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1 Prerequisites and description

This course is 4 credits. Its prerequisites are a C– or better in both CMSC 132 and MATH 141.

The goal of the course is to convey the fundamental concepts that enable programs to execute on real hardware. These include how the operating system virtualizes the hardware to provide services and abstractions to allow a user program to effectively use available resources. The course also addresses how different programming constructs work at a low level. The basic abstraction of a program running as one or more threads of control in a single flat address space (a UNIX *process*), and emphasizing it as the model for understanding how a program works, from both the user program and hardware perspective (with the operating system in between), is a theme through the course.

In addition to the policies in this syllabus, various University policies apply to students. These are summarized in or linked to from www.ugst.umd.edu/courserelatedpolicies.html.

2 Course materials and textbooks

Course materials will be provided via ELMS <https://umd.instructure.com/courses/1286168>, the University’s learning management system. Registered students (as well as the top five on the waitlist in each section during the drop/add period) will automatically get access to ELMS for this course. Essential announcements that students are responsible for reading will be made via ELMS. The textbooks are listed below. Do not use illegal copies of the texts.

Pointers on C, Reek, Addison–Wesley, 1998; ISBN 0673999866 (required): You will be assigned some readings from this text on material that will not be covered in lecture and will be in graded coursework.

Computer Systems: A Programmer’s Perspective, 2nd edition, Bryant and O’Hallaron, Prentice Hall, 2010, ISBN 0136108040: Although this text is neither required nor recommended, some course material (mostly in the second half of the semester) will come from it. For those who need or want more explanation of this material the

UM libraries may be able to provide scans this semester of the relevant pages from it (under Course Reserves).

3 Instructional staff, office hours, email, and course evaluations

When the teaching assistants and their duties are finalized, a separate handout will be provided with their information.

3.1 Instructors

	Larry Herman
sections:	010X and 020X
office hours:	TBA
phone:	(301) 405-2762

	A.U. Shankar
sections:	030X
office hours:	TBA
phone:	(301) 405-2688

3.2 Office hours and email

The office hours schedule and procedures for visiting them will be provided separately soon. While assistance with projects is available in the TAs' office hours, you are ultimately responsible for developing and debugging them yourself; learning these skills is part of the coursework and what you're being graded for. Expect the TAs to point you in the right direction if you come to office hours for help writing or debugging a project, after which it will be up to you to continue working on things on your own. A student will be able to receive help with any questions about writing or fixing programming projects in the TAs' office hours no more than **three times each day**.

Just like everything else in this course this semester, all office hours will be held remotely, in particular via Zoom. As explained in the separate short handout provided on ELMS shortly before classes began, due to the class size (around 700 students) and the online nature of the semester, we (the instructors as well as TAs) will not use email (ELMS message) except in a few very rare situations. Instead, we **will** be able to discuss almost anything that is needed verbally during these office hours. The instructional staff is not able to explain course material, discuss administrative issues, assist with programming projects, etc., except verbally during online office hours.

Even in cases of the few types of issues that we will be able to discuss electronically, the instructional staff will **only** read and reply to messages sent via the ELMS message system (click on *Inbox* in ELMS). (We will **not** reply to anything emailed to us at any other email address.) And even in these cases do **not** send a message to all members of the instructional staff. (There is no problem that requires ~30 people to address it.)

3.3 Course evaluations and feedback

Course evaluations are important, and the department and instructors take student feedback seriously. Please complete your evaluation later in the semester at www.courseevalum.umd.edu. However, rather than waiting until the end of the course to give feedback, please bring any suggestions or concerns to our attention (verbally during online office hours) during the semester. Although we cannot guarantee to be able to change anything that is brought up, we welcome hearing any comments or questions, that you may have, and will see if they can be addressed.

4 Course topics

The following list of topics may vary according to the pace of lecture, so their order and duration are approximate. (B&O refers to the Bryant & O'Hallaron text; where the name of a book is omitted this means the Reek text.)

