

MEMO

Glassboro State College

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To All Concerned

Re Curriculum Additions and Changes

Date August 3, 1977

From Lawson J. Brown

The Concentration in Computer Science has been approved by the Curriculum Committee, the appropriate Dean and the President. The structure and organization of the Concentration is as follows:

18 - 21 Credits

Required Courses: (the first is a prerequisite for all the others)

0701.102	Intro to Computer Science	3 S.H.
0704.204	Computers and Programming	3 S.H.
0704.315	Programming Languages	3 S.H.
0704.322	Computer Data Structures & Algorithms	3 S.H.
0799.300	Computer Field Experiences	3-6 S.H.

Also, one of the following must be selected:

1701.322	Numerical Analysis	3 S.H.
1701.210	Linear Algebra	3 S.H.
1702.360	Intro to Prob. and Stat. I	3 S.H.
1702.100	Elementary Statistics I	3 S.H.

The Concentration is approved for implementation Fall, 1977.

LJB/bos

cc: Deans
Registrar
Departments
Community Relations
Faculty Senate

Transitions for Jersey

Department of Education

1. Identify the following:

a. The purpose of the program

b. The target population

c. The program's objectives

d. The program's structure

e. The program's evaluation

f. The program's funding

g. The program's staff

h. The program's resources

i. The program's risks

j. The program's sustainability

k. The program's impact

2. Describe the following:

a. The program's goals

b. The program's outcomes

c. The program's activities

d. The program's products

e. The program's processes

f. The program's systems

g. The program's policies

h. The program's procedures

i. The program's protocols

j. The program's standards

k. The program's practices

l. The program's methods

m. The program's techniques

Even for those not electing it, the existence of the concentration will have some impact. Prospective teachers, for example, will enter their careers more aware of the relevance and importance of mathematics as a practical subject.

D. Program Objectives:

1. To guide math majors, interested in non-teaching careers, into those courses which will adequately prepare them for such careers.
2. To increase the student's ability to apply various fields of mathematics in the analysis and evaluation of contemporary problems in the physical, biological and social sciences.
3. To stimulate students to acquire more mathematical maturity and to appreciate the relevant and dynamic character of modern mathematics and its uses.
4. To inform prospective students of a very important direction their mathematics education could take at Glassboro State College.

E. Structure and Organization

This concentration is designed to fit into the Arts and Science Degree Model for Mathematics Majors.

1. Applied Mathematics Concentration

1701.130	Calculus I	4 s.h.
1701.131	Calculus II	4 s.h.
1701.230	Calculus III	4 s.h.
1701.330	Intermediate Analysis	3 s.h.
1701.340	Modern Algebra I	3 s.h.
1701.210	Linear Algebra	3 s.h.
0701.102	Intro. to Computer Science	3 s.h.
1702.360	Prob. and Statistics I	3 s.h.
1701.353	Differential Equations	3 s.h.
1701.332	Numerical Analysis	3 s.h.
✓ 1703.400	Applications of Mathematics	3 s.h.

and at least one of the following:

1701.430	Complex Analysis	3 s.h.
✓ 1702.361	Prob. and Statistics II	3 s.h.
1902.315	Analytical Mechanics	3 s.h.
1902.425	Mathematical Physics	3 s.h.

2. General Education under the Arts & Science Model:

Students interested in the applied Math Concentration will be already advised that in fulfilling the 39 hours of Fundamental Studies, they should not overload courses in

GLASSBORO STATE COLLEGE
Glassboro, New Jersey

Department of Mathematics

I. Identification of the Proposal

- A. Title: Concentration in Computer Science
- B. Sponsor: Jack Cimprich, Department of Mathematics
- C. Administrative Responsibility: Dr. John Sooy, Chairman, Mathematics

