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PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

Cover Page

FOR CONSIDERATION BY NSF ORGANIZATIONAL UNIT (Indicate the most specific unit known, i.e. program, division, etc.)		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> ; IF YES, LIST ACRONYM(S):	
College Science Instrumentation Program			
PROGRAM ANNOUNCEMENT/SOLICITATION NO.: NSF 84-66		CLOSING DATE (IF ANY): January 11, 1985	
NAME OF SUBMITTING ORGANIZATION TO WHICH AWARD SHOULD BE MADE (INCLUDE BRANCH/CAMPUS/OTHER COMPONENTS)			
Hope College			
ADDRESS OF ORGANIZATION (INCLUDE ZIP CODE)			
Holland, MI 49423			
TITLE OF PROPOSED PROJECT			
Microcomputer Network for Introductory Computing and Statistics			
REQUESTED AMOUNT (a)	NON-NSF CONTRIBUTION (b)	TOTAL PROJECT COSTS (a + b)	
\$44,145	\$44,146	\$88,291	
PI/PD DEPARTMENT	PI/PD ORGANIZATION	PI/PD PHONE NO.	
Computer Science	Hope College	(616) 392-5111	
PI/PD NAME	SOCIAL SECURITY NO.*	SIGNATURE	MALE* FEMALE*
Herbert L. Dershem	271-40-3660	<i>Herbert L. Dershem</i>	X
FOR RENEWAL OR CONTINUING AWARD REQUEST, LIST PREVIOUS AWARD NO.: N/A			
SUBMITTING ORGANIZATION IS: <input type="checkbox"/> For-Profit Organization; <input type="checkbox"/> Small Business; <input type="checkbox"/> Minority Business; <input type="checkbox"/> Women-Owned Business; (See cover page instructions, Page 3, GSER)			
*Submission of social security numbers is voluntary and will not affect the organization's eligibility for an award. However, they are an integral part of the NSF information system and assist in processing the proposal. SSN solicited under NSF Act of 1950, as amended.			
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW:			
<input type="checkbox"/> Animal Welfare	<input type="checkbox"/> Human Subjects	<input type="checkbox"/> National Environmental Policy Act	
<input type="checkbox"/> Endangered Species	<input type="checkbox"/> Marine Mammal Protection	<input type="checkbox"/> Research Involving Recombinant DNA Molecules	
<input type="checkbox"/> Historical Sites	<input type="checkbox"/> Pollution Control	<input type="checkbox"/> Proprietary and Privileged Information	
PRINCIPAL INVESTIGATOR/ PROJECT DIRECTOR	AUTHORIZED ORGANIZATIONAL REP.	OTHER ENDORSEMENT (optional)	
NAME	NAME	NAME	
Herbert L. Dershem	Irwin J. Brink		
SIGNATURE	SIGNATURE	SIGNATURE	
<i>Herbert L. Dershem</i>	<i>Irwin J. Brink</i>		
TITLE	TITLE	TITLE	
Professor	Dean for the Natural Sciences		
DATE	TELEPHONE NO.	DATE	TELEPHONE NO.
1-4-85	Area Code: 616 392-5111	1/4/85	Area Code: 616 392-5111

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Detailed Budget

b. Computing Equipment

<u>Description</u>	<u>Qty</u>	<u>Unit Cost</u>	<u>Total Cost</u>
IBM PC Workstation IBM PC, 320K RAM, Single Disk Drive Color monitor and adapter, MS-DOS 2.1 Network cable, adapter, and software	15	\$4,109	\$61,635
Software packages Framework (\$695), LOGO (\$175)	15	\$ 870	\$13,050
Network Driver IBM PC/AT, 512K RAM, 1.2Mbyte floppy 40Mbyte hard disk, Color monitor Serial/Parallel adapter, color adapter MS-DOS 3.1	1	\$8,739	\$ 8,739
Dataproducts Printer	1	\$2,240	\$ 2,240
IBM Wheel Printer	1	\$1,895	\$ 1,895
Network Accessories 1 Translator Unit, 1 Base Expander 2 PC Network Short Distance Kits	1	\$ 732	\$ 732
Total Cost			\$88,291
Funds Requested from National Science Foundation			\$44,145
Funds Provided by Hope College			\$44,146

NATIONAL SCIENCE FOUNDATION

Project Summary Form

1. NAME OF INSTITUTION <div style="text-align: center; font-size: 1.2em;">Hope College</div>	2. ADDRESS OF INSTITUTION (INCLUDE BRANCH/CAMPUS & COMPONENT) <div style="text-align: center; font-size: 1.2em;">Holland, MI 49423</div>
3. PRINCIPAL INVESTIGATOR <div style="text-align: center; font-size: 1.2em;">Herbert L. Dershem</div>	4. MAJOR DISCIPLINE CODE <div style="text-align: center; font-size: 1.2em;">CS</div>
	5. FIELD OF SCIENCE AND ENGINEERING CODE(S) <div style="text-align: center; font-size: 1.2em;">TA, MH21</div>
6. THIS PROJECT IS PRINCIPALLY AIMED AT STUDENTS EXPECTED TO PURSUE CAREERS: <input type="checkbox"/> A. AS SCIENTISTS/ENGINEERS <input type="checkbox"/> B. AS PRE-COLLEGE SCIENCE TEACHERS <input checked="" type="checkbox"/> C. IN FIELDS NOT DIRECTLY SCIENCE RELATED	
7. HIGHEST DEGREE OFFERED IN SCIENCE/ENGINEERING BY ANY DEPARTMENT ON THE CAMPUS SUBMITTING THIS PROPOSAL. CHECK ONE: ASSOCIATE <input type="checkbox"/> BACCALAUREATE <input checked="" type="checkbox"/> MASTER <input type="checkbox"/> DOCTOR <input type="checkbox"/> OTHER, SPECIFY _____	
8. TYPE OF INSTITUTION <input type="checkbox"/> PUBLIC <input checked="" type="checkbox"/> PRIVATE <input type="checkbox"/> CONSORTIUM	
9. TITLE OF PROJECT <div style="text-align: center; font-size: 1.2em;">Microcomputer Network for Introductory Computing and Statistics</div>	
10. SUMMARY OF PROPOSED WORK <div style="text-align: justify;"> <p>The objective of this project is to use a network of microcomputers to enable all Hope College students to become effective users of computers and statistics. Fifteen microcomputers will be networked together to give students experience with personal computers while permitting the sharing of disk and printer resources. Through the use of this laboratory, students will learn to apply important computer tools such as spreadsheets, databases, word processing, graphics, and programming languages in their future academic and professional careers. Students in statistics classes at Hope will use the laboratory to obtain experience in the analysis of data and enhance their understanding of statistics through the use of computer graphics.</p> </div>	

