The University of Texas at Tyler

COSC 3325.001 **Algorithm Analysis and Foundations**

Course Description: Introduction to the foundations and formal techniques used to support the design and analysis of algorithms, focusing on both the underlying mathematical theory and practical considerations of efficiency. Topics include asymptotic complexity bounds, techniques of analysis, algorithmic strategies, basic computability, and complexity classes.

Course Prerequisites: Data Structures and Algorithms (COSC 2336)
Discrete Structures (MATH 2330)

MWF 9:05 AM - 10:00 AM F2F -- COB 211

Instructor: Dr. Arthur S. Williams

Office: COB 315.06
DEPARTMENT PHONE: TBD
E-MAIL: arthurwilliams@uttyler.edu

Office Hours: MW 8:00 AM – 9:00 AM, 11:10 AM – 1:10 PM
Or by appointment

Required Textbook: *The Design and Analysis of Algorithms*, Third Edition
Anany Levitin
Pearson - ISBN 13: 9780132316811

Grade Determination:

Homework Quizzes and Programming Assignments	20%
Examination I (Chapters 1-5)	25%
Examination II (Chapters 6-8)	25%
Final Examination (Comprehensive)	30%

Grading Scale

A = 100% - 90%	D = 69% - 60%
B = 89% - 80%	F = 59% - 0%
C = 79% - 70%	

Course Outline:

1. Introduction to Algorithm Analysis
2. Fundamentals of Analysis of Algorithm Efficiency
3. Analysis of Brute Force Algorithms
4. Analysis of Decrease-and-Conquer Algorithms
5. Analysis of Divide-and-Conquer Algorithms
6. Analysis of Transform-and-Conquer Algorithms
7. Space and Time Tradeoffs
8. Dynamic Programming
9. Greedy Technique
10. Limitations of Algorithm Power
11. Coping with Limitations of Algorithm Power

UT Tyler Honor Code: I embrace honor and integrity. Therefore, I choose not to lie, cheat, or steal, nor to accept the actions of those who do.

Course Examinations: An official one-week notice will be provided preceding each course examination. At least one class period prior to each examination, a review guide will be provided, detailing exam format, major topical coverage, problem descriptions and types, etc. Unless otherwise noted, no electronic devices will be allowed during the testing period including classroom computers, calculators, mobile or smartphones, etc. Examinations will be graded on as timely a basis as possible with results posted in Canvas. Relevant problems from graded exams will be discussed in a subsequent class or via video posted in Canvas.

Academic Dishonesty: You are expected to do your own work. You may discuss with each other general concepts, but direct assistance with any particular assignment or any attempts to gain an unfair academic advantage will not be tolerated. Cheating is considered a serious academic offense both by the department and the University. It may result in a failing grade from this course for all parties involved. In order to preserve academic integrity, the instructor reserves the right to ask you to explain any programming assignment that you turn in to judge if the work is actually yours and/or employ plagiarism detection software to authenticate student authorship.

Disability/Accessibility Services: If you have a disability, including a learning disability, for which you request an accommodation, please contact the Student Accessibility and Resources office so that the appropriate arrangements may be made. In accordance with federal law, a student requesting accommodation must provide documentation of his/her disability to the Student Accessibility and Resources counselor. For more information, call or visit the Student Services Center located in the University Center, Room 3150. The telephone number is 903-566-7079; email address is: saroffice@uttyler.edu. Requests for disability accommodations are the responsibility of the student and submissions must be approved by the Student Accessibility and Resources office prior to the official census date.

