ECS 145, Scripting Languages
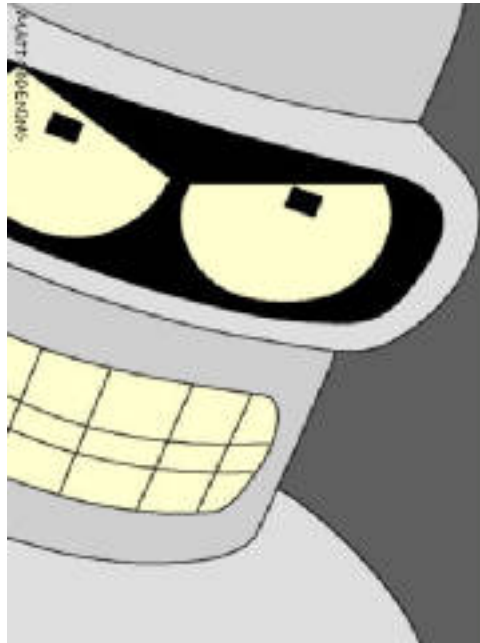
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Fall 2011

FOLLOW
DIRECTIONS!

Contents

1 Required Course Materials

1.1 Textbooks

The textbooks are my open source books. You can buy them at the campus bookstore (printed at cost), or can download them at `http://heather.cs.ucdavis.edu/~matloff/145/PLN/FastLanePython.pdf` and `http://heather.cs.ucdavis.edu/~matloff/145/PLN/RMaterials/145R.pdf`.

2 What Is This Course—and What Is It NOT?

What this course IS:

- This is a course in scripting languages.

- We'll cover one general language, Python, and one data language, R.

- In the case of R, it will be viewed as a programming language—object-oriented and functional programming-based—rather than focusing on its statistical procedures.

- We discuss the philosophy of scripting languages—their aims, their pros and cons.

What this course is NOT:

- The course is not about syntax. Lectures won't be spent delineating where one puts the commas. You'll learn this information on your own, in order to do the Homework. You won't be tested on things like the most general form of naming R variables, say.

- Similarly, the course does not aim to cover every nook and cranny of Python and R.

- Nor does the course aim to cover the latest, greatest version of Python, 3.0. The latter has not attained a great following, and in any case see the previous bullet.

3 Workload

The Homework will consist of approximately four or five assignments.

IN ORDER TO ACHIEVE A DECENT GRADE, PLAN TO SPEND SIGNIFICANT TIME ON CAREFUL READING OF THE TEXT, AT LEAST FIVE HOURS PER WEEK.

All in all, the number of hours per week you'll put in should be similar to something like ECS 60.

4 Prerequisites

You should be familiar with basic concepts of data structures and algorithms on the level of ECS 60, and have experience writing code (in any language) to read and write files.

But by far the most important prerequisite is that **you are a programmer**. If you've made it this far without ever written a program from scratch on your own, without help or an outline from an instructor, you will find

this course very difficult. On the other hand, if you're good at coding, you (hopefully) will find the course fun.

Python and R are available for every major platform—Linux, Windows and Macs. However, **I strongly prefer to that you run on Linux, as that would make it easier for me to help you fix your bugs**. So, a basic background in Linux at the level of usage of ECS 40 would be helpful but not required. Prior background in Python or R themselves is NOT required.

5 Machines

Our base machines will be the Linux PCs in the CS instructional labs (CSIF). If you pre-enrolled in this course, or if you took a CS course last quarter, you should already have an account.

When you write code, it is not considered valid unless it works on CSIF.

HERE IS A SHOCK FOR SOME OF YOU: Most jobs obtained by UC graduates in the computer area are at firms that are either fully or partially based on Linux or some other kind of Unix. Google is such a strong Linux shop that it has developed its own version of Linux, Goobuntu. You probably know that Android, the popular OS for smartphones and tablets, is a variant of Linux. Apple's OS is Unix-based.

Intel has complained that UCD grads don't know Linux well. Of course, students from UC Berkeley know Linux thoroughly.

