C and Software Tools

Course Syllabus

CSC 230, Section 601
Fall, 2015

Meeting:
Online

Instructor:
David Sturgill, EB2 2294

Office Hours:
Mo 10:30 - 11:30 pm, EB2 2294
Tu 10:30 - 11:30 pm, EB2 2294
We 10:30 - 11:30 pm, EB2 2294

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Text:

Course Description

In this course, students will develop skills in several important areas. First, we’ll get some experience working in C, a language that lets us think like procedural rather than an object-oriented developer. Also, being a fairly low-level language, C lets us see and control more of what’s going on in the hardware. This can help us think about using the hardware more effectively, whether we’re actually programming in C or in a higher-level language. While we learn C, we’ll also learn about tools and techniques that help us build, manage, debug and analyze software projects.

The computer science department captures the essential content of all undergraduate courses in the form of a list of course objectives. This helps to make sure that the most important material gets emphasized even if different instructors lead the course from semester to semester.
Course Objectives

By the end of the course, students should be able to do the following.

- Write small to medium C programs having several separately-compiled modules.
- Explain what happens to a program during preprocessing, lexical analysis, parsing, code generation, code optimization, linking, and execution, and identify errors that occur during each phase. In particular, they will be able to describe the differences in this process between C and Java.
- Correctly identify error messages and warnings from the preprocessor, compiler, and linker, and avoid them.
- Find and eliminate runtime errors using a combination of logic, language understanding, trace printout, and gdb or a similar command-line debugger.
- Interpret and explain data types, conversions between data types, and the possibility of overflow and underflow.
- Explain, inspect, and implement programs using structures such as enumerated types, unions, and constants and arithmetic, logical, relational, assignment, and bitwise operators.
- Trace and reason about variables and their scope in a single function, across multiple functions, and across multiple modules.
- Allocate and deallocate memory in C programs while avoiding memory leaks and dangling pointers. In particular, they will be able to implement dynamic arrays and singly-linked lists using allocated memory.
- Use the C preprocessor to control tracing of programs, compilation for different systems, and write simple macros.
- Write, debug, and modify programs using library utilities, including, but not limited to assert, the math library, the string library, random number generation, variable number of parameters, standard I/O, and file I/O.
- Use simple command-line tools to design, document, debug, and maintain their programs.
- Use an automatic packaging tool, such as make or ant, to distribute and maintain software that has multiple compilation units.
- Use a version control tools, such as subversion (svn) or Git, to track changes and do parallel development of software.
- Distinguish key elements of the syntax (what’s legal), semantics (what does it do), and pragmatics (how is it used) of a programming language.

Grading

Your final grade in this course will reflect your score on two preliminary exams, a comprehensive final exam, small, programming exercises, larger homework assignments and online quizzes. These will be combined
with the following weights:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Online Quizzes</td>
<td>6</td>
</tr>
<tr>
<td>Programming Exercises</td>
<td>8</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>40</td>
</tr>
<tr>
<td>First In-Class Exam</td>
<td>13</td>
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<tr>
<td>Second In-Class Exam</td>
<td>13</td>
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<tr>
<td>Final Exam</td>
<td>20</td>
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</tbody>
</table>

After your final average is computed, your letter grade is determined based on the following table. If your average is at least the value on the left, you are guaranteed a grade that’s at least as good as the one on the right. For example, if you end up with an average of 86, you will get at least a B. You may even get a B+ if, for example, your performance shows a trend of improvement through the semester or you’ve taken advantage of opportunities for extra credit.

<table>
<thead>
<tr>
<th>Minimum Score</th>
<th>Letter Grade</th>
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<tbody>
<tr>
<td>97</td>
<td>A+</td>
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<tr>
<td>93</td>
<td>A</td>
</tr>
<tr>
<td>90</td>
<td>A-</td>
</tr>
<tr>
<td>87</td>
<td>B+</td>
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<td>83</td>
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<td>80</td>
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<td>77</td>
<td>C+</td>
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<tr>
<td>73</td>
<td>C</td>
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<tr>
<td>70</td>
<td>C-</td>
</tr>
<tr>
<td>67</td>
<td>D+</td>
</tr>
<tr>
<td>63</td>
<td>D</td>
</tr>
<tr>
<td>60</td>
<td>D-</td>
</tr>
</tbody>
</table>

Students auditing this class are required to take all the exams and to earn an exam average of 60 or higher. Students enrolled for credit only must earn a course average of C- or better across all components of the course (exams, projects and exercises) in order to receive a grade of S.

