Syllabus
CMSC 160: Intro to algorithmic design I

Spring 2023

Lecture:	MWF 12noon, Rotunda 354
Lab:	Tue 2pm, Rotunda G56
Websites:	`https://www.cs.longwood.edu/courses/cmsc160`
	`https://canvas.longwood.edu/courses/1307865`

An introduction to problem solving and algorithmic design using an object-oriented programming language. Topics include programming logic, iteration, functions, recursion, arrays, memory management, user-defined data types, abstraction, and complexity analysis. 4 credits.

Professor:	Don Blaheta
Office:	Rotunda 334
Phone:	x2191
Email:	`blahetadp@longwood.edu`
100% Office hours:	Mondays 3–4pm; Wednesdays 10–11am; Thursdays 1:30–3pm; Fridays 2–3pm

Overview

Edsger Dijkstra[1] famously said that "computer science is no more about computers than astronomy is about telescopes." What did he mean?

In this course, we will indeed spend plenty of time with computers, but my focus is ultimately to teach a different way of thinking about problems. The key skills you will develop are analytical problem solving and thinking in terms of abstractions. Should you choose to continue in computer science, you will use these skills in every CS course you take, whether you are writing programs in C++, or in some other language, or not at all. And if I really do my job, the precision of thought you learn here will help to shape how you think about problems in your other courses, even if you never take another CS course again.

Textbook and resources

The "textbook" is a course pack that I have written. It is free, and online.

[1] A pioneer of computer science. More info available on Wikipedia.

You will be given an account on the department's computer systems, where we'll use the Linux operating system and a compile system built on the `gcc` compiler. You may also be interested in installing Linux on your own machine; if so, contact me and I'll help you get it set up. Some of the assignments, especially early in the semester, will use the classroom software at `codeboard.io`, so you will get an account there too (which we'll walk through how to sign up for it).

I'll ask you to join the Slack channel for this course. Slack is a communication system similar to IRC or Discord, widely used in the professional tech community to manage team communications, and seems like a better way to ask and answer questions than a Canvas discussion board. This is the first semester I'm integrating its use into my 160 class, so this is a little experimental; let me know if you have any feedback. You'll get an invite in your Longwood email, but if you prefer to connect from another email address that's fine too (just tell me so I can send the invite).

In the hopefully unlikely event that you need to go into quarantine or isolation (for Covid-19 or for some other reason), but are otherwise well enough to continue working, I'll expect that you have a device (your computer, or a phone or tablet) that is capable of connecting to a live meeting via Zoom, and reasonable bandwidth to accommodate that.

In the hopefully even more unlikely event that the campus returns to a classroom mask mandate, you will be expected to have (and wear) a mask or the equivalent.

Covid-19 notes

This section is happily much-abridged from the version I wrote for the last few years, but as the pandemic isn't quite over yet, some attention to Covid-19 is still relevant.

Attending class. There are two ways you can attend class: in person, or via Zoom link. Either mode of attendance is sufficient for purposes of evaluating your presence and participation; if you attend via Zoom link,

- you must have a reason, and
- you must say what it is,

but I don't need any medical detail and if it's not directly covid-related I'm not going to police that. (Basically: be an adult and make good choices.) The Zoom experience is nowhere near equivalent to the in-person experience and is not a replacement for it; but if you are quarantined, or otherwise just can't attend in person on a particular day, zooming is better than total absence.

Important note: I plan to, in general, turn on Zoom every day; but it's possible I won't if I don't know for sure someone will be attending that way. Try to fill out the "why am I zooming today" link as soon as you know you'll need to.

Zooming vs masking. As we work out how to emerge from the pandemic, I'd just like to remind everyone that masking is still a tool in our toolkit. If you have had a Covid-19 exposure, or have just emerged from isolation, or even just feel a bit sniffly today and "it's probably just allergies", you're not required to zoom (and, as noted, we do prefer in-person attendance where possible) but I do encourage you to wear a mask. We all have masks, we all got really good at wearing them, and it's a courtesy to your classmates to take this easy step to decrease the likelihood of spreading anything. (Including colds and other stuff! Masks help us not spread *lots* of things.)

Of course, if the university returns to a classroom mask mandate, then we'll all wear masks in the classroom per the updated policy.

What if the professor gets sick? Same as for students: if I'm feeling a little sniffly, I'll wear a mask, and if I am more seriously sick (but well enough to teach), I'll zoom myself into the class. If necessary I can teach from a zoom window on the projector screen (and have done so!); I'll send an email with instructions as soon as I know I need to do this.

Course learning outcomes

At the end of this course, the successful student will be able to:

1. implement algorithms using C++;
2. read, write, and debug programs that use standard control constructs such as if/else, loops, and functions;
3. appropriately choose among the fundamental programming data types; and
4. use standard design strategies for ensuring that programs are robust and readable.