In other words: If you've been using Windows to do your CS Homework, you've been limiting your future career opportunities! Not a smart strategy, right?

So, if you don't know Linux, you should remedy that problem now, to enhance your future career prospects. And the only way to learn it is to USE IT IN YOUR DAILY LIFE—not just for coursework, but also for e-mail, writing term papers, developing Web pages, video editing, and so on.

I have a Linux installation and usage tutorial at `http://heather.cs.ucdavis.edu/~matloff/linux.html`. If you are going to use Linux in your daily life, as again I urge you to do, then I recommend installing on a dual-boot basis. Otherwise, install on USB key or an external hard drive. Instructions are given in my tutorial.

6 Each Student Must Have His/Her Own Course Materials

Note that Tests are open-book, and there is no sharing of books or other materials during Tests. Thus every student must have his/her own hard copy of the textbook and any other course materials.

7 Bring the Course Materials with You to Class

Bring the entire textbook and other course materiels to lectures, discussion sections and Tests.

8 Terminology

- the term *Exam* refers to the midterm examination given in lecture; there is also a take-home project that serves as the Final Exam and the last Homework assignment; see Section 9.1

- the term *Quizzes* refers to short tests given in discussion section; see Section 9.2

- the term *Tests* refers to the Exam and Quizzes

- the term *Homework* includes both math and programming work (most courses, other than ECS 132/256, won't have math work)

9 Tests

9.1 Exam Schedule

There will be one midterm Exam, approximately at the 8-week point of the quarter.

There are no early or late midterm Exams. Provisions for <u>oral</u> makeup Exams will be made if you have a medical excuse. Note: Oral Exams are very difficult for the student, and are difficult for the professor to grade. Try to avoid this situation if possible.

The Final Exam will be take-home and collaborative with your Homework Group, submitted by e-mail to me. It will be due at 11:59 p.m. of the official final Exam date for the class. (Heavy penalties will be imposed for lateness.) Details will be given later.

9.2 Quizzes

A Quiz will be given almost every week in discussion section. Quizzes will not be announced; assume that there will be one each week.

Quizzes will be shorter than Exams, typically about 30 minutes long and about four questions in length. They will consist largely of fill-in, multiple choice and very short-answer questions, and thus will not probe quite as deeply as the Exam will.

The Quizzes will be graded by the TA, who will give you letter grades on them.

The last Quiz, given in lecture on the last day of class, will consist of an in-class group project.

9.3 Open-Materials Policy

TESTS ARE TAKEN ON AN OPEN-MATERIALS BASIS. Bring the textbook and other course materials with you to each Test. You are also welcome to bring whatever other materials you wish, e.g. technical books, dictionaries, whatever you want. Whatever you bring, **make absolutely sure that you remember to bring all your course materials, as many of the Test questions will refer to specific pages in them.**

Please note that in program code on the Tests you are only allowed to use language, functions, etc. constructs presented in our course.

9.4 Electronic Devices

You are not allowed to use any electronic devices, INCLUDING CALCULATORS, during Tests.[1] (Only simple arithmetic computations will be required.)

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[1] In programming-oriented courses, the last Quiz will involve programming on your own laptops, in your Groups.

9.5 Work Only on the Test Sheet

Please work ONLY on the test sheet, front and back. Do NOT turn in any supplementary sheets of paper. **A DEDUCTION OF 5 POINTS WILL BE MADE FOR NOT FOLLOWING THIS POLICY.** Please, it's important.

9.6 How to Do Well on the Exams

9.6.1 Think, Not Memorize

The Test questions assess insight, not memorization. In a software class, for instance, the slogan is "test for insight, not for syntax." The Tests assume *active* reading and *thinking* about the material. **If for example you encounter a statement in the reading which puzzles you, don't just skip it—ask me or the TA about it.** A Test question may later ask you to explain it.

9.6.2 Old Tests Yes, "Practice" Tests No

Please note carefully that I do not give practice Tests. This is because I believe that learning does not consist of memorizing, and because computer science courses are not like "calculus-style" courses:

Calculus courses can have practice Tests because the real Tests have predictable, technique-oriented content. In a calculus class, you might have a lecture on integration by parts, then have a Homework assignment of integration-by-parts problems, and then on the exam there would be a couple such problems.