- 11. INSTITUTION'S OPENING FTE UNDERGRADUATE FALL ENROLLMENT AS REPORTED IN FALL ENROLLMENT IN HIGHER EDUCATION 1982 NATIONAL CENTER FOR EDUCATION STATISTICS, NCES#84-305** 2337.9
- 12. NUMBER OF STUDENTS TO BE AFFECTED BY THE PROJECT OVER A 5-YEAR PERIOD** 2500
- 13. FROM 12, ESTIMATE THE NUMBER:**
- A. TO TERMINATE SCIENTIFIC STUDIES WITH THE ASSOCIATE DEGREE 0
- B. TO TERMINATE SCIENTIFIC STUDIES WITH THE BACCALAUREATE DEGREE 2300
- C. TO CONTINUE SCIENTIFIC STUDIES BEYOND THE BACCALAUREATE DEGREE 200
- D. TO ENTER SCIENCE TEACHING CAREERS AT THE JUNIOR 40 OR SENIOR 80 HIGH SCHOOL LEVEL.
- 14. CHECK APPROPRIATE BOX(ES) BELOW IF THE PROJECT EMPHASIZES THE LOWERING OF BARRIERS TO SCIENCE CAREERS FOR:**
- ☐ WOMEN
 ☐ MINORITIES
 ☐ PHYSICALLY HANDICAPPED.

Narrative

A. The Present Situation

Description of Hope College

Hope College was established in 1866 as an institution affiliated with the Reformed Church in America. It is a four-year, liberal arts college which presently has 2,500 students and 146 full-time faculty. All students are required to complete a comprehensive, broad-based core curriculum and a concentrated study in one of 36 major areas, leading to the Bachelor of Arts, the Bachelor of Science, the Bachelor of Science in Nursing, or the Bachelor of Music degree.

Description of the Computer Science Department

The Computer Science Department at Hope College was formed in 1974 as an interdisciplinary department. Since that time, enrollment in the department has increased at an annual rate of 20%. The department has graduated 117 majors and has served as a model for the formation of Computer Science Departments in liberal arts colleges across the country. Presently, over 75% of all Hope College students take at least one course in Computer Science and 27 majors will graduate in 1985.

The department offers three majors, the Bachelor of Arts, the Bachelor of Science, and the Bachelor of Arts with secondary education certification (state approval pending). The Computer Science curriculum has been designed to provide students with the opportunity to pursue any of four directions, namely, business data processing, scientific computing, systems programming, and computer hardware engineering.

The faculty in Computer Science consists of four full-time persons. Each of these persons has been active in computing, and together provide excellent coverage of the various aspects of this field. In addition to teaching the 17 courses in the regular curriculum, the faculty has, in the past 5 years, offered 9 special topics courses, directed 84 students in independent study and research projects, published 6 scholarly papers and consulted with 41 businesses, industries, and institutions.

Description of the Mathematics Department

The Mathematics Department has long been an integral part of Hope College. The Department's role is three fold:

(a) To provide courses for students in pure and/or applied mathematics so that they are able to teach, go on to graduate school, or obtain employment in a mathematically based vocation.

(b) To provide training in mathematics as a service to students majoring in chemistry, physics, computer science, economics, psychology, etc.

(c) To provide a course in mathematics for a student in the humanities as a part of their liberal arts training.

Each semester approximately 750 students take a course in mathematics. Each year there are around 18 students who graduate with a major in mathematics. These students earn either a Bachelor of Arts degree, a Bachelor of Science degree, or a Bachelor of Arts with secondary education certification degree.

The faculty in Mathematics consists of 9 full-time equivalent members. The Department has a reputation on campus for excellent teaching. Members of the department have presented scholarly papers at state, national, and international conferences. Students have presented papers at state meetings of the Mathematical Association of America and national meetings of Pi Mu Epsilon, a national mathematics honorary fraternity. Two members of the department have published textbooks, one in statistics and the other in differential equations. Campus

Computer Facilities

The main campus computer facility consists of three Digital Equipment VAX 11/750 computer systems. One of these is devoted to administrative applications while the other two are solely used for academic work. Each of these VAXes has 32 communications ports available. There are approximately 95 public access student terminals of VT-100 type provided on campus. In total, there are over 200 terminals used on campus including those in offices and laboratories.

