CSCI 350- Digital Logic and Computer Organization

Contents

1 Logistics

1.1 Instructional Staff

Instructor: Michael Levet (He/Him/His); lastnamefirstinitial (at) cofc (dot) edu.

1.2 Key Dates

Last Day to Drop Before Grade of 'W' Is Recorded: Wednesday, January 17.
Last Day to Drop Before with Grade of 'W': Friday, February 9.
Breaks: March 3-9 (Spring Break). **Midterms (Tentative):** February 15, April 4.

1.3 Course Website

All announcements will be posted to the course website: `https://michaellevet.github.io/S24/CSCI350/index.html`. Students are responsible for checking the course website daily. Assignments and other course materials will be posted to OAKS.

1.4 Lecture

Lectures:

- Section 1: TR, 9:55-11:10 (HWEA 300)

- Section 2: TR, 11:20-12:35 (HWEA 300)

1.5 Office Hours

There will be a mix of in-person (HWEA 312) and Zoom office hours. The Zoom link and days/times for office hours will be posted to my course homepage. Your success is my top priority- if any of these times don't work, please do not hesitate to email me to schedule an appointment! **If you have COVID or another contagious illness, please do not attend my office hours in-person. I will be happy to facilitate remote participation.**

2 Course Description

2.1 Prerequisites

Students should be familiar with first-order logic, evaluating summations (series), manipulating expressions involving exponentials and logarithms, and some proficiency in analyzing algorithms. Students may occasionally be asked to formulate mathematical proofs. This course is mathematical in nature. Comfort with mathematical formalisms will be helpful.

Officially, the course prerequisites are as follows.

- CSCI 250 Computer Organization (Grade of C- or Better)

- Math 207 (Grade of D- or Better). **Students who earned below a C- in Math 207 are especially likely to struggle in this class.**

- Math 307 (prerequisite or corequisite)

2.2 Workload

CSCI 350 is a 3-credit course. Well-prepared students should expect to spend on average 9-12 hours/week outside of class. Students who have significant gaps in their backgrounds may find that they need to carve out additional time to review the prerequisite material.

2.3 Course Content

The primary focus of this course will be on the design and analysis of digital circuits. We will focus on **combinatorial circuits**, which are memoryless; as well as **sequential circuits**, which take into account the current input and the state of the circuit. Along the way, we will discuss minimizing combinatorial circuits, as well as the equivalence of sequential circuits with finite state automata. We will also briefly discuss hardware concerns, including cache memory organization, processor speed, and CPUs,.

2.4 Learning Objectives

There are several key learning objectives for this course.

- Understand the relationship between Boolean functions, logic circuits, and truth tables.

- Know how to analyze simple combinational circuits by giving a truth table or Boolean function for it.

- Use Boolean algebra and Karnaugh maps to simplify Boolean expressions.

- Use basic MSI components such as adders, decoders, multiplexers in more complex circuits.

- Design sequential circuits using state diagrams – state tables – and flip-flops.

- Analyze sequential circuits by constructing state diagram/state tables.

2.5 Course Text

The primary text for this course will be *Structured Computer Organization* by Andrew S. Tannebaum and Todd Austin. We will loosely follow this text. For a more theoretical (mathematical) treatment of much (but not all) of the material, I like Chapters 2-3 of Savage's text Models of Computation.

3 Course Structure and Grading

There will be several components counting towards the course grade: Homework, Quizzes, the Final, and a Syllabus quiz. Homework and quiz questions will be graded according to the following scale: Outstanding (T), Demonstrated Proficiency (P), Progress (PR), Significant Errors or Misconceptions (ATT), No Attempt (NA). Grades of Outstanding and Demonstrated Proficiency count for full credit, while grades of Progress, Significant Errors or Misconceptions, and No Attempt do not count for credit. There will be opportunities to revise and resubmit homework on which you did not receive a grade of Outstanding or Demonstrated Proficiency. More details to follow.

