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Fall 2019

CSCI 316: Principles of Programming Languages (M W 1:40, 3:10, and 8 pm Sections)

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Instructor's Office Hours M W 4:35 – 5:00 in SB A106 or B145; 9:25 – 10:00 pm in SB A106 or B141

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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 topics related to 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. Other topics (e.g., syntax of programming languages) will be covered separately and/or may be the subject of reading assignments.

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.

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. Coursepack sold by the Queens College Online Bookstore (`https://qc.textbookx.com`); this is a course reader that contains selections from: R. Sethi, *Programming Languages*, 2nd ed., Addison-Wesley, 1996.[1] **IMPORTANT: You may refer to your purchased copy of this course reader (*but not a photocopy*) during exams *if the pages have no notes or markings*.**
2. D. S. Touretzky, *Common Lisp: A Gentle Introduction to Symbolic Computation*, Dover, 2013. ISBN 978-0486498201.[1,2]

Some Recommended Textbooks

3. M. L. Scott, *Programming Language Pragmatics*, 4th ed., Morgan Kaufman, 2016.[3]
4. P. Seibel, *Practical Common Lisp*, Apress, 2005.[1,4]
5. R. Wilensky, *Common LISPcraft*, Norton, 1986.[1]
6. P. H. Winston and B. K. P. Horn, *Lisp*, 3rd ed., Addison-Wesley, 1989 (reprinted with corrections, August 1997).[1]

[1] This book is on reserve in the Library—see `https://qc-cuny.libguides.com/er.php?course_id=18376`
[2] An older edition of this book is available online—see `https://www.cs.cmu.edu/~dst/LispBook/book.pdf`
[3] An older edition of this book is available online (to Queens College students) through the Library—see `https://site.ebrary.com/lib/qc/detail.action?docID=10502565`
[4] The text of this book is available online—see `http://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[5] (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 will be as follows:

Exams 1 and 2:	25 points each
Cumulative Final Exam:	40 points
For-Credit Lisp Assignments:	0.5 + 2.0 + 2.0 = 4.5 points
TinyJ Implementation Assignments:	1.5 + 2.0 + 2.0 = 5.5 points

Whenever I compute the sum of a student's exam 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 Exam 1 and Exam 2 are equal then at most one of those two scores can be replaced in this way.) Now let:

a = (sum of your exam scores and scores on for-credit assignments)
b = (sum of your exam scores) × 100/90
$m = \max(a, b)$

Your grade will be computed 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. You have a higher Final Exam score than at least 70% of the students in the class, and 2. $m \geq 87$.

If $a \geq 97$ and, in addition, you are an A-range student who has a higher Final Exam score than at least two-thirds of the A-range students, 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 stated that you do *not* wish to be considered for D+ and D grades,[6] and a is less than the threshold score for C.

(ii) You are an undergraduate who has stated that you wish to be considered for D+ and D grades,[6] 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 say they wish to be considered[6] for D+ and D grades, D+ 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 absent from Exam 2 and the Final Exam may possibly receive a WU.

Assignments and Late Submission Policy

Tentative approximate[7] due dates of the for-credit assignments are as follows:

Lisp Assignment 3:	Late September or early October (e.g., September 26)
Lisp Assignment 4:	Mid-October (e.g., October 12)
Lisp Assignment 5:	Late October (e.g., October 24)
TinyJ Assignment 1:	Mid- or Late November
TinyJ Assignment 2:	Early December
TinyJ Assignment 3:	After the last class

[5] 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 40%*** towards your grade.

[6] Undergraduates will be asked before the end of the semester 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.

[7] The ***actual*** due date of each of these assignments will be stated in another document that gives details of the assignment; you will receive that document at least one week before the actual due date (and often sooner).

Late / corrected submissions of any assignment may be made until a late-submission deadline that will be announced later. Assignments will not be graded before their late-submission deadlines. Different assignments may have different late-submission deadlines, but no late-submission deadline will be earlier than November 1.