The campus microcomputer laboratory consists of 12 Radio Shack TRS-80 Model III systems with 48K of memory. Two systems have attached dot matrix printers. This laboratory also contains four Apple II+ computer systems. The proposed equipment would replace this laboratory and would be placed in the same room as the present laboratory. This room was just constructed in August, 1984 and is set up as a teaching laboratory with all systems facing the front of the room where there is a blackboard.

In addition to the above mentioned equipment, there are numerous other microcomputers in various locations on campus. Included among these are an IBM PC owned by the Mathematics Department and an IBM PC owned by the Computer Science Department.

Present Status of Introductory Computer Science

Students at Hope College can be introduced to the computer through any one of three courses in the present curriculum.

Computer Science 110 - Computer Information Systems: This course is provided for those students who wish to take only one Computer Science course and whose objective is to learn to use the computer as a tool. Enrollment is 133 in 1984-5.

Computer Science 120 - Introduction to Computer Science: This course provides an introduction to the discipline of Computer Science and programming through the use of the Pascal language. It is the first course in the Computer Science sequence, serving as a prerequisite for all later courses. Enrollment is 262 in 1984-5.

Computer Science 160 - Scientific Computer Programming: An introduction to computer programming and the use of the computer as a tool for science students. The FORTRAN language is taught in this course.

Catalog descriptions of these courses are given in the Appendix.

This proposal addresses improvements in the Computer Science 110 course that can be made with the addition of the proposed equipment. The course, as presently offered, spends about half of the time on computer terminology, software and hardware principles, and computer applications. The remainder of the course is

devoted to teaching the students the use of computer software which is of widespread applicability. Presently we teach the use of a text processor, a word processor, a spreadsheet, a database management system, an electronic mail system, and a programming language. With the currently available equipment, the students are given limited access to the appropriate software because of the limited software and resources in the present microcomputer laboratory and the competition with many other users for the use of the campus VAX systems. The present microcomputers, Radio Shack TRS-80 Model IIIs, have neither the power nor the reliability to provide adequate facilities for this course.

The Computer Science Department projects an increase in enrollment in this course in the next several years. This will result from a shift in students from Computer Science 120 to Computer Science 110. Presently, many students find Computer Science 120 too time-consuming and too programming-oriented. We project that 25% of the current enrollment in Computer Science 120 should be in Computer Science 110. In addition, there is serious discussion on campus about making the software tools part of Computer Science 110 a college requirement for all students. Presently there is no college requirement in Computer Science. With the combination of these two projections, the enrollment in Computer Science 110, or a modified version of it, could go from 133 students per year to 350 students per year.

Present Status of Course Offerings in Statistics

The Mathematics Department offers three courses in statistics.

Math 210 - Introductory Statistics is a course designed for students majoring in the social sciences and has high school algebra as a mathematics prerequisite. The enrollment is approximately 250 per year.

Math 212 - Laboratory for Introductory Statistics is a computer based laboratory for students taking Introductory Statistics. In the spring of 1984 16 students took this laboratory.

Math 310 - Statistics for Scientists is a one semester course for students majoring in computer science and the natural sciences and has a year of calculus as a prerequisite. The enrollment has been increasing each year. During 1984-85 about 70 students will take this course.

Math 361,362 - Mathematical Probability and Statistics is a year long course that is designed for students who are majoring in mathematics and science students who would like a deeper understanding of the mathematical concepts in probability and statistics. Approximately 20 students take this year long course annually.

Math 363,364 - Laboratory for Mathematical Probability and Statistics is a computer based laboratory for students who are taking Math 361,362. Usually half of the students in Math 361,362 also take the laboratory which meets for 1 1/2 hours each week.

Computers have been an integral part of our statistics curriculum since 1971. A grant from NSF in 1971 provided support for us to develop computer based laboratory materials for both Math 212 and Math 363,364. Results of that project have been presented at state, national, and international conferences and the materials that were developed are available for others to use from CONDUIT. The materials were originally written in FORTRAN and used batch processing. We then converted the computer programs so that they could be run interactively.

A grant from NSF in 1979 helped us purchase 10 TRS-80 Model I microcomputers. Hope College provided support so that we could revise our FORTRAN programs into BASIC programs that run on a microcomputer. In 1982 the college upgraded the microcomputer laboratory so that it now contains 12 TRS-80 Model III microcomputers. A new room was provided for the laboratory in the fall of 1984.

B. The Development Plan

Improvement in Introductory Computer Science

The proposed equipment and software would enable us to make a great improvement through the revision of Computer Science 110, Computer Information Systems. The proposed improvement would convert the laboratory part of the present course into a modularized course where students could select three modules that would be most useful to them. These modules would each be offered for one-third of the semester, allowing the students to complete the three modules during a single semester. The modules would be taught by faculty from many disciplines in addition to Computer Science, matching faculty with their particular expertise.

Tentative List of Modules

1. Word Processing. Fundamentals of word processing using a microcomputer-based word processing software package such as found within Framework. This is presently taught using Lazy Writer on the TRS-80s.
2. Computerized Spreadsheets. Facilities and techniques of using spreadsheet software on a microcomputer using the spreadsheet within Framework. This is presently taught using Supercomp-20 on the VAX.
3. Using a time-sharing system. Principles of files, editing and command language usage on the VAX time-sharing system. This will continue to be offered as it is now.
4. Computer Graphics. Principles of computer graphics utilizing a graphics package on the microcomputers, such as graphics facilities in Framework and those available through the BASIC programming language. This is presently not offered.
5. Database Systems. Features and techniques of creating, retrieving, and updating databases on the microcomputer through the Framework package. This is presently taught using Ingres on the VAX.

