ECS 158, Programming on Parallel Machines

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Highlights

• hard copy of (open source) textbook is required, student-printed
• discussion section is required, weekly Quizzes given there
• heavy emphasis on Group work; everyone must participate fully
• Homework grading is interactive, in person, with the TA asking questions of each Group member
• no final exam; instead, have final Group Project/Homework
• it is required that you read the course Blog every day
• in-class Group Quiz, last day of lecture
• see Important Dates, Section 1
• textbook reading is required, taking at least 3-4 hours each week
• submission of work:
  – Quizzes taken in-class, but required to submit electronic version of your answers (very short) via handin to the professor
  – submit Homework via handin to the TA

• failure to comply with course procedures may result in penalties to grades on Tests or Homework, or to final course grades

1 Important Dates and Deadlines

• formation of Homework Groups: January 7 (in disc. sec.)
• ordinary Quizzes: weekly
• Group Quiz: March 12
• Group Project due: March 18
2 Prep

- Programming, at the level of ECS 60, in C/C++. (We will also use R, but you are not expected to have prior knowledge of it.)
- GOOD math skills, especially linear algebra.

3 Textbook and Other Required Materials


You can print the book in town, say at Copyland on G Street and Davis Copy Shop on 3rd St., but you may find it’s cheaper elsewhere. Cost, including binding, should be between $20 and $30. One student said she got her book from Digital Copies on 3rd St. for just $16. (Note: When you talk to a vendor on this, be sure to distinguish between pages and sheets.)

It is required that you have a hard copy of the book, as it will be used during Tests.

4 Workload

There will be approximately five programming assignments. They will typically have fewer lines than, but require considerably more thought than, a typical ECS 60 program.

5 Why This Course Is Important

Everything is parallel today. It’s basically impossible to buy a single-core PC nowadays, and even smart phones are now dual core.

Yet employers complain that skill in parallel programming is in short supply. Having that skill is a big advantage in the job market.

One student who interviewed for jobs when he was taking ECS 158 wrote to me about one interview he had had:

The senior advanced systems engineer asked me several questions about multi-threading including several on how to go by debugging pthreads code...I was well prepared!

He followed up a few days later:

I got a job offer from two different departments including the interview with the Senior Manager Software Engineer who asked me about pthreads. I got an offer and am taking the job with him...

[ Goes into detail on the questions he was asked. ]

...I definitely would not have gotten the offer if it weren’t for this class.
6 Course Content

• types of parallel hardware
  – multicore and multiprocessor machines
  – networks of workstations (NOWs)
  – graphics processing units (GPUs)

• introduction to major parallel programming packages (APIs for C/C++ and other languages):
  – OpenMP and threads
  – CUDA
  – MPI
  – Hadoop

• parallel programming in specific fields of application, including
  – database operations
  – image processing
  – scientific computing
  – statistics
  – data mining

7 Course Web Page

Information about office hours etc. is available on our course Web site, [http://heather.cs.ucdavis.edu/~matloff/158.html](http://heather.cs.ucdavis.edu/~matloff/158.html).

8 Machines

When you submit Homework code, it is not considered valid unless it works on the Linux PCs in 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, meaning Linux or Mac OS. Google is such a strong Linux shop that it once developed its own version of Ubuntu Linux, Goobuntu. You probably also know that Android, the popular OS for smartphones and tablets, is based on Linux. Apple’s OSs, ranging from Macs to iPads to iPhones, are also Unix-based.

Intel has complained that UCD grads don’t know Unix well. Of course, students from UC Berkeley know Unix thoroughly; why be at a disadvantage to them?

See an interesting Quora discussion on this at [http://www.quora.com/Is-a-Mac-or-Windows-better-for-a-CS-undergraduate](http://www.quora.com/Is-a-Mac-or-Windows-better-for-a-CS-undergraduate)

The general consensus was, use Linux or a Mac, not Windows.
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? Windows is used throughout the world with great effectiveness, but in the CS world it’s generally not considered to be the right tool.

So, if you don’t know Unix well, 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](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.

### 8.1 Your Own Machines at Home

OpenMP, MPI, CUDA and Hadoop are open-source, cross-platform packages, so in theory you could work on your own machine at home in some cases. However, this is a course in parallel programming, so you need a parallel machine:

- You probably have a dual-core machine at home. You’ll be able to do some of your OpenMP/threads work on it, but in some cases we’ll be using the quad-core machine Tetra on CSIF.
- CUDA requires a high-end NVIDIA video card, as we have on some CSIF machines. If you have this on your machine, you can work there.
- MPI requires a network of machines, such as CSIF.

