



STATE OF CONNECTICUT

BOARD OF TRUSTEES
FOR THE STATE COLLEGES

P. O. BOX 2008 NEW BRITAIN, CONNECTICUT 06050
TEL. NEW BRITAIN: 203-229-1607 TEL. HARTFORD: 203-566-7373

RESOLUTION


concerning

BACHELOR OF ARTS
in
COMPUTER AND INFORMATION SCIENCES
at
EASTERN CONNECTICUT STATE COLLEGE

June 8, 1979

RESOLVED, Under the authority granted the Board of Trustees in Chapter 164, Section 10-109 of the General Statutes and Public Act 77-573, Eastern Connecticut State College is hereby authorized to submit a program proposal leading to a Bachelor of Arts Degree in Computer and Information Sciences to the Board of Higher Education for planning approval.

A Certified True Copy:


James A. Frost
Executive Director

APPLICATION SUMMARY
(For Planning Approval and Licensure)

CONNECTICUT BOARD OF HIGHER
P.O. BOX 1320, HARTFORD, CONNECTICUT 06101

HE-7 NEW 7-78

DESCRIPTION OF PROPOSED ACADEMIC PROGRAM OR DEGREE		
PROGRAM NAME Computer and Information Science	DATE OF SUBMISSION	
DEGREE (and abbreviation) Bachelor of Arts (B.A.)		
SUBJECT FIELD CODE (No.) 0 7 9 9	TITLE Computer and Information Sciences - other (includes systems analysis, software engineering)	
DEPARTMENT, SCHOOL, OR COLLEGE Department of Mathematical Sciences, School of Arts and Sciences		
INSTITUTION Eastern Connecticut State College	PROPOSED DATE OF INITIATION September 1979	
GEOGRAPHIC LOCATION OF PROGRAM Willimantic, Connecticut		
INSTITUTIONAL LIAISON PERSON Dr. Thomas A. Porter	TITLE Exec. Officer - Academic/Stud. Affairs Board of Trustees for Conn. State Colleges	TELEPHONE 827-7000
BOARD OF TRUSTEES STAFF PERSON (When Trustees Staff is involved) Dr. Thomas A. Porter		

SUMMARY (Describe the proposed academic program or degree. An additional sheet may be attached if necessary)

The proposed Bachelor of Arts Program in Computer and Information Science is designed as a form of general education for a technological society and aims to integrate the three computer cultures (computer technology, computer mathematics, and computer science) within the training of liberal arts specialists who will be assisted to acquire significant mathematical skills in computer and information science. Within this program, computer science is viewed as the study of computer systems from the point of view of computer architecture, systems software, and theoretics. Closely associated with newer technological developments in the field of communications, the proposed program includes the study of the organization and administration of information through the design, analysis, representation, and application of algorithms on computers. The curriculum provides for essential backgrounds while, at the same time, preparing the student to work as an applied mathematician as well as a computer scientist.

DO NOT FILL IN These items will be completed by the BHE for entry into the Informational System.	PLANNING APPROVAL ACTION SAAC _____ BHE _____	LICENSURE ACTION SCA _____ SAAC _____ BHE _____
--	--	---

*To be selected from the TAXONOMY OF INSTRUCTIONAL PROGRAMS (Provisions: Appendix D)

III. PROGRAM JUSTIFICATION (Educational Impact).

A. This program is in accord with the mission of Eastern Connecticut State College and the mission of the Board of Trustees for State Colleges of Connecticut. The academic master plan for Eastern Connecticut State College includes this program as a proposed new offering in the 1979-80 timetable, with two additional positions proposed by 1982. This combined academic and occupational program is also in keeping with the Board of Higher Education's stance on educational planning challenges viewed as opportunities to provide improved educational offerings within a dynamic and responsive system of higher education for the State of Connecticut.