6. BASIC programming. A brief introduction to programming in BASIC on the microcomputers using a subset of the BASIC language. This is presently taught on the TRS-80s.

7. LOGO programming. This module will introduce programming in LOGO, especially for students in education. This is presently not taught.

8. Data Analysis. The principles and techniques of data analysis using the SPSS-X software package on the VAX computer. This is presently not taught in this course.

These modules will each be 5 weeks long, meeting for 2 hours per week. A student would select 3 modules based upon the needs for his or her academic area. This selection would prepare the student for the use of the corresponding software as tools in later courses in the curriculum, eliminating the need for the topics to be taught in those later courses. Further modules will be added as they become important in the future.

Some students will desire more than three of the modules. They could be accommodated by taking the desired modules beyond three during a later semester.

The proposed equipment would provide facilities which would serve about half of the Hope College student body, providing them with instruction in the use of computer software tools which are important in their areas of study. This instruction will assist them in their later coursework at Hope and in their future careers, by making them comfortable with using the computer as a tool and familiar with its application. The proposed equipment will also give these students experience on the most commonly used computer hardware, the IBM PC.

This proposal will also improve the entire Computer Science program at Hope College. The use of this microcomputer network by the students in Computer Science 110 would reduce the load on the VAXes, resulting in better service to all other academic users. In addition, the presence of the IBM PC network would make a greater number of software products available for use in the Computer Science curriculum.

Improvement in the Statistics Curriculum

There are two major drawbacks to our present microcomputer laboratory as it applies to the statistics curriculum - the poor graphics capability of the TRS-80 and its slow processing speed. In addition the reliability of these computers has not always been the best. With the purchase of the IBM PC's, we would plan to make the following changes in our curriculum.

Math 210 - Introductory Statistics: Many students in this course have had little or no exposure to the use of a computer. Currently some of the sections use software that we have written for the TRS-80 to solve contingency table and analysis of variance problems. We would like to expose all of our students in introductory statistics to the use of computers in statistical analysis and expand the number of computer applications including topics for which graphics is a valuable tool.

Math 212 - Laboratory for Introductory Statistics: More students could be served more efficiently and they should have a better experience with the proposed equipment.

Math 310 - Statistics for Scientists: A greater variety of exercises and more meaningful data sets could be stored on the master disk so that students would not have to spend time typing in the data but could concentrate on analysing and interpreting the data.

Math 361,362 - Mathematical Probability and Statistics: Mathematics students are often good at manipulating symbols but they are weak at graphical visualization. The graphics capabilities of the new computers would be used extensively to help students "see" what a function looks like and/or what a data set represents.

Math 363,364 - Laboratory for Mathematical Probability and Statistics: All of the graphical routines, e.g., for superimposing a probability density function over a histogram or for comparing a theoretical and empirical distribution function for simulated data, would be re-written to take advantage of the superior graphics capability of the IBM PC over that of the TRS-80.

C. Instrumentation

1. The Equipment Request

The equipment requested is necessary for the Introductory Computer Science modules because the IBM PC and other MS/DOS machines have the largest selection of application software such as that which we wish to use in this course. The use of the microcomputer is more efficient than the use of the VAX systems because software such as database, spreadsheet, word processing, and graphics run inefficiently on the VAX and the VAX resources are needed for teaching programming, for upper-level Computer Science, and for research.

The color graphics facility will be utilized within the statistics classes and in the graphics module of the Computer Science course. The IBM PC/AT system will be used as the network controller, the print server, and the file server. It will also be equipped with communications so that files can be transferred between this network and the VAXes.

The network facility is included to make optimal use of available funds through the sharing of printer and disk resources. It will also permit better control by the instructors over the use of the systems.

The printers will be used to obtain printouts and listings, one being a high-speed, draft quality printer, the other of letter quality for word processing.

The software proposed is listed as the best choice for the purposes of this proposal at this time. Other selections may be made with the permission of NSF at the time the proposal is funded. Naturally, the software used as well as the modules taught will change in the future as software applications and technology continue to develop.

Likewise, the choice of the IBM PC Network is the best available at the time this proposal is being written. However, other recently announced networks may prove to be better at the time of acquisition. Several possibilities are presently being studied. Such changes will also be made only with NSF approval.

2. Equipment On Hand

The proposed equipment will replace Hope College's present laboratory of Radio Shack Model III computer systems. This laboratory is not adequate for the needs outlined in this proposal because the equipment is not powerful or reliable enough, nor does it run the selection of software needed for this project.

The VAX systems on campus do not have the resources available for the kind of usage proposed. In addition, much of the software to which we wish to expose our students runs exclusively on microcomputers.

3. Equipment Maintenance

Hope College will provide for the maintenance of the proposed equipment on a per occurrence basis, as it provides for maintenance of all microcomputer equipment on campus. It is anticipated that the maintenance of the proposed network will cost no more than the maintenance of the present microcomputer laboratory. The college will also provide for regularly scheduled preventive maintenance to insure the maximum useful lifetime for the equipment.

D. Personnel

The two key participants in this project are Herbert L. Dershem and Elliot A. Tanis. Professors Dershem and Tanis have extensive experience in the areas of the proposed work, and the proposed equipment will allow them to proceed to the next stage of technology with work which has been in progress for 15 years. Their work was initiated in the project "Introduction of the Computer into the Statistics Curriculum" which was funded by the Office of Computing Activities of NSF from 1971 to 1973. The introduction of microcomputers followed under the project "A Microcomputer Laboratory for use in Teaching Statistics" supported by the Instructional Scientific Equipment Program of NSF from 1979 to 1980. Both of these projects were co-directed by Tanis and Dershem with Tanis serving as Principal Investigator. From 1978 to 1980, Dershem served as Principal Investigator of the project "A Modular Approach to the Introductory Course in Computer Science," with support from the Local Course Improvement Program of NSF.