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 ≥ 4, the student is subject to a penalty of $N - 3$ points, where N is the number of assignments submitted late. There is no penalty if $N < 4$.

Enter the command `ls -lc` ***name*** on `euclid` (e.g., `ls -lc doe-3.lsp` or `ls -lc TJ1asn/Parser.java`) to see 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.

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.***

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`.[8] You will be given a `euclid` account for that purpose—see page 6 of today's handout. As explained on p. 5 of today's handout, you also have an account on another machine, `venus (149.4.211.180)`. You can do assignments on `euclid` or on `venus` or on your own PC, but assignment submissions must be left on `euclid` (***not*** `venus`)!

You can do assignments on your PC if you can install GNU Clisp (see the "Lisp Assignment 1" handout for instructions) and have installed or can install the Java SE JDK. The latter is available from:

`https://www.oracle.com/technetwork/java/javase/downloads`

After installing the JDK, update the PATH environment variable by following the instructions at:[9]

`https://bit.ly/jdk11setpath`

Note that `jdk-11` in these instructions should be replaced with the actual folder name (e.g., `jdk-11.0.4` or `jdk-12.0.2`). Students who are unable to get Clisp or the JDK to work on their PCs may have to do assignments on `euclid` or `venus`.

If you do assignments on `venus` or your own PC then, when you are ready to submit, you can use an scp client[10] to put a copy of the `.lsp` or `.java` file(s) you are submitting in the right directory on `euclid`.[11] ***Keep a backup copy of each submitted file on*** `venus`***, and another elsewhere***.

Academic Conduct. Plagiarism

Students found to have submitted work of others as their own will receive penalties ranging from a zero on the assignment or exam to 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 assume that I will assist them in doing that.*

E-mail Forwarding

I will send important e-mail to your `euclid` account from time to time. ***So you need to set up your*** `euclid` ***account to automatically forward e-mail to your regular e-mail address.*** See page 6 of today's handout 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.

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[8] Attempted "submissions" by e-mail ***will not be graded***!

[9] In Windows 8, 8.1, and 10, the effect of step 1 of the instructions can be achieved as follows: Type Windows-`r` (i.e., hold down the Windows logo key, type `r`, and release the Windows key) and enter `sysdm.cpl` into the `Open:` textbox.

[10] `PuTTY` and `pscp` are free ssh/scp clients for PCs. To install them, download `putty-????-installer.msi` (where `????` is the current version no.) from `https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html` and run it.

[11] For example, you can copy the file `myfile.lsp` from the current working directory on `venus` into your home directory on `euclid` by entering `scp myfile.lsp xxxxx316@euclid.cs.qc.cuny.edu:` on `venus`, where `xxxxx316` means your user name on `euclid`. (*Note that* `.edu` *is followed by a colon here.*)

C SCI 316 (M W 1:40, 3:10, and 8 pm Sections): Preliminary Schedule

1 8/28 W Grading policies and other course information.

9/02 M College is closed.

2 9/04 W Functional Programming.
LISP: Introduction.
3 9/05 **Th** LISP: Atoms and lists.
Some primitives. DEFUN.
4 9/09 M LISP: More primitives. Predicates.
5 9/11 W LISP: Predicates, COND/IF.
6 9/16 M LISP: AND/OR, LET/LET*.
7 9/18 W LISP: Recursion.

8 9/23 M TBA

9 9/25 W LISP: Recursion (continued).

9/30 M No CUNY classes scheduled.

10 10/02 W LISP: Recursion (continued).

11 10/07 M TBA

10/09 W No CUNY classes scheduled.

10/14 M College is closed.

12 10/16 W LISP: Functions as arguments,
MAPCAR, FUNCALL, APPLY, LAMBDA.

13-15 10/21 M – 10/28 M Syntax of Programming Languages.

16 10/30 W **Probable Date of Exam 1**.

17–18 11/04 M & 11/06 W Syntax (continued).

19-20 11/11 M & 11/13 W TinyJ project: lexical analysis and recursive descent parsing.

