I. Overview

Computer Science E-50b is the second half of a two-semester introduction to computer science using the Java language.

The official prerequisite for this course is Computer Science E-50a, which covers the fundamental principles of object-oriented programming using Java; however, students who are experienced in other languages (e.g., C++ or even C) may be able to succeed in this course if they master elementary Java during the first week or two. This means that by mid-February all registered students are expected to be comfortable with designing, coding and debugging programs of modest complexity while employing good programming style in the Java language. In particular, we presume students will be competent at writing Java code that contains iterative and conditional control structures, parameter passing, elementary class declarations/object creation, and single-dimensioned array manipulation.

In CSCI E-50b you will write larger and more complex programs than in CSCI E-50a, including (at least for the graduate-credit students) a significant original term project. Most of the problem sets will involve programming in Java on a Unix/Linux environment using the 1.6 implementation of the Java language. You can use your own personal computer for much of the course work, but we’ll have more to say about that in lecture.

The emphasis of CSCI E-50b is on learning the principles and practices of object-oriented programming (OOP), which includes the design and implementation of abstract data types (ADTs) such as stacks and queues. After a quick review of Java basics, we continue with recursive processes, bit manipulation, inheritance mechanisms and interface design, exception
handling, and file and stream I/O. We then turn our attention to the design and implementation of graphical user interfaces (GUIs) and related topics, such as event-handling, drawing and threading. We also touch on such data structures as singly linked-lists. The last unit of this course is concerned with the MIPS “RISC” architecture; at this point you will learn an assembly language and come to understand the underlying structure or “architecture” of a typical digital computer, including the low-level representation of diverse types of data.

Although we believe the content of CSCI E-50b is fairly straightforward, this is one of those computer courses in which the problem sets can be somewhat time-consuming. It is not unusual for students to spend as many as 10-15 (or more) hours per week, on the average, doing the homework. If you have other major time commitments (e.g., a part-time job, other courses, a family, friends, hobbies, etc.), then you might wish to reconsider whether or not to take Computer Science E-50b. You have been warned!

The computing facilities at the Harvard Science Center are available for student use 24 hours a day, 7 days a week (in theory, at least). The 53 Church Street facilities are available from early in the morning until late in the evening, 7 days per week. Note that the Church Street classrooms are occasionally reserved for section meetings and are therefore inaccessible for general use at those times. More information about the Science Center’s facility is at http://www.fas-it.fas.harvard.edu/newToFas/students. The Church Street lab’s website is at http://lab.dce.harvard.edu
II. Course Staff

Faculty: Henry Leitner  
51 Brattle St., rm. W-725  (617) 495-9096  
e-mail: leitner@harvard.edu

Dr. Leitner will generally be available for consultation on Monday evenings at 7:30 P.M. (after class) at Maxwell-Dworkin. If you need to speak with him at some other time, the best way to get in touch is by sending an e-mail message to arrange an appointment.

Teaching Assistants:  
Ms. Jan Jackson  
e-mail: jjackson@fas.harvard.edu
Mr. Jaime Bermudez  
e-mail: jaime_bermudez@harvard.edu
Mr. Anthony Cahillane  
e-mail: acahill@fas.harvard.edu
Mr. David Habermehl  
e-mail: habermehs@fas.harvard.edu
Ms. Yifan Wu  
e-mail: yifanwu@college.harvard.edu
others to be announced, if enrollment warrants

Each CSCI E-50b student will be assigned to one of the teaching assistants listed above. The TAs are responsible for grading homework and for helping students, in general, with the material covered in this course. They can all be contacted via e-mail. Students can reach the entire course staff at once by sending an e-mail message to libe50b@fas.harvard.edu.

Each student is expected to attend a mandatory 60-75 minute “section meeting” every week, beginning the week of February 4. During the first week of class (starting January 28), we may hold an optional section meeting, primarily for students who want to review elementary Java, including a brief introduction to writing Java programs under Unix using javac.

The section meetings are run entirely by the various teaching assistants, and are held in Science Center classrooms. The precise times and places for these meetings will be announced in lecture and will be posted at all times on our course website:

1 Note that Ms. Jackson will assume “head teaching fellow” responsibilities; she will be the one to contact for various administrative matters, such as questions about grading guidelines.
In addition to running section meetings, the TAs will hold regular “office hours” to assist students with homework assignments and other course-related matters. The schedule of TA office hours will be announced shortly. Later on we will provide you with more detailed information on how the TAs are individually sharing their responsibilities; for the moment, you are encouraged to contact any one of the TAs if you need some quick help or advice.

