ECE 477

Hardware Applications of C

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Homepage: **http://sites.google.com/a/maine.edu/ece477**

Course Description: Using the C programming language to control physical hardware devices

Credits: 3

Prerequisites: Introduction to C programming, familiarity with the Linux operating system, basic electronic skills.

Faculty Information

Name: Bruce Segee

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Where students may leave physical messages/assignments for you:

~~There will be a collection box outside my lab~~

No physical messages or assignments. Assignments should be a single google doc shared with me and with a filename given in the assignment.

Office hours: ~~If I am in my office, the door will be open and you may walk in. Please, if you are having a problem, do not wait for a certain date and time. Drop in immediately. The sooner you can get help, the happier everyone will be.~~Pandemic...when you want to speak to me, send me an e-mail. I will arrange a zoom call as soon as we both(all) can make it.

Instructional Materials and Methods

Class notes and web and computer based references will be used. Students are encouraged to have a good C language reference, but no particular one is required. The web is an excellent resource for this class.

Student Learning Outcomes – (Required for ALL courses and General Education categories)

Course Goals:

1) Students will learn the inner workings of the C programming language

2) Students will learn methods of interfacing between computers and the "real world"

3) Students will learn good programming techniques in a team environment.

4) Students will learn to write software to meet specifications

Instructional Objectives:

1) Students will learn C syntax

2) Students will learn C style

3) Students will learn voltage levels and timing characteristics of various interfaces

Student Learning Outcomes:

1) Students will be able to write programs to control physical devices.

2) Students will understand scope of variables, stack frames, and memory allocation.

3) Students will be able to document software including English text, commented code, hypertext documents.

Outline of the course:

I Learning C
II Doing neat things with C
III Projects and special topics

Text:

None

Note: I have not listed a required book for this course for several reasons. The first and foremost is that you probably have several C books already. Secondly, I almost never follow a book that closely anyway. Finally, there are a number of tutorials and references available. This course at one time used "Applications Programming in ANSI C" and before that "The Waite Group's New C Primer Plus". I still highly recommend these books if you would like a supplement for the course.

Another note: If you do not have a good C book, you should.

Warning: This course may not be as rigidly structured as you may be used to. Some people find this exciting and refreshing. Others find it unsettling. If you are in the latter category ~~please come and talk with me.~~ please let's set up a zoom meeting and talk about it.

I am always looking for new ideas. The computer industry changes rapidly. This course similarly needs to change to keep up. This is a very different course than it was just a few years ago.

Stronger Warning: You will be expected to build and use hardware devices. In place of a textbook you will be expected to provide your own connectors, wire, tools, breadboards, etc. As far as possible I will try to make sure that the ECE store has a reasonable supply of parts and supplement as necessary from my lab. We will be building and programming circuits using Raspberry Pis, embedded controllers and virtual machines. I would recommend buying tools and supplies as needed, but you (or your partner) will require, at minimum, wire cutters, wire strippers, breadboard, and a multimeter.

Grading:

Attendance and participation (yes even in a pandemic participation is important) 15%
Labs 25%
Quizzes 30%
Project 30%
You are highly encouraged to work together in teams of two (or even three) on labs, homework, and the project. Quizzes and attendance are an individual effort. Working together may be difficult during physical distancing, so there is no penalty in working alone (but I still HIGHLY encourage you to work together in teams of two or three)

Attendance (the threatening part)

I will expressly be taking attendance and using it for calculating your final grade. The primary mechanism will be quizzes given in the first five minutes of class. If you miss the quiz, you will show as missing the class. The attendance grade is as follows (0-1 misses A, 2 misses B, 3 misses C, 4 misses D, 5 or more count the same as if you had never come to class. Pandemic clause: coming to class means participating in the synchronous zoom meeting.

In-class discussions are the most important part of a classroom experience. When I assign labs, I will usually spend a considerable amount of time discussing details. Having someone come by later and say "I didn’t come to class because I was working on an assignment for a different class, could you spend 45 minutes telling me exactly what you said in class?" or worse still "It's not my fault I did the wrong thing for lab, I missed class the day you told us what you wanted." is annoying and rude.

