CSCI 316: Principles of Programming Languages (M W 8:00 pm Section)

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Office: SB A106  
Office hours: M W 3:25 – 4:00 pm in SB A106 and M W 9:20 – 9:45 pm in PH 113


About This Course

Students will complete an implementation of a small programming language (“TinyJ”) that is a subset of Java. This major programming project will involve reading and understanding code that is already written as well as writing code. It is to be done in Java, which students are assumed to have learned in an earlier course.

The project will provide a basis for concrete discussions of many aspects of programming languages—e.g., expressions and their evaluation, structured statements and their execution, arrays and pointers, storage allocation (static, stack-dynamic, and heap-dynamic) for variables, function call and return, parameter passing, scope, virtual machines.

In addition, this course will acquaint students with the functional programming paradigm (as an alternative to the procedural and object-oriented imperative paradigms that students will be familiar with from earlier courses). Students will learn to program in a functional style in the language Lisp.

Other topics relating to programming languages (e.g., programming language syntax) will also be covered, in class and/or by reading assignments.

Learning Goals

- To understand a variety of fundamental concepts relating to the design, specification, and implementation of programming languages.
- To become acquainted with the functional programming paradigm and the use of the programming language Lisp to solve problems in a functional style with frequent use of recursion.

Required Course Reader and Required Textbook

1. Course reader sold by the Queens College Online Bookstore (https://qc.textbookx.com); this contains selections from: R. Sethi, Programming Languages, 2nd ed., Addison-Wesley, 1996. IMPORTANT: Certain exam questions may assume you have a copy of this course reader that you can refer to during the exam. A copy of the course reader may be used during exams if it is a legal copy, its pages have no notes or markings, and nothing else is enclosed within its pages—course readers that violate these conditions will be confiscated during exams. The exams will otherwise be closed book.


Some Recommended Textbooks

5. R. Wilensky, Common LISPcraft, Norton, 1986.1

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3An older edition of this book is available online (to Queens College students) through the Library—see https://ebookcentral.proquest.com/lib/qc-ebooks/detail.action?pq-origsite=primo&docID=649018.
4The text of this book is available online—see https://www.gigamonkeys.com/book/.
Grading Policy

Grades will be a measure of attainment (not effort). Your grade will be based on your scores on the cumulative Final Exam, two other exams, and six for-credit programming assignments (the last three of which will constitute the above-mentioned TinyJ implementation project). Some exam questions will relate to programming assignments. The maximum possible scores on the exams and assignments will be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>25 points</td>
</tr>
<tr>
<td>Exam 2</td>
<td>25 points</td>
</tr>
<tr>
<td>Cumulative Final Exam</td>
<td>40 points</td>
</tr>
<tr>
<td>For-Credit Lisp Assignments</td>
<td>4.5 points</td>
</tr>
<tr>
<td>TinyJ Implementation Assignments</td>
<td>5.5 points</td>
</tr>
</tbody>
</table>

When I consider your scores for grading purposes, I will first replace the lower of the scores on Exam 1 and Exam 2 with (Final Exam score × 25/40) if the latter is higher. (If your scores on Exams 1 and 2 are equal, at most one of those scores will be replaced in this way.) Bearing this in mind, let:

\[ a = \text{sum of your exam scores and scores on for-credit assignments} \]
\[ b = (\text{sum of your exam scores}) \times 100/90 \]

Your grade will be computed from the values of \( a \) and \( b \) using rules A and B below—if the rules give different grades, you will receive the higher of those two grades. (Note that no grades of C− will be given.)

Rule A I will consider you to be an A-range student if the following are both true:

1. \( a \geq 87 \)
2. You have a higher Final Exam score than at least 70% of the students in the class.

If \( a \geq 97 \) and you have a higher Final Exam score than at least 90% of the students in the class, then your grade for the course will be A+.

If you are an A-range student and the previous sentence does not apply to you, then your grade will be A− or A according to whether \( a < 90 \) or \( a \geq 90 \).

