



CSCE211 — Digital Logic Design

instructor — Jeremy S Lewis, Ph.D.

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office hours¹ — TR 1–2:30 pm, W 10–11:30 am, and by appointment

Course Details

Section	Meeting Time
002	8:30–9:45 am
001	10:05–11:20 am
003	2:50–4:05 pm

Location — SWGN 2A14

Credit Hours — 3

Bulletin Description — Number systems, Boolean algebra, logic design, and sequential machines.

Prerequisite(s) — MATH 141

Learning Outcomes

Students will (or will be able to):

1. Represent numbers and perform arithmetic in bases other than 10.
2. Encode symbols and numbers in binary codes.
3. Addition and subtraction using twos complement encoding.
4. Evaluate and simplify logical functions using Boolean algebra.
5. Represent logical functions in Canonical Form.
6. Analyze and design combinatorial circuits.
7. Simplify combinatorial circuits using Karnaugh maps.
8. Implement functions with NAND and NOR logic.
9. Analyze and design modular combinatorial logic circuits containing decoders, multiplexers, demultiplexers, 7-segments display decoders and adders.
10. Use the concepts of state and state transition for analysis and design of sequential circuits.
11. Use the functionality of flip-flops for analysis and design of sequential circuits.
12. Introduce computational problem-solving techniques

Course Materials

Required Text — Alan B. Markovitz, *Introduction to Logic Design, Third Edition*, McGraw Hill, 2010.

Required Software — Burch, Carl. *Logisim*. www.cburch.com/logisim. Retrieved January 11, 2021, from <http://www.cburch.com/logisim/download.html>.

All reading/materials comply with copyright/fair use policies.

Course Overview

All sections of CSCE 211 are synchronous and in-person. Attendance is mandatory as described in the Course Delivery section below. Students unable to attend a synchronous session will face no prescribed course penalties.

Student-to-Instructor Interaction — There will be two synchronous, in-person course meetings each week. Those meeting times and locations can be found in Course Details section, above.

Student-to-Content Interaction — Students will complete readings, submit graded assignments taken from and inspired by the course text (see Course Materials section), take short quizzes based on assigned readings, and take in-class exams.

Technologies and Software

Blackboard — This course relies extensively on Blackboard for posting homework, projects, and exams. Each student is responsible for monitoring posted course content.

Logisim — This course uses the simulation software Logisim for the circuit projects. The software may be freely downloaded here: [downloads](#). It is available for any system running the Java version 5 (or later) runtime environment. That environment can be downloaded here: [downloads](#). To use this software, students should have the ability to:

- Download and install a Java Virtual Machine (JVM) for their operating system of choice if one is not already installed,
- Download and install a Java program from the provided link, and
- Organize, save, share, and upload electronic files created by Logisim.

Topics Covered²

Introduction — An introduction to Logic Systems. Number systems including hexadecimal, binary addition, signed numbers, binary subtraction, binary coded decimals(BCD), and other codes.

Combinational Systems — Design process for combinational systems. Switching algebra. Implementing functions with AND, OR, and NOT gates. Complements. From truth tables to algebraic expressions. NAND, NOR, and XOR gates. Simplifying algebraic expressions. Manipulating algebraic functions and NAND gate implementations. General Boolean algebra.

The Karnaugh Map — Introduction. Minimum sum of product expressions using Karnaugh map. Don't cares. Product of sums. Five- and six-variable maps. Multiple output problems.

Designing Combinational Systems — Iterative systems. Binary decoders. Encoders and priority encoders. Multiplexers and demultiplexers. Three-state gates. Gate arrays—ROMs, PLAs, and PALs. Testing and simulation of combinational systems.

Analysis of Sequential Systems — State tables and diagrams. Latches. Flip flops. Analysis of sequential systems.

The Design of Sequential Systems — Flip flop design techniques, Design of synchronous counters. Design of asynchronous counters. Derivations of state tables and diagrams.

Solving Larger Sequential Problems — Shift registers. Counters. Programmable logic devices (PLDs). Design using ASM diagrams. One-hot encoding. Verilog for sequential systems. Design of a very simple computer.

