Year
CO 432 CO YYY CO 380	CO YYY CO 480	Fourth Year

Note: If CO 493 is elected, CO 380 should be taken in the immediately preceding semester.

(1) Foreign Language III and IV are counted as Liberal Studies electives.

(2) Any of the Mathematics options satisfy both the Learning Skill requirement and one course may be counted as a Liberal Studies elective. The 4-credit minimum applies to students who take MA 123 and MA 216. The 10-credit maximum applies to students who take MA 121, MA 122, and a 6-credit statistics option.

(3) Credit for both CO 320, Software Engineering Practice, and CO493 , Internship in Computer Science, may be counted toward the degree but only one will be counted toward the major requirements.

**RATIONALE for Proposed Changes
(by Charles Shubra and John Cross, January 30, 1991)**

From its inception in 1972 the Computer Science department offered two degrees: a B.A. in Computer Science and a B.S. in Computer Science. The B.S. in Computer Science contained two paths. One consisted of the traditional Computer Science courses which would prepare a graduate for graduate school or for a position with a computer hardware or software manufacturer, i.e., the more technical details of machine architecture and system software. This first path attracted 10 - 15% of our graduates.

The second path was quite innovative at the time and it is the source of much of the reputation that IUP Computer Science has for excellence. This second path concentrated on information processing and the construction of application software. The vast majority of the graduates in Computer Science have chosen this second path. While the preparation was different and the goals and destinations of our graduates were different between the two paths the graduates were earning a single degree, namely the B.S. in Computer Science.

The department has long discussed and mapped (well over 10 years now) how to identify and serve the three distinct groups of graduates which we were producing (B.A., B.S. for applications, B.S. for computer science goals). A lack of facilities and faculty and the crush of students choosing computer science as a major kept the department from formalizing a new curriculum.

Other Computer Science programs have had similar experiences. By the late 1970's the meaning of an undergraduate degree in Computer Science had become so clouded that something needed to be done. The Association for Computing Machinery (ACM, the premier academically-oriented computer society) began efforts to accredit programs in the 1980's. This effort has merged with the efforts of The Computer Society of the Institute for Electronic and Electrical Engineers (IEEE) and evolved to form the Computing Sciences Accreditation Board (CSAB). This is currently an active, respected organization with 96 accredited undergraduate degree programs.

The IUP Computer Science Department has followed these activities and studied how it could gain accreditation. We have steadily progressed on several fronts (e.g., numbers of faculty holding terminal degrees, types of facilities, student/faculty ratios, library holdings etc.) toward meeting the accreditation criteria. However, the strength of our program is the second path above, while the CSAB view of Computer Science programs is the first path above.

While a majority of the course work needed for an accredited computer science program has long been a component of our curriculum, the accreditation guidelines require that a separate degree program exist. Our success in the applied path and the integrity of our programs require that we retain our current program under a more accurate name and that we bring our Computer Science path into agreement with CSAB guidelines. Therefore, we have undertaken a reorganization of our degree requirements so as to meet the accreditation and naming requirements.

In summation, this request for a B.S. in Computer Science and a B.S. in Applied Computer Science to accompany the existing B.A. in Computer Science is largely an adjustment and recognition of what has existed almost since the inception of the department. The identification of separate degrees instead of paths will allow the department to petition for accreditation, attract students to the separately identifiable programs, assure requirements are met and attract faculty in the various programs.

Coincidentally, we are changing the Mathematics requirements for our degrees at this time. The change consists of removing MA 102 from our curriculum and replacing it with MA 219. The MA 102 course has not worked well, perhaps due in part to its placement at the beginning of our students' university education rather than after their first Calculus course. Because we must consider not requiring double majors in Computer Science and Mathematics to take both

MA 171 and MA 219, this change is not simple. We decided to not state that MA 171 is an automatic substitute for the MA 219 requirement at this time so that subsequent Computer Science courses could build on the things that students learn in MA 219. This change has the full support and encouragement of the Mathematics Department.

**COMPARISON OF CURRENT REQUIREMENTS FOR CO DEGREES
WITH PROPOSAL FOR 3 DEGREE TRACKS IN COMPUTER SCIENCE
(by John Cross, 2/13/91)**

	Current BA in CS	Proposed BA in CS	Current BS in CS	Proposed BS in applied CS	Proposed BS in CS
Liberal Studies (1)	54-57	55-58	54-57	55-58	56-58
Foreign Language (2)	0	0	0	0	0
Major	33-41	35-43	33-41	38-47	41-49
Technical Writing	3	3	3	3	3
Math (3)	3-10	3-10	3-10	3-10	10-12
Minor (4)	0	0	6-18	6-18	0
Free Electives	13-31	10-28	0-25	0-19	2-14
Total (5)	124	124	124-129	124-136	124
CSAB Eligibility	NO	NO	NO	NO	YES

(1) The Liberal Studies requirements consist of Learning Skills English (7), Learning Skills Math (4, MA 123 or MA 121), Humanities (9), Fine Arts (3), Natural Science (8-10), Social Sciences (9), Health and Wellness (3), Liberal Studies Electives (9-10, if a 4-credit Math is elected), Synthesis (3), and Non-Western Cultures (0, assuming an overlapping Social Studies is elected).