II. Essence of the Concentration

- A. Type of Concentration: This concentration is primarily instructional.
- B. Scope and Size of Concentration: It is estimated that approximately twenty-five students each year will avail themselves of this concentration (with approximately ten graduating in 1978 and going up to twenty-five by 1981).
- C. Curricular Pattern: This concentration will be supervised by the Department of Mathematics and is designed to be incorporated into the College's recognition of various undergraduate concentrations.
- D. Degree Awarded: No special degree is awarded; however, completion of the concentration should be noted on the graduate's transcript.
- E. Basic Need for the Concentration: Computer science deals with the data structures, problem-solving techniques, programming languages, and architecture associated with modern computers. There is an increasing demand for computer usage in all areas of our society and, consequently, an ever-increasing need for people to work in computer-related positions. The number of our graduates who find employment as computer professionals has been increasing. This is particularly dramatic when compared with the worsening job market for teachers and other occupations. This need is emphasized by a recent survey of the Mathematics Department's graduates which shows that 75% would have taken more computer courses had they been offered and that 25% of recent Math Department graduates have found computer-related employment.

It should be noted that the computer science concentration would require no additional courses since all the necessary courses are official courses that are presently being taught (cf. Appendix B for course descriptions). In fact, There are presently fifteen to twenty students in each of the advanced courses required by the concentration which is significant considering that these courses are not required by any other program.

- F. Eligibility: Any student may take this concentration.

III. Details of the Concentration

A. Concentration Goals:

1. To enhance the student's occupational profile by equipping him or her with highly marketable skills.
2. To increase the student's ability to use the computer as a tool in other disciplines.
3. To increase the level of computer literacy of our students in keeping with the increasing importance of computers in our society.
4. To enable a student to obtain a job in computer operations, programming or systems work.

B. Concentration Objectives: Upon completion of the Computer Science Concentration, a student should be able to:

1. Determine the feasibility of computerizing a specific application,
2. for a given job, design an algorithm in flowchart form consisting of computer executable operations and the proper ordering among them,
3. choose the best programming language and data structures to use for a desired task to be put on a computer,
4. construct, test, debug, and document a computer program in either a high-level language (e.g. FORTRAN, COBOL, APL) or in an assembly or machine language,
5. interface a program with the operating system software of a typical large-scale computer using the appropriate job control language statements,
6. function equally well in either a batch or time-sharing environment,
7. evaluate the efficiency of a particular programming procedure compared with other alternatives,
8. encounter a new computer system and master its differences in a reasonably short amount of time,
9. command a sufficient vocabulary to communicate with others in the computer field.

C. Structure and Organization: (18-21 credits)

Required Courses: (the first is a prerequisite for all the others)

0701.102	Intro to Computer Science	3 S.H.
0704.204	Computers and Programming	3 S.H.
0704.315	Programming Languages	3 S.H.
0704.322	Computer Data Structures and Algorithms	3 S.H.
0799.300	Computer Field Experiences	3-6 S.H.

Also, one of the following must be selected:

1701.332	Numerical Analysis	3 S.H.
1701.210	Linear Algebra	3 S.H.
1702.360	Intro to Prob. and Stat. I	3 S.H.
1702.100	Elementary Statistics I	3 S.H.

Note: Students interested in the Computer Science Concentration will be strongly advised that in fulfilling their fundamental studies, they should include courses in physics, statistics, economics, and other fields where computers play an important role.

It should also be noted that the Computer Field Experiences course will be the final computer course taken by the student and, as such, and because of the nature of the course will permit a unification of all the topics studied by the student. This integration occurs under faculty supervision and interaction while the student holds employment in the field.

- C. Concentration Administration: This Concentration will be administered by the Mathematics Department.
- D. Resource Utilization: Many department members have excellent qualifications to participate in this concentration; and the computer facilities, library and institutional resources are quite adequate.
- E. Program Impact: An immediate impact will be that students presently taking the courses listed above will be able to receive recognition for their effort by having this entered on their transcript.

Also, since so many disciplines make use of computers today, a student electing this concentration will be more valuable in his major field.

In general, fulfilling the requirements for a teaching certificate may make it difficult for those students to find time for this concentration. However, because of the growing demand for teachers with some knowledge of the applications of computers, it is anticipated that many students obtaining certification will take some part of the concentration.