	Topic	lectures
1.	Course introduction (B&O Ch. 1)	1/2
2.	Moving from Java to C (Ch. 1-5)	5
3.	Pointers, strings, and structures in C (Ch. 6-10)	3 3/4
4.	Memory management (Ch. 11)	1 1/2
5.	Make and makefiles	1
6.	Dynamic data structures in C (Ch. 12)	3/4

	Topic	# lectures
7.	Testing	3/4
8.	Advanced pointer topics, the preprocessor (Ch. 13-14)	1 1/2
9.	I/O and standard libraries (Ch. 15, Sec. 16.1, 16.2, 16.7, 16.8)	3/4
10.	Implementation of memory management (B&O Sec. 9.9)	1 1/4

	Topic	lectures
11.	Process control and intro. to systems programming (B&O Sec. 8.1–8.5, 9.1, 9.2, & Ch. 10, Reek Sec. 16.5)	3
12.	Assembly language	3 1/2
13.	Concurrency and multithreading with Pthreads (B&O Ch. 12)	1 1/2

	Topic	lectures
14.	Time, program measurement, and optimization (Reek, Sec. 16.3, B&O Ch. 5)	1 1/4
15.	Libraries and linking (B&O Sec. 7.6.2, 7.10, 7.11)	1/2
16.	Data representation (B&O Ch. 2)	1/2

5 Coursework, grades, and dates

5.1 Coursework

Coursework will count toward the final grade according to the following percentages:

Midterms	three midterms	48%	(equally weighted)
Final	expected to be comprehensive	16%	
Programming projects	thirteen expected projects	28%	(weighted differently)
Practice worksheets		8%	(equally weighted)

Besides the graded coursework, ungraded practice problems will be provided as practice worksheets, homework and exam practice problems (with solutions), all via ELMS. These problems will allow you to test your knowledge of the material and prepare for graded coursework. If you have questions about these problems or need help solving them, ask during the TAs' online office hours (or during online discussion section, if time permits). Some of the practice worksheets will be graded. You will be informed around a day in advance of a graded practice worksheet, and instructions on how to submit your answers will be provided with the first one.

5.2 Project policies and minimum project requirements

Unlike the preceding courses, the program development environment in CMSC 216 will not be the Eclipse IDE, but rather Linux command-line. Programming will be done on the Division of Information Technology's Grace Cluster, which can be accessed at grace.umd.edu. Students will use a TerpConnect account to access the Grace cluster and do coursework (your TerpConnect account should be created automatically).

Projects will be submitted to the same CMSC project submission and testing server as in the preceding courses. However, a different mechanism will be used to turn programs in now. Details will be provided with the first project.

A handout with the project submission and grading policies will be provided when Project #1 is assigned. Projects will all be worth 100 points, but they will be weighted differently based on difficulty. Some projects will be much larger and more difficult, and will have more time to be done in. Others will be much smaller and easier, and will be assigned for just a few days. Because their relative difficulty can't necessarily be known in advance, their weights will be approximated in the gradebook, and finalized near the end of the semester. In order to pass the course, a student **must** submit versions of all projects that satisfy minimum criteria, as the project policies will explain.

5.3 Grading and grades

Grades will be recorded on ELMS. There will be more assignments in the gradebook than we will actually end up having; unused assignments in the gradebook will just be deleted later.

Ask questions or discuss concerns about any grades verbally during online office hours. Do not make comments on grades in the ELMS gradebook; due to the size of the course they will not be read. Questions about project grading should be directed to the TA who graded the project (**not** the instructors or your teaching TA). Procedures will be provided after the first exam as to what to do if you feel that a grading mistake may have been made on an exam.

Final course grades will be curved as needed, based on each student's total numeric score for all coursework at the end of the semester. (In other words, individual assignments or exams will not be curved; just the final course grades.) It is expected that plus/minus grades will be given, although the distribution of grades and performance of students will dictate what the curve will look like (or if there even is one), how many grades in each range there will be, etc.; these are things that cannot be predicted in advance. Course grades may be given separately by the two instructors.

5.4 Exam and project dates

Midterm exams will be held during your **own lecture time** on the days below. If your situation would make that time extremely inconvenient, you can talk to one of the instructors during online office hours about permission to take the exam during one of the other lecture times. The exam and project due dates below might vary depending on lecture progress and other factors. Inform an instructor immediately if you have a conflict with a scheduled midterm date.