B. Relationship to other programs.

1. The Liberal Arts major in Computer and Information Science is well suited to the qualifications of our present faculty. The program, similar to one recommended in the March, 1975 issue of the Journal of the Math. Association of America, carries a heavy mathematics emphasis. The calculus and differential equations courses are taught by all the members of the department. The two advanced math courses required in the new program, Set Theory (Math 300) and Real Analysis I (Math 420), can be taught by any one of the staff, though they are usually handled by Harkness and Kenton, the staff members who are chiefly concerned with theoretical mathematics. The introductory programming language courses in Fortran (CIS 111) and Cobol (CIS 115) can be taught by Carter, Geissert, Duchow and Ferbrache, though the latter two usually handle this. The advanced computer and information science courses can be taught by the following qualified instructors, with the principal instructor's name underlined (new courses are marked with a star (*)):

<u>Course CIS #</u>	<u>Title</u>	<u>Instructors</u>
*300	Assembly Language Prog	Duchow, <u>Ferbrache</u> **
350	Numerical Analysis	<u>Carter</u> , Geissert, Kenton
360	Operations Research	<u>Carter</u> , Geissert, Sharlow
*370-1	Systems Design	Duchow, <u>Ferbrache</u>
*420	Advanced Programming Lang.	Carter, <u>Duchow</u> , <u>Ferbrache</u>
*430	Compiler Writing	Duchow, <u>Ferbrache</u>
*460	Electronic Data Processing	Duchow, <u>Ferbrache</u>

**David Ferbrache, new position added 1978-79.

Other courses in Comp. and Info. Science will be added to meet the expected student demand. Of the current math majors, approximately 50% of those reaching the senior year have indicated serious consideration of a CIS major, were it available. Among freshmen, the percentage is higher. Some of the students who do not continue their math major beyond the freshman or sophomore year either transfer to another school to get a computer science major, or change to another major within the college.

2. Similar academic programs in Connecticut. (as of date of first submission 1977-78)

Of the State Colleges, only Central has a major in Computer Science, while Southern and Western have concentrations in the area. Central has about seventy-five students, while Southern and Western have about thirty each. In Connecticut, Yale, the University of Connecticut and the Hartford Graduate Center (R.P.I.) have major programs; Yale has a major in mathematics/computer science and a major in computer science with a combined enrollment of about thirty-five students; the University of Connecticut has about sixty advanced students and R.P.I. has about 220 students (mostly part-time) enrolled in its Master's program. Several other colleges in Connecticut have concentrations in computer science: the Coast Guard Academy (20 students), the University of New Haven (35 students), Wesleyan University (25 students), Trinity College and the University of Bridgeport.

C. Future outlook (social need, social change).

There is little doubt that a technological age requires citizens who

will bring to their society humanistic values as well as technological expertise. The proposed program will provide access to both, and will ensure delivery within the state system of post-secondary education of modern concepts and skills in math and computer sciences together with traditional values and learning. Nationally, computer science is one of the fastest-growing professional careers. Within the state, numerous opportunities for employment are available in a wide variety of public and private settings. Most certainly, computer technology will, in the future, inform and assist every field of human endeavor. In order to avoid the danger voiced in New England more than a century ago by Ralph Waldo Emerson, "Things are in the saddle and they are riding mankind," the proposed program would aim to prepare state college graduates with the technical skills, humanistic values, and social awareness needed to provide human and ethical controls for man's technology, together with the communicational skills needed to articulate its values and shape its future. The program will be accessible to the same student population which now manifests an aptitude for an interest in mathematics and computer science and will provide a rigorous discipline suited to the needs and abilities of the state college student without being, in any sense, an "elitist" program. In an age of overabundant information, graduates of this proposed new program will be better able cognitively and practically to process information and to perform other essential processes with understandings and skills acquired in working toward the bachelor's degree in Computer and Information Science. (3% of student S.A.T. Math scores for Eastern's 1977 freshman class were 600 or over (2% of 1978's freshmen), only slightly lower than the national norm (4%), and 15% scored 500 or over in 1977, 16% in 1978 (national norm 21%).