Writing Center: The UT Tyler Writing Center provides professional writing tutoring for all students. If you wish to use the Writing Center, you should plan in advance for a minimum of two hour-long tutorials per assignment: the first to assess your needs, and the second to follow up. Be prepared to take an active role in your learning, as you will be asked to discuss your work. While tutors at the Writing Center will be happy to give constructive criticism and teach effective writing techniques, they will under no circumstances write your paper for you. Appointments are strongly encouraged: call 903-565-5995 or email:writingcenter@uttyler.edu

Use of Artificial Intelligence: This course has specific assignments where artificial intelligence (AI) tools (such as ChatGPT or Copilot) are permitted and encouraged. When AI use is permissible, it will be clearly stated in the assignment directions, and all use of AI must be appropriately acknowledged and cited. Otherwise, the default is that AI is not allowed during any stage of an assignment.

UNIVERSITY POLICIES AND ADDITIONAL INFORMATION THAT MUST APPEAR IN EACH COURSE SYLLABUS

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester. Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:
   - copying from another student's test paper;
   - using, during a test, materials not authorized by the person giving the test;
   - failure to comply with instructions given by the person administering the test;
   - possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
   - using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
   - collaborating with or seeking aid from another student during a test or other assignment without authority;
   - discussing the contents of an examination with another student who will take the examination;
   - divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
   - substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
   - paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
   - falsifying research data, laboratory reports, and/or other academic work offered for credit;
   - taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
   - misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by plagiarism software.

UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses. UT Tyler Counseling Center (903.566.7254)

Course Syllabus
Fall 2026

1. *Course number and name*
   COSC 3325: Algorithm Analysis and Foundations

2. *Credits and contact hours*
   3 Credit Hours

3. *Instructor's name*
   Instructor: Dr. Arthur S. Williams

4. *Textbook, title, author, and year*

   The Design and Analysis of Algorithms, Anany Levitin, Third Edition, 2012
   ISBN 13: 9780132316811

5. *Specific course information*:

   a. *A brief description of the content of the course (catalog description)*
   Introduction to formal techniques used to support the design and analysis of algorithms, focusing on both the underlying mathematical theory and practical considerations of efficiency. Topics include asymptotic complexity bounds, techniques of analysis, algorithmic strategies, basic computability, and complexity classes.

   b. *Prerequisites*
   COSC 2336 (Data Structures and Algorithms) and MATH 2330 (Discrete Structures)

   c. *Indicate whether a required, elective, or selected elective course in the program* Required course for BSCS program.

6. *Specific goals of the course*:

   Specific outcomes of instruction, the student will be able to:

   1. Design efficient algorithms and compare competing designs based on their complexities.
   2. Be familiar with mathematical and scientific principles relevant to computer science.

3. Explain the mathematical concepts used in describing the complexity of an algorithm.
4. Select and apply algorithms appropriate to a particular situation.
5. Demonstrate basic understanding of some design approaches such as greedy algorithms, dynamic programming and divide-and-conquer.
6. Employ one from a range of strategies leading to the design of algorithms to serve particular purposes.
7. Explain the trade-offs that exist between a range of algorithms that possess the same functionality.
8. Be familiar with advanced and modern topics in computer science.
9. Be able to debug implemented software in a proficient manner.

7. *Abridged list of topics to be covered*:

1. Analysis Basics
    i. Big O, Big Omega, and Big Theta notations
    ii. Recurrence relations and their solution
    iii. Rates of growth: worst, best, and average analysis iv. Analysis as a design tool
2. Design and Analysis of Divide-and-Conquer Algorithms
    i. Analyzing recursive algorithms
    ii. Recurrence relations
    iii. Closest pair
3. Design and Analysis of Searching and Sorting Algorithms
    i. Optimal searching and sorting algorithms
    ii. Priority queues and heaps, heapsort
    iii. Quicksort,
    iv. Sorting in linear time
4. Design and Analysis of Graph Algorithms
    i. Depth-first traversal algorithms
    ii. Breadth-first traversal algorithms
    iii. Minimum spanning tree
    iv. Shortest path algorithms
5. Advanced Designing Techniques: Dynamic Programming and Greedy Algorithms
    i. Traveling salesperson approximation
    ii. Fibonacci numbers and binomial coefficients iii. All-pairs shortest path algorithm