Instructor: Catalin Zara  
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Note: Throughout the semester, I will communicate with you via your UMB email account. You may have e-mail redirected from your official UMass Boston address to another e-mail address. The University will not be responsible for the handling of e-mail by outside vendors or by departmental servers.

Course Description: This course is an undergraduate seminar on mathematical problem solving. It is intended for students who enjoy solving challenging mathematical problems and who are interested in learning various techniques and background information useful for problem solving.

Additional Information: This course promotes creative thinking and logical reasoning. The course is built around solving problems, which are used to learn key methods of mathematical reasoning, such as: looking for patterns, testing via examples, reasoning by contradiction, invariants, induction. The course also teaches students how to explain ideas and write them down in a well-organized, logical, and convincing way. The goal is to use problems to teach mathematics that is not usually seen in ordinary classes.

I will give a short lecture on a topic and then hand out a slate of problems. Students work in small groups and present their solutions. We discuss the problems and ideas for their solutions for a week or so, identifying the particular techniques used and situations where similar techniques may be useful.

MATH 390 counts as a 300+ elective for the Mathematics degrees (BS/BA/Minor). You may take this course for graduation credit twice, but only one instance (highest grade) will be counted towards your Math elective requirement and your GPA in the major requirement.

Credits: 3.

Prerequisites: MATH 280 (Introduction to Proofs) OR Permission of Instructor.

Class Meetings: TuTh 4:00PM – 5:15PM  
Location: TBD

Office hours: TuTh 3:00PM – 3:55 PM in S 3-091 (and other times by appointment).

Textbook (Recommended):  
*Putnam and Beyond*, by Razvan Gelca and Titu Andreescu, published by Springer.  
Assignments:

- **Homework assignments**: For each topic there will be about 12 assigned problems, with various levels of difficulty. For full credit you are expected to submit solutions to 75% of the assigned problems.
- **Active participation**: For each topic, you are expected to present a solution to at least one problem. For each class meeting you should come with ideas for several problems.
- **Midterm exam**: The test will have the format of the Putnam Competition. There will be six problems, with a wide range of difficulty. For full credit you are expected to solve one of the problems and make significant progress towards finding a solution for another one. You will be given the opportunity to continue to work individually on the problems at home and submit more solutions for credit at the next class meeting.
- **Term paper**: The topic is "What have I learned in the Problem Solving Seminar?" A draft is due around the mid-term (please see the schedule) and the full version is due at the last class meeting. The goal of the paper is to offer you an opportunity to reflect about the contribution of the seminar activities to the development of your mathematical maturity. It should also be an opportunity to review the new techniques and concepts learned throughout the semester.

**All students taking the seminar are expected to**:

- Work on the assigned problems.
- Participate actively in group problem solving.
- Present problem solutions to the class.
- Turn in carefully written solutions for assigned problems.

**Grading**: The final grade will be determined as follows:

- 35% - Homework. Written solutions to problem sets: correct, complete, clear.
- 35% - Class activities: participation, active involvement, presentations, and ideas.
- 20% - Midterm Exam – Tuesday, October 15, 2013.
- 10% - Term Paper: "What have I learned in the Problem Solving Seminar?"
- Extra Credit: Good faith effort and performance on the 2013 Putnam Competition.

**Attendance Policy**: Regular class attendance is required and active class participation is expected. Students are responsible for material and announcements missed due to an absence.

**Student Conduct**: Students are required to adhere to the University Policy on Academic Standards and Cheating, to the University Statement on Plagiarism and the Documentation of Written Work, and to the Code of Student Conduct as delineated in the University Catalog and Student Handbook. The Code is available online at: [http://www.umb.edu/life_on_campus/policies/code](http://www.umb.edu/life_on_campus/policies/code)

**Accommodations**: Section 504 of the Americans with Disabilities Act of 1990 offers guidelines for curriculum modifications and adaptations for students with documented disabilities. If applicable, students may obtain adaptation recommendations from the Ross Center for Disability Services, Campus Center, UL Room 211, (617-287-7430). The student must present these recommendations and discuss them with each professor within a reasonable period, preferably by the end of Drop/Add period.
Tentative Schedule

- Week 1:
  o Tue, Sep 3: Introduction. **Topic 1 - Induction.**
  o Thu, Sep 5: Problem Set 1 - discussion

- Week 2:
  o Tue, Sep 10: Problem Set 1 - discussion
  o Thu, Sep 12: **Solutions to Problem Set 1 due. Topic 2 - Pigeonhole Principle.**

- Week 3:
  o Tue, Sep 17: Problem Set 2 - discussion
  o Thu, Sep 19: Problem Set 2 - discussion

- Week 4:
  o Tue, Sep 24: **Solutions to Problem Set 2 due. Topic 3 - Invariants.**
  o Thu, Sep 26: Problem Set 3 - discussion

- Week 5:
  o Tue, Oct 1: Problem Set 3 - discussion
  o Thu, Oct 3: **Solutions to Problem Set 3 due. Topic 4 - Counting.**

- Week 6:
  o Tue, Oct 8: Problem Set 4 - discussion
  o Thu, Oct 10: Problem Set 4 – discussion.

- Week 7:
  o **Tue, Oct 15: Solutions to Problem Set 4 due. Midterm Exam**
  o Thu, Oct 17: Midterm - discussion

- Week 8:
  o Tue, Oct 22: **Topic 5 – Games and Puzzles**
  o Thu, Oct 24: Problem Set 5 – discussion. **Draft of term paper due.**

- Week 9:
  o Tue, Oct 29: Problem Set 5 - discussion
  o Thu, Oct 31: **Solutions to Problem Set 5 due. Topic 6 - Combinatorics**

- Week 10:
  o Tue, Nov 5: Problem Set 6 - discussion
  o Thu, Nov 7: Problem Set 6 - discussion

- Week 11:
  o Tue, Nov 12: **Solutions to Problem Set 6 due. Topic 7 – Number Theory**
  o Thu, Nov 14: Problem Set 7 - discussion

- Week 12:
  o Tue, Nov 19: Problem Set 7 - discussion
  o Thu, Nov 21: **Solutions to Problem Set 7 due. Topic 8 - Sequences and Series**

- Week 13:
  o Tue, Nov 26: Problem Set 8 - discussion
  o **Thu, Nov 28: Thanksgiving Vacation**

- Week 14:
  o Tue, Dec 3: Problem Set 8 - discussion
  o Thu, Dec 5: **Solutions to Problem Set 8 due. Review - miscellaneous**
  o **Sat, Dec 7: 2013 W.L. Putnam Competition**

- Week 15:
  o Tue, Dec 10: 2013 Putnam Competition - discussion
  o Thu, Dec 12: 2013 Putnam Competition – discussion. **Term paper due.**

**Alternative topics:** Complex Numbers, Identities, Inequalities, Groups, Graphs, Matrices and Determinants, Vector Calculus, Geometry