University of Louisiana at Monroe
Computer Science Scholarship Program

1. Project Objectives and Plan

For years researchers have been writing about the declining numbers of women and underrepresented minorities in science, mathematics, engineering and technology careers and suggesting strategies for solving this problem (1,2,3,4,5,6,7,8,9,10). The Computer Science Scholarship Program (CSSP) at the University of Louisiana at Monroe (ULM) will incorporate many of these strategies in an attempt to improve the recruitment and retention of low-income, academically capable students, especially women and African Americans. The specific objectives of the project will be:

- Increase the number of freshmen women majoring in computer science in the fall of 2001;
- Increase the number of freshmen African Americans majoring in computer science in the fall of 2001;
- Increase the overall retention rate for computer science majors from freshman in fall 2001 to junior in the fall of 2003;
- Increase the number of women graduating in computer science from 16.7% in 1998-2000 to 35% in the spring of 2005; and
- Increase the number of African Americans graduating in computer science from 6.7% in 1998-2000 to 20% in the spring of 2005.

These objectives will be achieved by establishing 25 scholarships to be awarded to beginning freshmen for a period of up to two years. In addition, scholarship recipients will be supported by existing institutional infrastructure and by computer science faculty members.

As discussed in section 5, awardees will be selected on the basis of financial need and academic potential. The funds provided to each student by the scholarship program ($2,500 per year) will be complemented with funds available through the state of Louisiana Tuition Opportunity Program Scholarships (TOPS). TOPS funds can be used to pay for tuition costs of Louisiana high school graduates who complete a college preparatory curriculum with a grade point average of 2.5 or larger and obtain a minimum composite ACT score of 20. The TOPS funds, in conjunction with the amount provided by a CSSP scholarship and other sources of aid such as Pell Grants, will allow entering freshmen to cover all of the essential costs of attending the University of Louisiana at Monroe, including tuition, fees, room, board, and books.

The university currently operates with an open admissions policy. The figures presented in section 7 indicate an extremely high attrition rate during the first two years of the computer science program. While some of the students who fail to complete the program lack the preparation and/or motivation to succeed in an academically rigorous curriculum, a significant number of capable students simply find it difficult to balance academic requirements with the need to secure and maintain employment to help defray

the costs of attending the university. It is the second type of student that will be targeted by the Computer Science Scholarship Program.

It is our experience that students who complete the first two years of the curriculum in good standing usually continue in the program and eventually fulfill all graduation requirements. This observation is supported by the demographic figures in section 7. Because of the critical nature of the first two years in improving student retention, the proposed scholarship program targets entering freshmen.

While students will be eligible for up to two years of financial assistance, the decision to renew scholarship awards will be made on a semester-by-semester basis and will be primarily contingent upon a student's satisfactory academic progress. To help students in this regard, a departmental support mechanism will be established to monitor their academic progress and to intervene at the earliest sign of problems to help ensure success.

2. Significance of the Project

The University of Louisiana at Monroe is located in the Northeast sector of Louisiana, an area which is predominantly rural and where economic activity has traditionally been based on agriculture. The institution's service area extends into Southeast Arkansas and the Mississippi River's delta region, which are also characterized by low-income, predominantly rural communities.

It is widely accepted that further economic development in the region can only occur with an educated labor force. Although statewide initiatives such as a new accountability program for K-12 education and the TOPS program for higher education should have positive long-term effects, special incentives are needed to address the acute need for graduates in technological areas such as Computer Science.

By attracting students into the computing field and improving their chances for academic success, the CSSP project could significantly raise the number of graduates in the field and contribute to the region's economic development. The successful placement of graduates in industry has the added positive effect of encouraging current and prospective students to pursue similar careers, thus increasing the project's long-term effects.

The student population at the University of Louisiana at Monroe is very diverse. In the 1999-2000 academic year, 63% of students were female and 26% of students were African-American. However, as indicated in Section 7, the percentage of women entering computer science is only 25.3% and retention to graduation is only 16.7% (ULM's graduation rate is consistent with the findings of Davies and Camp). The number of African Americans entering computer science is 35.4%, but retention to graduation is only 6.7% (ULM's graduation rate is much lower than the findings of Georges) . According to Georges, "financial aid awards may be the key variables that

can be considered at the policy level to improve the minority retention rate." We believe that the proposed scholarship program will greatly increase the number of women entering the program and the number of women and African Americans retained to graduation.