Class begins at 8:00 AM. That means you should be ready to go at 8:00. Attendance will be taken at the **BEGINNING OF CLASS**. If you came in late, you were not here. Very often attendance will be in the form of a quiz, making it doubly important to come to class on time.

Having said that, bad things happen to good people. If you are sick, or if you have an emergency, let me know. I'm not unreasonable. Letting me know **AHEAD** of time (e-mail is fine) is much better than after the fact.

Attendance (the motivating part)

This should be one of the coolest courses that you will ever take. The material is not hard, but it is unbelievably worthwhile to know. I am convinced that everyone can do well in this course, provided that they come to class and do the assignments. If you come to class and do the assignments, I will bend over backward to make sure you get a good grade. Alternatively, if you are unwilling to expend even enough effort to occupy space in the classroom, that has a definite negative impact on my grading decisions.

Quizzes

Quizzes will be given in class, at the beginning of class, on a regular basis. There will be no prelims or final exam. Quizzes will be unannounced and there will be no make-up quizzes. Please do not ask me in advance if there will be a quiz on a certain date. Quizzes missed with prior approval will be counted as the average of all your quizzes to date, otherwise missed quizzes will count as zero. Note that missed quizzes severely affect your quiz average as well as your attendance grade. Quizzes will, be in-class, open book, open notes. Please note that by definition one cannot get prior approval after missing a quiz.

Labs and Homework

Labs and homework will be assigned on a regular basis, generally every week. I highly encourage you to work in teams of two (or even three). I especially encourage you to find a partner whose skills complement your skills, i.e., if you are a hardware person, team up with a software person and vice versa. Actually, "encourage" is a bit weak. I will only allow a team of one if you can make a compelling case for why you cannot work with a partner. The notion of "I want to work alone because I will learn more" is fundamentally flawed.

Programs are assessed on how well they meet the lab specifications, on style and ease of understanding. Writing confusing code in C is very easy. Writing clear, well documented code should be your goal. The result of the lab is a written report on which you will be graded. Source code, even well commented source code, is not a report. The lab report should be correct and complete, so much so that a person (in particular your future self) should be able to recreate the lab from just the report.

Generally, lab assignments will consist of two parts, the first part will consist of "do this particular thing this particular way" and the second will be "use your imagination and do something cool based on the first part of the lab". Grading on the first part will include how well it conforms to the specifications. Grading on the second part will include originality and appropriateness. Generally Part B should consist of a fairly significant undertaking, not simply "Part A with a green background".

~~Lab assignments should be placed in the collection box before 4PM on the day that they are due. Don't put them in my mailbox, don't hand them in in class, or give them to me in the hall (particularly if I am going somewhere other than my office). Handing in an executable version of the code is generally not helpful, however, a video demonstration, either on youtube, on another website or e-mailed to me is EXTREMELY helpful. As they say a picture is worth a thousand words...so a video is very helpful indeed.~~

Your lab reports (one per team) should be in the form of a single google document shared with me that stands alone. It should contain a human readable description of the lab, methods and results as well as code, schematics, etc. It is acceptable (well, more than acceptable...HIGHLY encouraged) to include a link to a video demonstration.

Don't wait until the last minute to do the labs. Typically, we will talk about a lab on early in the week, answer questions about it throughout the week, and have it due the following Friday (nearly two weeks from when we started talking about it). However, during the week immediately before it is due, we will be talking about another lab. Your approach should be, think about the lab EARLY, get your questions answered while we are still talking about it and hand it in in plenty of time. If you hit a snag, figure it out and handle it during the week before the lab is due.

Hand in whatever you are going to hand in before the due date and time. No late work will be accepted. Quite frankly, it's not worth that much and you're probably better off to let it go and work on the next lab anyway.

