# Digital Logic Design I

CPE100 Fall 18

http://www.ee.unlv.edu/~b1morris/cpe100


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|---|---|---|---|
| Professor: | Brendan Morris | Class: | TuTh 13:00-14:15, SEB 1243 |
| E-mail: | brendan.morris@unlv.edu | Office Hours: | MTuWTh 16:00-17:00 |
| Office: | SEB 3216 | Final: | Tu. 12/11, 13:00-15:00 |
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**Textbook**

Digital Design and Computer Architecture, Harris and Harris, 2nd Edition [link 1st Edition] ISBN: 978-0123944245

**Recommended Text**

Fundamentals of Logic Design, Roth and Kinney, 7th Edition ISBN: 978-1133628477

**Grading**

| | | |
|---|---|---|
| Final: | 25% | Tu. 12/11 13:00 |
| Midterms: | 40% | Th. 10/04, Th. 11/15 |
| Homework: | 25% | Weekly |
| Participation: | 10% | In Class |

- Exams are cumulative but will emphasize new material. All exams will be closed book and closed notes. Calculators will NOT be allowed. Questions can be answered with basic mathematics.
- Homework will be assigned weekly. There will be a "hands-on" component to the homework where students will use logic design software to build and test digital circuits.
- Students may study together in groups but all assignments must be completed individually. Copying homework is unacceptable and will result in a fail in the class with an F grade.
- Homework will be due at the beginning of class on the designated date. No late homeworks will be accepted unless prior notification and arrangements are made.
- Students are expected to come to lecture prepared. Lecture notes will be made available online beforehand and can be printed to take notes. Additionally, lecture reading assignments should be completed before lecture in order to be successful.
- Class attendance is required. You will not be successful if you are not engaged.
- Class participation will be recorded through online questions using https://kahoot.it/. You will need to bring a smart phone or other web connected device to class (App Links). Be sure to use your webcampus username for credit.
- It is expected that you will spend 6 hours per week outside of lecture.
- Course grades can be tracked using Webcampus.

**Catalog Description**

Number systems, including unsigned binary and two's complement numbers. Logic gates. Boolean algebra. Combinational circuits. Introduction to sequential circuits.

**Prerequisites**: Prerequisites: MATH 127 or MATH 128 or MATH 181 or higher; or SAT math score of 630 or higher or ACT math score of 28 or higher. MATH 127 or MATH 128 must be completed with a grade of C or better.

**Topics**

- Number Systems, Coding, and Conversion
- Boolean Functions, Simplification Methods (K-maps, Tabulation Method)
- Combinational Network Design
- LSI, MSI circuits including Adders, Decoders, Multiplexers
- Flip Flops and Introduction to Sequential Circuit Design

Additional course material not present in the textbook will be distributed to the class when needed. Extra problems can be found in the recommended text.

**Course Outcomes** (ABET) [UULO]
Upon completion of this course, students will be able to:

- Convert numbers to different bases, understand coding and conversion (a, e) [1, 2]
- Form a Boolean equation and simplify it using different methods (a, c, e) [1, 2]
- Derive a truth table and design combinational circuits (a, c, e) [1, 2]
- Understand and use decoders, multiplexers, and PLDs (a, c, e, k) [1, 2]
- Understand the function of flip flops and timing issues (a, c, e, k) [1, 2]
- Possess basic knowledge of sequential circuits (a, c, e, k) [1, 2]

**Course Policies**

- Questions are best addressed during office hours. You may send and email and expect a response by the following business day.
- There will be no make-up exams or late homework without prior arrangements.
- Extensions will only be granted for medical emergencies or due to the observance of a religious holiday. The instructor must be notified of the absence prior to the last day of late registration.
- As a university student it is your responsibility to conduct yourself ethically and with integrity as described in the Academic Misconduct Policy. Cheating and plagiarism will not be tolerated. Any student caught cheating will be given an F grade.
  (`http://studentconduct.unlv.edu/misconduct/policy.html`)