If you are not an A-range student, then your grade will be F if either of the following is true:

(i) You are a graduate student, or are an undergraduate who has asked to be excluded from consideration for D+ and D grades, and \( a \) is less than the threshold score for C.

(ii) You are an undergraduate who has not asked to be excluded from consideration for D+ and D grades, and \( a \) is less than the threshold score for D.

If you are not an A-range student and neither (i) nor (ii) applies to you, then you will receive the highest grade below A− for which \( a \) is greater than or equal to that grade’s threshold score. Provisional threshold scores for grades below A− are as follows: B+ 83, B 80, B− 76, C+ 73, C 69, and, for undergraduates who are being considered for D+ and D grades, 63, D 60. The threshold score for C may be lowered by up to 1 point for some students, at the instructor’s discretion.

Rule B No grades of A+ will be awarded on the basis of this rule. Otherwise, rule B is the same as rule A except that \( b \) is used in place of \( a \), threshold scores for grades might be a little lower, and the definition of “A-range student” might be a little broader.

There will be no make-ups for Exams 1 and 2: Missing either exam will be equivalent to scoring 0 on that exam, but the 0 will be replaced by (your Final Exam score × 25/40) if you miss just one exam.

Students who are absent from Exam 2 and the Final Exam may possibly be given a WU.

Assignments and Late Submission Policy

You may work either on your own or with up to two other students on the for-credit assignments. However, when two or three students work together on an assignment each student must write up his/her own submission (which needs to clearly state the name(s) of his/her partner(s)) independently, and is expected to fully understand all parts of the submission. No two students may make submissions that are essentially the same.

Although the for-credit programming assignments will not count more than 10% towards your grade, and other homework exercises will not carry any credit, you should not underestimate the importance of doing this work. When you are given any homework (e.g., a reading assignment), assume that the work is to be done before the next exam unless some other deadline is explicitly indicated. Exam questions that are similar or related to for-credit and not-for-credit assignments or other homework exercises will count at least 35% towards your grade.

Undergraduates in this course will be asked in May to say whether they wish to be considered for D+ and D grades in the event that they do not qualify for a course grade of C or better.
For-credit programming assignments are to be submitted by leaving your source file(s) in the appropriate directory on the machine euclid.cs.qc.cuny.edu. You will be given a euclid account for that purpose—see page 6 of this document. Attempted “submissions” that are not made on euclid—e.g., “submissions” by e-mail—will not be graded! As explained on p. 5 of this document, you also have an account on another machine, venus / mars. You can do assignments on euclid or on venus / mars or on your own PC, but assignment submissions must be left on euclid (not venus / mars)!

You can do assignments on your Windows PC if you can install GNU Clisp (see the “Lisp Assignment 1” document for instructions) and have installed or can install the Java SE JDK. The latter is available at this URL: https://www.oracle.com/java/technologies/downloads/. Make sure your PATH environment variable includes the directory containing the program jar.exe that is part of the installed JDK.7 Example: For a typical installation of version 17.0.6 of the JDK, the directory containing the program jar.exe is likely to be c:\program files\java\jdk-17\bin.

If you do assignments on venus or your own PC then, when you are ready to submit, you can use an scp or sftp client to put a copy of the .lsp or .java file(s) you are submitting in the right directory on euclid.8 You must keep a backup copy of each submitted file on venus / mars, and another elsewhere.

Here are tentative approximate9 due dates of the for-credit assignments:

- Lisp Assignment 3: Early March.
- Lisp Assignment 4: Mid- or late March.
- Lisp Assignment 5: Late March.
- TinyJ Assignment 1: Late April or early May.
- TinyJ Assignment 2: Second week of May.
- TinyJ Assignment 3: After the last class.

Late / corrected submissions of any assignment may be made until a late-submission deadline that will be announced later, but may incur a penalty as explained below. Assignments will not be graded until after the late-submission deadline.