Important to note: Your homework and labs will be graded primarily on how understandable they are. I want a write-up describing the code, how it works, how to use it, significant features, problems, "if I had it all to do over

again", etc. Organization, comments, and clear code will get you far, but remember that source code listings are not a writeup, they are a section of a writeup. Generally it is easy to write horrible code that works, but it is difficult to write good code that doesn't work. I don't want you to simply create a mass of code that gives the right answer. I want you to create code that is so clear that it is obvious that it gives the right answer.
Remember: You will not hurt your grade by helping someone else. If you work in a team, pass in only one result from the team. Do not pass in a team effort as your own work.

Your lab will be graded based on what is ~~in the collection box~~ in the google doc at 4PM, absolutely nothing after that time will help your lab grade.

Your lab does not need to work to be passed in, but it must be passed in on time to get a grade other than zero.

Project !!??

Yes, you need to complete a project for this course. Not only must you do one, but it is a very significant portion of your grade. A project includes an ~~in-class~~ presentation and a written report. Projects must also be somehow related to C programming. It is the goal of the projects to introduce topics of interest to the class.

Early projects: The projects will be of great benefit to the people involved as well as the class. However, presenting all the projects at the end of the semester is not the best way to make use of this information. I would like people to volunteer to complete their projects early. People completing early projects will be rewarded in several ways.
1) Bonus points (the exact number is undecided at this writing)
2) Early projects may result in lab exercises on the same topic for the rest of the class. Obviously these labs would be a breeze for the people who did

the project.
3) The end of the semester crunch will be eased.
Some project ideas
(Note you do not need to choose from this list)
1) The C++ language and object oriented programming (beyond what we cover in the course)
2) Fuzzy logic
3) Network programming
4) Controlling hardware
5) Utility programs for the UNIX system.
6) Digital Signal Processing
7) Neural Networks
8) Compression/Decompression
9) Windows programming
10) HIgh Performance computing
11) Communication (e.g., 232, 485, 488, etc.)
12) Raspberry Pi, or other such platform
13) Virtual machines
14) VNC
15) Low power devices
16) Home automation
17) Graphics
18) Interfacing with other software packages or libraries
19) Roomba vacuum cleaner

Any of these are good candidates for early projects.

I have noticed an alarming trend in recent years of projects starting later and later. For goodness sake, the project is worth more than all of the labs combined! It should show thought, creativity, and should look good and run well. Projects with a high coolness factor are always appreciated.

Closing remarks (pet peeves)

Come to class. Since there is no book, the vast majority of what happens happens in class. Attendance will affect your grade. Attendance will statistically affect your quiz average.

Come to class ***on time***. ~~It is very disruptive to have people wander in throughout the lecture. I consider it the ultimate in rude and offensive behavior to walk in loudly, walk up to the table where I have my class notes, rummage through the papers looking for handouts, returned quizzes, labs, etc. It has really happened...and it bugs me... a LOT.~~

~~If you miss class or come to class late, don't compound my annoyance by coming to my office and asking me to repeat the class for you at a time that is more convenient for you. Get the notes from someone else.~~

~~Pass in labs where they belong, when they belong there, I have tried in the past accepting late assignments, and it really was bad for an awfully lot of reasons.~~

Participate in class discussions. Believe me, I know, there is nothing worse than me standing up in front of a room droning on and on. I work better, and the class works better with in-class discussions. You will get more out of the class if you give me a clue what is going on inside your head.

These four policy statements are required for every syllabus at the University of Maine:

1. Academic Honesty Statement: Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the

source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.

2. Students with disabilities statement: If you have a disability for which you may be requesting an accommodation, please contact Ann Smith, Director of Disabilities Services, 121 East Annex, 581-2319, as early as possible in the term.

3. Course Schedule Disclaimer (Disruption Clause): In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

4. Sexual Violence Policy: Sexual Discrimination Reporting The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination involving members of the campus, your teacher is required to report this information to the campus Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: at 207-581-4000.

For confidential resources off campus: Rape Response Services:
1-800-310-0000 or Spruce Run: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help:
For support services on campus: Office of Sexual Assault & Violence

Prevention: 207-581-1406, Office of Community Standards: 207-581-1409,

University of Maine Police: 207-581-4040 or 911. Or see the OSAVP website for a complete list of services at http://www.umaine.edu/osavp/