Project #1:	Wed, Sep 16
Project #2:	Wed, Sep 23
Exam #1:	Thu, Oct 1
Project #3:	Wed, Oct 7
Project #4:	Fri, Oct 9
Project #5:	Tue, Oct 13

Project #6:	Thu, Oct 15
Project #7:	Mon, Oct 26
Exam #2:	Thu, Oct 29
Project #8:	Tue, Nov 3
Project #9:	Thu, Nov 12
Project #10:	Mon, Nov 16

Project #11:	Mon, Nov 30
Exam #3:	Tue, Dec 1
Project #12:	Tue, Dec 8
Project #13:	Sun, Dec 13
Final exam:	Wed, Dec 16, 4–6

The final exam will be rescheduled **only** for students having an **extremely good reason**, or for University–approved reasons (which are having another final at exactly the same time, which should only apply to BIOM 301, EDMS 451, and ENMA 300/ENME 382, or for students with more than three final exams on the same day). If either situation applies to you, or if you think you have some other extremely good reason to have the final exam rescheduled, you must inform one of the instructors during online office hours **at least two weeks in advance** of the final exam.

6 Class, absences, and accommodations

Class times are in the Schedule of Classes at <https://ntst.umd.edu/soc>. Students are responsible for all academic and administrative material discussed in online lectures and discussion sections and via ELMS announcements.

6.1 What to do if you will be absent

An absence refers (this semester) to being unable to complete required course activities when expected to. As discussed in the separate short handout provided on ELMS just before classes began, although students are strongly encouraged to attend and participate in synchronous lectures (on days when their section is invited to participate) and discussion sessions, attendance in these will be not be mandatory. Videos of all online classes will be provided on ELMS afterwards.

If you will miss (or have already missed) an exam due to a last-minute emergency, send a message via ELMS to both instructors immediately.

For all **other** cases (besides last–minute absences for exams) where you will miss an exam or other course activity, do **not** email the instructors or any of the TAs. Instead fill out the [Report an absence](#) form on ELMS, and **read the information on it carefully** (as well as the rest of this section of the syllabus). You must fill out this form **in advance, or as soon as possible if advance notification is impossible**, otherwise an absence will likely not be excused (and no adjustments will be made to coursework or deadlines as a result of the absence).

Filling out the [Report an absence](#) form **does not** give you an excused absence. It just avoids us having to receive email every time a student has an absence. Besides filling out this form you will **also** need to **discuss the absence verbally with an instructor during online office hours as soon as you are able**, to determine if the absence is excused, and make arrangements (if necessary) for coursework affected by the absence. Be sure to read the entire rest of this section of the syllabus before discussing the absence.

6.1.1 Excused absences and other course–related policies

An excused absence refers (this semester) to being unable to complete required course activities when expected to, due to a University–approved reason, which will not affect a student’s grade. The University’s course–related policies for excused absences and other situations, which include the reasons that an absence would be excused, are summarized at

www.ugst.umd.edu/courserelatedpolicies.html

Most policies there are not repeated here– you should read that information carefully (not only about absences, but everything). Here we only emphasize a few points from that page and define specifics for this course.

- For it to be excused, notification of absence must be provided **in advance**, or **as soon as possible** for situations where advance notification **cannot** be given.
- This semester, due to the online nature of most courses, the University is not requiring certain types of documentation for absences. For example, documentation must still be provided for an illness but it does not have to be from a medical professional; a self–signed note is sufficient.
- For this course, any documentation provided to support an excused absence, including a self–signed note, must be in **PDF**, and sent to an instructor via the ELMS message system. (Please not send pictures or other formats.) If you write a self–signed note you can either scan it if you have a scanner, or install a camera scanner app from your phone’s app store (just search for “camera scanner”) to take a picture of it that will be converted to PDF. (Note that the official Adobe Reader phone app has this functionality.)

Any documentation, including a self–signed note, must include: (a) Your name, UID, and section number; (b) The dates of the absence; (c) A specific list of the coursework affected by the absence; and (d) A **brief** (few sentences or less) explanation of the absence. (Even though you will be discussing it via online office hours, and you will be filling out the [Report an absence](#) form for most absences, a description is important for us to be able to remember things later.) Please figure out from announcements and lecture/discussion videos on ELMS what specific coursework was affected by any absence (in a course of around 700 people please don’t leave it to us to have to look up what coursework was affected based upon the dates of an absence).

In summary, if you are going to have an absence which you think is for a reason that would make it an excused absence (and it is not a last–minute unexpected absence affecting an exam), do the following:

- First, report the absence at [Report an absence](#).
- Next, talk to one of the instructors about the absence during their online office hours **as soon as you are able**.
- Lastly, send documentation (via ELMS message) as described above to the instructor that you talked with.

