CS 530 - Mathematical Foundations in Computer Science

Fall 2017

Course Description

This course covers mathematical foundations of Computer Science focusing on basic mathematical structures, mathematical logic and probability theory. It is designed to provide students with proficiency in applying these concepts to problem solving and formal reasoning. To achieve this, the course provides students with significant hands-on practice including through the use of computational tools.

Instructor

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Office hours: by appointment

Teaching Assistant

TBA

Class

Enterprise Hall, Room 178
Monday, 7:20 PM - 10:00 PM (see exceptions below)

Prerequisites

- MATH 125 or INFS 501
- STAT 344

Text Books

1. Foundations of Computer Science by Alfred V. Aho and Jeffrey D. Ullman (http://infolab.stanford.edu/~ullman/focs.html)

2. Mathematics for Computer Science by E. Lehman, F.T. Leighton and A.R. Meyer
(https://courses.csail.mit.edu/6.042/spring16/mcs.pdf)
3. Lecture Notes on Mathematical Logic by Vladimir Lifschitz
(https://www.cs.utexas.edu/users/vl/teaching/388Lnotes.pdf)
4. Probability course notes by Richard Weber
(http://www.statslab.cam.ac.uk/~rrw1/prob/prob-weber.pdf)

Grading

- 6 Homeworks (5 points each) - 30%
- Midterm exam (30 points) - 30%
- Final exam (40 points) - 40%
- Bonus points:
  - Class participation - 3
  - Midterm exam - 3
  - Final exam - 4

100+ points: A+; [90, 100): A; [85, 90): B+; [80, 85): B; [75, 80): B-; [70, 75): C; [0, 70): F

Tentative Schedule

Date	Topic	Test
Aug 28	Foundations 1. Set theory - sets, relations and functions, composition, inversion. Algebra of sets and Boolean relations. *Text 1* - sections: 1 (preface), 7.2, 7.3, 7.7; exercises: 7.2.2, 7.7.1, 7.7.4. *Text 2* - exercises: 4.1, 4.5, 4.6, 4.15	HW1 assigned
Sep 4	Labor Day - no class	
Sep 11	Foundations 2. Iteration, induction, and recursion. Text 1: sections 2.2, 2.3, 2.6, 2.7.	HW1 due
Sep 18	Foundations 3. Graphs. Text 1: sections: 9.2, 9.4 (until page 470), 9.5 (until page 481).	HW2 assigned
Sep 25	Foundations 4. Recursive definitions, grammars. Text 1. Sections: 11.2, 11.3, 11.4.	HW2 due
Oct 2	Foundations 5. Number Theory. Text 2: sections 4.1, 4.2.	
Oct 10	Mathematical Logic 1. Propositional Logic. Text 3: section 1.	HW3 assigned

Oct 16	Mathematical Logic 2. Propositional logic - formal proofs. Text 3: section 2.	HW3 due
Oct 23	Midterm Exam	Midterm
Oct 30	Mathematical Logic 3. Predicate logic. Text 3: section 3.	
Nov 6	Mathematical Logic 4. Practice with computing applications	HW4 assigned
Nov 13	Probability Theory 1. Sample spaces. Text 4: sections 1.2, 1.3, 2.1, 2.2, 2.3	HW4 due, HW5 assigned
Nov 20	Probability Theory 2. Discrete probability. Text 4: sections 4.1, 5.2, 5.3, 5.4.	HW5 due
Nov 27	Probability Theory 3. Conditional probability. Text 4: sections 6.1, 6.2, 6.3, 6.4	HW6 assigned
Dec 4	Probability Theory 4. Random variables. Text 4: sections 7.1, 7.2, 7.3, 7.5, 8.2.	HW6 due
Dec 11	Reading Day - NO CLASS (office hours)	
Dec 18	Final Exam - 7:30 PM	Final

Policies

Please note that all coursework should be done independently. Plagiarizing the homework and cheating on the exam will be penalized; see Honor Code at
http://cs.gmu.edu/resources/honor-code.