The University of Texas at Tyler  
Bachelor of Science in Computer Science  

Syllabus

<table>
<thead>
<tr>
<th>Course Number:</th>
<th>COSC 2336</th>
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<tbody>
<tr>
<td>Course Title:</td>
<td>Data Structures and Algorithms</td>
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<tr>
<td>Course Description:</td>
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<td>Topics include recursion, the underlying philosophy of object-oriented programming, fundamental data structures (including stacks, queues, linked lists, hash tables, trees, and graphs), the basics of algorithmic analysis, and an introduction to the principles of language translation.</td>
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<tr>
<td>Pre-requisites:</td>
<td>MATH 2330, COSC 1337/1137</td>
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<td>Credits:</td>
<td>3</td>
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| Text(s): | *Data Abstraction and Problem Solving with Java, 2nd Edition*  
Frank M. Carrano and Janet J. Prichard  
Pearson/Addison Wesley |
| Languages Used: | Java |
| (if applicable) | |
| Topics: | 1. Introduction to Data Structures  
2. Review of Java Fundamentals  
3. Programming Principles and Software Engineering  
4. Fundamentals of Recursion  
5. Abstract Data Types  
6. Linked Lists and List Processing  
7. Introduction to Stacks  
8. Introduction to Queues  
9. Algorithm Efficiency and Sorting  
10. Introduction to Trees  
11. Implementation of Tables and Priority Queues  
12. Introduction to Graphs and Networks |
| Additional Materials: | JCreator (Java IDE) |
| Evaluation Method: (only items in dark print apply) | 1. Examination/Quiz  
2. Homework  
3. Paper/Report  
4. Computer Program  
5. Project  
6. Presentation  
7. Class Participation  
8. Peer Review |
### Course Objectives:

By the end of this course students are expected to:

1. Illustrate by example the basic terminology of graph theory, and some of the properties and special cases of each. [1,7]
2. Demonstrate different traversal methods for trees and graphs. [1,7]
3. Model problems in computer science using graphs and trees. [7]
4. Discuss the representation and use of primitive data types and built-in data structures. [1,4,7]
5. Describe how the data structures in the topic list are allocated and used in memory. [1,4,7]
6. Describe common applications for each data structure in the topic list. [7]
7. Implement user-defined data structures in a high-level language. [1,4,7]
8. Compare alternative implementations of data structures with respect to performance. [1,7]
9. Write programs that use each of the following data structures: arrays, records, strings, linked lists, stacks, queues, trees, and graphs/networks. [4]
10. Compare and contrast the costs and benefits of dynamic and static data structure implementations. [1,7]
11. Choose the appropriate data structure for modeling a given problem. [1,4,7]
12. Describe the concept of recursion and give examples of its use. [1,4,7]
13. Identify the base case and the general case of a recursively defined problem. [1,4,7]
14. Compare iterative and recursive solutions for elementary problems such as factorial. [1,7]
15. Describe the divide-and-conquer approach. [4,7]
16. Implement, test, and debug simple recursive functions and procedures. [1,4,7]
17. Describe how recursion can be implemented using a stack. [1,4,7]
18. Determine when a recursive solution is appropriate for a problem. [1,4,7]
19. Explain the use of big O notation to describe the amount of work done by an algorithm. [1,7]
20. Determine the time and space complexity of simple algorithms. [1,7]
21. Implement a divide-and-conquer algorithm to solve an appropriate problem. [1,4,7]
22. Implement the most common quadratic and O(N log N) sorting algorithms. [1,4,7]
23. Explain hashing functions for search applications. [1,7]
24. Explain collision-resolution for a hash table. [1,7]
25. Discuss the computational efficiency of the principal algorithms for sorting and searching. [1,7]
26. Discuss factors other than computational efficiency that influence the choice of algorithms, such as programming time, maintainability, and the use of application specific patterns in the input data. [1,7]
27. Solve problems using the fundamental graph algorithms, including all-pairs shortest paths and at least one minimum spanning tree algorithm. [1,4,7]
28. Demonstrate the following capabilities: to evaluate algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in programming contexts. [1,4,7]

Numbers in bracket refer to method(s) used to evaluate the course objective.
### Relationship to Program Outcomes:

This course supports the following Computer Science Program Outcomes, which state that our students at the time of graduation are expected to:

1. **Posses knowledge of the fundamentals of mathematics, science, and technology.**
   
   [1,3,4,9,11,14,15,16,17,19,20,21,22,23,24,25,26,27,28]

2. **Be able to use modern computational tools and techniques in the practice of computer science.**
   
   [3,4,7,8,9,11,16,17,21,22,27,28]

3. **Be able to develop logically sound and efficient algorithms.**
   
   [3,7,9,16,21,22,27,28]

4. **Be prepared to implement algorithms in multiple programming languages, on multiple hardware platforms, and in multiple operating system environments.**
   
   [4,7,9,11,12,13,15,16,17,18,21,22,27,28]

5. **Be able to perform analysis, design, implementation, testing, and maintenance of computer-based systems, stressing software engineering principles.**
   
   [4,7,9,11,12,13,15,16,18,21,22,27,28]

6. **Be prepared to seek continuing professional development, graduate studies, or professional certifications related to computer science.**
   
   [1-28]

7. **Demonstrate effective written, visual and oral communication skills.**
   
   [1-8,10-28]

8. **Posses an educational background to understand the global context in which computer science is practiced, including:**
   
   a. Knowledge of contemporary issues related to computer science;
   
   b. The impact of computers on society;
   
   c. The role of ethics in the practice of computer science.
   