3.1 Written Homework

Homework will be assigned regularly, with clearly posted deadlines. You are responsible for being aware of both the **dates** and **times** for these deadlines. Late homework will not be accepted, unless prior arrangements are made or in emergency situations. Please discuss with the instructor as soon as possible if you have a situation that may warrant an extension. Please submit your homework via OAKS.

- There will be a regular written homework. The written homework must be **typed** using LATEX. Diagrams (e.g., graphs, trees) may be hand-drawn and embedded in the LATEXdocument as an image and **oriented so that we do not have to rotate our screens to grade your work.** Note that **mathematical equations must be typed.** Please note that **handwritten solutions or those prepared without LATEXwill not be graded.** Similarly, **if we have to rotate our screens to grade your work, then your work will not be graded.**

- The first question on every homework will be an honor code agreement. Failure to indicate that you have upheld the honor code will result in your assignment not being graded.

- You are welcome to discuss the problems with your classmates, as well as reference outside resources. **Anything you submit must be in your own words and reflect your understanding of the material. You should be able to explain your solutions to the instructor, such as in an interview grading session.** If there are any questions about this, it is your responsibility to contact the instructor reasonably ahead of the submission deadline. **Looking up solutions or copying from other sources (including your classmates) is an honor code violation.** You must **cite** any resource (other than the course text, instructor) that you use. This includes any classmates with whom you collaborate. Failure to cite your sources will be treated as an **honor code violation.** See Section 3.6.

- Posting to online forums for help (e.g., Chegg, Reddit, StackExchange, etc.) is an **honor code violation.** See Section 3.6.

- Using generative AI (including, but not limited to ChatGPT) and regurgitating a solution it produces is an **honor code violation**. Again, anything you produce must be in your own words and reflect your understanding of the material.

- Individual assignments may have additional instructions beyond the syllabus. Students are responsible for adhering to those instructions.

Your overall homework grade will be:

$$(\#\text{Proficiency} + \#\text{Outstanding}) \, / \, (\text{Total} \, \# \, \text{HW Problems}).$$

Students may revise and resubmit any homework problem they missed *for full credit*, subject to the following:

- All revisions are due within 2 weeks after the graded assignment has been returned and no later than Wednesday, April 24 at 8 PM– whichever comes first.

- Homework problems must receive a good-faith, non-trivial effort to be eligible for revisions. Problems left blank or (in the instructor's judgment) received minimal effort may not be eligible for revisions. Note that revisions are intended to help students correct misconceptions and improve their understanding, and not to obtain a carte blanche two week extension. There is a Google form to request extensions. So if you need an extension, please use that.

- Any problem that is revised must be accompanied by a reflection. This reflection can take the form of a detailed tutorial on how to solve the problem- this should be written for a **CSCI 250** student who is just learning the material. Alternatively, this reflection can be a detailed discussion of your misconceptions when you first attempted the problem and what your understanding is now. **Note:** One-sentence responses of the form "I didn't know then, but I do now.", "I forgot to study.", or similar are **not sufficient**.

- Revisions should be the length of $1-2$ **solid** paragraphs. Please avoid writing fluff or filler text to meet page limits. Fluff writing is obvious.

- Only one revision is permitted on a given problem. You may not revise a revision attempt.

- You are welcome and encouraged to discuss problems you don't understand with myself, your peers, and anyone else! The point of the revisions is to help you understand the material. I am here to help you learn the material and succeed!

Fair Warning. Grading first attempts for assignments will in general be my top grading priority, to ensure that I am providing timely feedback on new concepts. As a result, grading for revisions may be considerably slower than for other assignments.

3.2 Quizzes

There will be regular quizzes throughout the semester. In general, quizzes will be announced clearly in advance, though I reserve the right to give pop quizzes. There will be two types of quizzes: (i) in-class quizzes, which are (unless indicated otherwise) closed book and closed note, and (ii) online quizzes, which will be open-book and open-note. All quizzes will be timed and individual effort.