21-25 11/18 M – 12/02 M TinyJ project: static, stack- & heap-dynamic storage allocation.
hand-translation of TinyJ source code into
TinyJ virtual machine code; compilation of
TinyJ statements, expressions, and methods into
TinyJ virtual machine code.

26-27 12/04 W & 12/09 M TinyJ project: execution of TinyJ virtual machine code.
Parameter passing modes.

28 12/11 W **Probable Date of Exam 2**.

Cumulative Final Exam:
1:40 section: Wednesday, 12/18, 1:45 – 3:45, in our regular classroom
3:10 section: Monday, 12/16, 1:45 – 3:45, in our regular classroom
8 pm section: Monday, 12/16, 8:30 – 10:30 pm, in our regular classroom

Last day of Fall 2019 Course Withdrawal and P/NC period: Tuesday, 11/5

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 (149.4.211.180 or mars.cs.qc.cuny.edu)`

You have a Linux account on the machine **`venus (149.4.211.180)`**. In many if not all cases your **`venus`** 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`

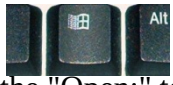
If you have used this account before (in another course), then your password is probably the same as it was when you last used the account. If not, then your initial password is probably your 8-digit CUNYfirst ID#.

It is important that you be able to logon to **`venus`**: If you cannot, then the Department's Assistant Systems and Network Manager Xiuyi Huang (**https://www.cs.qc.cuny.edu/compstaff.html** / **https://www.qc.cuny.edu/Pages/Phonesearch.aspx?k=Xiuyi%20Huang**) can help you. **Note**: This applies ***only*** to **`venus`**—if you can logon to **`venus`** but need help with your **`euclid`** account, see me.

Note: Do not confuse your **`venus`** account with your **`euclid`** account; **`euclid`** and **`venus`** are different machines. Your **`euclid`** account has a ***different username*** and a ***different password*** from your **`venus`** account! All assignments must be submitted on **`euclid`**.

If you are using a **PC** with an Internet connection, here are two ways to connect to **venus**:

Method 1: If PuTTY is not already installed on your PC, download **`putty-0.72-installer.msi`** from **`www.chiark.greenend.org.uk/~sgtatham/putty/latest.html`** and install PuTTY into the default installation folder, which will be **`c:\program files (x86)\putty`** or **`c:\program files\putty.`** To connect to **venus** using PuTTY:

1. Type **Win-`r`** (i.e., hold down the Windows key  and type **`r`**) to open the Run dialog box.
2. Enter the appropriate one of the following into the "Open:" textbox:
   `c:\program files (x86)\putty\putty 149.4.211.180`
   `c:\program files\putty\putty 149.4.211.180`
   The first or the second of these will be appropriate according to whether PuTTY is installed in the folder **`c:\program files (x86)\putty`** or in the folder **`c:\program files\putty`**.

If a "PuTTY Security Alert" dialog box pops up, click the Yes button at the bottom of the dialog box. When the **`login as:`** prompt appears (in a new terminal window), enter your username and password. To avoid having to type **`c:\program files\putty\`** or **`c:\program files (x86)\putty\`** at step 2, add the folder name to your PATH—see, e.g., **`https://java.com/en/download/help/path.xml`**

Method 2: Some PCs in College computer labs have a program named "SSH Secure Shell Client" installed. You can use this to connect to **venus**:

1. Launch SSH Secure Shell Client and click on its **Quick Connect** button.
2. In the dialog box that opens, type **`149.4.211.180`** in the **Host Name** textbox, and type your username (*see below*) in the **User Name** textbox.
3. Click on the **Connect** button to connect to **`venus`**.

If a "Host Identification" dialog box pops up, click the Yes button at the bottom of the dialog box.

