Computer Science 3870—Data Structures

Fall 2016

Instructor
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Office Hours
M,W 3:00–4:00 PM
T, R 11:00 AM –1:00 PM
F 12:00 – 1:00 PM
or by appointment

Class Meetings: MWF 2:00–2:50 AM, Old Main 2220

Text: Sedgewick and Wayne, *Algorithms, 4th edition,* Pearson Education, 2011.

Catalogue Description: Introduction to the design and analysis of data structures and their related algorithms; lists, stacks, queues, trees, heaps and graphs; sorting and searching. C++ or another object-oriented language will be used for any implementations.

Prerequisite: MAT 2345 and MAT 2670 or permission of instructor.

Learning Objectives: By the end of this course you will be:

- familiar with basic techniques of algorithm analysis,
- able to design and implement recursive methods,
- able to apply mathematical induction to prove the correctness of recursive methods,
- familiar with fundamental data structures and their various implementations including bags, queues, stacks, trees, search trees, and hash tables,
- familiar with various quadratic and sub-quadratic sorting methods, and
- able to construct Java implementations involving fundamental data structures and their associated algorithms.

Topics Covered:

Week of	Topic	Reading	Notes
Aug 22	Basic programming model	8–62	
Aug 29	Recursion and induction		
Sept 5	Data abstraction	64–119	Monday: Labor Day
Sept 12	Bags, queues, and stacks	120–171	
Sept 19	Analysis of algorithms	172–215	
Sept 26	Union-find	216–240	
Oct 3	Elementary sorts	243–269	**Friday: Exam 1**
Oct 10	Mergesort	270–287	Friday: Fall break
Oct 17	Quicksort	288–307	
Oct 24	Priority queues, applications	308–358	
Oct 31	Symbol tables	362–394	
Nov 7	Binary search trees	396–423	
Nov 14	Balanced search trees	424–456	**Friday: Exam 2**
Nov 21	—	—	Thanksgiving break
Nov 28	Hash tables, applications	458–512	
Dec 5	Review and consolidation	TBA	

Desire2Learn:
I will use the Desire2Learn account for the course to post this course outline and as much of the class handout materials as possible. Some of the homework will be writing assignments. These will be submitted through D2L. I will also post grades on D2L so you can keep track of your progress in the course.

Homework: Learning about data structures and their associated algorithms requires your participation. Like the Nike advertisement tells us, *"Just do it!"* If you want to play basketball well, for example, you can't just watch lots of games. Instead, it takes practice to accumulate the skills needed to be a good player. The same is true for computer science: you can learn a lot by reading the text and, I hope, attending class—but ultimately, some of your best learning experiences will come from solving problems on your own and "doing battle" at a computer keyboard.
The majority of homework assignments will require the implementation of Java programs. The two computer labs on the third floor of Old Main are equipped with the required software. You may also work with your own computer. In either case you will need to install the Java library provided by the authors of our textbook (algs4.jar – available on D2L) and connect it to the appropriate projects. You will need come Java development tools, including the Java Development Kit (currently 1.8), some IDE (such as Dr. Java, NetBeans, Eclipse, etc.).

Data Structures versus Algorithms: On first glance, it might seem peculiar that the assigned textbook for a course on data structures has the title *Algorithms*. The authors of our book have something to say about this (see *Algorithms*, last paragraph, page 4):

> Algorithms and data structures go hand in hand. In this book we take the view that data structures exist as the byproducts or end products of algorithms and that we must therefore study them in order to understand the algorithms. Simple algorithms can give rise to complicated data structures and, conversely, complicated algorithms can use simple data structures. We shall study the properties of many data structures in this book; indeed, we might well have titled the book *Algorithms and Data Structures*.

Participation: As with all university level computer science courses it will be crucial that you do the homework and practice the techniques. It will be equally important for you to come to class, to participate in the discussions, and to come and see me if you have problems. If you know you will miss a class you should let me know about it in advance.

Evaluation: In addition to homework exercises, there will be two exams and a final, as shown below. Exam dates are tentative, but will not be sooner than the dates given here.

Exam 1	Friday, October 7	20%
Exam 2	Friday, November 18	20%
Final	Wednesday, December 14, 2:45–4:45 pm	35%
Homework	—as assigned—	25%

The following scale will be used as a first approximation to your grade:

90–100: A 80–89: B 70–79: C 55–69: D 0–54: F

In borderline cases, factors such as overall trends and the final exam score will be taken into consideration. It is possible that the "cut-off" scores given above will be lowered. As a result, an overall score of 80 is *guaranteed* to receive at least a B, whereas a score of 78 *might* result in a B.

Attendance, Make-up, and Late Work: The course policy on attendance and make-up work follows the guidelines described in the EIU catalog[†]. To briefly summarize:

- You are expected to attend class meetings as scheduled.
- When an absence occurs, you are responsible for material covered in your absence.
- You are expected to notify me in advance of an anticipated absence on an exam day. If you cannot reach me, call the Mathematics and Computer Science Department (581-2028) and leave a message for me.
- You will have the opportunity to make up work for properly verified absences due to illness, emergency, or participation in official University activities. It is your responsibility to initiate plans for make-up work and complete it promptly.
- Late submissions of homework is permissible only for properly verified absences due to illness, emergency, or participation in an official University activity.

Miscellaneous:

- As with all university level computer science courses it will be crucial that you do the homework and practice the techniques. It will be equally important for you to read the textbook before class in order to be prepared, to come to class, and to participate in the discussions. You need to go over your notes and the textbook after class to consolidate what has been covered. Above all, you need to do problems and write out solutions. If you know you will miss a class you should let me know about it in advance.
- Please ask questions when you experience problems. Ask in class or see me outside of the regularly scheduled meeting times. If you can't make my posted office hours we can almost always arrange a separate appointment.
- As mentioned above, I will be happy to provide make-up privileges (when make-up is possible) to students for properly verified absences due to illness, emergency, or participation in an official University activity. It is the student's responsibility to initiate plans for make-up work and to complete it promptly. Whenever possible, you should contact me *before* such absences rather than after.
- You must, of course, recognize the principles of academic honesty. Anything you hand in for credit *must* be your own work and not the direct result of collaboration. I will operate under the assumption that everyone in the class understands this concept. Should you violate this, I will be greatly disappointed and I will report such behavior to the Office of Student Standards. The typical consequence of such a violation is a grade of F in the class. More details can be found through the Academic Integrity section in the box below.

Academic integrity: Students are expected to maintain principles of academic integrity and conduct as defined in EIU?s Code of Conduct (http://www.eiu.edu/judicial/studentconductcode.php). Violations will be reported to the Office of Student Standards.
Students with disabilities: If you are a student with a documented disability in need of accommodations to fully participate in this class, please contact the Office of Student Disability Services (OSDS). All accommodations must be approved through OSDS. Please stop by Ninth Street Hall, Room 2006, or call 217-581-6583 to make an appointment.
The Student Success Center: Students who are having difficulty achieving their academic goals are encouraged to contact the Student Success Center (www.eiu.edu/~success) for assistance with time management, test taking, note taking, avoiding procrastination, setting goals, and other skills to support academic achievement. The Student Success Center provides individualized consultations. To make an appointment, call 217-581-6696, or go to 9th Street Hall, Room 1302.

[†]See http://catalog.eiu.edu/content.php?catoid=23&navoid=796#clas_atte.