CS325 - Analysis of Algorithms:
Course Topics, tentative Schedule, and Coursework list

Spring 2014

March 28, 2014

Summary	**Course Topics**
Unit 0	**Review as needed to get ready for class**
anytime! Practice	Videos: Course designer video introduction, Binary example, Interactive questions, Doubling search, Doubling search pseudocode, Animation of recursive merge sort, Reading: Section 2.2 of Algorithms by Sedgewick and Wayne, Practice: play Robozzle, after getting used to the game try puzzles 330, 536, 656, and 1033,
Unit 1, Week 1 (3/31 - 4/6)	**Is it correct? (by induction)**
Assigned P0, D1.1	Reading: JEL "98 Introduction" Review: Khan academy: Proof by Induction, Video: Depth of a Perfect Binary Tree with n Leaves, Reading: Formal Proof of Binary Tree Depth, Interactive Tutorial: Induction, Video: Merge Sort Correctness, Assigned Coursework: Project0 (TEACH access) assigned, Discussion-based questions D1.1, Question 1: water-gun induction, Question 2: internal nodes and leaves,
Unit 1, Week 2 (4/7 - 4/13)	**Is it correct? (by contradiction)**
Assigned D1.2	Reading: Section 5.1 of DPV, Interactive Tutorial: Contradiction, Video: MST correctness, Video: Boruvka algorithm, Assigned Coursework: Discussion-based practice questions 1.2, Question: unique MST, Question: question 5.9 from DPV (on page 162 of Chapter 5 of DPV),
Unit 2, Week 3 (4/14 - 4/20)	Run-time Analysis
Assigned P1, D2	Project 1: Max Subarray, due: 4/27,

	Video: Plotting in Matlab ? loglogplots, File created: loglogplots.m Reading: Chapter 0 of DPV, Khan Academy: Logarithms, Interactive Tutorial: Big Oh, Summary of Asymptotic Notation, Video: big-Oh vs. big-Theta, Assigned Coursework: Discussion-based practice questions 2, Question: Show $log(n!) = \Theta(nlogn)$, Question: Show $\sum_{i=1}^{n} \frac{1}{n} = \Theta(logn)$,
Unit 3, Week 4 (4/21-4/27)	**Recurrence Relations and Divide and Conquer**
Assigned D3	Reading: JEL Section 3, Video: Make Postage Recurrence, Video: Binary Search Recurrence, Reading: JEL 1.5-1.8, Video: Recursive Multiplication, Khan Academy: Computing a Geometric Series, Interactive Tutorial: Power Series Video: Finishing Up Recursive Multiplication, Interactive Tutorial: General Recurrence, Assigned Coursework: Discussion-based practice questions 3, Question: 2.5 from DPV (on p83 of Chapter 2 of DPV), (All of the parts, rather than just parts a and b) Questions related to STOOGESORT, Question about some binary tree orderings, Question related to Tree-ify (pre, post) algorithm, Anything else to say about Project 1?
Exam 1	**Be sure to schedule your first exam for sometime during week 5!**
Unit 4, Week 5 (4/28-5/4)	**Dynamic Programming**
Assigned P2, D4	Project 2: Dynamic Programming for Max Subarray, due 5/4, Video: Introduction to DP Video, Interactive Tutorial: Fibonacci DP, Read: DPV Chapter 6 (section 6.2), Interactive Tutorial: Longest Increasing Sequence, Video: LIS Run Time Top Down, Read: DPV Chapter 6 (section 6.4), Assigned Coursework: Discussion-based practice questions 4, Question about longest increasing subsequence, Question about modified knapsack, Question about dynamic programming for a specific task,
Unit 5, Week 6 (5/5-5/11)	**Linear Programming**
Assigned D5	Project 3: Linear Programming, due 5/18, Reading: Section 7.1 of DPV,

	Interactive Tutorial: Simple LP, Reading: Bicycle-Problem PDF, Video: Bicycle Problem Setup, Video: Bicycle Problem Matlab, Video: Bicycle Problem Polyhedron, Reading: Section 7.2 of DPV, Video: Shortest Paths LP, Assigned Coursework: Discussion-based practice questions 5, Consider a couple problems (problems 1 and 2), Exercise 7.2 in Algorithms (problem 3 on the forums), Exercise 7.29 in Algorithms (problem 4 on the forums),
Unit 6, Week 7 (5/12-5/18)	**Computational Complexity: Complexity classes**
Assigned P4, D6.1	Video: Intro to Complexity, Reading: Undecidable Problems, Reading: An Undecidable Problem, the Halting Problem, Reading: Story of Sissa and Moore-Chapter 8 of DPV, Interactive Tutorial: Polynomial Time and Exponential Time, Reading: Sorting Lower Bound-Chapter 2 of DPV, Video: Sorting Lower Bound, Video: Non-Determinism, Certificates, NP and P vs NP, Video: Overview of P, NP, computable, TM, etc-Venn diagram, Assigned Coursework: Discussion-based practice questions 6.1, Exercise 2.2 in DPV, Show that some problems are in NP,
Unit 6, Week 8 (5/19-5/25)	**Computational Complexity: NP-completeness and reductions**
Assigned D6.2	Project 4: Traveling Salesperson Problem (TSP), due 6/1, Video: A working definition of NP-hard, Reading: Section 29.3 and 29.5 of JEL, Video: Reduction, Interactive Tutorial: Decision Search Optimization, Reading: DPV Chapter 8, Interactive Tutorial: NP v NP-hard, Video: TSP is NP-hard, Assigned Coursework: Discussion-based practice questions 6.2, Question about Experimental cuisine, Exercise 8.10 in DPV,
Unit 6, Week 9 (5/26-6/1)	**Computational Complexity: Project four: TSP**
Assigned Finish TSP	Complete work on unit 6 materials, Complete TSP project,
Week 10 (6/2-6/8)	**Review and complete project four (TSP)**
Assigned: Study for exam	Review for second exam, Discuss topics, discussion questions and projects, Alterations to TSP might be allowed,