### 9 Following Directions—It Matters!

Failure to follow directions can have a heavy adverse impact on your course grade. Note in particular the following:

- The Quizzes are graded by a semiautomatic program. As with any program, it fails, or at least stalls, if its input is not in the expected format. Thus you must be thoroughly familiar with the required format, and make sure to stick to it.
- Important information is regularly disseminated on the course blog. It is required that you read it every day.

I very often serve as employment references for graduating students. When employers call me, they rarely ask about the student’s technical abilities. Instead, they ask about the student’s CHARACTER—especially whether he/she reliable. Repeat failure to follow instructions is the exact opposite of reliability.

### 10 Each Student Must Have His/Her Own Course Materials

Note that Quizzes are open-book, and there is no sharing of books or other materials during Quizzes, nor are electronic devices allowed. Thus every student must have his/her own hard copy of the textbook and any other course materials.

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1 An exception is the Group Quiz, given the last day of class.
11 Bring the Course Materials with You to Class

Bring the entire textbook and other course materials to lectures, discussion sections and Quizzes.

If you forget to bring your book to a Quiz, the TA or instructor will lend you one; if several students forget, you’ll need to take turns.

12 Terminology

- the term *Group* refers to your Homework team (Section 17)
- the term *Quizzes* refers to tests given in discussion section; see Section 13
- the term *Homework* includes both math and programming work (most courses, other than ECS 132/256, won’t have math work)
- the term *Final Project* refers to the take-home Group project that serves as the final Homework assignment and final exam, in lieu of a written, in-class final exam

13 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 consist of fill-in, multiple choice and very short-answer questions.

13.1 Why Quizzes?

The Quizzes will form the biggest part of your course grade.

This is a lot of work for me. For example, in Fall 2012, I was teaching two courses, one of which had two different discussion sections. That meant I needed to compose and grade 3 quizzes per week—yikes! But I do this for two reasons:

- It’s a natural way to ensure that you don’t fall behind, which is a serious problem for universities using the quarter system.
- It’s much better for the student, with far less pressure. Giving a midterm and a final is quite stressful to the students, as they count so much in a course grade. Giving Quizzes instead relieves that stress. It’s also better for your grade. In a final exam, you could be misgraded and never know it.

13.2 PLEASE NOTE: There Are No Makeup Quizzes

There are no makeup Quizzes. If you miss a Quiz, for whatever reason, it simply will become one of the two Quizzes you exclude from your grade.

If there are extenuating circumstances, e.g. illness, let me know. I will make a note of it in my records, and try to take that into account when making out the course grades.

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2Except for the one on the last day of lecture.
13.3 Group Quiz, Last Day of Lecture

The last Quiz, given in lecture on the last day of class, will consist of an in-class Group effort, i.e. you will work on the Quiz with your Group.

(Please note: Unforeseen circumstances may result in this becoming an ordinary individual Quiz.)

This will be done on computers. Each Group must have at least one laptop computer among them. Let me know if no one in your Group has one. The laptop computer must contain all software needed to do the Homework assignments for this class.

You submit your Group Quiz in the same manner as for Homework, as detailed in Section 19.4 Make sure to heed the point about subdirectories. You use handin, in my directory on CSIF, using the subdirectory xgroupquiz, e.g. 50groupquiz.

13.4 Partial Credit on Quiz Problems

Quiz problems will be short answer, but you still may be able to get partial credit, in the case of arithmetic or algebra errors, or in the case of code, spelling or syntax errors. In fact, you will probably get full credit in those situations. But it is your responsibility to bring it to my attention after the grades are out.

13.5 Electronic Submission Is Required

Here is the procedure for the Quizzes (except for the final one). You take the Quiz in class and turn it in on paper, but then also turn it in electronically. It is then graded semi-automatically, using a grading program but with some human intervention (mine).

Below are the rules. Please note that your submission will be gradely mostly by a PROGRAM; if you don’t use the format expected by the program, the program goes crazy and bad things happen.

- Before you turn in your Quiz paper during the discussion section, copy your answers to another sheet; the Quiz problems will have only short answers, so this will be quick and easy. IT IS BEST THAT YOU COPY YOUR ANSWERS AS YOU GO THROUGH THE EXAM, rather than waiting for the end; this also serves as a way for you to double-check your answers.