This would be impossible in my courses because every Test problem is unique, and the problems test understanding of concepts, rather than techniques. Thus, it would be impossible to have practice Tests. Actually, even if I were to teach calculus, I would not give practice Tests, again because learning is not memorizing.

Sometimes during a lecture I do mention a "focus area" that could be featured in an upcoming Test. For instance, I may say, "I really want you to know this particular example especially well," and then the Test may contain a question (or even more than one question) on this example.

9.6.3 Homework-for-Learning Yes, Homework-as-Practice-for-Tests No

Similar to the point that I do not give practice Tests, it is important to understand that the Homework is not considered practice for Tests either. The goal of the Homework is to give you a chance to think more deeply about the material, and to nonpassively implement some of the course concepts. Sometimes an Test problem will indeed be similar to some Homework problem, but most Test problems will be quite new.

Again, the best way to prepare for Tests is to constantly sift the material through your mind in a nonpassive manner, thinking about questions involving How?, Why/Why Not? What is the goal? and so on. The Homework will really help you prepare for Tests in this sense, because it will make you think thoroughly about the course material, but you should <u>not</u> expect problems to be explicitly similar to the Homework.

9.6.4 Concentrate During Class

MAKE SURE TO LISTEN CAREFULLY IN CLASS.

Weird statement! What does it mean?

> Many Test problems will come from the answers I give to questions students ask during lecture, or will be related to off-hand remarks I make during lecture when I suddenly get an inspiration.

Therefore, listen carefully to questions students ask in class, and to the answers I give. Make a note of seemingly-casual comments I make in lecture, and think about them carefully at home. These things may well pop up in Tests. Such questions will still be answerable from the course materials if you miss class, but there is a definite advantage to paying close attention in class.

10 Regarding Academic Dishonesty

An embarrassing subject which nevertheless must be mentioned is academic dishonesty, i.e. **cheating**.

If a student is found to be cheating, it will be treated as a VERY SERIOUS matter, not a harmless prank. It will harm his/her standing at the university, and also possibly make it difficult for him/her to get a job when seeking employment after graduation.

10.1 UC Davis Honor Code

You can find the UC Davis Honor Code at `http://sja.ucdavis.edu/files/CAC.PDF`. Our course will be conducted according to that code, as of course all classes are.

There is nothing surprising in the code; it's just common sense.

10.2 Tests

Official university policy[2] forbids

> "Wandering eyes," talking during exams...or leaving the exam room without permission.

Please work as follows during Tests:

- Try to sit in alternate seats if possible.

- **ABSOLUTELY NO TALKING** to classmates at any time during the Test, **ESPECIALLY INCLUDING** during the time the TA or professor is collecting the Tests.

- Keep your Test paper covered when you are not actually writing, so that it will not be so exposed to view.

- It would be greatly appreciated if you **USE THE RESTROOM BEFORE THE EXAM STARTS, RATHER THAN DURING THE EXAM.** Please do not be offended if the instructor or TA reminds you of this policy. And never leave the exam room without permission.

During a Test, if your paper is exposed, I or the TA will come to you and mention this to you. If the TA or professor has to talk to a student twice about the rules, the professor will hold a conference with that student.

Thanks very much for your help.

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[2]See the *Class Schedule and Registration Guide*.

10.3 Homework

Outright copying of homework, whether in the form of code or algorithm or math, is of course a serious violation of university policy and personal ethics. Similarly, asking for advice on the Internet, or paying people for advice, is again a serious violation of university policy and personal ethics.

However, you are welcome, and indeed encouraged, trade tips with people in other Homework groups. You may also on rare occasions ask people whom you know outside the class for hints, say friends or relatives who have some knowledge of the field.

You are also welcome to make <u>reasonable</u> use of the Web. For example, I'm a big fan of Wikipedia and there is a ton of material on there.