**Tips for University Success**

- **Participate:** Attend class and take part in discussion.
- **Practice:** Spend ample time on homework. These give you the practice required for the exams. Do not wait until the last moment to complete an assignment. Starting early will give you time to get answers to your questions before they are due and will ultimately prepare you better for exams.
- **Question:** Do not be afraid to ask questions. You will not be the only one with the same question. Faculty are here to help you succeed but cannot do so unless we know where you are having issues.
- **Network:** Find people taking the same courses as you and build study groups. Support your friends and colleagues so everybody wins. It's dangerous to go alone!
- **Review:** Don't just do what is asked in class. Take time to review material between lectures. Look up lecture notes and videos online. Do extra problems from reference books.
- **Be RESPONSIBLE:** You are an adult and must be responsible for your academic career. Only you can ensure success by putting in the time and effort required. It won't be easy, but will be worth it.

**Schedule (Tentative)**

| Week | Date | Lecture Topic | Reading | Assignment |
|---|---|---|---|---|
| 1 | 08/28 Tu<br>08/30 Th | Digital Design Principles<br>Number Systems | Ch 1.1-1.4 | HW01<br>Due Th. 9/07 |
| 2 | 09/04 Tu<br>09/06 Th | Logic Gates & Truth Tables<br>Logic Levels | Ch 1.5, A.1-A.2, A.7<br>Ch 1.6 | HW02<br>Due Th. 9/14 |
| 3 | 09/11 Tu<br>09/13 Th | Transistor Design<br>Boolean Equations | Ch 1.7-1.9 Ch 2.1-2.3.2 | HW03<br>Due Th. 9/20 |
| 4 | 09/18 Tu<br>09/20 Th | Boolean Algebra<br>Boolean Simplification | Ch 2.3.3-2.3.5 | HW04<br>Due Th. 9/27 |
| 5 | 09/25 Tu<br>09/27 Th | Bubble Pushing<br>Two-Level Logic | Ch 2.4-2.6 | |
| 6 | 10/02 Tu<br>10/04 Th | Midterm Review<br>Midterm01 | | HW05<br>Due Tu. 10/11 |
| 7 | 10/09 Tu<br>10/11 Th | Karnaugh Maps<br>K-Maps | Ch 2.7 | |
| 8 | 10/17 Tu<br>10/18 Th | K-maps<br>Multiplexers, Decoders | Ch 2.8 | HW06<br>Due Tu. 10/25 |
| 9 | 10/23 Tu<br>10/25 Th | Timing: Delay & Hazards<br>Sequential Logic | Ch 2.9-2.10<br>Ch 3.1-3.2 | HW07<br>Due Tu. 11/01 |
| 10 | 10/30 Tu<br>11/01 Th | Registers<br>Finite State Machines | Ch 3.4 | |
| 11 | 11/06 Tu<br>11/08 Th | FSM<br>FSM Examples | | HW08<br>Due Tu. 11/13 |
| 12 | 11/13 Tu<br>11/15 Th | Midterm02<br>Timing Sequential Circuits | Ch 3.5 | |
| 13 | 11/20 Tu<br>11/22 Th | Timing Sequential Circuits<br>Thanksgiving | | HW09<br>Due Th. 11/29 |
| 14 | 11/27 Tu<br>11/29 Th | Counter Designs<br>Parallelism | Ch 3.6 | HW10<br>Due Th. 12/06 |
| 15 | 12/04 Tu<br>12/06 Th | Quine-McCluskey<br>Final review | Ch 5.4.1 | |
| 16 | 12/11 Tu<br>12/13 Th | Final<br>- | | |

**Electrical Engineering Program Objectives**

The Program Educational Objective of the Computer Engineering program is to create, apply, and disseminate knowledge so that within a few years after graduation the graduate:

1. can successfully practice and mature intellectually in the field of Computer Engineering or a related field.
2. can be admitted to and successfully progress through a post graduate program in Computer Engineering or related program.