- Your electronic file must conform fully to the rules below. Otherwise penalties will be imposed (which will be rescinded if you resubmit your file to me BY E-MAIL after you receive your grade and discover that you’ve been penalized).

- Later that SAME day, type your answers into a file, and submit it to me using the CSIF handin program. Log on to CSIF, and run (say for ECS 132, Quiz 6, student e-mail ID jsmith) handin matloff 132quiz6 jsmith.txt

If you forget to turn in your file on the same day, it will still be graded, but you will need to submit your file in a special late directory, e.g. 132quiz6late. A PENALTY MAY BE IMPOSED, since this defeats the purpose of having semi-automated grading. Typical penalties will be 10 points for Quizzes 1 and 2, while you get used to the system, and 25 points afterward. In any case it may be several weeks before I grade the late Quizzes, since they may keep drifting in and I need to grade them in a batch.
I typically grade a Quiz one or two days after it is given. At that time, I move all the late files to the nonlate directory, with no penalty imposed. But please do not submit to both directories; if you do that, my use of the `mv` command will fail.

If you have a format error, your Quiz score will be -1. You are allowed to fix the formatting without penalty, as long as you submit it to the correct directory, e.g. `132quiz6reformat`.

If you submit a file late, or if you submit a reformatted file, make sure to notify me by e-mail.

**LATE AND REFORMATTED QUIZ FILES MUST BE SUBMITTED WITHIN A WEEK OF THE DAY THE QUIZ GRADES ARE SENT OUT, AND IN ANY CASE NO LATER THAN THE LAST DAY OF LECTURE IN THE QUARTER.**

Note: You can log into CSIF from off campus via any SSH utility.

- As an added bonus, your grade on the Quiz, both letter and broken down by problems, will be automatically e-mailed to you as soon as the Quiz is graded.

You use R to answer any Quiz problem that requires a numerical answer. (Use of R code enables automatic grading of math problems.)

Here is a sample. Say your Problem 1 has the answer $3 \cdot (2/17)$, Problem 2(a) and 2(b) have the answers 8 and 88, and Problem 3 consists of filling in two blanks in code, with answers `x*y` and `if`. You did not answer 2(c). Your answers file would then be

```
#1 3 * ( 2 / 17 )
#2a 8
#2b 88
#2c 00
#3a x*y
#3b if
```

Here are the details:

- Your file name will consist of your official UCD e-mail address plus `.txt`, e.g. `jsmith.txt`. You must not deviate from this.

  **In order to get credit for your Quizzes, Homework and so on, make absolutely SURE than you use your official e-mail address. This is NOT necessarily you UCD login ID, which may be shorter.**

- The file structure for each problem will consist of two lines, the first containing the problem number, followed by one line for the answer.

- If you do not answer a problem or subpart, make sure to answer anyway, writing 00 (two zeros). (If you don’t answer an entire multi-subpart problem, then put 00 for each part.)
• In the case of questions with numerical answers, write them in program style, using R syntax, e.g.
  using * for multiplication, ^ (carat) for exponentiation, %% for the mod operator, etc. Call exp() for 
evaluating powers of e = 2.71... and pi for 3.14...

Use the concatenate function, c() if a numerical problem asks for more than one number, e.g.

> c (1.2 , 88 , 6)
[1] 1.2 88.0 6.0

Use as.hexmode() to print in hex, e.g.

> as . hexmode(18)
[1] "12"

Please note that the grading program is itself is written in R, and it will automatically parse your R 
syntax. So it must be real R; for instance, if asked how many rows a matrix has and the answer is 5, 
then answer 5, not “five” or “5 rows”.

I recommend that you do NOT simplify your answers, so as to maximize your chance of getting partial 
credit.

Here are examples of R functions you may find useful: choose(), combn(), sum(), min(), max(), 
exp(), log(), integrate().

Here are examples of integrate():

> integrate (function (t) 2 * t / 15 , 2.5 , 4) $ value  # Eqn. (5.25) in our text
[1] 0.65
> integrate (function (t) 2 * t ^ 2 / 15 , 1 , 4) $ value  # Eqn. (5.26)
[1] 2.8
> # E [ X | 0.5 ] for N(10 , 2.1 ^ 2)
> integrate (function (t) sqrt (abs (t)) * dnorm (t , mean = 10 , sd = 2.1) , - Inf , Inf) $ value
[1] 3.144017

Did you notice the “$value” above? Without it, the class is printed–in English–and thus not readable 
by my grading script:

> integrate (function (t) 2 * t ^ 2 / 15 , 1 , 4)
2.8 with absolute error < 3.1 e−14

You may put multiple R statements on one line, separated with semicolons, as long as the last state-
ment produces the correct answer.

