CSE 3318-003/004: Algorithms & Data Structures - Fall 2021

004: TR 11:00 a.m. - 12:20 p.m., Nedderman Hall 112
003: TR 2:00 - 3:20 p.m., Engineering Research Building 129

Instructor: Bob Weems, Associate Professor
Office: 627 ERB (weems@cse.uta.edu, http://ranger.uta.edu/~weems, 817-272-3785)

Hours: TR 12:30 - 1:30 p.m. and 3:30 - 4:30 p.m. (in office and on Teams)

GTA: Contact information will be on my personal webpage

Prerequisites: C programming (CSE 1320, including basic UNIX competence)
Discrete Structures (CSE 2315, including combinatorics, trees, and graphs)

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 applicability.
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: Cormen, Leiserson, Rivest, Stein, *Introduction to Algorithms, 3rd ed.,* MIT Press, 2009. (Henceforth known as CLRS)

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

Readings: Indicated on calendar later in syllabus.

Homeworks: Three homeworks with answers will be on the course web page.

Grade: Based on the following weights:

Exams: 80% divided evenly among 3 exams.
Exam 3: Thursday, December 9 004: 11:00 a.m. - 1:30 p.m.
003: 2:00 - 4:30 p.m.

Programs ("labs"): 20% divided evenly among five assignments. Labs 4 and 5 will be due after Thanksgiving.

Final grade cut-offs: A - 85, B - 73, C - 61, D - 50

Policies:

1. Regular attendance is expected. The lectures are being recorded and will have a link under Canvas.

   By University mandate, classroom density is being limited to 50% through Wednesday, September 8. You were sent a message indicating whether you may attend on Tuesdays or Thursdays during the early days of this semester.

2. Lecture notes, homework, old exams, lab assignment files and sample code for various algorithms are on the course web page `http://ranger.uta.edu/~weems/NOTES3318/cse3318.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. `http://www.uta.edu/conduct/`

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. Submissions for both sections are due at 5:00 p.m. on the specified date. After the due time, assistance will be minimal.

Degree of lateness	Penalty
Up to 5:00 p.m. next day	5 pts
Up to 5:00 p.m. two days	15 pts
Up to 5:00 p.m. three days	30 pts
Up to 5:00 p.m. four days	60 pts

7. Each lab is graded on a 100-point scale 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 standard ***C*** to compile and execute on `omega.uta.edu`. Execution on other platforms (e.g. Visual Studio, Code::Blocks) does not assure compliance.

You are responsible for correctly submitting each programming assignment on Canvas.

No points will 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.* Submissions not reflecting the algorithmic problem-solving techniques discussed in the lab handout will not receive credit.

8. 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`.

9. Occasional class-wide email messages (e.g. weather situations, clarifications) may be sent to the addresses recorded by MyMav.

Course Content (in chronological order)

1. (1, 2) Algorithmic Concepts - Selection Sort, Insertion Sort, Divide and Conquer, Mergesort (trivial recursion tree), Binary Search (with and without duplicates)
2. (3) Growth of Functions - Asymptotic Notation (O, Ω, Θ), Upper Bounds, Lower Bounds
3. (appendix A) Summations - Geometric Series, Harmonic Series, Math Induction, Integrals
4. (4.3, 4.4) Recurrences - Substitution Method, General Recursion Trees
5. (6.1-6.5) Heapsort/Priority Queues - Properties, Building a Heap, Sorting, Integrating with Other Data Structures
6. (16.1-16.3) Greedy Algorithms - Quality-of-Solution Issues, Unweighted Interval Scheduling, Knapsack, Huffman Codes
7. (15.1-15.4) Dynamic Programming - Weighted Interval Scheduling, Optimal Matrix Multiplication, Longest Common Subsequence, Longest Increasing Subsequence, Subset Sum, Knapsack/Memoization

Exam 1: Items 1.-7.?.

8. (7.1-7.2, 9.2, 8.1-8.3) Quicksort - PARTITION, Selection/Ranking, Lower Bounds - Decision Tree Model, Stability, Counting and Radix Sorts
9. (10.2) Linked Lists - Use in Dictionaries, Headers, Sentinels, Circular Lists, Double Linking
10. (10.1) Stacks/Queues - Policies and Applications
11. (10.4, 12.1-12.3, 14.1, 13.2) Rooted Trees - Structure, Traversals, Binary Search Trees - Properties, Operations
12. (13.1, 13.3) Balanced Binary Search Trees - Structural Properties, Rotations, Insertions

Exam 2: Items 7.?.-12.

13. (11.1-11.4) Hashing - Concepts, Chaining, Open Addressing
14. (22.1-22.5) Graph Representations - Adjacency Matrices, Adjacency Lists, Compressed Adjacency Lists, Search - Breadth-First, Depth-First, Search-Based Algorithms - Topological Sort, Strong Components
15. (21.3, 23.1-23.2) Minimum Spanning Trees - Three Versions of Prim's MST, Disjoint Subsets, Kruskal's MST
16. (24.3, 25.2) Shortest Paths - Dijkstra's Algorithm, Warshall's Algorithm, Floyd-Warshall Algorithm
17. (26.1-26.3) Network Flows and Bipartite Matching - Concepts, Augmenting Paths, Residual Network, Cuts, Max-flow Min-cut Theorem, Implementation, Performance Issues

Exam 3: Items 13.-16.

Calendar - with subject numbers from course content

August				September				October			
		26	Syllabus			2	2.	5	8.	7	
31	1.			7		9	3.	12	9.	14	10.
				14	4.	16	5.	19	11.	21	12.
				21	6.	23	7.	26	13.	28	14.
				28		30	Exam 1				

November				December			
2	Exam 2	4				2	
9	15.	11	16.	7		9	Exam 3
16		18	17.				
23		25	Holiday				
30							

November 5 is last day to drop; submit requests to major advisor prior to 4:00 p.m.

Messages/disclaimers/fine print from our sponsor:

Face Covering Policy: *While the use of face coverings on campus is no longer mandatory, all students and instructional staff are strongly encouraged to wear face coverings while they are on campus. This is particularly true inside buildings and within classrooms and labs where social distancing is not possible due to limited space. If a student needs accommodations to ensure social distancing in the classroom due to being at high risk they are encouraged to work directly with the Student Access and Resource Center to assist in these accommodations. If students need masks, they may obtain them at the Central Library, the E.H. Hereford University Center's front desk or in their department.*

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I expect regular attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Success Programs
UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring by appointment, drop-in tutoring, etutoring, supplemental instruction, mentoring (time management, study skills, etc.), success coaching, TRIO Student Support Services, and student success workshops. For additional information, please email resources@uta.edu, or view the Maverick Resources website.

The IDEAS Center (https://www.uta.edu/ideas/) **(**2nd Floor of Central Library) offers **FREE** tutoring and mentoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.

Institution Information
UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page (https://resources.uta.edu/provost/course-related-info/institutional-policies.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule