Math 4950, Problem Solving Seminar

Course Information Fall 2020

Instructors: This course is team-taught with three instructors:

- ▷ Dr. Lisa Mantini, 410 MSCS, lisa.mantini@okstate.edu, 405–744–5777;
- ▷ Dr. Detelin Dosev, 528 MSCS, dosev@okstate.edu, 405–744–5787;
- ▷ Dr. Jeff Mermin, 414 MSCS, mermin@okstate.edu, 405–744–5781.

Office Hours: All instructor office hours are via online teleconference this semester. Contact your individual instructor by email for instructions.

Course Objectives: The objectives of the Problem Solving Seminar are to provide students who enjoy mathematics with experiences in problem solving that help you add some new mathematical skills to your existing repertoire, help develop your creativity, and enhance your ability to read and write mathematical arguments, all while having some fun and hopefully creating a killer Putnam team in the meanwhile. Some sample problems are on the last page of this handout.

Course Times and Dates: This course meets Tuesdays from 4:30 until 5:45 PM in 114 MSCS, or online. The room is large enough to allow social distancing. These are very nice new classrooms on the first floor of Math Science, so no use of the elevators or stairs is required. We expect to have meetings during the weeks from **August 18 until November 17** coinciding with the Tuesday after the revised (pandemic) Putnam Exam date of **Saturday, November 14**. But see the Putnam Exam changes section, below.

Prerequisites: The official catalog prerequisite for this course Math 2153, Calculus II, with a grade of C or better. Students should ideally have mathematical curiosity, persistence, and enjoy the sense of satisfaction that comes from solving a difficult problem. Some experience with mathematical arguments as gained in Math 3613, Introduction to Abstract Algebra, might be helpful, but we will discuss mathematical writing and mathematical arguments throughout the semester.

Textbook: There is no required text. We will provide handouts if needed. The resources you want to be aware of are these:

- ▷ *Problem-Solving Through Problems*, by Loren C. Larson, Springer-Verlag, 1983, ISBN 0-387-96171-2, a compilation of problems from the Putnam exam and other sources, sorted by mathematical topic, with solved problems and additional commentary. This might be considered an optional text, and it is a great reference for Putnam competitors. A copy is on reserve for this course (two hour check-out time limit) in the Library.
- ▷ The archive of Putnam Exams and solutions at kskedlaya.org/putnam-archive.

Course format: This is a seminar course divided into three four-week segments, one taught by each instructor. Each class session may include a brief lecture on a problem-solving technique followed by time to work on problems individually or in groups as long as you can observe social distancing (seems weird to shout between tables – I would be OK with students talking to each other on the phone or via computer if they are discussing a problem solution and don't want to shout). There will be two assigned problems every week during the 12 weeks of instruction. All problems will be posted on canvas, and all problem solutions will be submitted online, uploaded into the relevant dropbox on canvas. Some solutions may be collected at the end of class time and some may be collected later, as homework.

Course Requirements: Your course grade will be computed out of 180 points (even though many more points are available) according to the following standards:

- 150 points will earn the grade of A;
- 120 points will earn the grade of B.

The guidelines for how to earn points are these:

- ▷ You may earn a maximum of 60 points from each instructor.
- ▷ Each problem assigned is worth 15 points.
- ▷ The first 5 points are earned by submitting a solution which makes some correct progress towards setting up or solving the problem. These 5 points substitute for attendance points that we would normally have assigned per week (attendance points are not permitted during Fall 2020 due to the pandemic).
- ▷ Earning the full 15 points for any problem requires both that the solution be mathematically correct, and that the solution be written neatly and clearly, in full sentences, with all steps justified carefully and completely. This is how to earn points on the Putnam Exam: solve the problem correctly *and* produce a well-written, complete justification of your solution.
- ▷ Some instructors may allow problems to be revised and resubmitted (possibly after giving a hint) for extra points.
- ▷ The deadline for submitting problems to an individual instructor is typically the Monday evening after their last session.