If when I compute a student’s course grade I see that the number of assignments submitted late (as defined in the next paragraph) is N ≥ 4, the student is subject to a penalty of 3N + 2 points, where N is the number of assignments submitted late. There is no penalty if N < 4.

If you are unsure whether one of your assignment submissions is on-time or late, you can find out using the command ls -lc name (e.g., ls -lc doe-3.lsp or ls -lc TJ1aan/Parser.java). Entering this command on euclid will show the “last change time” of the file whose pathname is name. For grading purposes, “number of assignments submitted late” means the number of different assignments for which the last change time of a submitted file (as shown by the command ls -lc name on euclid) is after the assignment’s due date.

Academic Misconduct. Plagiarism

Students found to have provided their answers to others during an exam or to have submitted work of others as their own will receive a grade of F for the course.

Attendance

Students are expected to attend all classes. Students who are absent from part or all of a class are responsible for catching up and must not expect me to assist them in doing that.

E-mail Forwarding

I will send important e-mail to your euclid account from time to time. Be sure to check that your euclid account automatically forwards e-mail to your qmail.cuny.edu e-mail address. See page 6 of this document for instructions on how to do this. E-mail forwarding is not 100% reliable; some forwarded e-mail may be blocked or removed as spam. So you should check e-mail on euclid at least twice a week: You can do this by entering alpine -i on euclid after you logon. Logging on to euclid at least twice a week will also reduce the risk of your forgetting your euclid password.

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7See, e.g., https://www.computerhope.com/issues/ch000549.htm if you don’t know how to inspect and update your PATH variable.

8For example, you can copy the file myfile.lsp from your current working directory on venus / mars or a PC into your home directory on euclid by entering scp myfile.lsp xxxxx_yyyy316@euclid.cs.qc.cuny.edu: venus / mars or in a powershell window on your PC; here xxxxx_yyyy316 means your username on euclid. (Note that .edu is followed by a colon here.) This command can also be used in a terminal window on a Mac to copy myfile.lsp from your working directory on the Mac to euclid.

9The actual due date of each of these assignments will be stated in another document that gives details of the assignment; that document will be provided to you at least one week before the actual due date (and often sooner).
C SCI 316 (M W 8 pm Section): Preliminary Schedule

1  1/25 W  Information about the course.
2  1/30 M  Functional programming.
3  2/01 W  Functional programming (contd.). Lisp: Introduction.
4  2/06 M  More on functional programming. Lisp: Using DEFUN to define functions.
5  2/08 W  Lisp: S-expressions--atoms & lists.
   2/13 M  No class: College is closed.
6  2/15 W  Lisp: S-expressions (contd.).
   2/20 M  No class: College is closed.
7  2/21 Tu (M Sched.)  Lisp: QUOTE. Built-in functions for working with lists.
8  2/22 W  Lisp: Built-in predicates.
9  2/27 M  Lisp: Built-in predicates (contd.). COND & IF
10  3/01 W  Lisp: AND/OR. LET/LET*.
11  3/06 M  Lisp: Recursion.
12  3/08 W  Lisp: Recursion (contd.).
13  3/13 M  Lisp: Recursion (contd.).
14  3/15 W  Lisp: Functions as arguments, MAPCAR, REMOVE-IF, REMOVE-IF-NOT, LAMBDA.
15  3/20 M  Lisp: FUNCALL, APPLY. Tail recursion.
19    4/03 M  Tentative date of Exam 1.
   4/05 W – 4/13 Th  Spring Recess (no classes).
20    4/17 M  Syntax of programming languages (contd.).
   hand-translation of TinyJ source code into TinyJ virtual machine code; compilation of
   TinyJ statements, expressions, and methods into TinyJ virtual machine code.
   Parameter passing modes.
28    5/15 M  Probable date of Exam 2.