Content

Graded work

I figure that I have on average about 12 hours of your time every week, including class and lab time as well as reading, practice, homework, and lab work. If you find you're regularly spending substantially more time than this, please do come discuss it with me, so that we can ensure you're making the most effective use of your time. The work you do for this course will be evaluated as follows:

Engagement. You need to be actively engaged in this class. Engagement comes in many forms, but I expect that you will be interacting with your classmates, and

with me, both in class (in-person or Zoom) and in the Slack channel. General engagement will be evaluated in two-week blocks—so you don't need to artificially say a thing every day—and it's ok if you lean more towards in-class participation or more towards Slack conversations but aim for at least a little of both. In addition, there may be occasional required specific interactions via Canvas or Slack that will be considered part of the engagement grade, and when I (occasionally) do reading quizzes they'll be part of this too. Engagement makes up 10% of the course grade.

Lab work. The central goal of the course is that you learn to program, so the bulk of the work you do will be programming work before, during, and after our assigned lab periods. Except where otherwise noted, work associated with a particular lab is due at 4pm on the following Monday. Lab work will make up 40% of the grade.

Exams. There will be two exams, one in February and one during the finals period. Each will have a take-home component and a sit-down portion. The final will not be explicitly cumulative, though of course the material from the second half of the course builds on the earlier stuff. **You are not permitted to discuss the exams *at all,* with anyone other than me.** Each exam is worth 25% of the grade.

The sit-down portion of the final exam will be 3–5:30pm on Tuesday, 2 May. If you will need to adjust that date you need to talk to me *well in advance* to arrange it.

Grading scale

I tend to grade hard on individual assignments, but compensate for this in the final grades. The grading scale will be approximately as follows:

A−	[85, 90)	A	[90, 95)	A+	[95, 100]
B−	[70, 75)	B	[75, 80)	B+	[80, 85)
C−	[55, 60)	C	[60, 65)	C+	[65, 70)
D−	[40, 45)	D	[45, 50)	D+	[50, 55)

While there will be no "curve" in the statistical sense, I may slightly adjust the scale at the end of the term if it turns out some of the assignments were too difficult. Final grades of A+ are recorded as an A in the grading system. Final grades below the minimum for D− are recorded as an F.

Note that *individual* grades recorded in Canvas should be accurate (and you should let me know if there's a data entry error!), but *averages* as computed by Canvas sometimes are not, if the averaging is complex or (especially) if an individual student has a special case scenario. The reference gradebook is my own spreadsheet, and while I will try to make Canvas reflect it (including averages) as well as I can, Canvas can't always handle it.

Calendar (tentative)

Wk	M	T	W	F
	January			
1			**11** Ch 1 How to read a textbook Variables Input	**13** §§2.1–2.2 Account setup Hello, world! **bring laptops**
2	[MLK Day **no class**]	**17** §2.3, Lab 1 Mad Libs	**18** §§2.4 & Sidebar Types Errors	* **20** §§3.1–3.3 if/else, if alone else if Flowcharts Comparisons
3	**23** §3.4 & Sidebar Comparison errors Blocks Nested if Flowcharts cont'd	**24** Lab 2 Test cases Conditional execution	**25** §4.1 Named values **bring laptops**	**27** §§4.2–4.4 Arithmetic expressions Order of operations Math functions
			February	
4	**30** — Algorithm design Do it by hand	**31** Lab 3 Tinkerblocks	**1** §§5.1–5.2 Vectors and loops	**3** §§6.1–6.2 Strings and string methods
5	**6** §6.3 Characters, `char` String loops Tracing and debugging	**7** Lab 4 Strings and vectors	**8** §§7.1–7.3.1 Assignment, increment Accumulation Sum/average	**10** §§7.3.2–7.4 Counting things Min/max const, constexpr
6	**13** §8.1 `.push_back` Input loops	**14** Lab 5 Standard loops Reading and modifying code	**15** §8.2 Loop-and-a-half break	**17** ** §8.3 `while` General loops
7	**20** §8.4 `do` More loop practice	**21** Lab 6 Loop practice ***Exam 1 TH out***	**22** — ***Exam 1***	**24** §9.1 Functions and parameters

* **19 January**: Deadline to add/drop classes (5pm)