Complete curricula vitae of these two men are found in the Appendix. Brief resumes for both, highlighting pertinent information, are given below.

Herbert L. Dershem

Highest Degree: Ph.D. Purdue University, 1969 (Computer Science)

Pertinent Experience: Member of the faculty, Hope College, 1969-present. Currently Professor of Computer Science and Chairman of the Department.

Pertinent Publications:

- "A Course on Computing and Statistics for Social Science Students", Proceedings of the 1972 Conference on Computers in the Undergraduate Curricula, pp. 525-8.
"Computers in Teaching Mathematics: A State of the Art Report", CONDUIT, May, 1977, with D. Smith, D. McLaughlin, and A. Ziebur.
Computer Exercises for Elementary Statistics, Compress, Inc., 1979.
"Computers in Teaching: 1979 State of the Art Report of Instructional Computing, Mathematics and Statistics", CONDUIT, 1979, with D. Smith.
"Computer Problem Solving", Educational Development Center, Project UMAP, 1980.
"Iteration and Computer Problem Solving", Educational Development Center, Project UMAP, 1980.
"A Modular Introductory Computer Science Course", SIGCSE Bulletin, 13,1(Feb, 1981), pp. 177-181.

Elliot A. Tanis

Highest Degree: Ph.D., University of Iowa, 1963 (Mathematics with research in Statistics)

Pertinent Experience: Assistant Professor, (Statistics), University of Nebraska, 1963-1965; Member of the Faculty, Hope College, 1965 - present, currently Professor of Mathematics.

Pertinent Publications:

- "Theory of Probability and Statistics Illustrated by the Computer," Proceedings of the 1972 Conference on Computers in the Undergraduate Curricula, June, 1972, pp. 513-520.
"A Computer Laboratory for Mathematical Probability and Statistics," Proceedings of a Fourth Conference on Computers in the Undergraduate Curricula, June, 1973, pp. 416-426.
"Mathematical Probability and Statistics Computer Laboratory", International Journal of Mathematical Education in Science and Technology, (Proceedings of the First British Conference on Computers in Higher Education, Lancaster, England), April, 1974, pp. 717-722.
Laboratory Manual for Probability and Statistical Inference, 1976, distributed by CONDUIT, The University of Iowa.
"A Computer-Based Laboratory for Mathematical Statistics and Probability," Proceedings of an Eighth Conference on Computers in the Undergraduate Curricula, June, 1977, pp. 339-346.
"Concepts in Probability and Statistics Illustrated With the Computer," Michigan Association of Computer Users for Learning Journal, Fall, 1978.
"Simulations Connected with the Game of Craps," Creative Computing, September, 1979.

- "An Instructional Computer-Based Package for Probability and Statistics," The American Statistician, November, 1979, p. 224.
- "Probability of Being a Loser," Pi Mu Epsilon Journal, Spring, 1980, pp. 107-114.
- "The Use of Microcomputers for Understanding Concepts in Probability and Statistics," First International Conference on Teaching Statistics Book of Abstracts, Sheffield, England, 1982.
- Probability and Statistical Inference, Second Edition, with Robert V. Hogg, Macmillan Publishing Company, 1983.
- "Using Microcomputers to Illustrate Concepts in Probability and Statistics," 1983 Proceedings of the Section on Statistical Education, American Statistical Association, pp. 14-15. A paper presented at the Annual Meeting of the American Statistical Association in Toronto, Canada, August, 1983.
- Pertinent Papers Presented but not Published:
- "Distribution Theory Illustrated Empirically," Annual Meeting of the American Statistical Association, Chicago, Illinois, August, 1977.
- "Using Microcomputers to Illustrate Concepts in Probability and Statistics," Annual Meeting of the Mathematical Association of America, Denver, Colorado, January, 1983.
- "Using Microcomputers to Teach Statistics," A Conference on Microcomputers in Statistics, sponsored by the Delaware Chapter of the American Statistical Association, University of Delaware, April, 1984.
- "Using Microcomputers in the Teaching of Probability and Statistics," A Meeting of the Southwest Michigan Chapter of the American Statistical Association, Kalamazoo, Michigan, May, 1984.
- "Using Microcomputers in the Teaching of Probability and Statistics," Sixth Annual National Educational Computing Conference, Dayton, Ohio, June, 1984.
- "A Computer Based Laboratory for Introductory Statistics," Annual Meeting the the Mathematical Association of America, Anaheim, California, January, 1985.

Summary of all Current and Pending Research Support

I. Herbert L. Dershem

- A. Current Support: None
- B. Proposals Pending: None

II. Elliot A. Tanis

- A. Current Support: None
- B. Proposals Pending: None

III. Transfer of Support

This proposal has not previously been funded by another agency.

IV. Other agencies to which this proposal has been/will be submitted: None

Appendix

Curriculum Vitae Herbert L. Dershem

Education: B.S. University of Dayton, 1965 (Mathematics)
M.S. Purdue University, 1967 (Computer Science)
Ph.D. Purdue University, 1969 (Computer Science)

Professional Experience:

Member of the faculty, Hope College, 1969-present. Currently Professor of Computer Science and Chairman of the department.
Professor of Computer Information Systems, Boston University Overseas Program, 1982-1983.
Visiting Research Scientist, Oak Ridge National Laboratories, 1977.
Visiting Honorary Associate Professor, Computer Science Department, University of Tennessee, 1978.
Resident Faculty Director, Oak Ridge Science Semester, 1977.
Series Editor in Statistics, CONDUIT, 1974-1984.

