

PSYCH 143P: Human Problem Solving, Spring 2022.  
Department of Cognitive Sciences

Instructor: **Zygmunt Pizlo**  
HH 262, MWF 9:00-9:50am.  
Office hour: SSPA 2187, Mon 10-11am.

Problem solving is known as our most important goal-directed activity. It includes planning an efficient tour of a number of places, which is known as the Traveling Salesman Problem, the Tower of Hanoi problem, and brain teasers such as constructing four equilateral triangles from six matchsticks, and the science problems students solve in Math and Physics classes, as well as scientific discovery. Considering such a wide range of problems that we humans solve, a question arises, namely, whether there is anything in common across all of them. This class will review experiments that tested how humans solve a wide variety of problems. It will then describe several concepts related to the mental representation of problems and will evaluate how these representations are used to solve such problems. Do humans perform searches for the best solution, the way Artificial Intelligence (AI) algorithms do? If not, how do humans handle a large number of possible solutions and how does human performance compare to optimal solutions provided by AI? Finally, how are discoveries actually made in the Natural Sciences and what will it take for AI to compete with humans in this area?

This class is based on a new textbook on human problem solving that was written by the instructor of this class. This textbook will be published in the Summer of the current year, but the students in this class will have access to a pre-print.

There will be a short quiz in class once a week, and their score will count towards your semester grade. The quiz questions will be based on the material covered in the prior 3 lectures.

Your course grade will be based on the lecture quizzes (33.3%) and on two exams, a midterm and a final (each exam counts 33.3%). The final exam will *not* be cumulative. These exams will have multiple-choice questions, short answer questions, and problems to solve. The scores in each exam will be normalized to the average of two highest scores. The semester grades will be assigned using the conventional cutoff points: 90% and above is A, 80%-90% is B and so on.

Text: Pizlo, Z. (2022) *Problem solving: cognitive mechanisms and formal models*. Cambridge University Press.

Topics:

Week 1: Introduction – goal-directed, purposive behavior and purposive reasoning.

Week 2: Animal problem solving.

Weeks 3-4: Search problems. The role of heuristics and the role of symmetry in producing fast solutions.

Week 5: Review and mid-term exam.

Midterm: November 1.

Week 6: Insightful problem solving. The role of symmetry in problem representation.

Week 7: Visual perception as inference. Cognitive inferences.

Week 8: Theory of Mind.

Week 9: Causality, intuitive physics and math problem solving.

Week 10: Review.