Course Activities

Exams: There are three in-class exams. Exams must be taken in-person and during the time and in the location for the section in which a student is enrolled, unless other arrangements through Disability Services have been established prior to the exam—see Students With Disabilities Resource Center section below. The three exams cover³

1. Chapters 1, 2 and Section 3.1 — **September 22**
2. Chapters 3.2–3.4, 5, and Section 6.1 — **November 03**
3. Chapters 6 and 7 (75%) with coverage of Exam 1 and 2 (25%) material —

Section	Date & Time
001	Tuesday Dec 6, 9:00 am
002	Thursday Dec 8, 9:00 am
003	Thursday Dec 6, 4:00 pm

Exams consist of short-answer answer problems derived from assigned problems and problems from the “Solved Problems” section in each chapter of the course text indicated in the Course Materials section above.

Exams are timed and students must complete an exam in a single sitting.

Exam attendance is mandatory. Any student missing an exam without a medical excuse and documentation from the correct medical professional will receive a grade 0. If an excuse is accepted, then the student will have the opportunity to replace the missing Exam with her/his Final Exam grade. Documentation dated after the exam cannot be accepted. Any student missing the Final Exam will receive an F for the course.

Assignments — There will be six graded assignments consisting of problems taken from the course text covering concepts discussed in lecture. Assignments will be subsets of the “Exercises” presented at the end of each chapter of the course text detailed in the Course Materials section. They will be a combination of short-answer, tables, mappings, and hand-drawn circuits using switching algebra symbols.

Assignments must be neatly hand-written and scanned into a PDF file or software generated. Disorganized or poorly-written submissions will not be graded.

You must submit your homework assignments via Blackboard (as opposed to email, for example). Homework assignments must be single (multi-page) PDF documents written in a neat legible format, typed, or generated using drawing software. Submissions which do not meet these criteria will not be graded. If you do not have a scanner, you must use a document scanning application. One highly rated free applications is **Adobe Scan** and it is available for both Android as well as iPhone.

Assignments must be submitted by end of day (11:59 PM) the day they are due. Assignments will not be accepted for any reason after the rubric is presented.

Quizzes — There will be quizzes periodically through the semester. These may increase in frequency if engagement in the class is poor. There are no make-up quizzes, because the lowest quiz grade is dropped. If attendance warrants enough quizzes, an additional quiz may be dropped.

Most students who engage in lecture and complete their out of class assignments will have no problem with quiz difficulty.

Projects — There will be three group projects requiring students to implement combinational and sequential digital logic design concepts discussed in lecture. Projects will be built using the simulation software Logisim detailed in **Technologies and Software**. Late circuit assignment submissions can not be accepted. Group members dissatisfied with unresponsive members may speak with me for redress.

Grading

Quizzes:	5%	Midterm Exam 1:	20%	A	grade $\geq 90\%$	C	grade $\geq 70\%$
Assignments:	20%	Midterm Exam 2:	20%	B+	grade $\geq 85\%$	D+	grade $\geq 65\%$
Projects:	15%	Final Exam:	20%	B	grade $\geq 80\%$	D	grade $\geq 60\%$
				C+	grade $\geq 75\%$	F	grade < 60.0

Grades are rounded to three decimal places e.g., 89.445% is a 90%.

Assignments and projects are weighted as follows

Assignment 1 (Chapter 1): 2 points	Project 1: 3.0/2.0 points
Assignment 2 (Chapter 2): 5 points	Project 2: 3.0/3.0 points
Assignment 3 (Chapter 3): 4 points	Project 3: 2.5/2.0 points
Assignment 4 (Chapter 5): 3 points	
Assignment 5 (Chapter 6): 5 points	
Assignment 6 (Chapter 7): 2 points	

Students With Disabilities Resource Center

Students with disabilities should contact the Student Disability Resource Center. The contact information is below:

1705 College Street, Close-Hipp Suite 102,
Columbia, SC 29208

Phone: 803.777.6142

Fax: 803.777.6741

Email: sasds@mailbox.sc.edu

Web: https://sc.edu/about/offices_and_divisions/student_disability_resource_center/index.php

These services provide assistance with accessibility and other issues to help those with disabilities be more successful. Additionally, students with should review the information on the Disabilities Services website and communicate with the professor during the first week of class. Other academic support resources may help students be more successful in the course as well.

Library Services (http://www.sc.edu/study/libraries_and_collections)

Writing Center (<http://www.cas.sc.edu/write>)

CarolinaTechZone(<http://www.sc.edu/technology/techstudents.html>)

Academic Integrity

All students must review the Office of Academic Integrity sanctions. This information may be found at USC Honor Code Sanctions One or more of the following sanctions may be imposed for Academic Integrity violations:

1. Expulsion from the University,
2. Suspension from the University for a period of no less than one semester, and/or
3. Probation.