D. Student demand and citizen interest.

1. Provisions made to identify prospective students. The College's Office of Admissions and Records reports from staff experience in visits to high schools and interviews a great interest among prospective college students concerning the computer sciences as their intended area of study. Most of these students do not now come to Eastern. Of students who actually do list Eastern as one of the colleges of their choice, a recent report by the Admissions Testing Board of the College Board, (January 1979 "A.T.P. Summary Highlights of the 1977 and 1978 Freshman Class, Eastern Connecticut State College") shows that a higher percentage than the national norm listed computer science as their intended area of study at Eastern: 2% of students tested nationally in 1977 and 1978 listed computer science as their intended major; of the students whose scores were sent to Eastern in 1977, 2% chose computer science; in 1978 that number had risen to 3%, with a corresponding increase in student numbers. Of the current math majors now in senior year, 50% have indicated they would have been interested in a Computer and Information Science major if such a program had been available. Among freshmen, the percentage is even higher. Academic advisement shows that some students who have left Eastern after freshman or sophomore year did so to take advantage of computer science programs elsewhere. A few have changed majors within the institution. The Office of Academic Advisement records for July 1978 show 62 students with a declared major in Mathematics, with an additional 27 in Mathematics-Data Processing, and 3 more with a concentration in Mathematics-Secondary Education. The current ECSC catalog lists a minor in Computer Information Science

that serves mathematics majors, liberal arts non-math majors, with a separate Business Track for students in Business/Economics. These tracks are also helpful in identifying prospective students.

2. Estimated student enrollment.

<u>1979-80</u>	<u>1980-81</u>	<u>1981-82</u>	<u>1982-83</u>	<u>1983-84</u>
30	70	120	200	

1979-80 estimates are predicated on incoming freshmen preferences and a few changes of major among students currently enrolled.

Limitations will be imposed on numbers until equipment needs can be handled (plans currently in progress) and staff added. As shown in III B. 1, present staffing can accommodate the initial stages of the program.

3. Placement and/or student follow-up.

Since completion of internal planning for this program (Nov. 1977) the chairman of the Department of Mathematical Sciences has been actively engaged in exploring with area business and corporate leaders the possibility of internships and employment opportunities for students in this program. The Dean of Arts and Sciences has also contacted John Marsh, Technical Director of the new I.T.T. Communications Center in Shelton, in response to an August 1978 item in the Hartford Courant and Willimantic Chronicle citing Director Marsh's difficulty finding 75 communications engineers, computer scientists and programmers to staff the new facility. I.T.T. has expressed an interest in the proposed program and their Lab Director and Director of Software Technology have agreed to meet with department staff to arrange for student interns and to

advise concerning the program itself. In addition, Michel Guilloud, Director of the Schlumberger-Doll Research Center in Ridgefield, has informed the Dean of Arts and Sciences of SDRC's interest in hiring qualified liberal arts graduates from the program and in placing student interns; there is also a possibility of scholarships available from the Schlumberger Foundation (which stipulates the CIS major must be accompanied by a minor in English or Communications, particularly writing) and from other corporations contacted by the department chairman. The Director of Career Planning and Placement would be directly involved with the department and staff in assisting students by means of placement and follow-up procedures now in effect for existing programs at Eastern. The department already has a very active internship program for college or industrial experience in computer science or operations research making further placements in internship situations no problem. As is done now, the student will gain experience in using skills learned during the first three years of study. Supervision will be provided by both the employer and the internship coordinator.

The Director of Career Planning and Placement (ECSC) is of the opinion that this is a very marketable program; the Director of Admissions and Records (ECSC) believes it will be an effective response to prospective student needs and will prove useful in recruitment. Open hearings held by the Five Year Academic Master Plan Committee during the fall 1978 semester reveal general faculty support for the proposed program.

E. Program/Employment Articulation

1. The proposed new program in Computer Information Sciences combines two features in demand today by prospective employers: a strong foundation in general education, including improved communications skills, values clarification, and cognitive skills, together with structured development of mathematical skills in computer and information sciences. Following the lead of personnel management who urge greater diversification among liberal arts graduates and the acquisition of marketable skills, students following this proposed curriculum will be prepared to work as applied mathematicians and/or computer scientists and will be prepared as educated persons to cope with and participate in the technological world of work and leisure. Since computer and information sciences comprise a rapidly growing field that will continue to expand, graduates having the flexibility produced by the strong mathematical background and computer skills integral to this program can be expected, in the foreseeable future, to find ready employment in both public and private sectors. Of the many corporate interviews arranged by the Director of Career Planning and Placement on campus since January 1978 (three of these specifically for majors in the Department of Mathematical Sciences), the majority of personnel management emphasize the need for strong background in computer science, with fluency in Fortran and Cobol particularly necessary; however, it was also indicated that management requires flexibility among graduates in the acquisition of on-site skills through follow-up training provided by each company. For this reason, and reasons cited above, the

inclusion in this program of software engineering (manufacturer programming), systems analysis (user designed programs), logical design, and computer architecture should greatly enhance the marketability of skills acquired by students in the program and yet remain within the range of mathematical abilities of the state college undergraduate student as manifest in current enrollments.