Grants and Awards:

Co-director of project, "Introduction of the Computer in the Statistics Curriculum", supported by the Office of Computing Activities, NSF, 1971-3.
Director of project, "A Modular Approach to the Introductory Course in Computer Science," supported by the Local Course Improvement Program, NSF, 1978-80.
Co-director of project, "A Microcomputer Laboratory for use in Teaching Statistics," supported by the Instructional Scientific Equipment Program, NSF, 1979-80.
Oak Ridge Associated Universities Summer Fellow, 1977
NASA/ASEE Summer Research Fellow, Goddard Space Flight Center, 1976.
Author and participant in Project COMPUTe, Dartmouth College, 1974.
NDEA and Honeywell Corporation Fellow, Purdue University, 1965-1969.

Other Activities (1979-1984):

Consultant to 11 businesses, 10 industries, 7 colleges, and 9 school systems.
Designed and offered 21 professional workshops, seminars, and courses.
Taught and directed six workshops for elementary and secondary teachers.
Delivered 54 public lectures.
Presented workshop on Computer Science in the Liberal Arts College to meeting of college presidents, Captiva Island, FL, January, 1984.
Taught graduate courses in Computer Science for Central Michigan University to Amway employees, military personnel, and health care professionals, 1983-4.
Visiting Rufus Foundation Professor, Ripon College, November, 1983.
Reviewer of articles, books, and NSF proposals.
Interim Director of Computer Services, Hope College, July-August, 1984.

Herbert L. Dershem Publications

"Approximation of the Bessel Eigenvalue Problem by Finite Differences", SIAM J. Numer. Anal., 8,4(Dec,1971), pp. 706-716.
"Bessel Difference Systems of Fractional Order", Math. Anal. and Appl., 39,3(Sept,1972), pp. 558-563.

Appendix

- "A Course on Computing and Statistics for Social Science Students", Proceedings of the 1972 Conference on Computers in the Undergraduate Curricula, pp. 525-528.
- "A Relationship Between Approximation Theory and Statistical Measurements", Pi Mu Epsilon Journal, 6,2(Spring,1975), pp. 69-74.
- "Data Base Management Systems: An Evaluation of their Potential Use in the Management Systems Office", NASA Technical Report, Goddard Space Flight Center, 1976.
- Computers in the Teaching of Mathematics: A State of the Art Report, CONDUIT, May, 1977, with D. Smith, D. McLaughlin, and A. Ziebur.
- "An Experience Component for Undergraduate Computer Science Education", SIGCSE Bulletin, 10,1(Feb,1978), pp. 24-26.
- "Computer Science at a Liberal Arts College", College Curriculum in Computer Science, Engineering, and Data Processing, 1978, pp. 128-132.
- "Factor Game", Personal Computing, 2,6(June,1978), pp. 44-49.
- "Introducing Elementary School Children to the Computer", Calculators and Computers, 2,6(Sept/Oct,1978), pp. 69-71, with J. Whittle.
- Computer Exercises for Elementary Statistics, Compress, Inc., 1979.
- Computers in Teaching: 1979 State of the Art Report of Instructional Computing, Mathematics and Statistics, CONDUIT, 1979, with D. Smith.
- "A Survey of Computing in Private Liberal Arts Colleges", Journal of Data Education, 19,2(Jan,1979), pp. 7-10.
- "Recursive Programming in BASIC", Personal Computing, 3,4(Apr,1979), pp. 16-18.
- "A General Game Playing Program", Personal Computing, 3,6(Jun,1979), pp. 70-75.
- "TRS-80: Tower of Hanoi", Recreational Computing, 8,3(Nov-Dec,1979), pp. 34-35.
- "Using Computer Games to Challenge Elementary School Students", The Computing Teacher, 7,5(Apr/May,1980), pp. 32-34, with J. Whittle.
- "A Computer Workshop for Elementary and Secondary Teachers", Proceedings of the 1980 National Educational Computing Conference, 1980, pp. 65-67, with J. Whittle.
- "Recursive Programming in BASIC", Digital Design, 10,7(Jul,1980), pp. 20-24.
- Computer Problem Solving, Educational Development Center, Project UMAP, 1980.
- Iteration and Computer Problem Solving, Educational Development Center, Project UMAP, 1980.
- "A Modular Introductory Computer Science Course", SIGCSE Bulletin, 13,1(Feb,1981), pp. 177-181.

Appendix

Curriculum Vitae Elliot A. Tanis

Education: B.A. Central College, Pella, Iowa 1956 (Mathematics)
M.S. The University of Iowa, 1960 (Mathematics)
Ph.D. The University of Iowa, 1963 (Mathematics [Statistics])

Professional Experience:

Assistant Professor, University of Nebraska, 1963-65
Member of the faculty, Hope College, 1965-present. Currently Professor of Mathematics
Visiting Professor of Mathematics, University of Lancaster, England, 1974

Grants and Awards:

Director or Associate Director, NSF Summer Institute for Advanced Placement Teachers of Mathematics, Hope College, 1967, 1968, 1969
Lecturer, NSF Summer Institute, Hope College, 1968
Co-director of project, "Introduction of the Computer into the Statistics Curriculum," Office of Computing Activities, NSF, 1971-73.
Co-director of project, "A Microcomputer Laboratory for Use in Teaching Statistics," Instructional Scientific Equipment Program, NSF, 1979-80.
Outstanding Educators of America, 1971
Listed in American Men and Women of Science
Listed in Who's Who in the Midwest