Problem Submission: All problem solutions should be written clearly on $8.5'' \times 11''$ paper that is preferably white and unlined, scanned, saved as a single pdf, and uploaded into the relevant dropbox on canvas. You must upload solutions as a clear and readable pdf file. No jpg's or other images, and no word or other documents will be accepted. There are many very good scanning apps for your phone including Adobe Scan, which is available to you using OSU's campus license. Ask us if you need help with this.

Putnam Exam: All students in the course (and other interested students) are encouraged to participate in the Putnam Exam. The William Lowell Putnam Mathematical Competition is the preeminent mathematics competition for college students in the US and

Canada (probably in the world!). It has been held annually dating back to 1938. It is both an individual competition, with each student eligible to participate at most four times, and a team competition, with the top 3 students from each University forming that school's team. Typically more than 2000 students participate from hundreds of colleges and universities, and typically the median score on the exam is 0. Here are sources for additional information:

- ▷ Additional information on the exam is available at the web site at Santa Clara University, math.scu.edu/putnam.
- ▷ A history of winning individuals and teams is available at the web site of the Mathematical Association of America at www.maa.org/programs/maa-awards/.
- ▷ The Art of Problem Solving organization also has additional information on its web site at artofproblemsolving.com.

Putnam Exam Recognitions: The highest ranking contestant from Oklahoma State University will have their name engraved on our plaque, mounted on the fourth floor of MSCS. In addition, the highest ranking contestant from the Oklahoma-Arkansas region will have their name listed on the web site of the MAA Oklahoma-Arkansas section and engraved on a plaque.

Course Calendar: Here is an approximate course schedule.

Date	**Topic/Event**	**Instructor(s)**
August 18	Course introduction	All
August 25 September 1 September 8 September 15	Part 1	Mantini
September 22 September 29 October 6 October 13	Part 2	Dosev
October 20 October 27 November 3 November 10	Part 3	Mermin
November 14	Official Putnam Exam (tentative)	
November 17	Last class, wrap-up	All
December 5	Unofficial Putnam Exam (tentative)	

Pandemic Changes for the Putnam Exam: The Putnam Exam traditionally is held the first Saturday of December, but this is not a traditional year. As of this writing

(in August), the official Putnam Exam, if held, will take place on **Saturday, November 14**. This depends on the state of the pandemic, as is to be expected. We will, of course, find a very large, well-ventilated room and use social distancing during the exam. However, if the state of the pandemic worsens sufficiently, the Putnam Exam may be officially cancelled. If this happens the MAA will send out an "unofficial" Putnam Exam, intended for students to work on independently, just for fun. They would then publicize solutions later, but no exam solutions would be collected from any student. If this happens, the exam would revert to its original date of the first Saturday in December, which is **Saturday, December 5**.

Academic Integrity: Oklahoma State University is committed to the maintenance of the highest standards of integrity and ethical conduct of its members. This level of ethical behavior and integrity will be maintained in this course. Participating in a behavior that violates academic integrity will result in your being sanctioned. These behaviors include, but are not limited to, unauthorized collaborations and plagiarism. Violations may subject you to disciplinary action including the following: receiving a failing grade on an assignment, examination or course, receiving a notation of a violation of academic integrity on your transcript (F!), or being suspended from the University. See academicintegrity.okstate.edu.

- ▷ With regard to this course, we encourage the discussion of problems and their solutions. However, you must write all of your submitted problem solutions *yourself* unless an assignment is specifically listed as a group assignment. You must never claim ideas that are not your own as your own. If you obtain significant help from an individual other than one of the instructors, that person should be cited in your assignment's Bibliography as Last Name, First Name, *Personal Communication*, with a brief description of the help received. Yes, if sources other than your own head are consulted, you need a Bibliography.
- ▷ When consulting written sources, in addition to properly citing your source, you must make sure that you have come to understand whatever you read in your own way. Problem solutions must never be copied verbatim but must be written in your own words. This means that you should close your book or browser and process the material on your own before writing it up on your own. If you don't understand an idea or could not explain it verbally to us, then it should not be included on anything you submit to us.
- ▷ Our grading policy, and indeed this entire course, is designed to encourage you to try to solve challenging problems without feeling too much pressure on producing correct solutions to all (or most) of them. Please ask if you need a hint. Do not risk your integrity for one credit hour.