Online quizzes will always be clearly announced in advance. For online quizzes, a LaTeX template will be provided. Students may either type their work or handwrite their work and embed them as images, **provided their work is legible and I do not have to rotate my screen to grade the work**. In either case, use of the LaTeX template is required. Students will have a total of 45 minutes to submit the quiz **as a PDF** to OAKS. The intent is that 30 minutes (scaled for students with disability accommodations) are spent taking the quiz, and 15 minutes are there to prepare the PDF. In practice, students are welcome to allocate the 45 minutes as they see fit. However, as 15 minutes are allocated to prepare the quizzes for submission, late quizzes will not be accepted.

If your internet goes out, you may take a picture (such as with Cam Scanner) and send a **legible** picture (in JPEG, PNG, or PDF formats) within the 45 minute window to the instructor. **I am unable to accept HEIC files.**

As mentioned above, online quizzes are open-book and open-note, but are individual efforts. Consulting anyone who is not a member of the instructional staff about a quiz, which includes your classmates, tutors, generative AI (including, but not limited to ChatGPT) and posting online (e.g., Chegg, Reddit, Discord, StackExchange, etc.) constitutes an **honor code violation.** Similarly, all answers must be in your own words and reflect your understanding of the material. Copying from any resource is strictly prohibited. See Section 3.6.

You are welcome to email the instructor with clarification questions, with the understanding that doing so counts against your allotted time and that we may not respond to you in time.

In-person quizzes will be timed at 15 minutes (scaled for students with disabilities). Unless otherwise stated, these are closed-book, closed-note and an individual effort. **Students who are out sick, such as with COVID, should contact me for alternative arrangements. Please do not come to class if you are sick.**

Each quiz will contain at least one problem. In order to earn credit for a problem, it is necessary to have earned a Demonstrated Proficiency or Outstanding.

Your quiz score will be:

$$(\#\text{Proficiency} + \#\text{Outstanding}) / (\text{Total} \# \text{ Quiz Problems}).$$

There will be 2 midterms; I reserve the right to give in-person midterms. The midterms will count towards your quiz score, in that each question on a midterm counts as one quiz question. There will be some replacement as follows:

- For the quizzes taken before MT1, if your quiz score is lower than your MT1 score, I will replace that portion of your quiz score with your MT1 score.

- For quizzes taken between MT1 and MT2, I will similarly replace your quiz score with your MT2 score if it is beneficial to you.

- There may be some quizzes after MT2, which may not be eligible for replacement as there will not be a MT3 or traditional final.

So for instance, if you have only demonstrated proficiency (or earned an Outstanding) on 50% of your quizzes before MT1, but then demonstrate proficiency (or earn an Outstanding) on 70% of the questions on MT1, I will– for the purposes of calculating your final grade– record that you have demonstrated proficiency on 70% of the quizzes before MT1. Note that this is an aggregate replacement– I will not be manually updating individual quiz scores.

3.3 Final

In place of a traditional final exam, there will be a final reflection assignment. More details about this will be posted as we close in on the end of the semester. However, the final will be graded as follows:

- A grade of Outstanding will be awarded for thoughtful, detailed reflections that indicate engagement with the course content. There might be minor technical mistakes, but these will be (in the instructor's judgment) few and far between.

- A grade of Satisfactory will be awarded for reflections that generally indicate some effort, but where there may be insufficient detail (low-effort responses on some of the prompts) or non-trivial incorrect information.

- A grade of Not Satisfactory will be awarded for reflections that exhibit minimal effort, have glaring technical inaccuracies, or are not turned in.

3.4 Cutoffs

Final grades will be issued according to the following cutoffs. Note that you must satisfy **all** of the conditions in each of the columns to receive the given grade. Doing better in one column will not counter-balance lower performance in another.