- F. Implementation: As soon as the concentration is approved.
- G. Evaluation: The type of employment a graduate obtains after electing the Computer Concentration will be surveyed and evaluated on a continuing basis.

IV. Consultation:

1. The Mathematics Department Curriculum Committee.
2. The report "Curriculum 68 - Recommendations for Academic Programs in Computer Science", Comm. of the ACM, March 1968.
3. "A Computer Science Course Program for Small Colleges", Comm. of the ACM, March 1973.
4. "Data Processing and Computer Science Graduates", SIGSCE Bulletin, February 1975.
5. "the Computing Profession and the Curriculum", Proceedings of Second Annual N.J. Conference on Use of Computers in Higher Education, 1975.
6. Catalog descriptions of eleven N.J. Colleges.
7. Recent Math Department survey of 300 graduates to determine interest and need of computer offerings.

APPENDIX A

Catalog Description of Courses offered at Kean College (those marked with an asterisk are very similar to courses in this proposal)

Similar to our Course numbered:

Computer Science Course Offerings

Comp. Sci. 1931 Computer Arithmetic Algorithms (3) Staff
Historical development of computers, components of electronic data processing equipment, flow charting, programming, keypunching, and verifying arithmetic algorithms for electronic digital processing, debugging and analysis of results related to processed algorithms. This course is designed specifically for non-mathematics majors. Laboratory facilities allow for a maximum of 25 students per section.

Comp. Sci. 1932 Principles and Procedures of Electronic Data Processing (3) Arnow, Deavours
Fundamental principles and procedures of electronic data processing include: historical development of electronic machines, punched-card data processing, machine language coding, systems analysis and procedure, flow charts, utilization of coded-data representation for arithmetic and control units, and programming scientific and sequential information for various kinds of electronic machines.
Prerequisite: Comp. Sci. 1931 or 3993.

Comp. Sci. 3900 Digital Computer Circuit Principles (4) Jahn, Silano
The theory and application of switching circuits, electronic devices as logic elements, and the arrangement of these elements in digital computer systems.
Prerequisite: Phys. 3393, I.E. 3503 or permission of the instructor.

1701.332

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Math. 3941 Numerical Analysis (3) Garb
Basic operations of numerical computation related to aspects of elementary mathematical operations, approximation and exact data, interpolation, error analysis, recursion formulas, sequences and series, quadrature, linear and non-linear equations, numerical differentiation, and ordinary differential equations. The impact of computers, both electronic and manual, from the standpoint of efficiency, accuracy, and suitability to processing problems for solution sets.
Prerequisite or corequisite: Math. 3451. Comp. Sci. 3993 recommended.

Math. 3942 Numerical Calculus (3) Garti, Giegerich
Developing computer algorithms for the solution to numerical calculations, error analysis, polynomial approximations, composite integration formulas, quadrature, Newton's Method, Bisection method, linear system of equations, solution of non-linear equations, and numerical solution of ordinary differential equations. Computational aspect of problems processed via the computer applying an adaptable machine -- oriented language.
Prerequisite: Math. 3941 and Comp. Sci. 3993. May be taken with Comp. Sci. 3994. Math 2275 and 3215 recommended.

0701.102

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Comp. Sci. 3993 Computer Programming I (3) Staff
Concepts of functions and algorithms in writing and key-punching programs processed on an electronic digital computer. Flow-charting, single loop and nested loop processes; arithmetic processed, fixed-point, and floating-point arithmetic and non-numeric values, iteration and approximations; and non-numeric repetitive processes as applied to numerous types of elementary mathematical problems.
Prerequisite or corequisite: Math. 3941.

Comp. Sci. 3994 Computer Programming II (3) Staff
Double precision, complex, and logical values, predefined and written subroutines, n-dimensional arrays, subprograms, numeric, logical alphanumeric, literal and blank data, mixed mode, indexing, and optimized programs utilized in more intricate mathematical problems.
Prerequisite: Comp. Sci. 3993.

APPENDIX A - continued

Catalog Description of Courses Offered at Kean College - continued.
(Those marked with an asterisk are very similar to courses in this proposal.)

