

<u>Title</u>	
99 Problems (And How to Solve Them!)	

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Office hours: Mondays 3:30-5:00 in Physics 220 (TA room) and by appointment
Course Meeting Time: Tuesdays 4:00-5:50
Location: Physics Building 218

Prerequisites: None. All majors welcome.

Course Description

99 Problems (And How to Solve Them!) is an introduction into the methods, tools, and mindset of problem solving. There are many more applications for analytical problem solving than just math and science. For example, how would you best play a game that you have just been taught? Or decipher the meaning of a word you have never seen before? We will explore methods of approaching, attacking, and ultimately solving a wide variety of problems, from basic math and science to games and puzzles to language and art.

We will spend one to two weeks covering each of a few topics, including (but not limited to) games and creative thinking, logic and puzzles, language dissection, and computer science. In this course you will see several types of problems and approaches for solving them. You will learn to see patterns and commonalities between problems of very different natures, for example a basic computer science problem might follow the same broad steps as creating a work of origami. In this course we will dissect, discuss, and analyze a selection of problems that will teach you, through an examination of their parts and solutions, to use a similar broad, step-by-step approach to solve problems in almost any other discipline.

This course is designed for all students who want to improve their problem solving skills, regardless of prior experience or major. We will show how solving a problem in one discipline can be extremely beneficial for solving a problem in a seemingly unrelated discipline. You will also be able to appreciate how fun and enjoyable problem solving - either academic, professional, or recreational - can be.

Course Objectives

- *Improve your ability to solve problems by learning problem solving techniques, including how to approach a problem and what questions to ask while looking for a solution*
- *See how widely applicable and useful problem solving is across numerous subjects and in everyday life*
- *Become confident in your abilities by practice, practice, practice!*
- *Have a lot of fun!*

Required Text

[How to Solve it: A New Aspect of Mathematical Method](#) by George Polya, ISBN 9781400828678

Recommended Texts

[The Colossal Book of Mathematics: Classic Puzzles, Paradoxes, and Problems](#) by Martin Gardner, ISBN 9780393020236

[The Art of Problem Solving, Vol. 1: The Basics](#) by Sandor Lehoczky and Richard Rusczyk, ISBN 9780977304561

[The Art of Problem Solving, Vol. 2: And Beyond](#) by Sandor Lehoczky and Richard Rusczyk, ISBN 9780977304585

[Gödel, Escher, Bach: An Eternal Golden Braid](#) by Douglas R. Hofstadter, ISBN 9780465026562

Evaluation and Course Components

This course is two credits and is evaluated as credit/no credit for all students. In order to receive credit, students must complete the course with a minimum of 80%, evaluated through the following criteria:

Attendance and Participation (30%)

As a significant portion of this course will be in-class activities and lectures, it is crucial that students attend every class and participate actively. Students must email the instructors *before* class begins if they are going to be absent one week, and a make-up activity will be provided. Students with more than one unexcused absence will receive a score of zero for the attendance and participation portion of the grade, and therefore will not receive credit for the course.

Homework (40%)

Learning problem solving techniques takes practice, so homework activities are an important component of the course. Homework is not intended to be tedious or especially challenging, but rather as an enjoyable supplement that allows students to practice and reinforce concepts introduced in class. Unless otherwise specified, all homework assignments will be due at the beginning of class the week after they are assigned. Graded homework to be completed outside of class fall into two categories:

(W) Worksheets/activities (20%): A worksheet of problems, puzzles, and/or activities to be completed outside of class. Worksheets will sometimes require the use of online resources.

(R) Reflections (20%): Reflections are a valuable component of the course because they ask students to assess themselves. Through reflections, students will pinpoint their own strengths and weaknesses throughout the course. They will also reflect on readings they have done in order to better understand the reading. The instructors will use students' reflections to determine how well the students are grasping concepts and to improve the course as the semester progresses. Reflections will be graded on completion.

Final Project (30%)

Students will work on a creative problem solving project based on their own interests. These projects can be about exploring different problems in a mathematical topic, engineering a solution to an everyday problem, or anything that interests the student and demonstrates how the student would go about solving a problem. Projects will be presented on the last day of the course. In presenting their projects, students will explain what challenges they

encountered and how they went about solving them. Every presentation will be followed by a discussion of the solution(s). Final project grades will be determined based on both presentation of the project and participation in discussions of other projects.

Calendar

Class meeting day	Class topic	Homework assigned this week
Aug 25	Introduction: Importance of problem solving, course outline, nine dots problem Game: Sprouts Activity worksheet	Read <u>How to Solve It</u> : Part 1 and 2 Post a reflection on the Forum in Collab (Not required, but interesting) Read c.36 "Sprouts and Brussel Sprouts" in <u>The Colossal Book of Mathematics</u>
Sep 1	Book Discussion Computational Linguistic Problems Traffic Jam (team activity)	Do last week's homework if you didn't get a chance to or if you added the class late. Finish the two worksheets on linguistics problems that were handed out in class. For this assignment, you can look online, email and/or discuss it with us, and talk with your peers. Just make sure you understand the solution .
Sep 8	Go over linguistics problems Logic Puzzles Traffic Jam	Please post a comment about the Polya reading on the Forum on Collab if you haven't! This counts as a homework completion grade and we are reading all of these! For next class, try to finish the worksheet called "Knights and Knaves". It is posted on Collab in case you lose it. Bring it finished to class next week. Collaboration is fine, but make sure you understand the solution . Come to office hours if you have questions!
Sep 15	Eleusis Work on extra problems	Finish until at least level 15 on <u>gameaboutsquares.com</u> and email or bring a screenshot of it to class. Also, if you didn't get all the problems right on either of the last two homeworks then do the corresponding extra problems and bring it to class. You need to get the extra problems right to get credit.

Sep 22	Introductory computer science problems Turing Machines	Go to the Assignments tab on Collab and do Reflection 1 .
Sep 29	Review Material	TBD
Oct 6	<u>NO CLASS- FALL BREAK</u>	TBD
Oct 13	(TENTATIVE) CS problems, Tech Interview questions	TBD
Oct 20	(TENTATIVE) Engineering problems	TBD
Oct 27	(TENTATIVE) Guest Lecture – Professor Robins	TBD
Nov 3	(TENTATIVE) Physics problems	TBD
Nov 10	(TENTATIVE) Review	TBD
Nov 17	Work on Final Project	Work on final project - DUE 12/1/15
Nov 24*	<u>NO CLASS - THANKSGIVING</u>	Work on final project - DUE 12/1/15
Dec 1	Presentation of Final Projects	

Revisions to Syllabus

The instructors for this course reserve the right to modify any part of this syllabus at any time, with the exception that due dates for homework that has already been assigned will not be moved up. Additionally, the instructors will inform students whenever a change has been made to the syllabus, and they will distribute an updated version promptly following any change.