• Your file must follow the above format exactly, alternating problem number lines with answer lines. 
AN ANSWER MUST BE LIMITED TO ONE LINE. If a problem asks you to write code and you 
believe more than one statement is needed, put all the statements on one line, separated by semicolons.

• Your file must have no blank lines.

• Your electronic answers must be identical, LETTER FOR LETTER, to what you wrote on paper. For 
numerical problems, on paper you can have math symbols instead of R, but your R expression in your 
electronic file must compute exactly the same quantity. If you discover an error in your paper version, 
DO NOT CHANGE IT IN THE ELECTRONIC VERSION.

• If a problem asks you to fill in a blank in some program code but you believe nothing should go there, 
answer Nothing.
For the in-lecture, Group Quiz on the last day of lecture, submission will be electronic too, but in a different form.

13.6 Coverage
Quizzes always cover all material through the most recent lecture, including all reading through the latest page covered in lecture. (Note: I will not cover every word in every line on every page of the text. If at Quiz time I have covered through page n, that means you are responsible for pages 1-n, unless I state otherwise.)

Special note for ECS 145: On Quizzes, do not use any Python or R features that have not yet been covered in our course. On Homework, you are welcome to use any feature, provided you comply with the Homework specs.

13.7 Open-Materials Policy
TESTS ARE TAKEN ON AN OPEN-MATERIALS BASIS. Bring the textbook and other course materials with you to each Quiz. 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 Quiz questions will refer to specific pages in them.

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

13.8 Electronic Devices
You are not allowed to use any electronic devices, INCLUDING CALCULATORS, during Quizzes.

14 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.

14.1 UC Davis Honor Code
You can find the UC Davis Honor Code at [http://sja.ucdavis.edu/files/CAC.PDF](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.

14.2 Quizzes
Official university policy forbids

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3 The last Quiz will involve work on your own laptops, in your Groups.
4 See the Class Schedule and Registration Guide.
“Wandering eyes,” talking during exams...or leaving the exam room without permission.

Please work as follows during Quizzes:

• Try to sit in alternate seats if possible.

• **ABSOLUTELY NO TALKING** to classmates at any time during the Quiz, **ESPECIALLY INCLUDING** during the time the TA or I are collecting the Quizzes.

• Keep your Quiz 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.**

  And never leave the exam room without permission. **If you do need to use the restroom, you must leave your paper with the proctor.**

Thanks very much for your help.

Please note that in the case of larger classes, students may be photographed, including video.

Please do not wear hats during Quizzes.

14.3 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, paying people to do your work, or otherwise improper consultation, is again a serious violation of university policy and personal ethics.

However, you are welcome, and indeed encouraged, to trade tips with people in other 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 reasonable use of the Web. For example, I’m a big fan of Wikipedia and there is a ton of material on there.

15 Lecture Format

My lecture style is very nontraditional.

15.1 I Seldom Write on the Blackboard

Instead, I talk about what’s 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 explanation.**
15.2 You Will LEARN MORE This Way

Traditionally, the professor writes on the board (or shows slides), and the students copy down what he/she says. That’s a waste of time! Instead, what I do is give you in print what I would have written on the board. 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.

The latter aspect, discussion, is key. 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.

Note carefully: Often points that arise during class discussion wind up as Quiz questions!

This is a lecture style which you may not be accustomed to, but you will LEARN MORE this way.

15.3 Bring the Materials to Lecture

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

15.4 Use of Laptops 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. It is very distracting. If you wish to use a laptop in class, PLEASE SIT IN THE BACK OF THE ROOM.

Use of tablets is OK (during lectures, not Quizzes), as long as you do so quietly, with the device lying flat on the desk.

16 The Discussion Section

The discussion section is required. It will be used for the purpose of giving Quizzes, and occasionally for presenting material not covered in lecture. (That material will appear on Quizzes.)

17 Groups

The following will be done in Groups:

- Homework
- the last Quiz of the quarter, in class
- the take-home Final Project

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

Group size must be at least three (two if the class enrollment is under 25), and no more than four. You must submit to the TA your Group membership lists by the deadline given in Section [1]. This deadline will typically be the day of the second or third lecture.

