CS 530 Syllabus & Assignments: Spring 2017

Instructor: Prof. William D. Ellis E-mail: wellis1@gmu.edu
Office Hours: By appt. Wed. 5-6 PM 5321 Engineering Bldg.

Web Site: Syllabus updates, sample problems & solutions, lecture notes etc. are posted weekly after class at http://mymason.gmu.edu.

Schedule: 14 Classes 7:20-10:00 PM Innovation Hall, Room 136
- Wednesdays 1/25/2017 - 5/3/2017 except March 15, 2017
- The Final Exam is Wednesday May 10, 2017, 7:30-10:15 PM

Prerequisite: (1) Math 125 or INFS 501, and (2) STAT 344

Topics: We will study the mathematical foundations of Computer Science: basic mathematical structures, mathematical logic, and probability theory. We will apply these concepts to problem solving and formal reasoning. Students will get significant hands-on practice including through the use of computational tools.

Textbooks: Our 4 textbooks are available free on-line.
(1) ("AHO"): Foundations of Computer Science by Alfred V. Aho and Jeffrey D. Ullman (Lehn)
(http://infolab.stanford.edu/~ullman/focs.html)
(2) "LEHMAN": Mathematics for Computer Science by E. Lehman, F.T. Leighton and A.R. Meyer, rev. Wed. 28th September, 2016 (new) (https://courses.csail.mit.edu/6.042/spring16/mcs.pdf)
(3) "LFSTZ: Lecture Notes on Mathematical Logic by Vladimir Lifschitz
(https://www.cs.utexas.edu/users/vl/teaching/388Lnotes.pdf)
(4) "WEBER": Probability course notes by Richard Weber
(http://www.statslab.cam.ac.uk/~rrw1/prob/prob-weber.pdf)
- Additional material will be provided by the instructor.

Exams: We will have: (i) 2 Quizzes, (ii) 2 Hour Exams, and (iii) a comprehensive Final Exam (Wednesday May 10, 2016). Exams and Quizzes will be given only one time - no makeup exams. I often give partial credit when grading. However, no partial credit will be given for a purported proof to a false statement. During an exam or quiz: Use all available classroom space, and do not sit next to a friend or close to anyone else.

Grades: 1 Final Exam: 45% of final grade.
2 Hour Exams: 40% of the final grade (20% each)
3 Quizzes and Homework together: 15% of final grade.

Help: Questions? Send me an e-mail! Use the ^ symbol for exponents, * for multiplication. You may also e-mail a scanned image (black/white) or a pdf.

Homework: Homework assignments will be on the weekly Syllabus updates. See http://mymason.gmu.edu. Homework will never be accepted late. However, of the 13 Homework assignments, only the 12 with the highest percentage scores will be counted toward your grade.

Honor Code: Honor Code violations are reported to the Honor Committee. See http://cs.gmu.edu/wiki/pmwiki.php/HonorCode/CSHonorCodePolicies

E-mail: To comply with privacy rules, please use your Mason email for all e-mails with me. You may forward your campus email elsewhere, but I may respond only to a Mason email account.

Assignments are updated on Blackboard after each class. Rev. 12/20/2016

1. Foundations

- Set Theory: Sets, relations and functions, composition, inversion
- Algebra of sets, binary relations, and graphs
- Induction and recursion
- Structural inductions, inductive definitions
- Recurrence Relations, solving recurrence relations and generating functions
- Number Theory

2. Mathematical Logic

- Propositional logic (syntax and semantics; transforming English specification into logical statements and creating proofs; consistence and completeness w/out proofs)
- Predicate logic w/examples (syntax and semantics; transforming English specification into logical statements; consistence and completeness w/out proofs)
- Practice/problem solving by proving theorems/finding counterexamples; hand vs. mechanized proofs and counterexamples; theorem proving vs. model checking
- Practice with computing applications

3. Probability Theory

- Sample spaces, possibility trees, probability set function and axioms
- Discrete and continuous random variables
- Joint, marginal, and conditional probabilities
- Bayes' theorem
- Expectations, mean, variance, covariance
- Independent events and independent random variables
- Univariate and multivariate normal (Gaussian) distribution
- Other important distributions: Poisson, Exponential, Bernoulli, Binomial, Multinomial, Exponential
- Biased and unbiased estimators
- Maximum likelihood estimation
- Bayesian inference (e.g. for the Gaussian)
- Examples of applications in Computer Science

Semester Schedule: Hour-Exam and Quiz Dates Are *Subject to Change*

Class	Date	Event	Details
(1)	Jan 25, 2017	1st Class	
(2)	Feb 1, 2017		
(3)	Feb 8, 2017		
(4)	Feb 15, 2017	Quiz 1	The quiz will cover everything through Homework 2.
(5)	Feb 22, 2017		
(6)	Mar 1, 2017		
(7)	Mar 8, 2017	Hour Exam & Lecture	The exam will cover everything covered in class through Class (7)
	Mar 15, 2017	- no class	Spring Vacation!
(8)	Mar 22, 2017		
(9)	Mar 29, 2017		

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Class	Date	Event	Details
(10)	Apr 5, 2017		
(11)	Apr 12, 2017	Quiz 2	
(12)	Apr 19, 2017		
(13)	Apr 26, 2017		
(14)	May 3, 2017	Hour Exam & Lecture	
(15)	May 10, 2017	FINAL EXAM	The Final Exam will cover everything that was covered during the entire semester.

Row	Text	Homework Assignments	Due
(1)	LEHMAN	Read sections 1.1, 1.2 on Propositions, predicates. Solve problem 1.4.	2/1/2017
(2)	AHO	Read sections 7.2, 7.3, 7.7 on the Algebra of sets. (Note: AHO uses "set-former" to describe what are often called "set-builder" expressions.) Solve problems 7.2.1, 7.2.2, 7.2.3, 7.3.2, 7.7.1, 7.7.2, 7.7.4, 7.7.6. For 7.3.2, number Venn-Diagram regions instead of using shading.	2/1/2017
(3)	LEHMAN	Read section 4.3-4.5. Solve problems 4.15-4.20, 4.22-4.24, 4.27.	
(4)		...	