



**ISE 599: Reasoning Methods in Artificial Intelligence**

**Units: 4**

**Term/Day/Time: Summer 2021 (May 19th to August 10th); Thursdays 2:30-6:30pm.**

**Location: Online**

**Instructor: Prof. Satish Kumar Thittamaranahalli**

**Office: PHE324**

**Office Hours: By Appointment**

**Contact Info: [thittama@usc.edu](mailto:thittama@usc.edu)**

## Course Description

This course will provide a comprehensive introduction to modern algorithmic techniques used in Artificial Intelligence and Machine Learning. Topics include (but may not be limited to) Constraint Satisfaction, Combinatorial Optimization, Machine Learning, Probabilistic Reasoning and Graphical Models, Approximation and Randomization Techniques, Planning and Scheduling, Heuristic Search, and Model-Based Reasoning.

## Learning Objectives

Students will learn to use different algorithmic techniques developed in different communities to build practically viable algorithms for real-world problems.

## Recommended Preparation

Discrete Mathematics; Design and Analysis of Algorithms.

## Co-Requirement

None

## Course Notes

This course will comprise of lectures and a project. The course will ordinarily be taken for a letter grade. Students are advised to take down lecture notes in the classroom. However, additional readings will be distributed online via Blackboard.

## Technological Proficiency and Hardware/Software Requirements

Student projects will involve computer programming. Prior knowledge of computer programming languages like Python and C/C++ is an advantage. Alternatively, proficiency with these computer programming languages will have to be acquired during the course. Familiarity with a variety of operating systems, including Linux, will also be very useful.

## Required Readings and Supplementary Materials

References to research papers and other articles will be available via Blackboard. No textbook is required for this course. However, students can use the following books for reference:

- (a) "*Introduction to Algorithms*", by Thomas Cormen, Charles Leiserson, Ronald Rivest and Clifford Stein (Third Edition)
- (b) "*Artificial Intelligence: A Modern Approach*", by Stuart Russell and Peter Norvig (Third Edition)
- (c) "*Introduction to Machine Learning*", by Ethem Alpaydin (Third Edition)

## Description of Student Project

The project will have to be original research. Its topic will be agreed upon by the student and the course instructor. The instructor will suggest suitable resources for the selected topic and will meet

with each student to give guidance on the project. Project deliverables will include timely updates, a written report, and an oral presentation in class. The report is expected to be between 10 and 15 pages (single column), including figures and excluding references. The presentation is expected to be for 15-20 minutes.

### **Grading Breakdown**

<b>Course Element</b>	<b>% of Grade</b>
Student Project (Updates)	15%
Student Project (Report)	70%
Student Project (Presentation)	15%
Extra Credit	00%
<b>TOTAL</b>	<b>100%</b>

### **Statement for Observance of Religious Holidays**

USC's policy grants students excused absences from class to observe religious holidays: <http://orl.usc.edu/life/calendar/absences/>. In this case, please contact your instructor in advance to agree on alternative course requirements.

## Course Schedule: A Weekly Breakdown

	Topics	Readings	Deliverables
<b>Week 1</b>	Introduction, Graph Theory, Constraint Satisfaction.	Lecture Notes, Research Papers	
<b>Week 2</b>	Constraint Satisfaction and Weighted Constraint Satisfaction.	Lecture Notes, Research Papers	
<b>Week 3</b>	Combinatorial Optimization.	Lecture Notes, Research Papers	
<b>Week 4</b>	Probabilistic Reasoning and Graphical Models.	Lecture Notes, Research Papers	Project Update
<b>Week 5</b>	Approximation and Randomization.	Lecture Notes, Research Papers	
<b>Week 6</b>	Temporal Reasoning and Scheduling.	Lecture Notes, Research Papers	
<b>Week 7</b>	Heuristic Search.	Lecture Notes, Research Papers	Project Update
<b>Week 8</b>	Automated Planning.	Lecture Notes, Research Papers	
<b>Week 9</b>	Machine Learning.	Lecture Notes, Research Papers	
<b>Week 10</b>	Machine Learning.	Lecture Notes, Research Papers	Project Update
<b>Week 11</b>	Case Studies.	Lecture Notes, Research Papers	
<b>Week 12</b>	Student Presentations.		Final Project Report

## Statement on Academic Conduct and Support Systems

### Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

### Support Systems:

*Counseling and Mental Health - (213) 740-9355 – 24/7 on call*  
[studenthealth.usc.edu/counseling](http://studenthealth.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](https://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call*  
[studenthealth.usc.edu/sexual-assault](https://studenthealth.usc.edu/sexual-assault)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298*  
[equity.usc.edu](https://equity.usc.edu), [titleix.usc.edu](https://titleix.usc.edu)

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

*Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298*  
[usc-advocate.symplicity.com/care\\_report](https://usc-advocate.symplicity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

*The Office of Disability Services and Programs - (213) 740-0776*  
[dsp.usc.edu](https://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*  
[uscsa.usc.edu](https://uscsa.usc.edu)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*  
[diversity.usc.edu](https://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*  
[dps.usc.edu](https://dps.usc.edu), [emergency.usc.edu](https://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*  
[dps.usc.edu](https://dps.usc.edu)

Non-emergency assistance or information.