CSE 2320-001: ALGORITHMS & DATA STRUCTURES

Fall 2012: MWF 10:00-10:50 a.m., Nedderman 105

Instructor: Bob Weems, Associate Professor
Office: 627 ERB (weems@uta.edu, http://ranger.uta.edu/~weems)
Hours: MW 11:15 a.m. - 12:45 p.m.

GTA:
Office:
Email:
Hours:

Prerequisites: C programming (CSE 1320)
Discrete Structures (CSE 2315)

Objectives: In future design situations, students will be capable of developing, applying, and evaluating algorithmic solutions.

Outcomes:
1. Understanding of classic approaches to algorithm design - decomposition, dynamic programming, and greedy methods.
2. Understanding of particular algorithms and data structures that have wide applicabilty.
3. Understanding of basic algorithm analysis concepts by applying math skills to worst-case and expected time using recurrences and asymptotic notation.
4. Improved programming skills - especially data structures, recursion, and graphs.

Textbook: R. Sedgewick, *Algorithms in C*, *Parts 1-5, 3rd ed*., Addison-Wesley, 2003.

References: S. Baase and A. Van Gelder, Computer Algorithms: *Introduction to Design and Analysis, 3rd ed*., Addison-Wesley, 2000.

Cormen, Leiserson, Rivest, Stein, *Introduction to Algorithms, 3rd ed.,* MIT Press, 2009.

Readings: Indicated on calendar later in syllabus.

Homeworks: Six homeworks, with answers, are available on the course web page.

Grade: Based on the following weights:

Exams 1-3: 18% each.
Exam 4: 26%. Monday, December 10, 8:00-10:30 a.m.

Programs: 20% divided evenly among four assignments.

Policies:

1. Regular attendance is expected. You are expected to know lecture contents and announcements. I reserve the right to have surprise quizzes, each quiz being 2% of the semester grade taken from the 80% allocated to exams.

2. Lecture notes and sample code for various algorithms are on the course web page `http://ranger.uta.edu/~weems/NOTES2320/cse2320.html`.

3. You are expected to have read the assigned readings by the specified date. Lectures will review and augment the material, but will also consider exercises from the book.

4. CHEATING - YOU ARE EXPECTED TO KNOW UNIVERSITY POLICIES. If you are suspected of cheating, the matter must go through university channels outside of the CSE Department.

   a. **Academic Integrity Policy:** It is the policy of the University of Texas at Arlington to uphold and support standards of personal honesty and integrity for all students consistent with the goals of a community of scholars and students seeking knowledge and truth. Furthermore, it is the policy of the University to enforce these standards through fair and objective procedures governing instances of alleged dishonesty, cheating, and other academic/non-academic misconduct.

      You can assume responsibility in two ways. **First**, if you choose to take the risk associated with scholastic dishonesty and any other violation of the Code of Student Conduct and Discipline, you must assume responsibility for your behaviors and accept the consequences. In an academic community, the standards for integrity are high. **Second**, if you are aware of scholastic dishonesty and any other conduct violations on the part of others, you have the responsibility to report it to the professor or assistant dean of students/director of student judicial affairs. The decision to do so is another moral dilemna to be faced as you define who you are. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the University. Since dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

   b. **Statement on Ethics, Professionalism, and Conduct of Engineering Students**: The statement is attached. Failure to sign the statement will result in 1) programming assignments to not be accepted, i.e. late penalty and 2) failure on exams.

5. Any request for special consideration must be appropriately documented in advance. (Special consideration does not include giving a higher grade than has been earned.)

6. Late programs are penalized according to the following schedule. LABS ARE DUE AT 9:45 AM ON THE DUE DATE, NOT MIDNIGHT. After the due time, assistance will not be provided.