In order to be assigned to a section, you **must** run our automated “sectioning program” **BEFORE** the third week of class. To do this you must first **activate your FAS computer account**, even if you don’t plan on using it much. Once you have completed this step, login to your account, and issue the following command at the *Unix* prompt:

```
% ~libe50b/bin/section
```

### III. More Important Information ...

**Lectures** are held every Monday evening, from 5:30 PM until 7:30 PM in Maxwell-Dworkin room G115.

Attendance at both the weekly lecture and section meetings is **essential**, as this course moves very fast. If you **do** miss a lecture, be sure to get copies of whatever handouts you may have not received. The handouts are numbered sequentially, and extra copies will be available from the Extension School’s Focus Office located in Science Center 101a. They will be posted also on our course website.

Note that ALL students have the option of watching the streaming video of every lecture, beginning 36 to 48 hours after the live performance has taken place, “on demand.” Additional details are provided in the next section, below. In addition, the lectures from Maxwell-Dworkin will be streamed live which means students also have the option of watching the lectures in real-time along with the ability to communicate via a chat room. The URLs for both the live stream and the chat room will be posted on our course website,
along with information about how to connect, shortly before the first lecture.

Important course announcements (e.g., problem set errata) may occasionally appear on the computer terminal when you begin a session with the Unix system. Please pay careful attention to these notices. Some will be of greater and more immediate importance than others. Those of you who intend to make heavy use of computers other than our Unix mainframe system, take note of this! These announcements will also be posted on our website, along with additional information.

You should get into the habit of consulting our website frequently (at least once per week) for late-breaking news! Homework is due, in general, right before lecture on Monday evenings.

Note the following important dates (see the calendar at the end of this document):

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tr>
<td>March 25:</td>
<td>Open-book quiz (one hour long)</td>
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<td>April 15:</td>
<td>Graduate-student term project proposals due by 5:30 PM</td>
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<td>May 10:</td>
<td>Graduate-student term projects are due by 5:30 PM.</td>
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<td>May 13:</td>
<td>Open-book, two-hour final examination</td>
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IV. Distance Education

This year, CSCI E-50b lectures (along with other course-related materials) are being made available online. These streaming video/audio presentations can be viewed by students anywhere in the world, so long as there is a reliable connection to the Internet and the required software has been installed onto the student computer. See http://www.extension.harvard.edu/distance-education/how-distance-education-works for more detail. Enrolled students, including those in the Boston/Cambridge area, have the option of attending lectures when they are given on campus, or watching them online.

Students who take this course exclusively online must complete the same coursework (and will receive the same credit) as students who take the courses locally. Be aware that the lectures will not be available until at least 24 hours after the live class meeting has taken place. For additional requirements, and to view a sample lecture, see http://www.extension.harvard.edu/DistanceEd/
All students who live within the six state New England region must take the midterm and final examinations ON CAMPUS at the scheduled date and time. Students outside the New England area must arrange to take their exam in absentia and must submit a completed distance education form to the Academic Services department at 51 Brattle Street. For additional information, see: http://www.extension.harvard.edu/distance-education/how-distance-education-works/academic-policy-exam-proctoring

V. Readings

The two main textbooks for this course are for sale at the Harvard Coop bookstore. If you are at a distance from Harvard Square, you can order the books over the phone from the Coop or on online seller.


Many of you should already have this textbook if you enrolled in CSCI E-50a


There are several additional,
supplementary textbooks you may want to check out — which are NOT required for purchase. Each should be for sale at the Harvard COOP, and will be on reserve at the Harvard Extension School’s Grossman Library in Sever Hall:


*Remember, you are not required to purchase any of the supplementary books at this time!*

An initial set of Powerpoint lecture slides will be handed out in class, along with demonstration program listings. Subsequent material will be available on our website for you to download and print on your own.

**VI. Doing the Problem Sets**

The majority of the homework will involve problem-solving using one of the timeshared *Linux* computers located at the Science Center; they can be accessed through through the Internet using an SSH software client running on a Mac or a Windows PC. Some of the homework exercises will be short paper-and-pencil problems. In addition, there may, on occasion, be a number of “extra credit” programming problems — you can decide which ones (if any) you want to work on.

Do **not** attempt to finish up a homework during lecture or during section! We will deduct 10% for a homework assignment that is turned in up to 3 days late. 20% will be deducted if the homework is more than 3 days late. No homework will be accepted more than 7 days late. Electronic submission of your homework is due **prior to the start of lecture**, and if it is more than 10
minutes late arriving, then it will be considered a full day late.\footnote{If you know you will be turning in your work late, try to contact your teaching fellow via e-mail and inform him or her about the difficulty.} At section meetings and during regular office hours, your assigned TA will return your graded homework to you. As I usually plead, please, please

\textbf{Do NOT fall behind on homeworks!}

Just as you cannot expect to learn how to drive a car by reading about it or by watching other people do it, the same holds true for programming a computer. Do your work on time — this is one course you simply cannot “cram” for at the last minute, so don’t even try! We cannot stress this strongly enough. Remember that the homework will be quite time-consuming, so please reconsider your other commitments before you decide to continue with CSCI E-50b.