I will use the MIT policy here: **At the top of your Homework writeup, list the names of people outside your Homework group from whom you've received advice. Also list Web sites you've made use of, if any.**

Obviously, it is not allowed that you divide work across assignments (i.e. assignments with different due dates), with part of your group doing the odd-numbered assignments and the other part doing the even-numbered assignments. This is considered dishonest.

Obviously, dividing work across courses is even more dishonest. If you and your friend are both taking courses X and Y, and you agree that you do all the work in X and your friend does all the work in Y, then you will be referred to Student Judicial Affairs with formal charges of dishonesty.

11 Lecture Format

11.1 Bring the Materials to Lecture

Make sure you bring the textbook to every lecture. It will play a very active role in the lectures.

I very seldom write on the blackboard. Instead, I talk.

What I talk about is pages in the textbook. I typically will ask you to open to a certain page, and then will call your attention to various sentences, examples and pictures on that page. **The lectures will consist mainly of discussion and amplification of the examples in the textbook, with additional examples and comments.**

Please note again: I will seldom write on the blackboard. My lecture notes are already there, right there in the open source textbook. **SINCE THE TEXTBOOK ALREADY CONTAINS MY LECTURE, YOU DON'T TAKE NOTES (other than miscellaneous comments in the margin). THIS FREES YOUR ATTENTION TO ASK QUESTIONS AND TO ENGAGE IN CLASS DISCUSSION.**

You are very much encouraged to bring up any questions you might have. Please don't be shy about asking questions; there is no such thing as a "dumb" question. Similarly, listen carefully to the questions the other students ask; this can be a very valuable source of insight, to which you should pay special attention.

11.2 Please Do NOT Use Laptops or Tablets During Lecture

Really, this is rude. And though it has become commonplace, I (and many other professors) do not like it, and surveys have shown that many of your fellow students are annoyed by it too.

YOU ARE EXPECTED TO REFRAIN FROM USING LAPTOPS OR TABLETS IN CLASS. If some sort

of urgent need arises, I would rather you use the machine in class rather than leaving the room and missing the lecture. But...in such a situation, please move to the back of the room in order not to distract. (The problem is not that you might be doing non-class-related Web surfing, which doesn't bother me, but rather that it simply is distracting.)

And for those who normally use laptops for notetaking, remember, the notes are already taken for you! See Section 11.1 above.

12 The Discussion Section

THE DISCUSSION SECTION IS REQUIRED. It will be used for the purpose of giving Quizzes, and for presenting material not covered in lecture. (That material will appear on Tests.)

Please note that the purpose of the discussion section is NOT use as a forum for asking questions on how to do the Homework. As stated in Section 15.6, the TA and I are happy to help you with the Homework, but this should be done on an individual basis, not as a class. Please ask your questions either in office hours, or by e-mail, or individually after lecture or discussion.

13 Groups

The following will be done in groups:

- Homework

- the last Quiz of the quarter, in class

- the Final Exam, a take-home project

So, get to be very good friends with your Group, as you be working with them constantly!

13.1 Forming Groups

Group size must be at least three and no more than four.

You must submit to the TA your Group membership lists by 11:59 p.m. of the day of the second lecture, or the first discussion section, whichever comes later (unless there is no first discussion section).

If you are not yet in a Group, or have only a partial Group, ask the TA to assign you to a Group. Often, the TA will use the first discussion section to organize groups. Later, notify the TA immediately if, due to drops, your Group size falls below two.

In working with your partners, you must work TOGETHER, instead of simply dividing up the work among the partners. I've seen many cases in which the partners do the latter, with the sad result that they, for instance, miss an easy 30-point problem on a Test. **CLEARLY, THIS SHOULD BE AVOIDED!**

ALL MEMBERS OF THE GROUP MUST BE PRESENT DURING GRADING. When you present your work in interactive grading, the TA will ask questions of all members of the Group, to make sure everyone understands. If not, some members will get lower grades than others. See more on this in Section 15.5.