Degree of lateness	Penalty
Up to 9:45 next day	5 pts
Up to 9:45 two days	15 pts
Up to 9:45 three days	30 pts
Up to 9:45 four days	60 pts

7. Each lab is graded as follows:

		Some Issues
a. Output/Code	60%	If you know that your program has problems, you should let the GTA know what parts are functional. Test cases that demonstrate the limited functionality are useful.
b. Internal Comments	6%	Beginning of file including `main()` should identify the assignment and who you are, along with giving a high-level description. Each function: identify each argument, describe processing, and each `return`. You may reference notes and text. Excess line-by-line comments are not needed, but the processing for each iteration of a (significant) loop should be explained.
c. Modularity	6%	Functions are used appropriately. `main()` is kept simple.
d. Structure	6%	Code is not unnecessarily complicated or long. It is often better to rewrite code rather than patching several times.
e. Names	6%	Should indicate the purpose of the function, variable/field, or type. Cute or misleading names will be penalized.
f. Spacing	6%	Indenting, blank lines, placement of {}. Be consistent.
g. Generality	10%	Program is not unnecessarily limited.

All programs must be written in ***C*** to compile and execute on `omega.uta.edu`. Details for program submission will be included with each assignment.

You are responsible for correctly sending each programming assignment to the GTA as an attachment. (cc: yourself)

Points will not be awarded for programs that do not compile. *Points for b-g will not be awarded to submissions that are not substantially complete and perform significant processing.*

8. GTA duties:

   a. Provide first-level of assistance for homeworks and labs.
   b. Grade programs and short-answer test problems.

9. Instructor duties:

   a. Lecture.
   b. Guidance
   c. Tests - preparation and grading long-answer test problems.

d. Special consideration.
e. Design homework and programming assignments.

10. If you require a reasonable accomodation for a disability, please contact me no later than the second week of this semester. Further details are available at `http://www.uta.edu/disability`.

11. Occasional class-wide email messages (e.g. weather situations, clarifications) may be sent to the addresses recorded by MyMav. Messages will also be archived on the course web page.

Course Content (in chronological order)

1. Algorithmic Concepts (1.1-1.3, 6.1-6.3, 5.2, 8.1-8.7, 2.6, 12.4) - Disjoint Subsets, Selection Sort, Insertion Sort, Divide and Conquer, Mergesort (trivial recursion tree), Binary Search (with and without duplicates)
2. Growth of Functions (2.1-2.4, 2.6-2.7) - Asymptotic Notation (O, Ω, Θ), Upper Bounds, Lower Bounds
3. Summations - Geometric Series, Harmonic Series, Math Induction, Integrals
4. Recurrences (2.5) - Substitution Method, General Recursion Trees

Exam 1: Notes 1.-4.

5. Heapsort/Priority Queues (9.1-9.6) - Properties, Building a Heap, Sorting, Integrating with Other Data Structures
6. Greedy Algorithms - Quality-of-Solution Issues, Unweighted Interval Scheduling, Knapsack, Huffman Codes
7. Dynamic Programming (5.3) - Weighted Interval Scheduling, Optimal Matrix Multiplication, Longest Common Subsequence, Longest Increasing Subsequence, Subset Sum, Knapsack/Memoization

Exam 2: Notes 5.-7.

8. Quicksort (7.1-7.8) - PARTITION (2 versions), Selection/Ranking
   Lower Bounds - Decision Tree Model, Stability (6.1)
   Counting (6.10) and Radix Sorts (10.1, 10.5)
9. Linked Lists (3.3, 2.6, 12.3, 3.5, 3.4) - Use in Dictionaries, Headers, Sentinels, Circular Lists, Double Linking
10. Stacks/Queues (4.2, 4.4, 18.1, 4.3, 4.6) - Policies and Applications
11. Rooted Trees (5.4-5.7) - Structure, Traversals
    Binary Search Trees (12.5-12.9) - Properties, Operations

Exam 3: Notes 8.-11.

