MATH 297R (Mathematical Problem Solving) Fall 2020 Syllabus

Section 1 (Oser) - F 7am - 8am

Instructor: Paul Oser  Email: poser3@emory.edu
Zoom Office: 652-382-252 (hours to be announced in Canvas)
Pierce Hall Office: Rm. 124

Overview
This course is an exploration of mathematical problem solving and focuses on the development of skills used in mathematical research. The student will be given many opportunities to investigate mathematical problems, make conjectures, prove those conjectures, and reflect on the process of mathematical research employed.

Goals for Student Learning: The student at the conclusion of this course should ...

- Be more familiar with how mathematicians approach problems they research
- Have developed the ability to formulate good conjectures about “mathematically interesting” phenomena
- Be more practiced/skilled in crafting mathematical proofs
- Have connected in some capacity with a larger mathematical community to get ideas for further research

Materials for the Course
All necessary material for the course (problems, readings, etc.) will be provided to the student via email.

Pre-requisites
None.

Expected Workload
The student’s weekly commitment will consist of:

- **Weekly Meetings with the Instructor:** The instructor will be available via Zoom during the scheduled class time. This time will largely be spent introducing new problems to be investigated, assessing the student’s current progress on older problems (i.e., the student will be asked to explain what she has so far discovered in her investigations and how she came upon these results – the details of her analysis), and working together to determine appropriate “next steps” in the investigation of the problem/topic at hand.

- **Investigating/Solving Mathematical Problems:** For each problem/topic explored, the student will initially be engaged in finding solutions to some graded “starting questions”. The student will then need to formulate conjectures related to the answers to these starting questions, and then pursue the proofs of these conjectures, as well as proofs of deeper results arising from these initial activities and other observations.

- **Reflection Assignments:** The student will regularly be asked to reflect on the specific questions and techniques used in the pursuit of her work, critiquing both their efficacy in the proofs she has tackled, as well as their ability to apply more generally to other research questions in mathematics. The student will revisit these questions several times over the course of the semester, allowing her to refine/revise her thoughts on the matter.

The student should expect to spend at least two hours per week outside of class working on the investigations and reflection assignments in addition to time spent with the instructor during class time.

Final Reflection / Research Plan
The nature of the course does not lend itself to a final exam, so instead the student will be asked at the end of the course to write a final reflection and a plan for future mathematical research/problem solving arising from the investigatory work in which she engaged over the entire course of the semester. As part of this final
assignment/project, the student will be asked to formulate specific new questions to explore, citing her engagement with some larger mathematical community and how that engagement led to the design of the questions detailed. Additionally, the student will be asked to describe an overall strategy for attacking these new questions and how that strategy meshes with the questions and techniques she addressed in her earlier reflection assignments.

**Grading:** Final course grades will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>“Starting Questions”</td>
<td>20%</td>
</tr>
<tr>
<td>Development of Conjectures and Proofs of Related Results</td>
<td>40%</td>
</tr>
<tr>
<td>Reflection Assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Final Reflection / Research Plan</td>
<td>20%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
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Answers to “Starting Questions” initially given to the student for each topic/problem explored will be graded for correctness, while the grades that make up the “Development of Conjectures and Proofs of Related Results” category above will be dependent on an appropriate level of engagement and analysis with regard to the problems solved, conjectures made, and proofs constructed after the aforementioned motivating “starting problems”.

In general, letter grades will be determined as follows, based on points each student earns:

- A: at least 90%; B: 80-89%; C: 70-79%; D: 60-69% points; F: less than 60%. Grades of A-, B+, B-, C+, C-, D+ may be assigned for sums of points near these cut-off totals.

**Late Policy**

The student is expected to be present for all weekly meetings. Any conflicts should be brought to the instructor’s attention as soon as possible, so that the weekly meeting in question can be rescheduled, if possible. Missed meetings will result in a lower grade given to the student in the “Development of Conjectures and Proofs of Related Results” category.

In general, submitting a reflection assignment past its due date will result in a lower grade on that assignment. That said, the instructor reserves the right to waive this policy at his discretion if circumstances warrant (e.g., the student becomes ill, or some other emergency situation happens).

**Honor Code (see [http://oxford.emory.edu/catalog/regulations/honor-code.html](http://oxford.emory.edu/catalog/regulations/honor-code.html))**

The Oxford College Honor Code applies to all work done in this class.

**Special Accommodations**

The Office of Accessibility Services (OAS) works with students who have disabilities to provide reasonable accommodations. In order to receive consideration for reasonable accommodations, please contact the OAS and complete the registration process. Faculty may not legally provide you with accommodations until an accommodation letter has been processed and discussed with them; accommodations do not start until this point and are not retroactive. Students registered with OAS who receive a letter outlined specific academic accommodations are thus strongly encouraged to immediately coordinate a meeting with their professors to discuss a protocol to implement accommodations that will (or may) be needed over the course of the semester. This meeting should occur as early in the term as possible. Contact Megan Bohinc in OAS for more information at (770) 784-4690 or oas_oxford@emory.edu