13.2 Getting a Failing Grade in the Course Due to Nonparticipation in Your Group

YOUR HOMEWORK PARTNERS DEPEND ON YOU. **Failure to work cooperatively with them, may result in a substantial penalty being applied to your course grade, which could drop to an F.** Note that one type of such failure involves failure to prepare properly by doing the assigned reading BEFORE you start the Homework,

14 Our Class Web Page and Blog

Our class Web page is at `http://heather.cs.ucdavis.edu/~matloff/xxx.html`, where xxx is, e.g. 132 for ECS 132. It contains information on office hours and the like.

Our class Blog is linked to from our class Web page. **IT IS REQUIRED THAT YOU READ THE BLOG EVERY DAY**; it's used to announce Homework assignments (including clarifications), Exams and so on.

15 Homework

We will have approximately four or five Homework assignments through the quarter.

15.1 Homework Due Dates

The term *due date* means 11:59 p.m. of the stated date.

15.2 Announcements

Homework assignments will be announced in the class Blog. The Homework files themselves will be on the course Web site, so look there when an assignment is announced on the Blog.

Occasionally there will be news about a current Homework assignment, such as clarifications, hints and so on. These will be announced in the Blog.

15.3 Package Your Homework Files

It is REQUIRED that you use the Linux **tar** command to package all of your files, be there source code, **.pdf** or whatever, into one **.tar** file, say named **Hwk2.tar**.

15.4 Timestamp Your Package

(Note to ECS 132 students: Starting Fall 2011, these procedures, and those for interactiven grading, will be changed slightly. This will be announced.)

Then run the Linux **sum** command on the **.tar** file to produce a checksum, which is kind of a code number which is (for all practical purposes) unique to that file. E-mail that checksum (two numbers, actually) and your **.tar** file name (but not the file itself), to the TA. The date and time on your e-mail will verify that you sent the mail before the deadline. Then later during the grading, the TA will run **sum** again, and the fact

that the checksum has not changed will show that you have not changed the file subsequent to sending the e-mail.

15.5   Grading

We will use interactive grading. The TA will announce Homework grading times, and each Homework Group will sign up for a time slot. **All members of the Group must be present during the grading time.**

During a Group's time slot, the Group will log in to their account to access their files. They will then explain their Homework solution, and in the case of a program demonstrate that it works. In the case of analytical Homework, the Group will explain the reasoning behind the work.

The TA will ask each member of the Group questions to confirm that he/she understood what the Group did. For example, such questions might ask how a mathematical solution would change if the problem statement were slightly different. Again, the purpose of these questions is to ensure that all partners are actively involved in all the work. **The TA will assign separate grades for each Group member. Normally these grades will be identical, but if there is a substantial disparity in the levels of understanding the different Group members have regarding the assignment, the TA will assign different scores to each member.**

15.6   If You Need Help, Hints, Etc.

15.6.1   We Are Happy to Help If You Have Reached an Impasse

Please note that Homework assignments here will NOT lay out a detailed recipe, with tons of hints, telling you how to do the problems.

The work is designed to be challenging and thought-provoking. This thought-provoking nature of the assignments is the vehicle by which you get to really understand the concepts. You are not necessarily expected to see right away how to do an assignment. Instead, you are expected to spend a considerable amount of time pondering the assignment, gradually seeing more and more, until you finally see how to do the whole thing. It is that thought process which will develop insight into the course material.

The TA and I will be quite happy to help you, definitely including giving you hints—but only if, after giving a matter considerable thought, you still don't see what to do. Once you have reached the point where you cannot go any further, we very much encourage you to seek help from us. We want you to do well on the Homework!

15.6.2   Help by E-Mail

Again, you are welcomed and **strongly encouraged** to send me e-mail, at the address matloff@cs.ucdavis.edu, for help on Homework assignments. But you can help me if you keep the following in mind:

- **Please do NOT send me e-mail in HTML format, or with lines longer than 80 characters.** If you do, I will of course still answer it, but my answer will not be as clear or as detailed. This is because when replying to e-mail, I like to quote parts of the original message, making the reply clearer. I cannot do this easily if your mail is in HTML or has long lines.

- Make sure you have clear indenting and commenting in your code. (Again, for your own benefit, do NOT add these at the last minute; use them from the very beginning as you write your program.)