12. Balanced Binary Search Trees (13.3-13.4) - Structural Properties, Rotations, Insertions
13. Hashing (14.1-14.4) - Concepts, Chaining, Open Addressing
14. Graph Representations (3.7, 17.3-17.4) - Adjacency Matrices, Adjacency Lists, Compressed Adjacency Lists
    Search - Breadth-First (5.8, 18.7), Depth-First (19.2, 5.8, 18.2-18.4)
    Search-Based Algorithms - Topological Sort (19.6), Strong Components (19.8)
15. Minimum Spanning Trees (20.1-20.4) - Three Versions of Prim's MST, Kruskal's MST
16. Shortest Paths - Dijkstra's Algorithm (21.1-21.2), Warshall's Algorithm (19.3), Floyd-Warshall Algorithm (21.3)

17. Network Flows and Bipartite Matching (22.1, 22.2, 22.4) - Concepts, Augmenting Paths, Residual Network, Cuts, Max-flow Min-cut Theorem, Implementation, Performance Issues

Exam 4: Items 12.-17.

Calendar - with subject numbers from course content

August/September			October		
		24 Syllabus	1 7.	3 7.	5
27 1.	29 1.	31 2.	8 8.	10 8.	12 8.
3 Holiday	5 2.	7 2./3.	15 9.	17 9.	19 Exam 2
10 4.	12 4.	14 5.	22 10.	24 10.	26 11.
17 5.	19 6.	21 6.	29 11.	31 12.	
24 7.	26 7.	28 Exam 1			

November			December	
		2 12.	3 17.	5
5 13.	7 13.	9 Exam 3	10 Exam 4	
12 14.	14 14.	16 14.		
19 15.	21	23 Holiday		
26 16.	28 16.	30 17.		

October 31 is the last day to drop.

Statement of Ethics
Student Confirmation
(CSE 2320, Fall 2012)

The following is an excerpt from the College of Engineering's statement on Ethics, Professionalism, and Conduct of Engineering Students. The notes are modifications appropriate for Computer Science and Engineering courses. Read the statement carefully, sign it, and return it to your instructor. Additional copies of this statement can be obtained from your instructor or the Computer Science and Engineering office.

Statement on Ethics, Professionalism, and Conduct of Engineering Students
College of Engineering
The University of Texas at Arlington

The College cannot and will not tolerate any form of academic dishonesty by its students. This includes, but is not limited to 1) cheating on examination, 2) plagiarism, or 3) collusion.

Definitions:

A. **Cheating on an examination** includes:

1. Copying from another's paper, any means of communication with another during an examination, giving aid to or receiving aid from another during an examination;
2. Using any material during an examination that is unauthorized by the proctor;
3. Taking or attempting to take an examination for another student or allowing another student to take or attempt to take an examination for oneself.
4. Using, obtaining, or attempting to obtain by any means the whole or any part of an unadministered examination.

B. **Plagiarism** is the unacknowledged incorporation of another's work into work which the student offers for credit.
C. **Collusion** is the unauthorized collaboration of another in preparing work that a student offers for credit.
D. Other types of **academic dishonesty** include using other student's printouts from the ACS labs or students' disk, etc.

1. The use of the source code of another person's program, even temporarily, is considered **plagiarism**.
2. Allowing another person to use your source code, even temporarily, is considered **collusion**.
3. Use of another person's source code with your modification is considered **plagiarism.**
4. Taking material verbatim (without quoting the source) for reports and/or presentations is considered **plagiarism**
5. For this class, the specific exceptions given below are not considered scholastically dishonest acts:
   Discussion of the algorithm and general programming techniques used to solve a problem

The penalty assessed for cheating on a given assignment will be twice the weight of the assignment and will include notification of the proper authorities as stipulated in the **UTA Handbook of Operating Procedures** and on the web at ***http://www.uta.edu/studentaffairs/conduct/homedisci.html***

You may be entitled to know what information UT Arlington (UTA) collects concerning you. You may review and have UTA correct this information according to procedures set forth in UT System BPM #32. The law is found in sections 552.021, 552.023 and 559.004 of the Texas Government Code.

I have read and I understand the above statement.

Student's signature: _____

Student's name (printed): _____

Student's ID number: _____