Here are a few additional guidelines you should follow when turning in homework:

- Include your full name, course, date and assignment number in a comment line at the beginning of every program file.

- For the programming assignments, be sure to demonstrate that your program works by including a printout of its operation. Remember that your homework will be graded on the basis of both correctness and clarity (e.g., the use of meaningful identifiers, appropriate indentation of statements, modular design, comments). We will have more to say about this a bit later. Note that we will not always be providing you with a set of standard “test cases” on which your programs must operate successfully — so be careful when you try out your programs. In most cases, any feature that is not demonstrated will be presumed not to work!

- Those of you who use personal computers for some or all of the homework assignments will need to upload the programs you write to your Unix account and "submit" them electronically. Detailed procedures for doing this will be provided on our
course website.

✦ If you are taking this course exclusively “at a distance,” all your work, including submission deadlines, are the same as if you were taking the course on-campus. If some of the work involves drawing diagrams or writing something that is not suitable for electronic submission, then FAX your work to the attention of Jan Jackson at the following number: 617-384-8395

✦ You are NOT permitted to “borrow” code found on websites, magazines or books. Nor can you have friends or family members write your programs. If you wish to reuse small “snippets” of code from lecture demonstrations or from some other source, you may do so — provided you annotate such use and give proper credit to the original author. Violators of this rule will be subject to disciplinary action.

Student final grades in CSCI E-50b will be based on the problem sets, an open-book midterm quiz, an open-book final, a term project — which is required of all graduate-credit students only\(^3\) — and the teaching fellow’s appraisal of individual achievement.

Our grading policy allows that students who lose credit on homework will have up to half of the missing points added to the value of the exams. For graduate-credit students, the final exam will, on average, count towards 25\% of the final grade; the midterm quiz will count an additional 15\%; the term project will count 10\%; and the homework will count toward the remaining 50\%. For undergraduate-credit students, the final exam will, on average, count towards 33\% of the final grade; the midterm quiz will count an additional 17\%; and the homework will count toward the remaining 50\%.

Please note that an EXTension in CSCI E-50b will be granted only in extreme circumstances (e.g., illness), and only when appropriate documentation is provided. Such cases must be cleared with Dr. Leitner or Jan Jackson as early as possible, and before May in any event.

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\(^3\) Basically, an original, largish computer program written in Java. We will suggest some possible topics in a separate document.
VII. Syllabus

As a continuation of CSCI E-50a, the content of CSCI E-50b is divided into 4 additional “units” or components:

- **Unit 5** — Overview of the Unix operating system and useful shell commands. Quick examination of elementary Java control structures, including recursion; scope and the lifetime of variables and identifiers; classes/objects, member functions (including constructors), and data abstraction (*stack* and *queue* data types). Review of single and multi-dimensional arrays; introduction to *Vectors* and *ArrayLists*. Enumerated data types. File and stream I/O concepts, including exception handling. Programming with inheritance.

- **Unit 6** — Event-handling; the design and implementation of graphical user interfaces (GUIs) using the “abstract windowing toolkit” and the *Swing* components of the *Java Foundation Classes* (JFC) such as labels, buttons, textfields and textareas, layout managers, menus, events and listeners. *Graphics* objects for drawing simple figures such as lines, rectangles and ovals, and for displaying text using different fonts. Applets and multithreading, if time allows.

- **Unit 7** — Introduction to linked-lists and recursive backtracking techniques. Bit manipulation and bit fields. Sets as an abstract data type.

- **Unit 8** — Computer architecture. Instructions and addressing using the MIPS RISC assembly language. Internal representation of data structures. Stacks, subroutines and stack frames to explain how recursion operates. Bringing it all together: how high-level programming languages work: a *Java* program that implements an interpreter and a compiler for a high-level language.

The following calendar should give you an idea of how CSCI E-50b will progress. **Good Luck!**
January, 2013 and February 2013

Monday  Tuesday  Wednesday  Thursday  Friday

28  29  30  31  1

Lecture #1, Unit 5.0

OPTIONAL section meetings this week

4  5  6  7  8

Unit 5.1

“open” section meetings this week -- attend any one you wish!

11  12  13  14  15

Unit 5.2

18  19  20  21  22

HOLIDAY -- NO LECTURE TODAY!

25  26  27  28  1

Unit 5.3
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**March 2013**

Spring Break -- no lecture and no sections this week

Dr. H. H. Leitner
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Above all, have fun in this course!
"On the Internet, nobody knows you're a dog."