Similar to our
Course numbered:

Comp. Sci. 4900 Elements of Systems Programming (3) Garb
Computer structure, machine languages, specifications of registers, instruction codes, structure of assemblers, symbol tables for structures and techniques, macro operators, data-flow circuits, input/output control, and selected applications.
Prerequisites: Comp. Sci. 3994 and 4995 recommended.

* **Comp. Sci. 4910 Computer Programming Languages (3)** Garb 0704.315
A study of characteristics of programming languages and classifications: machine, procedure-oriented, numerical, scientific, business data processing, string and list grammars, multipurpose, control and basic compiler methods.
Prerequisite: Comp. Sci. 4995.

Comp. Sci. 4920 Compiler Construction (3) Santamauro
Techniques in analysis of a source language and the generation of an object code, construction aspects of a compiler, as well as programming applications to compiler design.
Prerequisite: Comp. Sci. 4900 or 4995 or permission of the instructor.

Comp. Sci. 4930 Data Communication Systems (3) Staff
A survey of machines and devices utilized to communicate with and retrieve information from a computer.
Prerequisite: Comp. Sci. 3994.

* **Comp. Sci. 4940 Data Structures (3)** Garb 0704.322
Representation of information as inside and outside data to a computer, stacks, lists and strings, storage of arrays and orthogonal lists, tree structures, storage systems and allocations, sorting, symbol tables, searching and applications that illustrate computer storage of information utilized in solving problems.
Prerequisites: Comp. Sci. 3994 and 4995; Math. 4800 and Comp. Sci. 4900 recommended.

Comp. Sci. 4950 Computer Operating Systems (3) Staff
An introduction to basic computer elements and logic design techniques employed in computer systems organization.
Prerequisite: Comp. Sci. 3994 and 4995.

Comp. Sci. 4960 Large-Scale Information Processing Systems (3) Staff
Computers, data communication systems and networks utilized in establishing a large information processing system. Computer centers, information retrieval, real-time and time-sharing. Objectives of systems and their design, the establishment of programs and procedures and the testing and operation of all components in the integrated systems.
Prerequisites: Comp. Sci. 4930 and 4950 or permission of instructor.

Comp. Sci. 4965 Problem Analysis and Solutions (3) Staff
Identification and analysis of scientific, business and/or research oriented problems. Sequential organization of computer oriented algorithms for efficient procedures involving minimization of computer time.
Prerequisite: Comp. Sci. 3994.

Comp. Sci. 4980 Special Topics in Computer Science (3) Staff
Research study of areas in computer science influenced by contemporary developments as well as interests and needs of students majoring in computer science. A maximum of nine semester hours may be taken in this area towards major electives.
Prerequisite: Permission of instructor.

* **Comp. Sci. 4995 Computer Assembler Language (3)** Garb 0704.204
Basic principles of an assembler language for the computer comprise: input/output instructions, the object program, arithmetic, machine language format, effective address, instruction statements, indexing, subroutines and disk storage techniques.
Prerequisite or corequisite: Comp. Sci. 3994.

APPENDIX B

Catalog Descriptions of Required Courses in this Proposal:

0700 COMPUTER & INFORMATION SERVICES

0701 Computer and Information Services, General

0701.102

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Introduction to Computer Science

This course is designed to acquaint the student with the logical structure of a computer, the algorithmic formulation of problems, and the FORTRAN programming language and to provide actual experience in using a computer for solving mathematical problems.

0704 Computer Programming

0704.204

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Computers and Programming

(Prerequisite: 0701.102)

This course is a continuation of the study of digital computers and programming begun in Introduction to Computer Science. The topics include computer structure, machine language, addressing techniques, and the elements of assembly language programming (e.g. IBM 370-BAL). The student is expected to successfully run five assembly language programs on the computer.

0704.315

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Programming Languages

(Prerequisite: 0704.204)

Students survey a variety of computer programming languages oriented toward different application areas and an exploration of the basic principles underlying the corresponding language processors. Languages covered include FORTRAN, COBOL, APL,

PL/1, BASIC, and LISP. The student will be required to run one or two programs in each of the languages covered.