3. Management and Administrative Plan

Dr. A. Dale Magoun will be responsible for the overall management of the project. He has taught computer science at ULM for twenty years and has been the department head since 1996. Prior to becoming department head, he served on the Faculty Senate for many years and is well known and highly respected across the campus. In addition, he has served as the PI for a highly successful NSF-funded Teacher Enhancement grant. He will work closely with the university's Division of Enrollment Management, which has instituted a number of new strategies for recruitment and retention of students (see section 6). Because many computer science majors have great difficulty with mathematics and physics, he will also work closely with the heads of the Department of Mathematics and the Department of Physics to develop intervention strategies that will ensure that the scholarship recipients make satisfactory progress. He will be responsible for arranging intern/co-op positions for scholarship recipients when the students have achieved junior standing.

Dr. Jose Cordova will be responsible for the day-to-day management of the project. Dr. Cordova has taught computer science at ULM since 1995 and was recently promoted to associate professor. He has been very interested in the retention of students in computer science and has served as the sponsor of the student chapter of ACM and the programming team. He is well known on campus because of his service on the Faculty Senate and the University Curriculum committee. For the past three years, he has held the Clark Williams Professorship in Computer Science. He will work closely with Dr. Magoun and Dr. Eaton on the recruitment and selection of scholarship recipients, the implementation of student support activities, the evaluation of the program, and the dissemination of program outcomes.

Dr. Virginia Eaton will assist Dr. Cordova in the day-to-day management of the project. She has taught computer science at ULM since 1988 and was promoted to full professor in 1999. She is well known across campus because of the many grant-writing workshops that she has conducted for university faculty. Throughout her career, Dr. Eaton has been interested in recruiting and retaining women and underrepresented minorities in computer science. In this context, she has actively sought grant monies for a variety of projects including supplemental REU projects, Young Scholars projects, Faculty Development projects, and Gender Equity projects. In addition, Dr. Eaton has served as a NSF program director for Young Scholars, POWRE, CRCD, and ITW, all of which are related to the recruitment and retention of women and underrepresented minorities in science, mathematics, and technology careers. She will work closely with Dr. Cordova and Dr. Magoun on all aspects of the program.

4. Quality of the Academic Program

The Department of Computer Science, which currently offers the Bachelor of Science degree in Computer Science, has excellence in undergraduate education as its primary mission. The program has been accredited by the Computing Sciences Accreditation Board (CSAB) since 1986. The department, one of the first 48 in the United States to be accredited by CSAB, currently has 8 full time faculty members, approximately 190 majors, and 10-15 graduates per year. The department supports active student chapters of the Association for Computing Machinery, the primary professional society for computing professionals, and Upsilon Pi Epsilon, the international computing sciences honor society. The department, as well as the ACM student chapter, regularly sponsors lectures featuring nationally recognized speakers.

The Bachelor of Science in Computer Science program is based on a very strong curriculum that follows national guidelines (Tucker 1991). The program consists of a total of 125 credit hours, including 46 hours in computer science courses, 17 hours in mathematics courses, and 8 hours in calculus-based Physics. Specifically, every computer science major is required to take senior level courses in software engineering, database systems, computer architecture, programming languages and compiler theory, operating systems, and artificial intelligence. In addition, each student must select three upper level electives from a list of courses that includes object-oriented design, data communications, Internet programming, Internet systems management, computer graphics, and systems simulation and modeling. In general, these courses include not only software design and implementation projects, but also assignments involving oral and written reports, both at the individual and team levels.

The Department of Computer Science enjoys a solid reputation both within and outside the institution. The quality of the department is evidenced by the performance of its graduates both academically and professionally. As previously stated, the Bachelor of Science in Computer Science degree is fully accredited by the Computer Science Accreditation Commission of the Computer Science Accreditation Board. During its most recent visit in November 1998, a team of CSAB representatives was very complimentary of the curriculum, the faculty, library resources, and support personnel.