	Homework	Quizzes	Syllabus Quiz	Final
A	90%	90%	Credit	Outstanding
A-	88%	88%	Credit	Outstanding
B+	86%	86%	Credit	Outstanding
B	83%	83%	Credit	Outstanding
B-	80%	80%	Credit	Satisfactory
C+	78%	78%	Credit	Satisfactory
C	76%	76%	Credit	Satisfactory
C-	70%	70%	No Credit	Satisfactory
D+	65%	65%	No Credit	Not Satisfactory
D	60%	60%	No Credit	Not Satisfactory
D-	55%	50%	No Credit	Not Satisfactory

Yes, the cutoff for a D- includes a 55% HW average; this is not a typo. Students who do not qualify for a D- will receive an F. Requests for a higher grade that are not consistent with the syllabus will be politely declined.

3.5 Regrade Requests

Students have 7 days (including weekends) from when a grade was returned to request a regrade. I am happy to fix mistakes in grading. Other regrade requests will not be considered. When you submit a regrade, please clearly indicate the error made in grading. All regrade requests must be submitted using the Google form on the course homepage.

3.6 Honor Code

I expect students are familiar with policies pertaining to academic integrity, outlined in the Student Handbook. Much of what you will learn about mathematics and theoretical computer science will come from your discussions with your peers. You are welcome and encouraged to discuss the homework problems with each other and with me. It is expected that you work the problems by yourself first, so that you can contribute to the discussion. This policy will be changed, reluctantly, if I find it is being abused. **Your submissions must be written in your own words and reflect your understanding of the material.** Note that you are responsible for citing any resource (including other people) that are not members of the course staff, the course lecture notes, or the lectures. Posting to online forums for help (e.g., Chegg, Reddit, StackExchange, etc.) is an **honor code violation.** Regurgitating solutions from generative AI (including, but not limited to ChatGPT) is an honor code violation. If there are any questions regarding this policy, please ask the instructor.

Any acts of suspected academic dishonesty will be reported to the Office of the Dean of Students and addressed through the conduct process. Students found responsible for honor code violations will be subject to the following minimum penalties:

(a) Your grade in the relevant category will be lowered by -2 *per problem on the assignment.* So for instance, if a HW assignment has 5 problems, then the numerator for your HW average would be decreased by 10.

(b) You will be reported to the Office of Academic Integrity, which may choose to impose additional penalties.

Honor code violations may result in an XXF for the course, which carries the same weight as an F. The XX modifier denotes that the grade was received for academic integrity violations. **Please do not cheat.** It is not worth it.

4 Course Policies

4.1 Office Hours: Norms and Expectations

There will be a mix of in-person and online office hours (see Section 1.5 for the Zoom link). The purpose of office hours is to supplement lecture and the associated readings. In order to get the most out of office hours, we recommend the following.

- Attend the lectures and read through the lecture notes. In particular, work through the provided examples. These materials are there to help you! **If you are out, such as with an illness, I will be happy to accommodate remote participation.**

- Spend some time working the problems first. Try to identify specific approaches you have made, as well as identify where you are stuck. If you are spending more than 30 minutes on a single problem without making much progress, then I strongly encourage you to seek help in office hours!

- If you wish to discuss specific work, please have it typed up so that you can share your screen on Zoom. It is very hard to help you if your work is on paper and you are holding it up to the camera.

- My goal is to provide hints about homework problems, as well as help students obtain momentum to keep working. In particular, I aim to help students arrive at the solutions on their own. It is completely normal to need time to digest a hint, and then come back to office hours with more questions! Learning CS Theory and Math is an iterative process- we encourage students to iterate!

- Please note that I will neither provide entire solutions in office hours nor grade work ahead of the due date.

Office Hours vs. Email: I am generally happy to discuss course logistics via email (e.g., scheduling appointments, etc.). However, email is usually not a conducive medium for tutoring. If you email me with a question about the homework (and you are certainly welcome to do so), I reserve the right to ask you to come to office hours with your question. Note that this does associate some risk with procrastination, in that you may not get your question answered until after the assignment due date (or after the quiz/exam). Similarly, if you email me late at night, I may not see your email until after the assignment is due. Please plan accordingly.