2. Professional and technical advisory groups as appropriate.

Using as basic models the approaches suggested in the official journal of the Mathematics Association of America (American Mathematical Monthly, March 1975) and the Dartmouth College "computer literacy" programs, the proposed program in Computer and Information Science was formulated with the assistance of internal staff, members of the ECSC Department of Mathematical Sciences, in consultation with the University of Connecticut Computer Center, which assisted also in preparation of hardware proposals for equipment best suited to their IBM 360/70. The chairman of the Department of Mathematical sciences has also consulted with members of the University of Connecticut Department of Mathematics, the University of New Hampshire, California Polytechnic University (San Luis Obispo), Central Connecticut State College, and individual computer scientists from education and industry.

IV. Resource Support (Fiscal Impact)

- A. Proposed budget for the first year of operation

1. Personnel--part time staff only. With the addition of David Ferbrache to the staff in 1978 the existing staff is qualified to initiate the program. At present, the two advanced math courses required in the new program can be handled by regular mathematics staff. Two introductory level and two existing and five new advanced courses in Computer and Information Science can be staffed by four

	FY 1979-80	FY 1980-81
<u>ESTIMATED NEW EXPENDITURES</u>		
Personnel		
Full-Time Positions		
Number	0	0
Cost*	0	0
Part-Time Positions		
Number	0	0
Operating Expenses*	3,500	3,500
Equipment	60,000	60,000
Total Expenditures		
<u>Extension Fund</u>		
General Fund	63,500 .	63,500
<u>ESTIMATED NEW REVENUE</u>		
Number of Students who will Constitute Additional Enrollment	20	20
Tuition and Tuition Fees from These		
Number of Existing Students Who Will Enroll in This Program	10	10
<u>USE OF CURRENT RESOURCES</u> --If plans include the use of current faculty and resources, please explain.		

*Put an E next to cost for Extension Fund, a G for General Fund. In cases in which both are necessary, show two figures.

qualified members of the department, including the return of Professor Paul Duchow (who has been on leave 1978-79 to pursue a Master of Science in Computer Science at California Polytechnic State University). Dr. John Sharlow, Department of Education, is also qualified to teach an advanced CIS course in Operations Research. Several math courses that will be required for the computer and information Science Program are not now filled to their maximum allowable enrollment (M150, 151, 160, 161, 263, 300, 420, 350, 360). It is thus possible to accommodate some students now without an increase in faculty.

2. Library and learning resources. Since inception of the planning stages for the proposed new program, the Department of Mathematical Sciences has been purchasing library materials to augment the mathematics collection of materials in statistics, operations research, numerical analysis, probability, and real analysis. Additional technical materials in machine language, logical design, switching theory, and electronic data processing are purchaseable within the department's normal budget for the three-year projection of library acquisitions for the program. Books and library materials for specifically computer and information science were purchased in the amount of \$1,085 for the current academic year.

3. Other facilities and equipment.

- a) Equipment directly related to CIS program:

Terminals to University of Connecticut facility, attached high-speed printer card-reader.

Microprocessor and allied equipment for machine language courses.

Service contracts.

CPV time.

Laboratory equipment such as Motorola M6800 and allied equipment.

Estimated Cost: \$30-40,000

b) Related materials (for service aspects of CIS Program):

Minicomputers with video terminals able to be programmed in BASIC; possible use of floppy discs, printer, and allied equipment.

Estimated cost: \$7,500-\$10,000.

B. Estimated income/expenditures four years after initiation:

Income accruing from full time student enrollments:

	<u>1979-80</u>	<u>1980-81</u>	<u>1981-82</u>	<u>1982-83</u>
Estimated Number of Majors	15	30	50	70
Estimated Total Enrollments (including students currently enrolled in other programs or undecided liberal arts)	30	70	120	200
(Estimated Number of Graduates	0	0	5	20)

At the present time, joint consideration is being given to combined operations for administrative and academic computer use. The Department of Mathematical Sciences has submitted (Spring 1979) a grant proposal currently under consideration for the 1/2 of one percent award for New Instructional Program Development and Improvement of Existing Instructional Programs at Eastern Connecticut State College. Disposition of that project proposal and administrative decisions concerning institutional equipment updating of computer facilities will necessarily impinge upon projected cost estimates of this program. Since the proposed new program at Eastern is a liberal arts program, continued additions of hardware should not be necessary once the essential equipment has been purchased. Since the program includes strong emphasis on software engineering and systems analysis, purchase of supplies and learning materials should be absorbable, with possible grants-in-aid from other sources, corporate and private, by an augmented departmental budget.

