Revised Course Proposal
MAT 1170G: Problem Solving

1. Catalog Description

    a. Course level: MAT 1170G

    b. Title: Problem Solving

    c. Credit: 3-0-3

    d. Term to be offered: F,S

    e. Short Title: Problem Solving

    f. Course Description: A writing-intensive course in which students are presented with challenging problems in mathematics and are required to develop their own problem solving strategies and tactics.

    g. Prerequisite: ENG 1001G. This course may not be taken by students with a high school mathematics deficiency that has not been removed. This course should not be considered as preparatory for other course in mathematics.

    h. The course is writing-intensive.

2. Student Learning Objectives

    a. *List student learning objectives that are designed to help students achieve one or more of the established goals of general education and university-wide assessment.* In completing this course, students will be able to:

        i. express themselves in the language of mathematics using correct mathematical exposition and symbolism *(writing)*.

        ii. apply the fundamentals of logical thought *(critical thinking)*.

        iii. be able to solve complex problems in any discipline *(critical thinking, citizenship)*.

        iv. write convincing mathematical arguments with clarity and precision *(written and oral communication, critical thinking)*.

    b. *Indicate additional student learning objectives, if any, that are designed to help students achieve the goals of the course and/or a particular discipline or program.* Upon successful completion of this course, students will:

        i. develop a broader view of mathematics.

        ii. know and appreciate that mathematics is much more than computation.

        iii. understand that mathematics provides a way of analyzing things that is valuable in every day life.

        iv. gain confidence in their own problem solving ability.

        v. understand how enjoyable and productive problem solving can be.

3. **Course Outline**

The following is a sample syllabus. The resource materials contain a variety of topics which allows each instructor to tailor the course to his/her interests and the interests of the students.

Weeks 1–3   **Following the Clues**
- Reasoning, both inductive and deductive
- Learning what to do when stuck
- Presenting a solution
- Tree diagrams
- Logic problems

Weeks 4–6   **Solve It With Logic**
- Conjunction, disjunction, and negation
- Conditional and biconditional statements
- Reasoning by contradiction
- Looking for patterns, making educated guesses, and checking conjectures
- Arguments and validity

Weeks 7–8   **More Logic**
- Learning to follow the clues when some of the clues are known to be false
- How to tell when you are being lied to
- Making valid conclusions from invalid data

Weeks 9–11   **Cryptarithmatic**
- Learning to do arithmetic with missing data.
- Changing bases and doing arithmetic in other bases
- Solving cryptarithmetic problems in other bases

Weeks 12–13   **Introduction to Networks**
- Graphs
- Euler paths and circuits
- Hamiltonian circuits
- Solving problems using networks

Weeks 14–15   **Potpourri**
- Learning to solve problems that combine the ideas of several of the previous sections.
- Shunting, coin weighing and other puzzles

The philosophy is that to teach problem solving you don't give someone a problem and then give the solution. Rather the idea is that you present students with a difficult but enticing problem and let them solve it. This is a course that emphasizes thinking and not just facts or formulae. Typically, a class will consist of the instructor posing one or two of these problems and then letting the class solve the problem as a class, in small groups, or individually. A typical assignment might consist of requiring each student to submit a write-up of one such problem from a choice of two or three. The

problems often take more than an hour to solve and a similar amount of time to write up.

4. **Evaluation of Student Learning**

   a. Solving a mathematical problem requires not only finding a solution, but also requires communicating the solution in a logical, coherent, and complete fashion. Therefore, the writing assignments (which normally range from 2 to 6 typewritten pages) are an integral part of this course and may count for between 50% to 80% of the student's grade. The remaining portion of the grade is based on class participation, exams, quizzes, and the final exam.

   b. The course will be writing-intensive because there are frequent writing assignments spread throughout the semester which serve to deepen students' understanding of mathematical problem-solving, while strengthening their writing skills. Several writing assignments will be revised by students after being read and critiqued by the instructor. The quality of the written assignments is the major factor in determining students' grades.

5. **Rationale**

   a. The course will be placed in the Mathematics segment of the general education program. The course develops critical thinking skills and ability to apply mathematics. In the proposed general education segment the Department of Mathematics is charged with providing a course under the mathematics segment for every undergraduate at the university. The department is mindful of the wide variety of interests and career goals within the diverse student population at the university. The majority of students are those whose majors require certain mathematical skills and who will be able to meet the mathematics general education requirement with such courses as: MAT 1440G, MAT 1441G, MAT 2110G, MAT 2120G, MAT 2250G, MAT 2420G. This leaves a portion of the student body having no mathematics courses required within the major. The majority of these students have been, and will continue to be, served by MAT 1160G, a standard general education course. At the same time, we have the opportunity to provide a more meaningful and useful mathematical experience for some students by adapting a course to fit their learning styles and career goals. This course is designed for those students who will benefit from intense mathematical study of logical thought, logical reasoning, logical argumentation and construction of proofs.

   The course will encourage the student to develop the skills necessary to take a mass of disparate material and to organize it. The student will then be directed to present the material in a clear, cogent and mathematically correct fashion. We have found this course to be valuable for pre-law and other pre-professional students who will be taking exams for admittance to professional schools following their undergraduate experience.

   b. The course is offered at the 1000 level, since the only prerequisites are English 1001G; and satisfactory completion (C or better) of high school geometry and algebra II, or MAT 1271.

c. This course is a revision of MAT 1170C and should maintain the same curriculum identification number as MAT 1170C. This course does not duplicate any other course.

d. MAT 1170G is not required in any major or program, but has proven to be helpful to those students who must take standardized tests for admission to graduate school and, in particular, law school.

6. **Implementation**

a. The course will be taught by select faculty members in the Department of Mathematics.

b. Texts: None. Materials will be selected from such sources as Averbach and Chein, *Mathematics: Problem Solving Through Recreational Mathematics*, 2000, or Emmet's *Puzzles for Pleasure*, 1995, various Dover problem paperbacks, as well as popular "Logic Problem" magazines.

c. There are no additional costs to the student.

d. Term to be first offered: Spring 2001.

7. **Community College Transfer**

A community college course may be judged equivalent to this course.

8. **Date Approved by the Department** 4/10/00

9. **Date Approved by the College Curriculum Committee** 4/21/00

10. **Date Approved by CAA** 10/19/00

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