0704.322

Computer Data Structures and Algorithms

(Prerequisites: 0701.102)

This is a continuation of Introduction to Computer Science requiring FORTRAN programs of more realistic complexity. Topics include data structures (strings, lists, graphs, stacks, trees) and methods (algorithms) of manipulating data (storage allocation, searching, sorting, and up-dating).

0799.300

3-6 S.H.

Computer Field Experience

(Prerequisites: 0704.0204, 0704.315, and permission of instructor)

Students will investigate off-campus computer centers in industry to study programming, operations, and systems. Reports will be required and experiences shared during on-campus seminars. Students must obtain the computer field experience supervisor's approval before signing up.

0823.362 - PRACTICUM FOR PARAPROFESSIONALS AND AIDES

Catelog Description

This course is designed for students employed as paraprofessionals/aides in preschool programs or those who wish to prepare for these positions. Emphasis is placed on beginning study of the preschool child and typical behavior at various stages of development. Students are helped to relate classroom practices and curriculum contents to the needs of children. The role and need for short-term and long-term planning is also explored.

0823.363 - ADVANCED PRACTICUM FOR PARAPROFESSIONALS AND AIDES

Catelog Description

This course extends knowledges and skills developed in 0823.362, Practicum for Paraprofessionals and Aides, (which is a prerequisite course). Increased emphasis is placed on classroom management skills, including a focus on the paraprofessionals/aides' role in the classroom and early childhood center. An overview of all segments of the curriculum is included, emphasizing the role of play and creative experiences in promoting the learning and development of the young child.

0023.362 - PRACTICUM FOR PARAPROFESSIONALS AND AIDES

Catalog Description:

This course is designed for students employed as paraprofessionals/aides in preschool programs or those who wish to prepare for these positions. Emphasis is placed on beginning study of the preschool child and typical behavior at various stages of development. Students are helped to relate classroom practices and curriculum contents to the needs of children. The role and need for short-term and long-term planning is also explored.

0023.363 - ADVANCED PRACTICUM FOR PARAPROFESSIONALS AND AIDES

Catalog Description:

This course extends knowledge and skills developed in 0023.362, Practicum for Paraprofessionals and Aides, (which is a prerequisite course). Increased emphasis is placed on classroom management skills, including a focus on the paraprofessional/aide's role in the classroom and early childhood center. An overview of all segments of the curriculum is included, emphasizing the role of play and creative experiences in promoting the learning and development of the young child.

8. Catalogue Description:

1701.100

Elementary Algebra

A basic course in mathematics which includes a study of introductory algebra through equations of one and two variables. This course is appropriate for those students whose mathematical background is not sufficiently strong for them to enter INTERMEDIATE ALGEBRA. (Not Credit for Graduation)

Catalog Description:

0705.542 (Suggested Hegis number)

Computer Science III -- Structured Design and Programming Using COBOL

This course prepares the student for proficiency in the COBOL programming language. The contents include: Structured and modular programming, top-down design, documentation such as hierarchy charts, and flow diagrams, table handling, and report preparation. Four or five projects will be developed completely by the student using Hollerith cards and an online editor.

∴ Catalog Description

0833.201* Computer Science for Teachers

This course will survey the history of computers, how they work, and the range of present applications. The course also will explore the economic, psychological and social significance of computers in education. Students will study the types of computer-related learning which are in use or under development. Software, hardware and multi-media systems will be demonstrated, analyzed and used by the students. While the course is designed primarily for elementary and middle school teachers, secondary teachers may enroll also.

* Recommended HEGIS number

Catalog Description:

0704.334*

Advanced Structured Design and Programming using COBOL

(Prerequisites: 0701.102 and 0704.333)

This course prepares the student for professional proficiency in the COBOL programming language. The contents include: Structured and modular programming, top-down design, documentation such as hierarchy charts and flow diagrams, programming standards, table handling, sorting, searching, report preparation, character manipulation, sequential files, ISAM files, the transaction-master update problem, and report preparation. If there is time, program linkage will be included. Three or four projects will be developed completely by the student using both Hollerith cards and an online editor.