If you are using a **Mac** with an Internet connection, you can connect to **venus** in the following way:

1. Click the magnifying glass icon in the top-right corner of your Mac's screen, type `terminal` in the Spotlight search box. In the menu that appears, click on a line that looks like: Terminal
2. In the Terminal window that opens, enter the following two commands:
   `ssh-keygen -R 149.4.211.180`
   `ssh ????????@149.4.211.180`
   where **`????????`** means your **venus** username. Enter `yes` when you receive a warning that ends with
   `Are you sure you want to continue connecting (yes/no)?`

If step 2 does not work, restart the Mac and try 1 – 2 again. You should only enter the **`ssh-keygen`** command at step 2 *the first time you connect to* **venus** *this semester*.

CSCI 316 (M W 1:40, 3:10, and 8 pm Sections): 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. Another reason you will need your **euclid** account is that I will e-mail important course-related information to everyone's **euclid** account; if you do 1 - 4 below, then a copy of such e-mails should be forwarded to your regular e-mail 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 logon**.

If you registered for this class ***before*** 8/26, your username is **xxxxx_yyyy316**, where:

xxxxx = **your last name in lowercase if it has ≤ 5 letters** (omit any space or hyphen)
xxxxx = **first 5 letters of your last name in lowercase if it has > 5 letters**
yyyy = **your first name (as shown on the attendance sheet) in lowercase if it has ≤ 4 letters**
yyyy = **first 4 letters of your first name in lowercase if it has > 4 letters**

Examples: **David Touretzky -> toure_davi316 Ada Lovelace -> lovel_ada316 Ravi Sethi -> sethi_ravi316**

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.
NOTE: ***No characters should appear on the screen when you type the password at a*** **"... password:"** ***prompt--the cursor shouldn't move--but the system will know what keys you pressed! Remember to press*** ENTER ***at the end.***

The first time you logon, you will be asked to choose a new password, **so think of a good password beforehand**! (See, e.g., https://computing.cs.cmu.edu/security/security-password.html for hints on choosing passwords.)

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

ssh ?????316@euclid

at **venus**'s shell prompt; here ?????316 is your **euclid** username.* **If you get a "Host key verification failed." error, retry** ***after entering the following command*****: /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 (see above): Enter it. You will be asked to change your password:

Changing password for ?????316.
(current) UNIX password:

At this prompt, **reenter q followed by the last 7 digits of your CUNYfirst ID** and then you will be prompted for a new password:

New password:

Enter a new password. You will be asked to re-enter it for verification:

Retype new password:

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

1. Create a file named .forward that contains your regular e-mail address. You can do this (e.g.) as follows: Enter **nano .forward** on **euclid** (notice that there is a space between "**nano**" and "**.**", but no space between "**.**" and "**forward**"), then enter your regular e-mail address and type the 3 characters **Ctrl-o ENTER Ctrl-x** [i.e., the 3 characters CTRL O ENTER CTRL X] to save the file.
2. Enter **finger ?????316** and check the address shown on the "**Mail forwarded to**" line--if there's no such line, or an incorrect forwarding address is shown, redo step 1. (Here **?????316** means your username on **euclid**.)
3. Enter the line: **echo test | mailx ?????316**
   (Again, **?????316** means your username on **euclid**; notice the **|** character.) After you do that, you should receive a test e-mail at your regular e-mail address.
4. When you have received the test e-mail, enter **xc** on **euclid** (which will send me a copy of your .forward file).

If you do 1 - 4 no later than **Monday, September 9**** and your .forward file is correct, then you will receive 0.25 pt. extra credit: I will substitute $m+0.25$, $a+0.25$, and $b+0.25$ for m, a, and b in grading rules **A** and **B** when I compute your grade for the course. (You should receive an automatically generated reply at your regular e-mail address. Make sure this and other messages relating to this course are not lost as a result of spam filtering!)

*You can also connect to **euclid** using an ssh client on your PC or Mac. [E.g., follow the instructions on p. 5, but replace **149.4.211.180** with **euclid.cs.qc.cuny.edu** in those instructions.]

****If you don't do 1 - 4 by Sept. 9, your account may be deactivated** (for security reasons). **To reactivate a deactivated account, or to reset a forgotten password, you must see me in person. [Note that I will *not* reactivate accounts or reset passwords in response to e-mail messages.]**