4.2 Late Work

Late work will **not** be accepted, unless prior arrangements have been made or in case of emergency situations. Extensions can be requested using the Google form on the course homepage. I recognize that you all will frequently have competing deadlines, including for your other classes as well as personal obligations. There is not always time to meet all of one's deadlines. The way to handle these situations is to communicate reasonably in advance. For non-emergency situations, please request an extension at least 24 hours in advance. In general, I encourage you to ask for what you need. While I will in general try to be flexible for short-term extensions, do note that that requesting an extension does not guarantee that you will receive one.

In the event of an emergency situation which prohibits you from turning in work before the deadline, I may choose to offer alternative flexibility instead of accepting late work.

For long-term emergencies, please talk to me.

Note that missing the homework or quiz deadlines by a couple minutes is not a valid reason for late work to be accepted. Homework due dates and times will be clearly posted, and students will have 15 minutes to submit their quizzes (on top of 30 minutes to take their quizzes). Please plan accordingly.

4.3 Late Enrollments

Students who enroll in the course after the first day of class are subject to the same deadlines as the rest of the class.

4.4 Attendance

Attendance is not required and will only be taken during the first two weeks, for the purpose of attendance verification as required by CofC. Students who have not engaged with class by attending, completing assignments, or emailing me may be reported as having "never attended." If you are sick, please stay home– let me know if this is in the first two weeks, so that you do not get dropped. In particular, if you have COVID, please quarantine until such time as you are not contagious. I will be happy to facilitate remote participation in these instances. In the event that any member of the class (myself included) contracts COVID, I reserve the right to move the entire class online. For in-person assignments, I reserve the right to provide make-ups, utilize (portions of) an exam, or handle the situation in another way that is in my judgment appropriate. Please contact me within 48 hours– or sooner if at all possible– if you anticipate missing an in-person assignments.

Note that ≥ 0 class sessions will be recorded via both voice and video recording. By attending and remaining in this class, the student consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class.

4.5 Modifications to the Syllabus

The instructor reserves the right to modify any of the policies in the syllabus at any time, particularly as dictated by the interests of learning and fairness. Students will not be graded any harsher than as outlined in Section 3.

4.6 Student Feedback

Student feedback regarding this course is welcome at any time. Those who wish to leave feedback anonymously are welcome to do so using the Google form on the course homepage. Students are also welcome to reach out to the instructor via email or in office hours to discuss their concerns.

5 Required Syllabus Statements

5.1 Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact the instructor within the first two weeks to discuss any conflicts with religious events.

5.2 Students with Disabilities

The Center for Disability Services/SNAP is committed to assisting qualified students with disabilities achieve their academic goals by providing reasonable academic accommodations under appropriate circumstances. If you have a disability and anticipate the need for an accommodation in order to participate in this class, please connect with the Center for Disability Services/SNAP. They will assist you in getting the resources you may need to participate fully in this class. You can contact the Center for Disability Services/SNAP office at 843.953.1431 or at snap@cofc.edu. You can find additional information and request academic accommodations at the Center for Disability Services/SNAP website.

If you are not registered with SNAP and believe you may need a disability accommodation, please do not hesitate to contact me.

5.3 Inclement Weather, Pandemic or Substantial Interruption of Instruction

In the event of inclement weather, I will communicate a detailed plan for how class will proceed (if at all). Please prioritize your safety in these situations, including any need to evacuate. If there is a need to evacuate, I will also be prioritizing my own evacuation. The university has allocated make-up days on the weekends to be used if class is canceled for inclement weather. I will communicate in a timely manner for if/how these days will be used.

In the event of a surge in the ongoing COVID pandemic, I reserve the right to make adjustments to the structure of the class. In particular, if there exists at least one member of the class with COVID, I reserve the right to move the course online.