IV. Program Evaluation

A. Performance Criteria

1. Reports of enrollment and degrees conferred.
2. Placement of graduates.
3. Alumni surveys.
4. Grants-in-aid and scholarships.
5. Interest surveys of related industries and evaluation of student interns and/or graduates employed.

B. Schedule for Evaluation:

1. June 1980: First-year progress report to Board of Trustees and Board of Higher Education.
2. October 1980: New England Association of Schools and Colleges, re-accreditation visit by team, preceded by year-long institutional self-study to examine solidity, integration, and viability of academic programs overall. (Team members will examine the new program, with possible provision for consultants in mathematics and computer science.)

In the regular course of admission to junior standing (1980 and every year thereafter), student evaluations of the program will be sought and its efficacy re-examined in the light of student progress and faculty evaluation of the program components.

VI. Equal Opportunity Statement.

This program will be operated under the provisions of approved non-discrimination plans as described in the 1978-79 undergraduate catalog of Eastern Connecticut State College (p. 18), which states that no applicant will be rejected "because of sex, race, color, religion, national origin, or handicap," and in the Eastern Connecticut State College Affirmative Action Plan updated and filed with the Commission on Human Rights and Opportunities, March 5, 1979 which states, in part,

"It is the policy of Eastern Connecticut State College to provide equal opportunity in all phases of employment based on qualification and competence without discrimination because of racial origin, color, religious belief or association, sex, age, national origin, physical disability (including, but not limited to blindness), criminal record, mental disorder, and marital status."

VII. Time Schedule

- A. 1. Institutional approval: February 1, 1978
- 2. Program plan approval by the Board of Trustees for State Colleges:
- B. Proposed date for initiating program: September, 1979
- C. Target date for conferring of first degree: June, 1982.

COMPUTER AND INFORMATION SCIENCE MAJOR

General degree requirements will conform to the basic requirements of Eastern Connecticut State College's Four-Year Curricula; a minimum of 123 semester hours required for the degree, and the general distribution requirements as listed below:

<u>General Distribution Requirements*</u>	<u>Semester Hours</u>
1. General Education Core	36
2. Health and Physical Education	3
3. Electives	38
4. Introductory Courses for Majors:	
a) Introductory Mathematics	18
b) Introductory Computer and Information Science	<u>6</u>
	101

The major in Computer and Information Science will have precisely the same distribution of requirements as the present major in mathematics. During the first two years, the only difference comes in the fourth semester when computer science majors take CIS 220.

* In addition to the General Distribution Requirements, the student must take seven credits in advanced mathematics and 15-16 credits in advanced computer and information science.

Computer and Information Science Requirements

1. Introductory Mathematics

<u>Course</u>	<u>Title</u>	<u>Sem. Hrs.</u>
Math 150, 151, 262	Calculus and Analytic Geometry	12
Math 263	Differential Equations	4
Math 170	Applied Linear Algebra	<u>2</u>
		18

2. Introductory Computer and Information Science

CIS 111	Fortran with Calculus	3
CIS 220	Intro. to Computer Organization	<u>3</u>
		6

3. Advanced Mathematics

Math 300	Set Theory and Logic	3
Math 420	Intro. to Real Analysis	<u>4</u>
		7

4. Advanced Computer and Information Science

Five courses (with advisor's consent) from among:

CIS 330	Machine Language	3
CIS 350	Numerical Analysis	3
CIS 360	Operations Research	4
CIS 370	Systems Design	3
CIS 371	Switching Theory and Logical Design	3
CIS 401	Topics in Computer Science	3
CIS 420	Programming Languages	3
CIS 430	Compiler Writing	3
CIS 460	Electronic Data Processing	3
CIS 480	Independent Study	<u>3</u>
		31

Major in Computer and Information Science, B.A.