**Evaluation**

**Exams**

We have three exams in this course, two preliminary exams and a final exam. The windows for taking the preliminary exams will end on September 25 and October 30 and the window for the final exam will end on December 11. Material in this course builds from basic language elements to larger ideas and constructs. This affects the exams. The second exam is intended focus on material covered since the first exam, but a good understanding of all previous material is necessary to do well on this exam. The final exam is intended to be comprehensive.

All exams are closed book, but students are permitted to bring one 3 × 5 note card to each exam. You may use both sides of your card, but your card must be hand written by you. Note cards will be collected after each exam¹.

¹Why all these peculiar rules about the note card? Well, if you’re going to have a note card during the exam, I want preparing that card to be one more chance to learn the material. If you’ve done a good job preparing your own note card, you may not even need to look at it during the exam.
Quizzes and Exercises

In this class, you get to earn some points toward your final grade through a number of online quizzes. Quizzes will be taken online through the course moodle page.

Exercises will give you a chance to write or fill in missing parts of short programs. They will generally be due the on Sunday evening, except during the last week of classes, when they will be due on December 2. Before a break, we may also change the deadline, so you don’t have to worry about submitting an exercise while your on break.

Hopefully, the quizzes will give you a good reason to keep up with the readings and the lectures and to pay attention. The exercises should give you an opportunity to practice the programming language concepts as we learn them, instead of just trying to apply concepts when you’re working on a homework.

I understand that students sometimes have to miss class, or forget about an exercise. You’ll get to drop your three lowest quiz grades and your three lowest exercise grades. You’ll also get to drop 5 percent of the remaining grade from each of these categories. This is our mechanism for handling any missed quizzes and exercises; it will let you miss a few and do poorly on a few more without any penalty to your final grade.

Homework Assignments

In addition to the frequent, small programming exercises, you’ll get to complete six homework assignments. These will give you a chance to use what you’re learning to solve larger, more interesting problems. As these homeworks are assigned, they will be posted to the course homepage. Electronic submission of homeworks will normally be due at 11:00 on their due date, with the last project due December 4.

If you have a conflict on the due date, just plan to complete and submit your homework early. Since homework submission is electronic, you can even submit your work while you’re away if you have to travel. If a documented emergency (e.g., hospitalization) prevents an assignment from being submitted, that assignment will simply be dropped from the student’s homework average.

Late Submission

If you miss the submission deadline for an assignment, you can submit it late for a 20 percent penalty. Late homework submissions will normally be accepted for 24 hours after the regular submission deadline.

If you make a homework submission before the due date, then, after the due date, you realize that you’ve made a mistake, you can still make a late submission if it’s within 24 hours of the deadline. Of course, you’ll need to decide whether it’s better to lose points for a mistake on an on-time submission or to lose 20 percent for a perfect but late submission. In general, you’ll earn more points with a correct-but-late submission than you will with a broken-but-on-time submission.

Grade Appeals

On exams and programming projects, the instructor establishes guidelines for grading, and grading responsibility is shared with Teaching Assistants and graders. Instructors supervise the teaching assistants and spot check some of their work. If you believe an error has been made on a homework assignment, write up a short description of your case and send it to the TA responsible for that part of the project (email is fine). The teaching assistant will consider your appeal and adjust your grade if necessary. If you are not satisfied with the decision made by the TA, then take the appeal to the instructor, who will make the final decision.

For exams, regrade requests should go directly to the instructor.

Students have one week from when project or exam is returned to begin an appeal. These limits obviously can’t apply to any assignment or exam graded within a week of the end of the term. For those assignments, appeals must be made before 11:00 am on December 14.
Reading Assignments

Regular reading assignments are included in the schedule of topics on the course homepage. The reading will support much of the class discussion, and keeping up with the readings can help you to do well on exercises and homeworks.

Programming Guidelines

You will get a chance to do some C programming on exercises and homework assignments. Style requirements for the exercises are not strict; unless it’s specifically part of the problem you’re solving, you can generally format your code and use any variable names you’d like.

Style requirements for the programming projects are strict, very strict. The course homepage includes a document describing the style guidelines, along with some tips about common problems students have. Why are the requirements so strict? In the workplace, it’s common to have a set of style guidelines that all developers are expected to follow. In this class, we try to help students get used to this idea.