6.2 How excused absences will be handled

- Instead of a makeup exam, an excused absence for a single missed midterm exam will be handled by giving you the average of all of your other exams to count for the missed exam. (This will not pull your grade either up or down; it is just like dropping that exam.)

If you miss more than one exam, or miss the final exam, we may need to give you a makeup exam instead of using the average of your other exams. Discuss such a situation with an instructor verbally during online office hours **as soon as you are able** so we can determine this.

- Rather than a makeup or extra time to complete it, the score for an excused absence for a practice worksheet will be the average of the student’s scores for the other in–class worksheets (also just like dropping that worksheet).

Note that excused absences are **almost never justification for extensions on projects**. Projects will be assigned with sufficient time to be completed by students who have a reasonable understanding of the necessary material and begin promptly, even if an excused absence occurs. In cases of **protracted, extremely serious** illness, or **severe emergency situations, short** extensions on projects may be considered, depending upon the circumstances. Discuss the situation with an instructor verbally **as soon as you are able** during online office hours.

6.3 Students with disabilities

A student with academic accommodations due to disability must provide documentation from ADS (Accessibility and Disability Support Services) to their instructor **near the beginning of the semester**. (Discuss verbally during online office hours, not via ELMS message.) Arrangements for exam accommodations **must** be made with an instructor **at least three business days prior to the exam date**, or (according to ADS) the right to an accommodation is forfeited.

7 Academic integrity

Campus policy asks students to include the honor pledge on each examination or major assignment in every course; consequently, you will be requested to write or attest to it on exams and projects.

Unless otherwise noted, all graded coursework is to be done **individually**, so cooperation or use of unauthorized materials on assignments is a violation of the University's Code of Academic Integrity. **Any evidence** of this **will be submitted** to the Office of Student Conduct, which could result in an XF for the course, suspension, or expulsion.

For academic honesty purposes, **projects are to be considered comparable to a take-home exam, so any cooperation that would be prohibited on an exam is also prohibited on a project.** Note the following:

- In learning the material students are welcome to study together or to receive help from anyone else. It's OK to discuss with others the course material or the **requirements** of a project.
- When it comes to actually designing, writing, or debugging a project, other than help from the instructional staff, these must **solely and entirely** be a student's **own work**.

VIOLATIONS OF THE CODE OF ACADEMIC INTEGRITY MAY INCLUDE, BUT ARE NOT LIMITED TO:

1. Failing to do any of the work on a project by yourself, other than assistance from the instructional staff.
2. Using any ideas or any part of another person's program, or copying anyone else's work in any way.
3. Giving any parts or ideas from your program, including test data or test cases, to anyone else.
4. Transferring any part of a program to or from anyone else, by any means.
5. Putting a program anywhere (for example, a website online) for any other students to access. (Note this also applies in the future to students taking the course in later semesters.)

In designing or writing projects, students are free to use information in the textbook and code provided by the instructional staff, **only** if the source is cited in a comment in the relevant section of the program, only short sections of provided code are used, and the substantial part of the coursework is the student's own individual work. If you have any question about a particular situation or source, ask an instructor in advance.

Should you have difficulty with a project you should see the teaching assistants in office hours, rather than soliciting help from anyone else in violation of these rules.

IT IS THE RESPONSIBILITY, UNDER THE HONOR POLICY, OF ANYONE WHO SUSPECTS ACADEMIC DISHONESTY HAS OCCURRED TO REPORT IT TO THE INSTRUCTOR, OR DIRECTLY TO THE OFFICE OF STUDENT CONDUCT.

You are encouraged to learn more about academic integrity at the Student Honor Council's website and to read the Code of Academic Integrity, the Code of Student Conduct, and the University's policy regarding acceptable use of information technology resources (including computer accounts) for yourself, using the links on the course's ELMS page.

8 Copyright for materials

Most course materials are copyright Larry Herman and A.U. Shankar (and in some cases other CMSC faculty and instructors not specifically listed due to space limitations) © 2020. All rights reserved for these materials. Students are permitted to use course materials for their own personal use only. Materials may not be distributed publicly or privately to any others (excepting other students currently in the course), in any way or format. A student who distributes copyrighted material without permission (for example, uploading materials that are copyrighted by the instructors to websites) is subject to being forwarded to the Office of Student Conduct.