- If you send me e-mail asking what to do about some error message, please send me (in a **.tar** file your source code and the **typescript** of running **script**. In the latter, it would also be helpful to run **pwd** and **echo $path** so I know your environment.

15.6.3 Start Early!

Please make sure to start the Homework soon after it is assigned. Don't wait until the last couple of days before the due date, because **when the due date approaches, I tend to be inundated with e-mail messages asking for help on the Homework, and thus my answers at that time will necessarily be short and without details, since I won't have time to say more.**

15.7 Late Work

An assignment is late if it is submitted to the TA after the due date. If—this should never happen, but just if—you are late, you will be assessed a 5% penalty the first late day, and 10%-per-day penalty after that in your grade for that assignment. (Since e-mail is available every day, each of the seven days of the week counts as one day.) The maximum total penalty is 50%.

Each project Group will be allowed a total of 2 late days over the quarter, time which is not penalized. You can use this as being late 2 days with no penalty on one assignment, or as being late 1 day with no penalty in each of two assignments.

In order to use this option, you must submit your work during the time you are using as your grace period. If for example you are 3 days late on an assignment, you will not be allowed to use your grace period time on that assignment; it will simply be counted as 3 days late.

Don't squander your grace period days in the first assignment. The subsequent ones will almost certainly be more difficult, so save your grace time for then.

The TA will keep the appropriate records as to how many days of grace period you have used..

15.8 Reading Homework

UC Berkeley professor Doug Giancoli is the author of a number of best-selling textbooks on physics. He has been writing books for decades, taking enormous care in writing them, agonizing over just the right phrasing and so on. So imagine his profound disappointment when I told him that most students don't read their assigned textbooks!

You <u>should</u> read your textbooks, and in the case of our course, it is crucial. The reading—in the textbook—is extremely important, and should be considered "Homework." As mentioned earlier, many the exam questions will come from the reading.

After each lecture, do the corresponding reading. **Do the reading PROMPTLY, that same day, rather than getting behind.** This is the only way that you can get any insight from the reading; doing the reading the night before an exam will not work. **If you still have not done the reading as of the night before the exam, you actually will be better off not doing it, and getting more sleep instead, as cramming overnight won't be beneficial.**

16   Grading

Grading is noncompetitive (there is no "curve"), so it is possible for everyone to do well.

16.1   Weighting

The formula used is

```
course grade = 0.45 x Quizzes grade + 0.30 x Exam grade + 0.25 x Homework grade
```

where the Exam, Homework and Quizzes grades are each on the 4-point scale (4 for an A, 3 for a B, etc.). Remember, the Final Exam is considered part of the Homework.

Missing the Exam will result in an "I" (Incomplete) grade for the course; it will not merely be treated as an F.

16.2   + and - Grades

The threshhold for a grade of n is (n-1).85; the threshhold for an 'n-' grade is (n-1).6; the threshhold for a '+' grade is n.2. So, for example, if your weighted average from the above formula is between 2.6 and 2.84, your course grade is B-; if the average is between 2.85 and 3.19, your course grade is B; if the average is between 3.2 and 3.59, your grade is B+.

16.3   Quizzes Grade

You will get a letter grade on each Quiz.

In recognition of the fact that on (rare) occasions you will not be able to attend discussion section, or you simply will have an "off day," your lowest two (letter) Quiz grades will be thrown out. Your other Quiz letter grades will be averaged to produce your overall Quizzes grade.

Missing many Quizzes may result in an F grade for the course, regardless of the grades on the Quizzes, Exam and Homework.

16.4   Homework Grade

16.4.1   Assignment of Letter Grades

You will receive a letter grade on each Homework assignment. The instructor has directed the TA to evaluate your work as follows:

> Assessment of the quality of a Homework Group's work is to be based on the TA's judgment, subject to the following guidelines. Since the TA and instructor provide whatever help is needed (though as a "last resort"), it is expected that most students will get A or A- grades on the Homework assignments, with an A- indicating that the work was correct except for minor problems. Grades in the B range are to be given if the material is "mostly correct," while grades below that range will be given for work of lesser quality.