40 semester hours

Required courses: CIS 200 Introduction to Computing
 CIS 230 Introduction to Computer Organization
 Math 160 Calculus and Analytic Geometry I
 Math 161 Calculus and Analytic Geometry II
 Math 170 Linear Algebra
 Math 262 Calculus and Analytic Geometry
 Math 263 Differential Equations

Strongly Recommended:

Math 263 Differential Equations
 Math 300 Set Theory
 Math 420 Real Analysis I

7 courses from CIS 300 and above. (may substitute two Math courses above 300 level)

Description of Computer and Information Science Courses

All courses: 3 semester hours, 3 credits

CIS 100 Computer Concepts

Introduction to computer applications in all fields, development of the five components of a computer system, binary and hexadecimal number systems, logic, flowcharting, introduction to programming methods.

CIS 110 Computer Programming--Fortran

An introductory course in computer programming for non-math majors using the Fortran language. Students will write, keypunch and debug their programs. Application will be from many fields. Not open to students who have passed CIS 111.

CIS 115 Computer Programming--Cobol

A beginning course in computer programming using the COBOL language. Flowcharting, writing programs, keypunching and running the programs on the college's computer, and debugging them. A minimum of six programs will be required. Applications will be chiefly in the area of business and data processing.

CIS 200 Introduction to computing
 Prerequisite: Knowledge of Fortran

Survey of computer systems, languages and applications. Methods of solving numeric and non-numeric problems using one or more programming languages. Organization and characteristics of computers. Data representation; basic programming, program structure, logic flow charting, testing and verification of programs.

CIS 230 Introduction to Computer Organization
 Prerequisite: CIS 200

Organization and data-handling capabilities of digital computers. Machine representation of information. Basic logic elements and use of Boolean Algebra.

- CIS 201 Computer Programming II--Fortran
Prerequisite: CIS 111. Offered on independent study basis
- A continuation of CIS 111. The complete utilization of the FORTRAN language will be employed for the solution of problems. A term project is required.
- CIS 202 Computer Programming II--Cobol
Prerequisite: CIS 115. Offered on independent study basis.
- A continuation of CIS 115. More applications from the field of business. A term project is required.
- CIS 215 Advanced Programming Concepts
Prerequisite: CIS 200
- Programming in a current high-level language (e.g. PL/1).
- CIS 330 Machine Language
Prerequisite: CIS 230
- CIS 350 (Same as Math 350) Numerical Analysis
Prerequisite: CIS 110 or consent of instructor
- Computer solution of problems of interpolation, approximation, numerical integration, polynomial equations and systems of linear equations.
- CIS 360 (Same as Math 360) Operations Research
Prerequisite: Math 170, 331, and CIS 110
- Mathematical models, linear programming, queueing theory, network theory, game theory, and other topics as time permits.
- CIS 370 Systems Design. Fundamentals of Digital Computer Systems
Prerequisite: CIS 230
- An introduction to the analysis and design of digital systems in terms of logical and sequential networks.
- CIS 371 Switching Theory and Logical Design
Prerequisite: CIS 370
- A continuation of CIS 370 with emphasis on optimization techniques in both combinatorial and sequential networks.
- CIS 420 Programming Languages
Prerequisite: CIS 230
- Introduction to the basic structure of an algorithmic language. The basic aspects of languages and grammar; systems programming concepts will be discussed.

CIS 430 Compiler Writing
Prerequisite: CIS 230

Current techniques in compiler writing.

CIS 460 Electronic Data Processing
Prerequisite: CIS 360

Students will write data processing programs for actual business or government problems.

CIS 480 Independent Study
Prerequisite: Consent of instructor

CIS 490 Computer Internship
Prerequisite: Thorough knowledge of at least one programming language, and permission of department.

On the job training. The student will work 16 to 20 hours per week for one semester or one summer, in the computer section of some private industry.

This proposal entails institution of 9 new courses, most of which can not be handled by the present staff. Requirements for institution of this major include:

1. Two new full-time qualified information scientists on teaching staff.
2. A tie-in with the UConn computer consisting of at least:
 - a. A batch terminal hook-up
 - b. six interactive terminals
 - c. one plotting system
 - d. at least six more key punches