**Computer Engineering Program Goals**

To achieve these objectives, the Computer Engineering program's goals are for the graduate to possess:

1. Appropriate technical knowledge and skills
2. Appropriate interpersonal skills
3. The knowledge and skills to be a responsible citizen

**ABET Student Outcomes**

To achieve these objectives and goals, each graduate of the Computer Engineering Major will attain the following outcomes before graduation:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Academic Misconduct**—Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility, and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: https://www.unlv.edu/studentconduct/student-conduct.

**Classroom Conduct**—Students have a responsibility to conduct themselves in class and in the libraries in ways that do not interfere with the rights of other students to learn or of instructors to teach. Use of electronic devices such as pagers, cellular phones, or recording devices, or potentially disruptive devices or activities, are permitted only with the prior explicit consent of the instructor. The instructor may rescind permission at any time during the class. If a student does not comply with established requirements or obstructs the functioning of the class, the instructor may initiate an administrative drop.

**Copyright**—The University requires all members of the University Community to familiarize themselves with and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you, nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: http://www.unlv.edu/provost/copyright.

**Disability Resource Center (DRC)**—The UNLV Disability Resource Center (SSC-A 143, http://drc.unlv.edu/, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

**Final Examinations**—The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. The general schedule is typically available at the start of the semester, and the classroom locations are available about a month before the end of the semester. See the schedule at: http://www.unlv.edu/registrar/calendars.

**Incomplete Grades**—The grade of "I"—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of "F" will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the "I" grade.

**Library Resources**—Librarians are available to consult with students on research needs, including developing research topics, finding information, and evaluating sources. To make an appointment with a subject expert for this class, please visit the Libraries' Research Consultation website: http://guides.library.unlv.edu/appointments/librarian. You can also ask questions via chat and text message at http://ask.library.unlv.edu/.

**Rebelmail**—By policy, faculty and staff should email students' Rebelmail accounts only. Rebelmail is UNLV's official email system for students. As such, it is a primary way students receive official university communications such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. **Emailing within WebCampus is acceptable.**

**Missed Classwork**—Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: http://catalog.unlv.edu/content.php?catoid=6&navoid=531.

In accordance with the UNLV Faculty Senate-approved policy regarding class time and assignments missed, students who represent UNLV in any official extracurricular activity shall also have the opportunity to make up assignments, provided that the student provides official written notification to the instructor no less than one week prior to the missed class(es).

The spirit and intent of the policy is to offer fair and equitable opportunities to all students, including those representing the university in extracurricular activities. Instructors should consider, for example, that in courses which offer a "drop one" option for the lowest assignment, quiz, or exam, assigning the student a grade of zero for an excused absence for extracurricular activity is both contrary to the intent of the Faculty Senate's policy, and an infringement on the student's right to complete all work and fairly earn her or his grade in the course.

This policy shall not apply in the event that completing the assignment or administering the examination at an alternate time would impose an undue hardship on the instructor or the university that could reasonably have been avoided. There should be a good faith effort by both faculty and student to come to a reasonable resolution. When disagreements regarding this policy do arise, they can be appealed to the department chair/unit director, college/school dean, and/or the Faculty Senate Academic Standards Committee.

For purposes of definition, extracurricular activities may include, but are not limited to: fine arts activities, competitive intercollegiate athletics, science and engineering competitions, liberal arts competitions, academic recruitment activities, and any other event or activity sanctioned by a college/school dean, and/or the Executive Vice President and Provost.

**Transparency in Learning and Teaching**—The University encourages students to use a transparency template to discuss with their instructors how assignments and course activities benefit student success: https://www.unlv.edu/sites/default/files/page_files/27/TILT-Framework-Students.pdf.

**Tutoring and Coaching**—The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit http://www.unlv.edu/asc or call 702-895-3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of SSC A (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TBE second floor.

**UNLV Writing Center**—One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: http://writingcenter.unlv.edu/.