Often, the TA will use the first discussion section to organize Groups. In any case, the TA will arrange Groups for anyone who has not found a Group to join on his/her own.

17.2 Group Participation: Your Responsibilities

YOUR HOMEWORK PARTNERS DEPEND ON YOU. Repeated failure to work cooperatively with your Group may result in a substantial penalty being applied to your course grade, which could drop to an F.

You must show up at agreed-upon meetings of your Group, or arrange virtual meetings through e-mail, Skype, Google+ Hangouts etc.

In working with your partners, you must work TOGETHER, instead of simply dividing up the work among the partners.

It is not acceptable to say something like “You do this assignment and I’ll do the next.” Each student in a group is expected to participate in every assignment.

IT IS EQUALLY UNACCEPTABLE for one group member to simply take on all the work him/herself. In a programming class, for instance, every member of the group must write part of the program. Maybe some will write bigger parts and some smaller, but everyone must be involved.

18 Our Class Web Page and Blog

Our class Web page is at [http://heather.cs.ucdavis.edu/~matloff/xxx.html](http://heather.cs.ucdavis.edu/~matloff/xxx.html), where xxx is our course number, 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), hints for Quizzes, and so on.

19 Homework

We will have approximately four to six Homework assignments through the quarter.

19.1 Homework Due Dates

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

Homework assignments will be announced in the class Blog. (Note: An assignment is not official until it is announced on the Blog.) The Homework specs 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.

19.3 Programming Work

Do not use any language construct that has not been covered in our course by the due date of the given assignment.

In general, you will not be docked points for poor style—indentation, comments, etc. But you should do these things FOR YOURSELF, to help organize your thinking, and to be able to understand your program two months from now.

Use a debugging tool! Learn my Principle of Confirmation! Don’t flail for hours when you can actually shorten your debugging time by a large fraction.

19.4 Submitting Homework

It is REQUIRED that you use the Linux tar command to package all of your files. For a programming course, this will be just your source code files, except in the Final Project, where you will include your .tex and associated .pdf files (e.g. output for running pdflatex). For ECS 132, there is another file needed, described below.

The file name will be email1.email2....tar where the “email” fields are the official UCD e-mail addresses of the members of your Group, e.g. jsmith.agutierrez.streddy.tjwong.tar. Be sure to get those addresses exactly correct, to avoid a situation in which your team member doesn’t get credit.

In submitting your .tar file, make SURE not to make subdirectories. When my grading script unpacks your .tar file, it will expect to see all your work files in the same directory from which the script invokes the .tar command.

You then submit your .tar file to the TA (not to me), using handin on CSIF.

19.4.1 Special Instructions for ECS 132

Your .tar package must include a file Answers.txt. The TA’s automatic grading program will check these in order to get a preliminary grade on your submission, prior to the interactive grading. It will have the same format as for your electronically submitting Quiz files, but in the Answers.txt file you write answers only for numerical problems.

Use exactly the same format as for the Quizzes, presented in Section 13.5

19.5 Typical Disasters with Electronic Submission

Here are common problems that arise with electronic submission of Quizzes, Homework and Projects:
• File has incorrect e-mail address. This must be your official UCD e-mail address, NOT your login name (which may be different).

• File is submitted to the wrong directory at handin.

• Incorrect file (e.g. from a previous assignment) is submitted.

19.6 Interactive Homework Grading

We will use interactive grading. The TA will announce Homework grading times, and each 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 TA will ask each member of the Group questions about their Homework submission, such as “What if the problem had asked...”, “Explain in detail why you did it this way...”, “What if you were to do it this way instead...”. 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. In many cases, 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 grades to each member.

It’s not expected that all members of a Group are equally proficient in programming or math, and thus it’s not expected that everyone contributed equally to their submitted work. However, it IS expected that everyone was very actively involved.

The TA will e-mail me a report after grading an assignment, with tentative grades for my approval. Below are samples of what the TA might say.

Example 1:

Group 3, John, Jim and Mary: All three students seemed to have actively contributed to this assignment, and all three answered my questions well. The program worked fine. Tentative grades—John A, Jim A, Mary A.

Example 2:

Group 3, John, Jim and Mary: The program worked fine, but Mary seems to have done most of the work. John had some trouble answering my questions, and Jim could answer almost nothing. Tentative grades—John C, Jim F, Mary A.

Example 3:

Group 3, John, Jim and Mary: The program worked mostly OK, but failed when I tried the input combination 8, 88 and 168. All three Group members did answer my questions well. Tentative grades—John A-, Jim A-, Mary A-.