Starting with the 1993 Spring Semester, computer science graduates have taken the Educational Testing Service's major field assessment test in computer science. The MFAT is a career-specific test administered nationally and designed to assess the knowledge base that a student has gained in his/her undergraduate major field. In 1999, the last year for which results are available, students from 131 institutions nationwide took the MFAT test in Computer Science, and ULM graduates obtained scores in the 92 percentile. These results are consistent with scores obtained in recent yearly evaluations.

Over 95% of computer science graduates responding to post-graduation surveys find initial positions in their field at companies both inside and outside the Northeast Louisiana region. Other graduates have successfully pursued advanced degrees at

institutions including Clemson University, Louisiana State University, Mississippi State University, North Carolina State University, SUNY at Buffalo, University of Louisiana at Lafayette, and University of North Carolina.

5. Process for Program Implementation

The PIs will develop and disseminate a recruitment packet that provides information about the scholarship program and the application process. This packet will be mailed to schools in Arkansas, Louisiana, Mississippi, and Texas. Dr. Magoun will negotiate in-state tuition for out-of-state recipients. Dissemination activities will be coordinated with the university's Division of Enrollment Management and will include visits to area high schools in the spring of 2001. Information also will be disseminated at the university's "Browse on the Bayou" program which invites area high school seniors to campus on a Saturday in the fall and spring. Other recruitment opportunities will be the High School Programming Contest, which the department sponsors annually, and the Regional Science Fair, which the university sponsors annually.

Initial applications for the scholarship will be due to the department by May 1, 2001. Twenty-five scholarship recipients will be awarded for the two-year duration of the grant. In addition, five alternates will be chosen. Scholarship recipients must remain eligible each semester. If a recipient becomes ineligible, an eligible alternate will be awarded a scholarship. A student who becomes academically ineligible can become an alternate if his/her grades improve during the following semester. Recipients who become academically ineligible for the scholarship will still be eligible for other student support activities. The PIs will do everything possible to help them reinstate their academic eligibility.

To be eligible for the scholarship, students must meet the following criteria:
- A student must be financially eligible for a Pell Grant.
- A student must be academically eligible for TOPS (i.e. a high school grade point average of 2.5 or larger and a minimum composite ACT score of 20).
- A student must be an U.S. citizen.
- A student must be a computer science major.
- A student must be enrolled full-time at ULM (i.e. enrolled for a minimum of 12 credit hours of college-level credit per semester).
- A student must be enrolled in at least one computer science class each semester.
- A student must maintain a 2.0 grade point average in computer science classes with not less than a C in any one course, and an overall 2.0 grade point average in all classes at ULM (i.e. minimum requirements for graduation).
- A student must agree to participate in the student support activities.
- Special consideration will be given to women, underrepresented minorities, and the physically challenged.

1. **Student Support Structure**

    The university's Division of Enrollment Management has already established a strong student support structure. The division includes the following departments: enrollment services, financial aid, scholarships, and career services and testing. The primary purpose of this division is to formulate strategies and implement programs to provide opportunities and academic services to enhance recruitment, retention, and graduation rates for all students planning to attend or currently attending ULM. Its recruitment activities include preparation and dissemination of recruitment materials, visits to area high schools, and the "Browse on the Bayou" program. "Browse on the Bayou" occurs twice a year – one Saturday in the fall and one in the spring. High school seniors are invited to campus for group tours, question and answer sessions with faculty and students, and group sessions of topical interest such as scholarships and financial aid. Obviously, "Browse on the Bayou" will be a perfect opportunity to promote the CSSP program. ULM's retention efforts begin with the PREP program in which all entering freshmen are required to participate. PREP stands for Preview, Registration, and Environment Program. During PREP, students meet with an academic advisor to ask questions and schedule classes for their first semester at ULM. Therefore, PREP will be an excellent opportunity for the PIs to help CSSP scholarship recipients to begin a successful transition from high school to college.

    In addition to the services offered by the Division of Enrollment Management, the university received a five-year grant for $1.7 million in 1999 to establish the Center for Academic and Student Success (CASS). The center provides services including intensive academic and career counseling primarily for freshmen and sophomores and a college survival skills center (computers, software, and a resource library to enhance academic and student success).