2-Hour Cumulative Final Exam:  Monday, 5/22, 8:30 – 10:30 pm

All exams will be given in our regular classroom unless a room-change is announced.

This schedule is preliminary and subject to change. However, any change in the date of an exam will be announced at least one week before the new date.
Accounts on *venus* / *mars* (*mars.cs.qc.cuny.edu* or 149.4.211.180)

You have a Linux account on the machine *venus* (which is also called *mars*). In most if not all cases your *venus* / *mars* username is as follows:

- first 2 letters of your *last* name (in lowercase) followed by
- first 2 letters of your *first* name (in lowercase) followed by
- last 4 digits of your 8-digit CUNYfirst ID.

**Example:** Washington, George  CUNYfirst ID: 12345678
Username: wage5678

If you have used this account before (in another course), then your password is probably the same as it was when you last used the account. If not, then your initial password is probably your 8-digit CUNYfirst ID#.

**Note:** Don’t confuse your *venus* / *mars* account with your *euclid* account; *euclid* and *venus* / *mars* are two different computers. Your *euclid* account has a different username from your *venus* / *mars* account, and *euclid* account passwords are unrelated to *venus* / *mars* account passwords. All assignments must be submitted on *euclid*.

The simplest ways to log on to *venus* / *mars* from a PC and a Mac are as follows:

**Logging onto your linux account using Mac**

- Open the terminal app from Applications/Utilities folder and type
  `ssh your_username@mars.cs.qc.cuny.edu`
- Type *yes* to continue connecting
- Type *your_password*. Nothing will display on your screen when you type your password. Press ENTER after you complete your password entry.

**Logging onto your linux account using Windows PowerShell**

- Click Start menu, type `Windows Powershell` to launch Windows Powershell and type
  `ssh your_username@mars.cs.qc.cuny.edu`
- Type *yes* to continue connecting
- Type *your_password*. Nothing will display on your screen when you type your password. Press ENTER after you complete your password entry.

*These instructions are copied from the CS Department's webpage [https://venus.cs.qc.cuny.edu/~xiuyi/](https://venus.cs.qc.cuny.edu/~xiuyi/).
The "Type *yes* to continue connecting" step applies the first time you use the `ssh` command on a particular PC or Mac to connect to *venus* / *mars*; it doesn't apply if you have previously used the `ssh` command on the same PC or Mac to connect to *venus* / *mars*. (If when you enter `ssh your_username@mars.cs.qc.cuny.edu` you are warned that "REMOTE HOST IDENTIFICATION HAS CHANGED!", then enter the command `ssh-keygen -R mars.cs.qc.cuny.edu` and try again after that.)

It is important that you be able to log on to *venus* / *mars*. Make sure you can do that before our second class meeting: If you cannot log on to your *venus* / *mars* account, then email the CS Department's Administrative Coordinator Xiuyi Huang at xiuyl.huang@qc.cuny.edu to ask for help.

**Note:** This applies only to *venus* / *mars*—if you can log on to *venus* / *mars* but need help with your *euclid* account, then see me during one of my office hour periods.

Any time you are logged in to *venus/mars*, you can login to your *euclid* account by entering

```
ssh ?????_????316@euclid
```

at *venus’s* [ ... @venus ~]$ prompt; here ?????_????316 means your euclid username.
If you get a “Host key verification failed.” error, retry after entering this: `/home/faculty/ykong/316setup`

But you should be sure read the next page before you try to login to your *euclid* account for the first time!
Accounts on euclid and E-mail Forwarding

In addition to your **venus** account, you have an account on **euclid**; **venus** and **euclid** are different machines. Your **euclid** account has a **different username** and a **different initial password** from your **venus** account. You will need your **euclid** account to submit assignments. I will e-mail important course-related information to everyone’s **euclid** account; by default, such email will be forwarded to your qmail.cuny.edu address.