Other Activities :

Statistical consultant to several colleagues and area businesses
Reviewer of articles, books, and NSF proposals
Member of the Hope College Board of Trustees, 1975-1977
Chairman of the Mathematics Department, 1971-1982

Elliot A. Tanis Publications

- "An Iterated Procedure for Testing the Equality of Several Exponential Distributions," (with Robert V. Hogg) American Statistical Association Journal, Vol. 58, 1963, pp. 435-443.
- "Linear Forms in the Order Statistics from an Exponential Distribution," The Annals of Mathematical Statistics, Vol. 35, 1964, pp. 270-276.
- "Theory of Probability and Statistics Illustrated by the Computer," Proceedings of the 1972 Conference on Computers in the Undergraduate Curricula, June, 1972, pp. 513-520.
- "A Card Matching Problem," The Mathematical Log, December, 1972.
- "A Computer Laboratory for Mathematical Probability and Statistics," Proceedings of a Fourth Conference on Computers in the Undergraduate Curricula, June, 1973, pp. 416-426.
- "A Statistical Hypothesis Test for the Classroom," The Mathematics Teacher, November, 1973, pp. 657-658.

Appendix

- "Mathematical Probability and Statistics Computer Laboratory",
International Journal of Mathematical Education in Science and Technology, (Proceedings of the First British Conference on Computers in Higher Education, Lancaster, England), April, 1974, pp. 717-722.
- Probability and Statistical Inference, with Robert V. Hogg, 1977, Macmillan Publishing Company.
- Laboratory Manual for Probability and Statistical Inference, 1976, distributed by CONDUIT, The University of Iowa.
- "A Computer-Based Laboratory for Mathematical Statistics and Probability," Proceedings of an Eighth Conference on Computers in the Undergraduate Curricula, June, 1977, pp. 339-346.
- "Concepts in Probability and Statistics Illustrated With the Computer," Michigan Association of Computer Users for Learning Journal, Fall, 1978.
- "Circular Coordinates and Computer Drawn Designs," with Lee Kuivinen, Mathematics Magazine, May, 1979, pp. 175-178.
- "Tessellations and the Tektronix 4051," Proceedings of the National Educational Computer Conference, June, 1979, pp. 233-236.
- "Simulations Connected with the Game of Craps," Creative Computing, September, 1979.
- "An Instructional Computer-Based Package for Probability and Statistics," The American Statistician, November, 1979, p. 224.
- "Probability of Being a Loser," Pi Mu Epsilon Journal, Spring, 1980, pp. 107-114.
- "The Computer As An Interface Between Mathematics and Art," Computers in Education, Proceedings of the 3rd World Conference on Computers in Education - WCCE 81, Lausanne, Switzerland, 1981, pp. 177-184.
- "The Use of Microcomputers for Understanding Concepts in Probability and Statistics," First International Conference on Teaching Statistics Book of Abstracts, Sheffield, England, 1982.
- Probability and Statistical Inference, Second Edition, with Robert V. Hogg, Macmillan Publishing Company, 1983.
- "M.C. Escher and Computers," Proceedings of the Sixth International Conference on Computers and the Humanities, June, 1983, pp. 688-693.
- "Using Microcomputers to Illustrate Concepts in Probability and Statistics," 1983 Proceedings of the Section on Statistical Education, American Statistical Association, pp. 14-15. A paper presented at the Annual Meeting of the American Statistical Association in Toronto, Canada, August, 1983.

Appendix

Present Computing Equipment Hope College January, 1985

VAX #1 - Administrative Machine

VAX 11/750
7 MB main memory
892 MB disk storage
TU77 tape drive (800/1600 BPI)
TU78 tape drive (1600/6250 BPI)
LP26 charaband line printer
32 terminal ports

VAX #2 - Academic Machine

VAX 11/750
7 MB main memory
785 MB disk storage
TU77 tape drive (800/1600 BPI)
LXY11 dot matrix line printer
LXY21 dot matrix line printer
32 terminal ports

VAX #3 - Academic Machine

VAX 11/750
4 MB main memory
661 MB disk storage
TU77 tape drive (800/1600 BPI)
LP25 charaband printer
32 terminal ports

Microcomputer Laboratory

12 Radio Shack TRS-80 Model III Computers
Half with one disk, half with two disks
48K main memory

4 Apple II+ Computers
Color monitors, 2 disk drives

Computer Science Unix Laboratory

NCR Tower XP
Unix System V, 1 Mbyte main memory
46 Mbyte disk storage
45 Mbyte streamer tape
8 serial ports

Appendix

Catalog Description of Pertinent Courses

Introductory Computing Courses

110. Introduction to Computer Information Systems - This course is designed to expose the student to enough computing to become an effective computer user. It is intended for the student who will take no further Computer Science. This course does not count toward the Computer Science major. Topics include: components and functions of a computer, description of file organization, study of data communications, data base and distributed processing in business computing, the systems analysis process, comparison of programming languages, an introduction to programming in the BASIC language, word processing, and electronic spread sheets.

120. Introduction to Computer Science - This is an introductory course and serves as a prerequisite for all other computer science offerings. Emphasis is placed on problem solving techniques, programming skills, and program style and design. Students in this class gain extensive experience in programming in Pascal.