(2) The Foreign Language requirement is zero credits because these courses count as Liberal Studies electives.

(3) The credits for the Math requirements are different in the catalog due to a difference in the way we count Liberal Studies requirements; the changes in this document are intended to clarify the comparison of degree requirements.

(4) The Minor requirement for a BS in CS has had the Independent Study option removed.

(5) No student will be required to take more than 124 credits to earn any of these degrees. Nine additional CO credits are taken by approximately 40% of our graduates who elect an Internship. Approximately 50% of our students currently take a Minor in Applied Statistics or Mathematics, both of which require 10 less credits than our Business Concentration. Only those students who elect both an Internship and a Business Concentration will take more than 124 credits and have no free electives.

Active Courses, Titles, and Prerequisites

- CO 105 Fundamentals of Computer Science
- CO 110 Problem Solving and Structured Programming
- CO 220 Applied Computer Programming
 - CO 110 or equivalent
- CO 250 Introduction to Numerical Methods
 - CO 110; MA 122 or MA 123 or MA 127; MA 219 or MA 171
- CO 300 Assembly Language Programming
 - CO 110
- CO 310 Data Structures
 - CO 110 or CO 220
- CO 315 Large File Organization and Access
 - CO 220 or CO 250, and CO 310 Corequisite
- CO 319W Software Engineering Principles
 - CO 315 or permission of the instructor
- CO 320 Software Engineering Practice
 - CO 319W
- CO 345 Data Communications
 - CO 110, any CO course numbered higher than CO 205, and MA 216 or equivalents
- CO 355 Computer Graphics
 - CO 310
- CO 360 IBM Job Control Language
 - CO 220
- CO 362 Unix and C
 - CO 310 (or permission for MIS majors)
- CO 380 Seminar on the Computer Profession
 - See course description
- CO 405 Artificial Intelligence
 - CO 310
- CO 410 Processor Architecture and Micro Programming
 - CO 300 and CO 310
- CO 419 Software Development with Ada
 - CO 310
- CO 420 Modern Programming Languages
 - CO 220 and CO 310
- CO 424 Compiler Construction
 - CO 300 and CO 310
- CO 430 Introduction to Systems Programming
 - CO 300 and CO 310
- CO 432 Introduction to Operating Systems
 - CO 300 and CO 310
- CO 441 Data Base Management
 - CO 310 and CO 315
- CO 450 Applied Numerical Methods
 - CO 250, MA 171, and MA 241, or equivalents
- CO 460 Theory of Computation
 - CO 310
- CO 480 Seminar on Technical Topics
 - See course description
- CO 481 Special Topics in Computer Science
 - 12 semester hours in Computer Science or consent of instructor
- CO 485 Independent Study
 - Permission of a Computer Science faculty member who agrees to supervise the student's project and departmental approval
- CO 493 Internship in Computer Science
 - CO 300, CO 310, CO 315, CO 380, other courses depending on the type of internship position desired, completion of application, and selection by committee

To: Dr. John Cross, Chairman
Computer Science Curriculum Committee

From: Gerald Buriok, Chairman
Mathematics Department JB

Date: March 1, 1991

Subject: Revised Computer Science Curriculum

The purpose of this memo is to state support for changes in Computer Science Department requirements which will affect the Mathematics Department.

We are in agreement with your statement that the MA 102 Finite Mathematics requirement has not worked well, and we feel it is appropriate to phase MA 102 out of your requirements. In fact, MA 102 will be replaced by MA 219 Discrete Mathematics (or MA 171 Linear Algebra, as a substitution), so that the total number of credits of mathematics required of students in the Computer Science Department will remain unchanged. The course content of MA 219 is more in line with CSAB accreditation requirements and should be more beneficial to your students.

Anticipating your new curriculum will become effective for the 1992-93 academic year, the Mathematics Department recognizes the need to insure a sufficient number of seats will be available in MA 123 for the fall semester of that year. With your suggested course ordering placing MA 216 in the spring semester of the 1992-93 academic year, we will likewise insure the seats will be available for that course. Although MA 102 will be offered according to our established pattern during the 1991-92 academic year, offerings of this course will be very limited beyond that time. During the 1992-93 academic year, possibly only one section of MA 102 and one section of MA 219 will be offered. During the 1993-94 academic year and beyond, an adequate number of sections of MA 219 will be offered annually to meet the needs of your department.

The Mathematics Department welcomes the addition of a Minor in Mathematics as a requirement in the B.S. in Computer Science program. With the exception of MA 219, all of the courses you are requiring for a minor are standard, multiple section offerings. As stated previously, MA 219 will be elevated to that status for the 1993-94 academic year.

cc: Elwood Speakman, Chair
Mathematics Department Service Courses Committee