Programming assignments are expected to compile and execute on what we’re calling our common platform. This is an installation of Linux that’s available to all students. The course homepage includes a description of this platform, along with some help with developing and testing your code on this platform.

Class Membership and Participation

Class Communication

We will use Piazza for out-of-class discussions. A link is provided on the course homepage. Students are welcome and encouraged to post questions and are requested to help answering other students’ questions. There are two requirements for all posts to the message board.

- The post must be courteous to and respectful of students, staff, and the University community.
- Students must consider the academic integrity expectations and the difference between answering a question and providing a solution. It’s OK to help out by explaining a problem you had, posting sample input and output, or pointing out a tricky special case. It’s not OK to post your code when you’re asking for help, and it’s not OK to post a working solution (even in part) when you’re trying to help someone else out.

In addition to the course homepage in Moodle and the Piazza message board, there is a mail alias for the course. This will used to provide time-sensitive and important information, such as a change in the due date for a homework assignment. You will want to make sure Moodle is using an email address that you check regularly.

Dissemination of Information

The course website in Moodle is the primary distribution medium for this course. Assignments, lecture slides, many examples, study guides and other materials will be available from this site.

Academic Integrity and Attendance

In short, you are to do your own work. Academic integrity can sometimes be a problem, so this document gives it some extra attention to help people stay out of trouble.

You may only work on an assignment with another student if the assignment explicitly states that this is permitted. In completing your assignments, you can talk to the instructor or the teaching assistants to get specific help. You can use materials posted to the course homepage on Moodle and examples from your
book. You can talk to anyone about some general techniques for solving a problem, but you should never share copies of source code or other parts of your work with another student.

Students are expected to maintain high standards of academic integrity and honesty. Normally, a case of cheating will result in a grade of zero for an assignment. A major offense, including any violation on a test, could result in failure of the course.

Suspected violations of academic integrity will be reported to the Office of Student Conduct. This benefits the student in that it provides an opportunity for independent review of the evidence. It also benefits the university by maintaining a centralized record of violations.

Examples of Cheating (this list is NOT exhaustive):

- to give any student access to any of your work which you have completed for individual class assignments.
- It is cheating AND plagiarism to use another person’s work and claim it as your own. You are expected to complete all assignments on your own, unless otherwise specified in the assignment.
- to interfere with another student’s use of computing resources or to circumvent system security.
- to email, ftp, post on the Internet, bulletin boards, message boards, etc. your work for others to obtain. Do NOT use sites that allow you to anonymously post code. Those sites are searchable, and others may find your code (like the teaching staff).
- to ask or pay another person or persons to complete an assignment for you.
- It is cheating AND plagiarism to decompile any compiled code and use the decompiled source code as your own. You may also break the law by decompiling code.
- It is cheating AND plagiarism to use code that you find online.
- to give another student access to your account (NC State account or others that you use for university work) or to give them your account password.
- for you and another student to work collaboratively on an assignment, unless otherwise specified by the assignment.
- to circumvent the intention of the assignment and/or the automated grading system (e.g., by hardcoding test case solutions).

Examples of NOT Cheating (this list is NOT exhaustive):

- Using the code from the class website (with citations in the comments).
- Using code from other programs YOU wrote.
- Help from TAs or instructor (with citations in the comments).
- Using code from the textbook or textbook website (with citations in the comments).

Example Citations

```c
/* (In file or function level comments)
* I received help from the TA, Martha Washington on DATE during her office hours.
* We discussed X.
*/
```

/*
* The code for this method is based on Exercise Y that I completed on date Z. */

Protecting Yourself

- Do not leave papers lying around your workstation.
- Do not dispose of important papers in the lab recycling bins and trash cans until after the assignment is graded.
- Do not give out your password.
- Do not leave your workstation unattended or forget to log yourself out.
- Do not leave your laptop unattended.
- Do not give other students access to any of your workspace or email them any code.
- Do not give other students access to your course materials or your personal computer.
- Do not email, ftp, or post your code on the Internet, message boards, etc.
- Keep all copies of final an intermediate work until after the assignment is graded.
- Keep all graded assignments until after you receive the final grade for the course.
- Do not discuss implementation details of the assignment with your peers.

Course Materials Acknowledgment

This course features materials provided by other instructors at NC State. Thanks to Dr. Sarah Heckman, Barry Peddycord and Dr. Douglas Reeves for generously providing their materials and assistance and helping to make this course possible.