In the case of ECS 132, there will be similar reports for math problems.
19.7 If You Need Help, Hints, Etc.

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 through that thought process that 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!

19.8 Late Work

An assignment is late if it is submitted to the TA after the due date. 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 handin is available every day, each of the seven days of the week counts as one day.) The maximum total penalty is 50%.

Each 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.

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.

20 Final Project

In lieu of a Final Exam, we have a Final Project, which also serves as the last Homework assignment. It will be take-home and collaborative with your Group, just as with your earlier assignments. It will be very different from regular assignments, though:

- it will be of a different nature, notably in its requirement that you submit a written report.
- it will involve less work than a regular assignment
- you submit your Final Project to me, not to the TA, and I am the one who will grade it (submit it via handin)
- no late Final Projects will be accepted
- an especially good Final Project may substantially your course grade, much more than a regular assignment would
You submit your Project reports in the same manner as for Homework, as detailed in Section 19.4. Make sure to heed the point about subdirectories. You use handin, in my directory on CSIF, using the subdirectory xproject, e.g. 50project.

Note these Project requirements:

- Do a good, professional job.
- Correct grammar and spelling, clarity/fluidity of the writing, etc., do count — a LOT.
- Use bold font for program variables in text.
- Use the listings package or similar for displayed code listings.
- Full code listings must be included in an appendix.
- Use Bibtex for references. Note: Lots of materials already have Bibtex entries available online, saving you work. In referencing a Web page, include at least the title and URL.

Details will be given later. If you are curious now, though, you can find model examples in files with names of the form “Exemplarx” on our class Web site, e.g. [http://heather.cs.ucdavis.edu~matloff/132/](http://heather.cs.ucdavis.edu~matloff/132/)

### 21 Grading

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

#### 21.1 Weighting

The formula used is

\[
\text{course grade} = 0.70 \times \text{Quizzes grade} + 0.30 \times \text{Homework grade}
\]

where the Homework and Quizzes grades are each on the 4-point scale (4 for an A, 3 for a B, etc., with + adding 0.3 and - subtracting 0.3).

Remember, the Final Project is also considered part of the Homework. If this is missing, it will not merely be treated as an F. Instead, you will be imposed a heavy penalty on your course grade.

#### 21.2 + and - Grades

The threshold for a grade of n is (n-1).85; the threshold for an ‘n-’ grade is (n-1).6; the threshold 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+.

#### 21.3 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.

If you receive an F grade on many quizzes, your course grade will be reduced, possibly to an F, regardless of overall grades on the Quizzes, and Homework.

21.4 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.**

21.5 Getting Feedback from the TA

My agreement with the TA is that he/she must grade Homework within one week. TAs are students themselves, so this shouldn’t be a completely firm rule, but if you find that the TA is consistently slow in grading, please remind him/her, and let me know as well.

21.6 Intangibles in Your Course Grade

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 21 would give. I would estimate this occurs in 20-25% of all the course grades I assign. Here are examples (note that I use many of these in writing letters of recommendation too):

- Student has been making a really strong effort in the class (or not).
- TA’s detailed reports to me of the student’s performance in the interactive Homework grading sessions show that the student has better insight than his/her Quiz scores show.
- Student’s group has an exceptionally good final project, and it is clear that the student made major contributions to this (e.g. because the student also got good Homework grades).
- “All’s well that ends well”-student showed a marked improvement in Quiz grades as the quarter progressed.
- Student’s insightful comments in class.
- Student got one or more really difficult Quiz problems right that few or no other students got.

Negatives can be an obstacle. Those who miss Quizzes (except for medical or similar reasons) will probably not receive the benefit of such intangibles, for instance. A pattern of missing many Quizzes, or lack of involvement in the Homework may produce a grade below what the rules of the course provide.
21.7 Failture to Participate

If you miss a large number of the Quizzes, or do not actively participate with your group in the Homework and Project, you may receive a course grade lower than what the above formula computes, even an F.

21.8 Extra Credit

I give Extra Credit (EC) for all kinds of things. If during lecture a student makes an insightful remark, or answers a tough question I throw out to the class, I record EC for the student. If a student gets a Quiz problem right that no other student gets, or only a couple of other students gets, then I give EC.

So, how do I use EC? There are two main ways: (a) EC can and often does raise the student’s course grade at the end of the quarter. (b) I make use of EC when recommending the student, for a job or grad school.

22 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.