*Suggested Hegis number

6. CATALOG DESCRIPTION:

INSTRUCTIONAL APPLICATIONS OF WORD
PROCESSING & DATA MANAGEMENT

3 S.H. 0833.525

Prerequisites: Instructional Applications of Computers I
and II or equivalent experience.

Word processing, data base management, and spreadsheet operations are combined into an integrated system suitable for educational applications. Students prepare sample student or personnel information, and enter it into a microcomputer system for subsequent handling. Applications include text preparation, maintenance of information files, and data manipulation including projection simulations. Current applications software will be used, discussed, and evaluated.

VE. Course Description.

9701.180# Computer Literacy

3 cr. or 4.5 C.E.U.

Students taking the course will survey the history of computers, how they work, and the range of present applications. Students also will explore the economic, psychological and social significance of computers and study types of computer-related learning in use or under development. Software and hardware will be demonstrated, analyzed and used by the students. The BASIC language will be introduced and used for simple programs. (Designed for those with no prior computer experience.)

* Recommended NCEES number

6. CATALOG DESCRIPTION

COMPUTERS AND THE CURRICULUM

3 S.H. 0833.510

Prerequisites: Instructional Applications of Computers

This course consists of four major components: The philosophical and psychological foundation for software selection and design; procedures for the selection and development of educational software in the content areas; implementation and adaptation of educational software; and evaluation of instructional software.

6. CATALOG DESCRIPTION

INSTRUCTIONAL COMPUTER LANGUAGES: PASCAL AND LOGO 3 S.H. 0833.521

Prerequisites: Computer Science I, Introduction to Com-
puter Science, or equivalent experience

This course covers structured programming languages appropriate for teaching students at the pre-college level. It also prepares teachers to teach those languages to students in elementary and secondary schools.

6. CATALOG DESCRIPTION

INSTRUCTIONAL APPLICATIONS OF COMPUTERS: I and II 0833.504
(1.5 S.H. per quarter course or module) 3 S.H. 0833.505

Prerequisites: None

The first half of the course surveys current topics and issues in computer science education, particularly as it applies to the K-12 levels. This includes educational, societal, and administrative implications and the history of computers and computing. Second half of the course includes using computers and software in the classroom, hands-on training, and elements of programming in BASIC.

6. CATALOG DESCRIPTION

SEMINAR IN EDUCATIONAL COMPUTING 0827.548 3 S.H.

Prerequisites: Completion of all other course requirements for the Post Baccalaureate Certificate in computers in Education or permission of the program advisor

Students shall review the issues, research, and the state of the art in educational computing. They will develop and carry out an in-depth research project and prepare a written report on it. Projects are to be selected from the areas of curriculum evaluation and development, computer assisted instruction or administrative applications.

6. CATALOG DESCRIPTION

Advanced BASIC 0704.551 3 S.H.

Prerequisites: Computer Science I, Introduction to
 Computer Science or equivalent
 experience.

Beginning with a brief review of elementary BASIC, the course covers functions, structured programming and subroutines, files, graphics, matrix operations, system and library functions, disk operating systems, machine-language extensions, and applications.

6. CATALOG DESCRIPTION

COMPUTER ASSISTED INSTRUCTION

3 S.H. 0833.530

Prerequisites: Instructional Applications of Computers
I and II or equivalent experience.

Following a brief review of instructional applications of computers, this course will permit practicing teachers to experience ways in which the computer can be used in an instructional setting. Students will use microcomputers to develop their own computer assisted instruction (CAI) units for classroom use. Included will be skills for additional applications, such as testing, scoring, and class record keeping.

6. CATALOG DESCRIPTION

USE OF DATA BASE SYSTEMS IN EDUCATION

3 S.H.

0833.528

Prerequisites: Instructional Applications of Computers
I and II

Students study Data Base Management Systems applied to education and learn to apply a typical system and to solve typical educational business management information problems. Students learn how to produce reports, provide efficient input data to computer programs and provide responses to educational needs.