New Course Proposal

1. **Course number:** CMSC 155

2. **Full course title:** Introduction to Scientific Computing

3. **Catalog description**

   Same course as CMSC 150 but with greater emphasis on programming applications in the sciences. A student may not receive credit for both CMSC 150 and CMSC 155.

4. **Prerequisites:** Math 211 or equivalent high school mathematics experience

5. **Hours of credit:** 4.0

6. **Estimate of student enrollment:** 18 per semester

7. **By whom and when the course will be offered:** The course will be offered by John Hubbard. It will be offered at most twice a year.

8. **Staffing implications:** None. The course will be offered only as staffing requirements for our computer science major allow.

9. **Adequacy of library and technology resources**

   The course has the same library and technology requirements as the existing course, CMSC 150. We have supported CMSC 150 at better than twice current enrollment levels in the recent past, so our technology resources are adequate.

10. **Relation to existing courses and curricula**

    This is a specially targeted version of the existing course Introduction to Computing (CMSC 150).

11. **Departmental Approval:**

    Approved 1/6/2005.

12. **Purpose and rationale**

    The course is designed to attract students who plan to major in one of the natural sciences. It is a parallel course to the existing CMSC 150 course and will satisfy the same prerequisites for more advanced computer science courses.

13. **Brief outline**
CMSC 155 is an introductory course that is equivalent to the existing CMSC 150. Both courses assume no previous computing experience, and both courses prepare the student for further study of computer science, serving as prerequisite to the next courses in the major sequence, Data Structures (CMSC 221) and Discrete Structures for Computing (CMSC 222). The primary differences between the courses are a function of their target audience: CMSC 155 is intended for students who are interested in the sciences. These include applied mathematics, physics, astronomy, chemistry, biology, medicine, psychology, economics, political science and engineering. Applications in these fields are used to illustrate computing principles and to motivate programming projects.

The course was originally developed in 1992 and taught in the Spring 1993 semester by John Hubbard. The only significant difference from the original course is the change from three to four credit hours. This change was made in CMSC 150 to accommodate the addition of a formal laboratory to the course, and CMSC 155 will also incorporate a formal laboratory component.

**Brief list of topics common to CMSC 150 and CMSC 155:**

**Language Topics**

1. Format of a complete program.
2. Basic Data types: int, char, float/double, bool/boolean
3. Classes: String, Math
4. Structured Types: array (single and two-dimensional)
5. Declarations
6. Expressions - arithmetic and boolean
7. Statements
   1. assignment
   2. if: both simple and if-else versions
   3. while
   4. for
   5. compound statement { }
8. Scope of variables
9. Input/Output
   1. console input and output
   2. file I/O, EOF detection
10. Functions and parameters, including reference parameters
11. Simple classes

**General**

Students should understand a simplified model of computer organization and operation.

Students should be able to process input data with a sentinel or with EOF detection.
Students are expected to write functions/procedures and use them. Students are expected to be able to write simple recursive methods.

**Algorithms**

1. Find largest or smallest on a list, either in an array or read on-the-fly
2. Linear search of an array
3. Binary search of a sorted array
4. Selection sort of an array
5. Mergesort of an array, including an intuitive explanation of Mergesort complexity.

**Sample application areas for CMSC 155:**

- Infectious disease models in epidemiology
- Predator-prey model in biology
- Birth-death processes in ecology
- Hardy-Weinberg Law in genetics
- Three-body problem in astrophysics
- Interest rates of annuities and insurance
- The physics of rainbows
- Traffic modeling in operations research
- Equitable redistricting of voting districts
- Fitting curves to real data

**14. Signoffs for items 8 & 9**

- Staffing (Dona Hickey) email 1/7/2005
- Library Resources (Melanie Hillner) email 1/6/2005
- Technology Resources (Pat Schoknecht) email 1/6/2005
- Classrooms (Susan Breeden) email 1/7/2005