**IMPORTANT:** E-mail forwarding is **not** 100% reliable; some forwarded e-mail may be blocked or removed as spam. For this reason, and to reduce the risk of forgetting your **euclid** password, be sure to **check e-mail on euclid at least twice a week**—you can do this by entering **alpine -i** on euclid after you log on.

If you registered for the class **before** 1/24, your username is **xxxxx_yyyy316**, where:

- **xxxxx** = your last name in lowercase if it has ≤ 5 letters (omit any space or hyphen in the name)
- **yyyy** = first 5 letters of your last name in lowercase if it has > 5 letters

Your initial password is **q followed by the last 7 digits of your CUNYfirst ID.**

Example: If your CUNYfirst ID is 12345678, then q2345678 is your initial password.

The first time you log on, you will be asked to choose a new password, so think of a **good password in advance**—see, e.g., [https://computing.cs.cmu.edu/security/security-password.html](https://computing.cs.cmu.edu/security/security-password.html).

Assuming you are already logged on to **venus**, you can log on to **euclid** by entering

```sql
ssh ?????_????316@euclid
```

at **venus**'s [ ... @venus ~]$ prompt; here ?????_????316 means your **euclid** username.*

If you get a “Host key verification failed.” error, retry **after entering this:**

```sql
/home/faculty/ykong/316setup
```

The **first** time you use ssh on **venus** to connect to **euclid** you will be asked if you trust **euclid**’s “key fingerprint”: **Answer yes**. You will then be prompted for your **euclid** password: Enter **q followed by the last 7 digits of your CUNYfirst ID.** **NOTE:** No characters should appear on the screen when you type the password at a "... password:" prompt—*the cursor should not move*—but the system will know what keys you pressed! Remember to press **Enter** at the end.

You will have to change your password, but you must first **re-enter your q ... password**:

Changing password for ?????_????316.

(current) UNIX password:

Do **NOT** enter your new password at this prompt: Enter **q followed by the last 7 digits of your CUNYfirst ID one more time**. You will then be prompted for a new password:

**New password:**

Now enter a new password. You'll be asked to re-enter the new password for verification:

Re-type new password:

If you re-enter your new password correctly, **your password will be changed and you will be logged off**. Immediately log on to **euclid** again (using your **new** password!) and then:

1. Enter the command **finger ?????_????316** (where ?????_????316 means your **euclid** username) and check that the "Mail forwarded to" line shows your email is being forwarded to your qmail.cuny.edu address: If you do not see a "Mail forwarded to" line, or it shows an incorrect email address, let me know!

2. Enter the command **xc** on **euclid**.

3. Enter the command **alpine -i** on **euclid** and check that an email with the subject "Automatically Generated Reply" is listed in your alpine message index; also make sure you can read the email. After that, **type q and then y to quit alpine**.

4. A copy of the same email should have been forwarded to your qmail.cuny.edu address. Check your qmail account to make sure the email was successfully forwarded. (If you do not see the email in your qmail account, look in your Junk Email folder.) If you do 1 - 4 no later than **Thursday, February 2***, then you will receive 0.25 pt. extra credit: I will substitute **a + 0.25** and **b + 0.25** for **a** and **b** in grading rules **A** and **B** when I compute your grade for the course.

*The first time** you log on to your **euclid** account, please do so by ssh from **venus**. (After you have verified that you can log on to euclid via venus, you may in future prefer to connect to euclid using an ssh client on your PC or Mac—e.g., follow the [Logging onto your linux account using Windows PowerShell](https://computing.cs.cmu.edu/security/security-radial.html) or the [Logging onto your linux account using Mac](https://computing.cs.cmu.edu/security/security-macos.html) instructions on the previous page, but replace **mars** with **euclid** in those instructions.

**If you don’t do 1 - 3 by Feb. 2,** your account may be deactivated **(for security reasons). To reactivate a deactivated account, or to reset a forgotten password, you must see me after class or during an office hour meeting. [Note that I will **not** reactivate accounts or reset passwords in response to e-mail messages.]**