Note carefully that students in a Homework Group are assigned grades <u>individually</u>. Though they typically will all get the same grade, that is not necessarily the case. See Section 13.

16.4.2   You Must Turn in All Assignments to Pass the Course

Note that all Homework assignments must be completed in order to get a passing grade in the course. **If you are missing any assignment, INCLUDING BEING FOUND NOT TO HAVE WORKED ACTIVELY WITH YOUR HOMEWORK PARTNERS, you may be given either an F or an I grade for the course.**

16.4.3   You Should Get an A or A- on the Homework

I aim for the vast majority of the class to get an A or A- on the Homework. Lots of help is available, so this aim should be achievable. (And it is; I use this policy in every course I teach, and it always works out that most people get A or A- Homework grades.)

The most important part of getting a good Homework grade is to **start an assignment as soon as it is assigned.** Don't wait until a few days before the due date to start. **And make sure you have read the textbook thoroughly before starting.**

16.5   Intangibles

This is not "CHEM 1A-style grading," calculated purely by formula, in which falling 0.5% below the cutoff point for an A results in a grade of B. The grade as determined above is just a lower bound. I can and often do use intangibles to increase your grade above that that the formula in Section 16 would give. I would estimate this occurs in 20-25% of all the course grades I assign.

Extra Credit counts, of course. Also, I have an "all's well that ends well" view; that a record of marked improvement near the end of the course will be given very positive consideration, as it indicates insight into how all the course concepts integrate with each other.

Negatives can be an obstacle. Those who miss quizzes (except for medical or similar reasons) will probably not receive the benefit of such intangibles. Again, though, no one will be given a grade below what the rules of the course provide.

Exceptionally good work on the final Exam may be rewarded in terms of increasing its weight in your course grade.

16.5.1   Back Up Your Files Frequently!

Accidental deletion or destruction of your Homework files will generally <u>not</u> be grounds for extending the due date.

16.6   Accuracy of Records

At the end of the quarter, it will be your responsibility to make sure that the TA's records are correct as to your Homework scores.

17 I Do Care!

I wish to emphasize that I care very much that you succeed in this course, and I look forward to getting to know all of you.

A Programming Issues

A.1 Style

Though it is not much of an issue in this class, I want to mention programming style.

Good programming "style"—good indenting, meaningful variable names, helpful comments—is extremely important. But it's not important for GRADING purposes; it's important for YOU¿ You will not be <u>graded</u> on style, but it is crucial for <u>communications</u> purposes. For example, suppose you are having trouble getting your program to work and you e-mail it to me for help. **If I can't read it, I won't be able to help you.**

Note that this means that you write your program in good style **from the beginning.** Do NOT insert indentation, comments, etc. only when you are finished with the program and ready to turn it in.

The same points apply to top-down (i.e. modular) programming. Do this not because it is required for <u>grading</u> (it isn't), but instead because it will make it easier for YOU, i.e. make it easier for you to write and debug your program, and easier for me to read if you ask me for help.

By the way, speaking of programming style: You may have been taught that global variables are "evil," to be avoided like The Plague. That is far too extreme an attitude, and the reasoning used doesn't make much sense. Moreover, in many cases in the real world, one <u>must</u> use globals. See a discussion on this at `http://heather.cs.ucdavis.edu/~matloff/globals.html`.

A.2 Debugging

A.2.1 Use a Debugging Tool!

You will help yourself greatly—both in this course and in all courses in which you do programming—by making good use of a debugging tool, such as GDB, DDD, Eclipse or whatever.

Make sure you understand the content of the first chapter of my book on debugging, available online at `http://nostarch.com/debugging.htm`. Even though it is for C/C++ and you may be using a different language, the principles are the same. That chapter explains the strategy you should use in debugging.

Do yourself a big favor: Get good at using debugging tools, both in this class and in others, and you will reap big benefits.

When you seek help from me or the TA, the first thing we will ask you is to show us your debugging tool output. Even if you are using a GUI tool, for this purpose send us the output of a text-based on. Make SURE you use the Linux script command to record your session.