160. Scientific Computer Programming - An introduction to computers, FORTRAN programming, and methods of scientific problem solving and data reduction under timesharing and batch modes of operation. Techniques in least squares fitting, sorting, transcendental equations solving, and the Monte Carlo method will be introduced. Features of the operating system, utility processors, and file management will be included. This course is intended for students majoring in the Physical Sciences. Corequisite is Calculus I. This course is the same as Physics 160.

Appendix

Statistics Courses

210. Introductory Statistics - A general introduction to the area of statistics for students majoring in other departments. Includes study of the binomial and normal distributions with application of estimation and testing of hypotheses, non-parametric methods, regression and correlation, and analysis of variance.

212. Laboratory for Introductory Statistics - The computer is used as a tool to aid in the learning and understanding of statistics. Experience given in the use of statistical analysis packages. Prerequisite or corequisite: Mathematics 210.

310. Statistics for Scientists - An introduction to the area of statistics for students majoring in natural or social sciences. The probability distributions studied include the normal (Gaussian), binomial, Poisson, Student's T, chi-square and F. Statistical topics include estimation, tests of statistical hypotheses, non-parametric methods, regression and correlation, analysis of variance. Data collected by students and/or professors in the sciences form an integral part of this course. A student may not receive credit for both Mathematics 310 and Mathematics 361. Prerequisite: Calculus II.

361. Mathematical Probability and Statistics I - Concepts of probability, probability as relative frequency, random variables, probability density functions, cumulative distribution functions, mathematical expectation, mean, variance, confidence intervals. Lecture, three hours per week for three hours credit. A student may not receive credit for both Mathematics 310 and Mathematics 361. Prerequisites: Multivariable Calculus, Sequences and Series, and Computer Science 120.

362. Mathematical Probability and Statistics II - Continuation of Mathematics 361 emphasizing statistics. Estimation, testing of statistical hypotheses, regression and correlation, analysis of variance. Prerequisite: Mathematics 361.

363. Laboratory for Probability and Statistics I - The computer is used to illustrate empirically theoretical concepts in probability and to graphically demonstrate that certain probability models are appropriate for particular random experiments. Corequisite: Mathematics 361. Prerequisite: a computer science course.

364. Laboratory for Probability and Statistics II - The computer is used for statistical analysis and to illustrate empirically certain statistical concepts. Corequisite: Mathematics 362. Prerequisite: a computer science course.

Appendix

Hope College Faculty Departments of Computer Science and Mathematics 1984-5

Department of Computer Science

- Mark Brown, Instructor of Computer Science
M.S. University of Michigan, 1978 (Computer, Information and Control Engineering)
- Bruce Dangremond, Instructor of Computer Science
M.B.A. University of Wisconsin - Milwaukee, 1973
- Herbert Dershem, Professor of Computer Science
Ph.D. Purdue University, 1969 (Computer Science)
- Gordon Stegink, Assistant Professor of Computer Science
A.M. Washington University, 1963 (Mathematics)

Department of Mathematics

- David C. Carothers, Assistant Professor of Mathematics
Ph.D. Purdue University, 1981 (Mathematics)
- Frank C. Sherburne, Jr., Associate Professor of Mathematics
M.S. Michigan State University, 1956 (Mathematics)
- John R. Stoughton, Assistant Professor of Mathematics
Ph.D. University of Tennessee, 1978 (Mathematics)
- Elliot A. Tanis, Professor of Mathematics
Ph.D. University of Iowa, 1963 (Mathematics)
- Richard Vandervelde, Associate Professor of Mathematics
Ph.D. University of Iowa, 1967 (Mathematics)
- John Van Iwaarden, Associate Professor of Mathematics
M.A. University of Michigan, 1958 (Mathematics)

MEMORANDUM

Date: January 14, 1985

To: Herb Dershem

From: Irwin J. Brink *IJB*

Subject: Preparation of NSF College Science Instrumentation Program Proposal

I wish to express my appreciation to you for all the time and effort you put into the preparation of the NSF-CSIP proposal that was recently mailed to Washington. The timing for the proposal came at a most inconvenient time so that you had to spend many hours during the holiday break scrambling to get the proposal out prior to the deadline date. It is this kind of dedication over the years that has been primarily responsible for the excellence of our science programs. You are to be congratulated for producing the proposal under very limited time constraints. I want you to know that I personally appreciate your work very much. Now all that remains is for NSF to fund the proposals and the quality of our instrumentation holdings will be substantially increased. Thanks again for your work.

D12U9

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C. 20550

Directorate for Science and
Engineering Education

June 5, 1985

Ref: OCSI-8552061

Dr. Herbert L. Dershem
Department of Computer Science
Hope College
Holland, MI 49423

Dear Dr. Dershem:

Careful consideration has been given to the proposal that you submitted to the National Science Foundation's College Science Instrumentation Program (CSIP). We regret to inform you that we are not able to provide support for your proposed project.

The Foundation's decisions regarding project support are based primarily upon the perceived scientific and educational merit of the proposals. The advice which we solicit and receive from the academic scientific community enters heavily into our decisions.

Verbatim (but anonymous) copies of the reviews received for your proposal will be sent to you at the above address within the next few weeks. The overall weight of the review and staff judgment serve as the basis for our decision. Please understand that the individual reviewer comments do not necessarily reflect the Foundation's policy or position.

We are grateful for your interest in improving science education and appreciate your effort in preparing and submitting a proposal. I hope the above information and the reviews explain the reasons for the Foundation's actions; but, if not, please contact the program at 202/357-7051.

Sincerely yours,



Robert F. Watson
Head, Office of College Science
Instrumentation

Ref: OCSI-8552061

Copy to: Business Officer or President
Hope College
Holland, MI 49423