** **17 February**: Deadline to elect pass/fail option (5pm)

Wk	M	T	W	F
	February			
			March	
8	**27** §9.2 Return values Find first match Early return	**28** Lab 7 Unit testing Stubs Debugging	**1** §§9.3–9.5 Random numbers Void functions Recursion	**3** §10.1 Conditionals revisited Boolean variables Boolean functions
		— SPRING BREAK —		
9	**13** §§10.2–10.3 Boolean operations Truth tables	**14** Lab 8 Writing functions	**15** — TBA	[Prof absent **no class**]
10	**20** §§10.4–10.5 Complex booleans DeMorgan's Law Test case coverage	**21** Lab 9 Boolean logic	**22** §11.1 Bundling data `struct`	**24** §§11.2–11.3 Struct parameters Struct return values
11	**27** §11.4 Vectors of structs	**28** Lab 10 UserLogin	**29** * §12.1 Functions on vectors Mapping data Producing vectors of structs	**31** §12.2 Filtering data Reference parameters
	April			
12	**3** §12.3 Adding data Removing data	**4** Lab 11 Weather statistics	**5** §§13.1–13.2 C-style indexed `for` Nested loops	**7** §13.3 Sorting
13	**10** §13.4 Vectors of vectors	**11** Lab 12 Lijnenspel	**12** §§14.1–14.2 newline and tab Formatted output	**14** §14.3 Line input Streams
14	**17** §§14.4 & Sidebar C strings .c_str printf	[Symposium **no class**]	[Research Day **no class**]	**21** Ch 15 Arrays, pointers Arrays as pointers 2D arrays
15	**24** Ch 16 Constructors Algorithm design	**25** Lab 13 Shuffle	**26** — Modeling and simulation	**28** — Modeling and simulation ***Exam 2 TH out***
	May			
		Exam 2: Tue 2 May, 3–5:30pm		

* **29 March**: Deadline to withdraw from a class (5pm)

Policies

You can find several university-wide course policies at
`http://www.longwood.edu/academicaffairs/syllabus-statements/` .

Support

This is an introductory course. That means that what is covered is an important basis for other work in the field, *not* that it is supposed to be obvious, or easy. So don't feel bad if something doesn't click right away. Never hesitate to ask me a question; I'll usually at least give you a hint as to where to look next.

You should also make use of your fellow students as resources. While you can't copy each other's work (see the collaboration policy), studying together is a great idea, and asking and answering questions of other students is actively encouraged.

"Office hours"

If I'm in my office and my door is open, that means I'm available for you to drop in and ask questions, and I'm happy to turn on my "office hours" zoom link so you can join me that way instead. At least four hours a week I've designated as 100% hours, i.e. there's a nearly 100% chance I'm available at those times.

But I'm in my office a lot and I'd like to effectively communicate to you when you're most likely to catch me, so if you look at my office schedule on my website or linked from Canvas, you'll also see many hours listed with other percentages like 60% or 40 or 10, as informal estimates of the probability I'll have office hours in that block for drop-in questions. (If you want more certainty, you can always give me advance notice and be extra sure I'll be there at whatever time!)

If you can't catch me in my office, email or Slack is probably your best bet.

Accommodations

If you have any special need that I can accommodate, I'm happy to do so; come speak to me early in the term so we can set things up. If you have a documented disability, you should also contact Longwood's Accessibility Resources Office (Brock Hall, x2391) to discuss some of the support the college can offer you. All such conversations are confidential.

Honor code policy

Above all, I ask and expect that you will conduct yourself with honesty and integrity—and not to ignore the other ten points of the Honor Code, either. Take pride in what

you are capable of, and have the humility to give credit where it is due.

The two main forms of academic dishonesty are "cheating" and "plagiarism". "Cheating" is getting help from someplace you shouldn't, and "plagiarism" is presenting someone else's idea as if it's your own. If you ever find yourself inclined towards either of these, know that there are always other, better options. Persevere! See my website[2] for some discussion and examples of how to steer clear of these problems, and feel free to come talk to me if you need help finding some of those other options (even if it's for another course).

Cheating or plagiarism (on any assignment) will normally receive a *minimum* penalty of lowering the *course* grade by a full letter, and may range at my discretion up to an F *in the course*. Cases will also be turned in to the Honor Board. But: I believe in your potential, and I hope that you will, or will grow to, observe this policy not simply to evade punishment but positively as a matter of character.

Attendance and late policy

Attendance is required, and assignments must be turned in on time. That said, if you have a good reason to miss class or hand something in late, I tend to be fairly liberal with extensions if you ask in advance. (Good reasons do include assignments due for other classes.) (And medical and family emergencies are exempted from the "in advance" part, of course. But contact me ASAP.)

Frequent absence will result in a lowered participation grade; habitual absence may in extreme cases result in a failing grade for the class. *Unexcused* late assignments will normally be given a zero.

Inclement weather policy

I don't plan to cancel class for weather unless the entire college shuts down; and if the campus closes, I'm likely to hold class in some form by zoom instead (check your email). If you are commuting or are otherwise significantly affected by a weather event, use your own best judgement (and remember that zoom is an option); and if you do miss class for this reason (e.g.: power's out too), contact me as soon as possible to make up missed work.

Early bird policy

Nobody's perfect, and on occasion an assignment gets written a little unclearly (or, once in a while, with an actual error in it). If you catch one and bring it to my attention early, so that I can issue a clarification or correction to the rest of the class, there'll be some extra credit in it for you.

[2] `http://www.cs.longwood.edu/~dblaheta/collab.html`