A combination of the above sanctions may be implemented. It should be noted that submitting someone else's work or work from a previous semester is plagiarism and against the Carolina Code. Any other Academic Integrity violations will result in penalties for all involved parties, to include persons supplying their work for plagiarism and group members claiming to be "unaware"

of a group member's violation. All parties will be referred to the Office of Academic Integrity and will receive a -100% score on the submission in question. Contact Information: Byrnes 201, 803.777.4333 <https://www.sa.sc.edu/academicintegrity>

In addendum, any student found to upload solutions to this class' problem set to any plagiaristic website like Chegg or Course Hero, at any point, will receive an automatic F for this course in addition to any sanctions imposed by Academic Integrity.

Course Delivery

This is an in-person synchronous course. Though amenities will be provided when possible, there can be no guarantee of availability to in-class materials outside of class or a guarantee of in-class submissions accepted outside of class. You will need to attend class. I cannot maintain additional online sections of courses along with the in-person sections. I do not have the resources. You should make contact with others in the class if you require notes from previous lectures. I will not provide personal lectures outside of class for students missing lectures.

Students suffering from any contagious or unknown illness should not attend class. Students should instead go to campus health and see a health professional. In addition to helping contain the spread of sickness, it will provide you with documentation for your absence or absences. Without correct documentation from a reasonable source, assignments, quizzes, and exams cannot be submitted late, made up, or dropped. With correct documentation, an Instructor of Record (in many cases) must attempt to provide reasonable accommodations by law and University Policy.

Students experiencing emotional distress should contact Mental Health in University Health Services. If short-term distress becomes a long-term problem, documentation may provide an avenue for consideration. Documentation of work with counselors and therapists is not listed in the prescribed reasons for excused absence, but provides documentation that may be useful in extreme cases e.g., a hardship withdrawal. Additionally, working with a counselor or therapist may allow a student to reduce or manage distress.

Schedule⁴

Date	Reading	Activites
August 18	Syllabus & Section 1.1, pages 1–4	Problem Assignment 1: Chapter 1 assigned
August 23	Sections 1.2.0–1.2.2, pages 4–11	
August 25	Sections 1.2.3–1.2.6, pages 11–18	
August 30	Sections 2.1–2.2, pages 29–48	
September 01	Sections 2.3–2.4, pages 48–54	Problem Assignment 1 due
September 06	Sections 2.5–2.6, pages 54–65	Problem Assignment 2: Chapter 2 assigned
September 08	Section 2.7–2.8, pages 65–78	
September 13	Section 3.1, pages 111–121	
September 15	Section 3.2, pages 121–135	Problem Assignment 2 due
September 20	Midterm Exam 1 Q&A	Midterm Exam 1: Chapters 1 and 2 and Section 3.1
September 22		
September 27	Section 3.3, pages 135–139	Problem Assignment 3: Chapter 3 assigned
September 29	Section 3.4, pages 140–143	Group Project 1 assigned
October 04	Section 5.1, pages 249–258	
October 06	Section 5.2, pages 258–267	Problem Assignment 3 due
October 11	Section 5.4, pages 269–274	Problem Assignment 4: Chapter 5 assigned
October 13	Fall Break (no class)	
October 18	Section 5.6, pages 276–288	Group Project 2 assigned, Project 1 due
October 20	Section 6.1, pages 365–370	
October 25	Section 6.2, pages 370–371	Problem Assignment 4 due
October 27	Section 6.3, pages 371–380	
November 01	Midterm Exam 2 Q&A	Project 2 due
November 03		Midterm Exam 2: Chapters 3 and 5 and Section 6.1
November 08	General Election Day (no class)	Problem Assignment 5: Chapter 6 assigned
November 10	Section 6.4, pages 380–390	
November 15	Section 7.1, pages 415–436	Group Project 3 assigned
November 17	Section 7.1 cont...	
November 22	Section 7.2, pages 437–447	Problem Assignment 5 due
November 24	Thanksgiving Recess (no class)	Problem Assignment 6: Chapter 7 assigned
November 29	Section 7.2 cont...	
December 01	Final Exam Q&A	Problem Assignment 6 due, Project 3 due

Notes

¹Office hours may be virtual, as necessary.

²This list may be extended or abridged as necessary.

³Coverage may be extended or abridged as necessary.

⁴This schedule may be reordered, extended, or abridged as necessary.