   [1-28]

9. **Be able to contribute effectively as members of a project development team.**

10. **Recognize the need to pursue continued learning throughout their professional careers.**

   Numbers in brackets refer to course objective(s) that address the Program Outcome.

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**Prepared By:** Stephen B. Rainwater  
**Date:** 10/25/04  
**Revised:** 1/15/07
Data Structure and Algorithms
COSC 2336.001
Spring 2010

Instructors: Dr. Kazem Mahdavi
Office: RBN 3007
Office Hours: MTWR: 2:00 pm to 3:00 pm, or by appointment
Telephone Number: 903-566-7115
Email: kmahdavi@uttyler.edu,
Class Meeting Time: 11:00-12:15pm TR
Room: RBN 3038

Course Description: Topics include recursion, the underlying philosophy of object-oriented programming, fundamental data structures (including stacks, queues, linked lists, hash tables, trees, and graphs), the basics of algorithmic analysis, and an introduction to the principles of language translation.

Prerequisites: MATH 2330, COSC 1337/1137

Important Dates:
Monday, Sept 6, Labor Day Holiday
Oct. 29, last day to withdraw from the course
Nov. 24-27 Thanks giving Holiday,
Tuesday Dec. 14, 2010, Final Exam, 11:00 am-1:00pm

Textbooks
Required
Data Abstraction and Problem Solving with Java, by F.M.Carrano, and J. J. Prichard.

Course Outline:
1. Review of elementary programming concepts
2. Stacks, queues, linked lists, hash tables, trees and graphs
3. Review of object-oriented programming
4. Sorting and searching techniques
5. Recursion
6. Basic algorithmic analysis
7. Algorithmic strategies: brute-force; greedy; divide-and-conquer; backtracking; branch-and-bound; heuristics; pattern matching; and numerical approximation algorithms
8. Overview of programming languages and programming paradigms
9. Software validation; testing and object-oriented testing

Attendance Policy: Attendance is mandatory and attendance records will be kept. Notify the professor in advance if you must miss a class, be late for a class or leave early. (Official University Policy: Class attendance is the responsibility of the student. When a student has a legitimate absence, the instructor may
permit the student to complete missed assignments. In many cases class participation is a significant measure of performance, and non-attendance may adversely affect a student’s grade. When a student’s absences become excessive, the instructor may recommend that the student initiate a withdrawal.)

**Evaluation:**

**Homework, projects, & participation:** Homework will be assigned regularly and students are expected to present homework problems in class on a regular basis. Homework assignments may be discussed with other students; in fact, you may find a regular study-buddy or study-group helpful. In-class assignments will be given regularly. We will have several projects during the semester. Participation will be graded based on taking part in classroom discussions and asking questions.

**Tests and Final Exams:** There will be two tests and a final exam.

- Test 1, 25%
- Test 2, 25%
- Final 25%
- Homework, project, and participation 25%

**Grading Scale**

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>100% - 90%</td>
</tr>
<tr>
<td>B</td>
<td>89% - 80%</td>
</tr>
<tr>
<td>C</td>
<td>79% - 70%</td>
</tr>
<tr>
<td>D</td>
<td>69% - 60%</td>
</tr>
<tr>
<td>F</td>
<td>59% - 0%</td>
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**Make-ups:** Make-ups for documented absences that are required as part of a UT Tyler obligation (e.g. athletes participating in an event, participating in a debate contest, etc.) or for religious observation will be granted. For all make-ups of this type, prior notification of at least one week and documentation are required. Other make-ups are granted only in extreme cases and at the sole discretion of the instructor.

**Cell phones, IPODs and other electronic devices:** Please set your cell phones and pagers to silent mode. If you are expecting an emergency call, please notify the professor in advance, sit near the door, and answer the phone outside. You will not be allowed to wear an IPOD or other electronic devices during an exam.
ADDITIONAL POLICIES:

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/StudentRightsandResponsibilities.html

Grade Replacement/Forgiveness
If you are repeating this course for a grade replacement, you must file an intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to do so will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates will receive grade forgiveness (grade replacement) for only three course repeats; graduates, for two course repeats during his/her career at UT Tyler.

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 12th day of class (See Schedule of Classes for the specific date). Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Registrar's Office and must be accompanied by documentation of the extenuating circumstance. Please contact the Registrar's Office if you have any questions.

Disability Services
If you have a disability, including a learning disability, for which you request disability support services/accommodation(s), please contact Ida MacDonald in the Disability Services office so that the appropriate arrangements may be made. In accordance with federal law, a student requesting disability services/accommodation(s) must provide appropriate documentation of his/her disability to the Disability Services counselor. In order to assure approved services the first week of class, diagnostic, prognostic, and prescriptive information should be received 30 days prior to the beginning of the semester services are requested. For more information, call or visit Disability Services located in the University Center, Room 3150. The telephone number is (903) 566-7079. Additional information may also be obtained at the following UT Tyler Web address: http://www.uttyler.edu/disabilityservices.

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.

Incomplete: Incompletes will only be given in extraordinary situations such as hospitalization or military service. Students must have had a passing grade in the class at the time they stop attending to be considered for an incomplete.