Algorithmic Robotics
COMP/ELEC/MECH 450/550

Handout #1: Course Information

Instructors:

Lydia E. Kavraki
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Teaching Assistants:

Mr. Clayton Ramsey
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Changes to office hours will be announced Canvas and Piazza

When: Tuesdays and Thursdays from 1:00-2:15pm DH 1064

Course URLs: The material of the course will be distributed through Canvas.

Piazza: Please use Piazza for questions. You can even post your question anonymously. Remember that your TAs are busy too. Please post your questions during the week for fast replies. Students are encouraged to answer questions, and this will be taken into account when the participation grade is determined. Check Canvas on how to enroll in the Piazza account of the class. You can find this information on Canvas.

Required Book: *Principles of Robot Motion* (MIT Press) by Choset, Lynch, Hutchinson, Kantor, Burgard, Kavraki and Thrun. Other material will be made available through Canvas.

Auditors: Auditors need to talk with the instructor. They need to register for the class as auditors.

Absence Policies:	If for any reason the student cannot follow the class, the student needs to contact Professor Kavraki.
Masking Policies:	Please wear a mask if you have a cold of any kind. The registrar has specified that students with Covid should stay home.

Grade Policies

This class will contain four graded homework assignments. As far as projects are concerned, undergraduates will have four projects while graduate students will have five projects. Two tests will be given and each is worth 20% of the total grade. Participation will account for 4% of the final grade, and is determined by attendance, contributions to classroom discussion, contributions to discussions, and short presentations. The four homework assignments are together 16% of the total grade, with each assignment weighted equally. The projects account for the remaining 40% of the grade.

For the undergraduate version of this course, the projects are weighted as 6%, 6%, 8%, 20% of the class grade respectively.

For the graduate version of this course, the projects and graduate assignment are weighted as 4%, 4%, 4%, 14%, 14% of the class grade respectively.

Late Assignments

All homeworks and projects are due by 1:00pm CST of the day specified in the assignment unless otherwise noted. 10% is taken off any homework or project received late. Each assignment must be handed in within at most one week from the due date. Otherwise, a zero grade will be given. **For the last assignment or project, or the last assignment handed in this class, the above policy does not apply. The absolute time when the last or any assignments can be handed in for a grade is 8 am on December 2, 2024. Nothing will be accepted after that and a zero grade will be given. Exceptions will be made only for documented medical reasons.**

The announcements section of the class will indicate the due date and time of the homeworks and projects. You have two grace days for the whole semester that can be used for your homework and projects. These grace days can be used to turn in an assignment late without penalty. It is strongly recommended that you save your grace days for your projects. You can not use the grace days past 8 am on December 2, 2024.

Regrading

All requests for regrading must be submitted in writing via e-mail to the instructor within one week of the return of the graded assignment or exam. Please note that the instructor reserves the right to regrade the assignment or exam in its entirety, which may result in a credit of points and/or a deduction of points, as appropriate. The score resulting from the regrade will be final, and no additional requests to regrade the particular assignment will be considered.

Prerequisites

COMP321 AND COMP215 are the official prerequisites. All students are encouraged to talk with the instructor regarding the pre-requisites, especially non-CS students. All students who have not taken COMP211 or COMP321 are encouraged to talk with the instructor. Students whose prerequisites have been waived need to determine if they can make this class in the first two weeks of classes. *Pre-requisites are waived for graduate students.*

Recommended Background

The following background is recommended:

1. Python
2. C++ programming experience (C is OK, Java is OK. Python needs remedial work.)
3. data structures and analysis of algorithms,
4. some mathematical sophistication.

There is no requirement for prior exposure to robotics, graphics, or artificial intelligence.

Honor Code

Besides the University Honor Code, the following rules apply to the class. Please note that violators will be reported to the undergraduate and the graduate honor code council without a warning.

- For homeworks, you can discuss with your peers, but you must write your own solutions.
- For some projects, you will work in teams. In that case, you may only discuss the project with your partners. If the project is not done in pairs, you need to complete it on your own without help from others.
- You are not allowed to look at homework, exams, or projects of previous years. You may not consult solutions from prior semesters of this course or similar courses at other universities. The instructor is going to distribute material in class.
- You may not obtain any code from anyone, regardless of whether or not they are in the course. You cannot obtain code from the web or AI tools (aside from code provided in the course, in reference books, or in standard code libraries). The instructor is going to distribute code examples in class.
- The use of AI tools is not allowed except when explicitly indicated in assignments and projects. In that case the specific tool use should be indicated.
- As far as the exams are concerned, you are not allowed to give or receive any help. Exams will be in class and short (40-50 mins).

Students with Disabilities

If you have a documented disability or other condition that may affect academic performance, you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with the instructor to discuss your accommodation needs.

Mental Health Sattement

The wellbeing and mental health of students is essential; if you are having trouble completing your coursework, please reach out to the Wellbeing and Counseling Center. Rice University provides cost-free mental health services through the Wellbeing and Counseling Center to help you manage personal challenges that threaten your personal or academic well-being. If you believe you are experiencing unusual amounts of stress, sadness, or anxiety, the Student Wellbeing and Counseling Center may be able to assist you. The Wellbeing and Counseling Center is located in the Gibbs Wellness Center and can be reached at 713-348-3311 (available 24/7).

Title IX Statement

Rice University cares about your well-being and safety. Rice encourages any student who has experienced an incident of harassment, pregnancy discrimination, gender discrimination, or relationship, sexual, or other forms of

interpersonal violence to seek support through The SAFE Office. Students should be aware when seeking support on campus that most employees, including myself, as the instructor/TA, are required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to Title IX professionals on campus who can act to support that student and meet their needs. For more information, please visit https://safe.rice.edu or email titleixsupport@rice.edu

Course Objectives

Students will learn:

- to represent 2D and 3D rigid body motion,
- to define and construct configuration and state spaces,
- to connect concepts of motion planning to their mathematical foundations,
- to connect concepts of motion planning to AI concepts and theories,
- understand how to check if two rigid bodies collide computationally,
- the fundamentals of potential-based and decomposition-based planning algorithms,
- the key algorithms of roadmap and sampling-based motion planning,
- the key concepts of planning with incomplete information and uncertainty,
- the key concepts of task and motion planning,
- the key concept of long-horizon planning and autonomy.

Course Outcomes

Students completing the course will be able to:

- apply a body of motion planning facts,
- apply core concepts and algorithms to the solution of robotics problems,
- name key features of motion and motion strategies,
- execute and compare motion planning techniques and strategies,
- construct a problem-solving model that controls and organizes motion planning,
- understand how to use AI methods in robotics and what are their limitations,
- identify applications of motion planning concepts to other domains in science and engineering.

A Final Note

Information contained in this handout, exclusive of the grading, absence, and participation policy, **is subject to change with reasonable advance notice**, as deemed appropriate by the instructor.