    The university also provides a Counseling Center for students who need help with personal problems. Specifically, the center offers help to students who have personal, career, substance abuse, and school-related needs. Students do not have to pay for the services of the center. All client-related information remains confidential according to the ethical standards set by the American Counseling Association.

    The department's student support structure will incorporate the services described above as well as the strategies that researchers have indicated will help retain women and African Americans. For example, Hewitt and Seymour found minorities had great difficulty dealing with large classes and impersonal faculty attitudes. Highsmith, Denes, and Pierre found that "role modeling and mentoring are important ingredients to the development of talent among groups traditionally underrepresented" in science, mathematics, engineering, and technology. Likewise, other researchers have found that women tend to need friendly teachers, mentors and role models so that they will not feel isolated by their career choice (1,5,8). Therefore, the department's student support structure will be based upon weekly visits between scholarship recipients and their advisors. Other components of the department's student support will include: peer study

groups, tutoring, group projects, positive classroom climate, and faculty training workshops (1,6,9,10).

Dr. Eaton and Dr. Cordova will serve as advisors. Advisors will monitor the academic progress of his/her advisees. If a student is having problems, intervention will begin immediately. Intervention may include any or all of the following:
- Group tutoring
- Individual tutoring
- Advising from the Center for Academic and Student Success
- Counseling through the ULM Counseling Center

One of the reasons for the high attrition rate of computer science majors at ULM during the first two years of college is the difficulty that they encounter in mathematics and physics classes.   Helping the scholarship recipients to successfully complete these classes will be a primary focus of the intervention efforts. Tutoring in mathematics and physics will be available for all scholarship recipients. Grant funds will be used to pay for this. Furthermore, Dr. Magoun will work with the heads of the Departments of Mathematics and Physics to find ways to ensure the success of scholarship recipients. All faculty members from the Departments of Computer Science, Mathematics, and Physics will be expected to attend a workshop conducted by Dr. Eaton. The purpose of the workshop will be twofold:
- To increase faculty awareness of, and sensitivity to, the difficulties that women and African Americans face in computer science, mathematics, and physics;
- To encourage faculty members to generate specific ideas to use in their own teaching to enhance the learning environment.

All of the scholarship recipients will be required to become members of the student chapter of the ACM (dues will be paid by the grant). Junior and Senior members of the ACM will serve as mentors for the scholarship recipients. In addition, alumni of the computer science program will be asked to serve electronically as Big Brothers and Sisters of the scholarship recipients. Industrial guest speakers and field trips will also be provided to give scholarship recipients insight into future career choices.

When the two-year grant ends, scholarship recipients will be entering their junior year of college. They will still be eligible for Pell grants and the TOPS program. To replace the scholarship money, intern/co-op positions will be arranged with local businesses for those recipients who have successfully completed the sophomore year of the computer science program. Recipients who are not juniors will be given jobs in the computer science lab until they attain junior status. At that point an intern/co-op position will arranged for them. Dr. Magoun will coordinate these placements. The department has close ties with most of the schools, businesses and industries in the area. These include Century Telephone, Entergy, Monroe City School System, Ouachita Parish School System, Riverwood International, and the U.S. Corp of Engineers Waterways Experimental Station.   The department has alumni working at all of these companies and regularly has students in intern positions at them.

Throughout the program, scholarship recipients will receive advice about graduate school and careers.   When they become first-semester seniors, they will begin to work closely with the Office of Career Services and Testing. The primary purpose of this office is to provide students with career planning consultation, assessment and advisement, opportunities to participate in career placement days, interviews with potential employers, selected workshops and seminars dealing with strategies for gainful employment. The office also coordinates a national testing program and operates a computer based testing center where students can take the GRE. In conjunction with this office, the PIs will help the scholarship recipients to prepare resumes, application forms, and cover letters and to practice for interviews.

7. Demographic Information about Educational Program

Table 1 summarizes the enrollment figures and number of graduates for the past few years. As can be observed from the data, while total undergraduate enrollment in the Computer Science program reflects a generally increasing trend, a high number of students fail to complete the first two years of the program. It is worth noting that the figures for Senior students may be artificially high, since they include any student having completed 90 credit hours who declares Computer Science as a major, regardless of the student's actual progress in the Computer Science program. Typically, these figures include students transferring from other programs and others who take a long time in completing their program requirements. Students in the latter group would continue to be classified as seniors from year to year.

