**Units: 4 units**

**Lectures:**

Section 30198D: 5:00-8:20 PM Monday

Section 30395D: 5:00-8:20 PM Wednesday

Section 30099D: 5:00-8:20 PM Wednesday (DEN)

**Instructor: Shawn Shamsian**

**Office:** SAL 318

**Office Hours:** Tuesdays and Thursdays 4-6 PM

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

**Teaching Assistant:**

**Office:** TBA

**Office Hours:** TBA

**Contact Info:** TBA

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**Course Information**

* **Course Outline:** The course is intended as a first graduate course in the design and analysis of algorithms. The focus is on developing an understanding of the major algorithm design techniques. Algorithmic techniques covered include divide and conquer, greedy, and dynamic programming. Other topics include network flow, NP-completeness, approximation algorithms, and linear programming. At times, the practical side of algorithm design and implementation is also explored with interesting examples of their usage in solving industry problems.

**At the end of this course, students should have:**

* A good understanding of major algorithm design and analysis techniques
* Ability to design, analyze complexity of, and prove correctness of moderately difficult problems
* A good understanding of the NP, NP-complete, and NP-hard classifications and ability to demonstrate hardness of NP-complete problems
* Ability to solve problems through reduction such as reduction to network flow problems (max flow, min cut, feasible circulation) or linear programming
* An understanding of different methods to solving problems approximately
* Overall better problem-solving skills
* **Textbook:**   
  **\* Algorithm Design**  
          Jon Kleinberg/Eva Tardos   
  The class will be relying mostly on this textbook, but additional material will occasionally be drawn from the following:   
  \* Introduction to Algorithms (second Edition)   
          Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest and Cliff Stein published by MIT Press and McGraw-Hill.

Students in the class are expected to have a reasonable degree of mathematical sophistication, and to be familiar with the basic notions of algorithms and data structures, discrete mathematics, and probability. Undergraduate classes in these subjects should be sufficient. If you have doubts about meeting these prerequisites, please contact the instructor.

**Exams and Grading Breakdown**

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| --- | --- | --- |
| **Exams** | **Date** | **% of Grade** |
| Exam 1 | February 18 | 33% |
| Exam 2 | April 1 | 33% |
| Exam 3 | April 29 | 29% |
| Final project | May 9 | 5% |
| Total | | 100% |

Exam 1 covers the material corresponding to weeks 1 through 5.

Exam 2 covers the material corresponding to weeks 7 through 11.

Exam 3 covers the material corresponding to weeks 13 through 15.

**Assignment Submission Policy**

Homework assignments are assigned on a weekly basis. Homework assignments are graded but homework grades do not count towards final grades as indicated in the grading breakdown. Students are highly encouraged to submit homework assignments for grading since this provides them an opportunity to receive feedback on their work before exams. Also, homework assignments contain questions from previous exams and help familiarize students with the types of questions they can expect on exams.

**Additional Policies**

Exam dates will be announced by first week of classes. Students need to make sure they can take exams on those dates and times. There will be no makeup exams.

**Course Schedule: A Weekly Breakdown**

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| --- | --- | --- | --- |
|  | **Topics/Daily Activities** | **Readings and Homework** | **Homework  Due Date** |
| Week 1 | intro, stable matching | Reading: chapter 1 Home assignment 1 | Week 2 |
| Week 2 | Asymptotic notation, BFS, DFS, greedy algorithms | Reading: chapters 2, 3, 4 Home assignment 2 | Week 3 |
| Week 3 | Greedy algorithms | Reading: chapter 4, supplemental text  chapters 6,19  Home assignment 3 | Week 4 |
| Week 4 | heaps, MST, shortest path | Reading: chapter 4, 5 Home assignment 4 | Week 5 |
| Week 5 | divide and conquer | Reading: chapter 5  Home assignment 5 | Week 6 |
| Week 6 | **exam I** |  |  |
| Week 7 | dynamic programming | Reading: chapter 6  Home assignment 6 | Week 8 |
| Week 8 | dynamic programming | Reading: chapter 6  Home assignment 7 | Week 9 |
| Week 9 | network flow - max flow | Reading: chapter 7  Home assignment 8 | Week 11 |
| Week 10 | **Spring Break** |  |  |
| Week 11 | network flow - circulation | Reading: chapter 7  Home assignment 9 | Week 12 |
| Week 12 | **exam II** |  |  |
| Week 13 | NP-completeness | Reading: chapter 8  Home assignment 10 | Week 14 |
| Week 14 | NP-completeness | Reading: chapter 8, supplemental text chapter 34  Home assignment 11 | Week 15 |
| Week 15 | approximation algorithms randomized algorithms linear programming | Reading: chapter 11, supplemental text chapter 35  Home assignment 12 | Week 16 |
| Week 16 | **exam III** |  |  |

**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 take a moment to refresh your understanding of these standards by visiting <https://policy.usc.edu/scampus/> for information about the Student Conduct Code.

Discrimination, sexual assault, and harassment are not tolerated by the university.  You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <https://dps.usc.edu/contact/>. This is important for the safety of the whole USC community.  Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person.  *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

## **Support Systems**

A number of USC’s schools provide support for students who need help with scholarly writing.  Check with your advisor or program staff to find out more.  Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students.  *The Office of Disability Services and Programs* [*https://dsp.usc.edu/*](https://dsp.usc.edu/)provides certification for students with disabilities and helps arrange the relevant accommodations.  If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* [*http://emergency.usc.edu*](http://emergency.usc.edu)will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.