Department of Mathematics
Math 390 - Problem Solving Seminar
Fall 2016

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.

Pre-requisites: MATH 280 (Introduction to Proofs) OR Permission of Instructor.

Schedule: TuTh 9:30am - 10:45am in University Hall Y-03-3380.
For every hour in class, you should dedicate at least three additional hours studying for this course.

Instructor: Catalin Zara, Associate Professor of Mathematics.
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Office hours: By appointment, TuTh 11:00am -12:00pm and 3:30pm - 4:30pm in S-03-091. Please use the online form available `https://catazara.youcanbook.me/` to schedule a 10 or 20 minute appointment. You can stop by without an appointment, but I may be not available.

Additional Info: 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. A new slate of problems will be assigned each week. 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.

Expectations: All students taking the seminar are expected to:
- Work on the assigned problems;
- Participate actively in group problem solving;
- Present solutions to the class;
- Turn in carefully written solutions for assigned problems.

(Recommended) Books: *Putnam and Beyond*, by R. Gelca and T. Andreescu, published by Springer. Softcover: ISBN 978-0-387-25765-5. E-book: ISBN 978-0-387-68445-1.
Mathematics and Plausible Reasoning, by G. Polya.

Assignments: *Homework assignments.* For each topic there will be about several assigned problems, with various levels of difficulty.

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. Topic: "What have I learned in the Problem Solving Seminar?" A draft is due around the mid-term 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 be an opportunity to review the new techniques and concepts learned this semester.

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.
- 20% - Midterm Exam Saturday, October 22, 2016.
- 10% - Term Paper: "What have I learned in the Problem Solving Seminar?"
- Extra: Good faith effort and performance on the 2016 Putnam Competition.

Attendance: Regular class attendance is required and active class participation is expected. Students are responsible for material and announcements missed due to an absence. Please come to class on time and turn off your cell phone before the class begins.

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/`

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.

Changes: Any changes or class cancellations will be announced in class or by e-mail or will be posted online at `https://piazza.com/umb/fall2016/math390/home`

Tentative course schedule:

Week 1	Tue, Sep 6:	Introduction. Set 1 posted.
Topic 1 - Induction	Thu, Sep 8:	Set 1 - discussion.
Week 2	Tue, Sep 13:	Set 1 - discussion. Set 2 posted
Topic 2 - Pigeonhole Principle	Thu, Sep 15:	Set 2 - discussion. Solutions to Set 1 due.
Week 3	Tue, Sep 20:	Set 2 - discussion.
	Thu, Sep 22:	Set 2 - discussion. Set 3 posted.
Week 4	Tue, Sep 27:	Set 3 - discussion. Solutions to Set 2 due.
Topic 3 - Invariants	Thu, Sep 29:	Set 3 - discussion. Set 4 posted.
Week 5	Tue, Oct 4:	Set 4 - discussion. Solutions to Set 3 due.
Topic 4 - Counting	Thu, Oct 6:	Set 4 - discussion. Set 5 posted.
Week 6	Tue, Oct 11:	Set 5 - discussion. Solutions to Set 4 due
Topic 5 - Games and Puzzles.	Thu, Oct 13:	Set 5 - discussion. Set 6 posted.
Week 7	Tue, Oct 18:	Set 6 - discussion. Solutions to Set 5 due.
Topic 6 - Combinatorics	Thu, Oct 20:	Set 6 - discussion.
	Sat, Oct 22:	**Midterm Exam** or
		Virginia Tech Mathematics Contest
Week 8	Tue, Oct 25:	Midterm - discussion. Solutions to Set 6 due.
	Thu, Oct 27:	VT - discussion. Set 7 posted.
Week 9	Tue, Nov 1:	Set 7 - discussion. Draft of term paper due.
Topic 7 - Number Theory	Thu, Nov 3:	Set 7 - discussion. Set 8 posted.
Week 10	Tue, Nov 8:	Set 8 - discussion. Solutions to Set 7 due.
Topic 8 - Sequences and Series	Thu, Nov 10:	Set 8 - discussion. Set 9 posted.
Week 11	Tue, Nov 15:	Set 9 - discussion. Solutions to Set 8 due.
Topic 9 - Complex Numbers	Thu, Nov 17:	Set 9 - discussion. Set 10 posted.
Week 12	Tue, Nov 22:	Set 10 - discussion. Solutions to Set 9 due.
Topic 10 - Linear Algebra	**Thu, Nov 24**:	**Thanksgiving Vacation**
Week 13	Tue, Nov 29:	Set 10 - discussion.
	Thu, Dec 1:	Review. Solutions to Set 10 due.
	Sat, Dec 3:	**2016 W.L. Putnam Competition**
Week 14	Tue, Dec 6:	Putnam - discussion
	Thu, Dec 8:	Putnam - discussion.
Week 15	Tue, Dec 13:	Putnam - discussion. Term paper due.