Academic Year	Freshmen	Sophomores	Juniors	Seniors	Total	Degrees Conferred
1999-2000	83	24	21	37	165	16
1998-1999	97	33	16	42	188	14
1997-1998	104	35	19	30	188	8
1996-1997	83	27	17	27	154	9
1995-1996	78	26	22	23	149	7
1994-1995	67	25	9	24	125	14
1993-1994	58	15	9	36	118	16
1992-1993	61	19	22	25	127	9

Table 1. Number of Students Majoring in Computer Science, by Academic Year

A closer examination at the student population in our program reveals that attrition rates are particularly high among female and African-American students. Table 2 shows a breakdown of recent freshman classes in Computer Science by race and gender. It can be observed, for instance, that one-fourth of the freshmen were female and more than one-third were African-American.

	Female	Male	Total
White	10.8	41.8	**52.5**
African-American	14.6	20.9	**35.4**
Asian	0.0	9.5	**9.5**
Other	0.0	2.5	**2.5**
	25.3	**74.7**	**100.0**

Table 2. Percentage of Computer Science Freshmen, 1995-1999

In contrast, Table 3 shows lower percentages of graduating female and particularly, African-American students. It must be noted that Table 3 includes graduates from 1998 to 2000. Therefore, when comparing these figures with those of Table 2, it is necessary to point out that Table 3 includes graduates who may have entered the program before 1995, and that Table 2 certainly includes students still making progress towards the degree. Nevertheless, the differences in attrition rates among the various segments of the student population are obvious.

	Female	Male	Total
White	10.0	56.7	**66.7**
Asian	6.7	20.0	**26.7**
African-American	0.0	6.7	**6.7**
Other	0.0	0.0	**0.0**
	16.7	**83.3**	**100.0**

Table 3. Percentage of Computer Science Graduating Seniors, 1998-2000

8. Rationale for the number of Scholarships and Scholarship Amounts Requested

We are requesting funds for 25 scholarships at $2,500 per year. Since we are assuming that tuition is covered by TOPS, that leaves the following annual costs to be covered:

Room $2,560 (from the 1999-2000 ULM catalog)
Board $1,100 (from the 1999-2000 ULM catalog)
Books $ 500 (estimate)
            _____
Total $4,160

This should be covered by the $2,500 scholarship and by other sources such as a Pell Grant, which provides students with an annual amount between $1,500 and $3,000, depending on the family's finances and other sources of income for the student.

Approximately 30% of our current computer science majors score in the ACT range of 20-25. Since a minimum score of 20 is required for the TOPS scholarship, we

are estimating that we will be able to recruit 25 eligible students for the scholarship program. Our recruitment efforts will be focused on women and African Americans.

9. Plans for Evaluation of Project Activities and Dissemination of Outcomes

Data will be collected to verify that the following outcomes have or have not been achieved:

- The number of freshmen women in computer science will be increased by at least 50% in the fall of 2001 as a result of the program. Our target will be 50% women entering the computer science program.
- The number of freshmen underrepresented minorities in computer science will be increased by 10% in the fall of 2001 as a result of the program. Our target will be 40% African-Americans entering the computer science program.
- The overall retention rate for computer science majors from freshman in fall 2001 to junior in the fall of 2003 will be increased by 50% as a result of the program.
- The number of women graduating in computer science will be increased from 16.7% in 1998-2000 to 35% in the spring of 2005 as result of the program.
- The number of underrepresented minorities graduating in computer science will be increased from 6.7% in 1998-2000 to 20% in the spring of 2005 as a result of the program.

A web site will be created as soon as the program is funded. This site will be used for recruitment; interaction between scholarship recipients, faculty, mentors, tutors, and alumni; and dissemination. Throughout the project, the PIs will be sharing information about successful and unsuccessful methods for recruitment, intervention, and retention. The PIs will also make presentations about program outcomes at state, regional, and national conferences such as the Louisiana Association for Computer Using Educators (LACUE), the Consortium for Computing in Small Colleges (CCSC), ACM Special Interest Group for Computer Science Education (SIGCSE), and the National Educational Computing Association (NECA).