Computer Science E-22
Data Structures

Harvard Extension School, Fall 2020

Syllabus

Overview
A survey of fundamental data structures for information processing, including lists, stacks, queues, trees, and graphs. The course explores the implementation of these data structures (both array-based and linked representations) and examines classic algorithms that use these structures for tasks such as sorting, searching, and text compression. The Java programming language will be used to demonstrate the concepts discussed in lecture, and programming problems must be completed in Java. Key notions of object-oriented programming, including encapsulation and abstract data types, are emphasized.

Prerequisites
A good working knowledge of Java (at least a grade of B in CSCI E-10b or the equivalent). If your background is in another language, you will need to quickly come up to speed with Java, and you may want to consider first taking Computer Science E-10b. You should also consider taking E-10b if you have had little or no prior experience with recursion. For a sense of the level of proficiency that is required, we encourage you to review the sample problems that are found here: http://sites.harvard.edu/~cscie22/problem_sets/sample.shtml

Instructor (see the course website for office hours)
David G. Sullivan, Ph.D. (sullivan@post.harvard.edu)
Master Lecturer on Computer Science, Boston University

Teaching Assistants (see the course website for office hours)
Alex Breen (abreen@bu.edu)
Cody Doucette (doucette@bu.edu)
Libby James (etjames@bu.edu)
Eli Saracino (esaracino@bu.edu)

Meeting Times and Places
lectures: Wednesdays, 7:40-9:40 pm, or on demand. Students can participate in live web conferences, or they can watch recorded lectures on demand.
sections: optional weekly one-hour meetings; times TBA, or on demand; also held via web conferences. We encourage you to attend or watch sections because they will reinforce the concepts covered in lecture and prepare you for the assignments.

Course website: https://sites.harvard.edu/~cscie22/
Requirements

1. Problem sets: five assignments including a combination of written exercises and programming problems. All programming problems must be completed in Java, and they must compile and run in order to be eligible for full credit. Graduate-credit students will complete additional work on most assignments.

2. Midterm exam (October 21; see below)

3. Final exam (December 16; see below)

Important note: The problem sets tend to be fairly time-consuming. Don’t wait until the last minute to begin them! You should plan on devoting approximately 10-20 hours of work per week. If you have other major time commitments, you should reconsider whether to take this course.

Graduate-credit students: Students taking the course for graduate credit must complete additional homework. On most problem sets, the problems required of all students will be worth a total of 100 points; graduate-credit students will complete one or two additional problems worth a total of 10 points. These graduate-credit problems are typically more challenging than the other problems, and thus graduate-credit students should plan to spend approximately 20% more time on the homework.

Grading Policies

Late penalties: Homework is due prior to the start of lecture. If it is submitted more than 10 minutes after the start of lecture, it will be considered a full day late. There will be a 10% deduction for homework that is up to four days late, and a 20% deduction for homework that is 5-7 days late. We will not accept any homework that is more than 7 days late. Plan your time carefully, and don’t wait until the last minute to begin an assignment. Starting early will give you ample time to ask questions and obtain assistance.

Determining the final grade: problem sets 35%, midterm 25%, final exam 40%

Your final-exam grade will replace your lowest problem-set grade if doing so improves your final grade. A letter grade will be given in accordance with the Extension School’s grading policy (see https://www.extension.harvard.edu/grades). The final grades are not curved. The performance of the class as a whole is taken into account when assigning letter grades, but this can only improve your grade.

Extensions and makeups will only be given in documented cases of serious illness or other emergencies. You cannot redo or complete extra work to improve your grade.

An EXT (extension) grade will be granted only in extreme circumstances (e.g., illness), and only when appropriate documentation has been provided. Please bring any such circumstances to Dr. Sullivan’s attention as soon as possible.

Exam Policy

The exams will be administered online using Canvas and the Proctorio online proctoring platform. They must be taken within a 24-hour period that begins with the start of lecture on the date specified in the schedule (see below). Students are expected to have a web cam, microphone, and reliable internet access for the exams.
Academic Conduct

Unless otherwise stated, all work submitted as part of this course is expected to be your own. You may discuss the main ideas of a given problem with other students (provided that you acknowledge doing so in your solution), but you must write the actual solution by yourself. This includes both programming assignments and other types of problems that we may assign.

Prohibited behaviors include:

- copying all or part of another person's work, even if you subsequently modify it
- viewing all or part of another student's work
- showing all or part of your work to another student
- consulting solutions from past semesters, or those found in books or on the Web.

You are also responsible for understanding Harvard Extension School policies on academic integrity:

www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity

Not knowing the rules, misunderstanding the rules, running out of time, submitting the wrong draft, or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity.

If we believe that a student is guilty of academic dishonesty, we will refer the matter to the Administrative Board of the Extension School, who could require withdrawal from the course and suspension from all future work at the School.

Other Extension School Policies

We also expect you to know and adhere to the general policies and procedures of the Extension School. You can find more information here:

http://www.extension.harvard.edu/resources-policies

Accessibility Services

The Extension School is committed to providing an accessible academic community. The Accessibility Services Office offers a variety of accommodations and services to students with documented accessibility issues. For more information, please visit:

www.extension.harvard.edu/resources-policies/resources/disability-services-accessibility

Textbooks

- Computer Science E-22 coursepack. This will be available for download from the course website. More information will be given during the first lecture.
- Optional readings will be also given from the following book:
  

  This book is not required, but you may find it useful to purchase it.
### Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>September 2</td>
<td>Introduction. Abstract data types and object-oriented programming</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>September 9</td>
<td>Recursion and backtracking</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>September 16</td>
<td>Sorting and algorithm analysis I</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>September 23</td>
<td>Sorting and algorithm analysis II</td>
<td>Problem set 1 due</td>
</tr>
<tr>
<td>5</td>
<td>September 30</td>
<td>Linked lists</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>October 7</td>
<td>Lists, stacks, and queues I</td>
<td>Problem set 2 due</td>
</tr>
<tr>
<td>7</td>
<td>October 14</td>
<td>Lists, stacks, and queues II</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>October 21</td>
<td><strong>Midterm exam</strong> State-space search (one hour of lecture)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>October 28</td>
<td>Binary trees and Huffman encoding, Binary search trees</td>
<td>Problem set 3 due</td>
</tr>
<tr>
<td>10</td>
<td>November 4</td>
<td>Balanced search trees (2-3 and B-trees), Heaps and priority queues</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>November 11</td>
<td>Heaps and priority queues (cont.), Hash tables</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>November 18</td>
<td>Graphs I, Hash tables</td>
<td>Problem set 4 due</td>
</tr>
<tr>
<td>13</td>
<td>November 25</td>
<td><strong>Thanksgiving break. No class.</strong></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>December 2</td>
<td>Graphs II</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>December 9</td>
<td>Wrap-up and review</td>
<td>Problem set 5 due</td>
</tr>
<tr>
<td>16</td>
<td>December 16</td>
<td><strong>Final exam</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Other important dates:**
- August 27: registration ends
- September 8: course change period ends
- November 20: last day to withdraw for a grade of WD (no refund)