CSI 3640 **Computer Organization** **Winter 2018**

Course Outline

Instructor

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Meeting Time

Lecture: 8:00–11:20 AM on F in 200 DH.

Office Hours: 5:20–6:20 PM on MW, after lectures, and by appointment.

Textbook

D. A. Patterson and J. L. Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, ARM Edition, Morgan Kaufmann, 2017. ISBN: 978-0-12-801733-3. No other edition is recommended.

Course Description

Assembly language, addressing modes, RISC and CISC architectures, assemblers, loaders, linkers, arithmetic and logic unit, hardware functional units, input/output organization, memory organization, cache memory, virtual memory, control unit, pipelining, parallel computer organization. *Prerequisite:* EGR 240 and major standing in CS/CE.

Course Objectives

The primary objective of the course is to learn key principles that are used in designing modern processors and computer systems. Upon successful completion of the course students will be able to:

- write simple assembly language programs (ABET: c, i)
- design ALUs and control units (ABET: a, b, c, i)
- describe RISC and CISC architecture, software systems such as assemblers, loaders, linkers, and compiler (ABET: a)
- describe cache and main memory units and explain how they affect system performance (ABET: a, j)
- explain organization and function of input/output systems (ABET: a)
- describe pipeline architectures and parallel architectures (ABET: a)

To help achieve some of the above objectives, the lecture will include the following topics:

- Assembly language programming: operands of the computer hardware, representing instructions in the computer, various kinds of instructions, supporting procedures in hardware, assembler, compiler, linker, and loader.
- Processor design: building data path and control unit, hardware for computer arithmetic, overview of pipeline, pipelined datapath and control, and pipeline hazards.

- Memory systems: address decoding, internal organization of memory, multi-dimensional memory architecture, cache memory, different mappings for cache memory, measuring and improving cache performance, virtual memory, and TLBs.
- Storage and I/O: interrupts, dependability and reliability, MTBF, disk storage, flash storage, and bus systems.
- Architectures: RISC and CISC architectures, difficulty with parallel architectures, shared memory multiprocessors, multicore processors, cluster computers, hardware multithreading, and power wall.

Evaluation and Grading

Students will be evaluated based on the following components with the given weights:

10% — Homework Assignments
15% — Design Project
20% — Term Paper
25% — Midterm
30% — Final Exam

Policy for converting total points to grades: grade 4.0 corresponds to 100% points, grade 1.0 corresponds to 50% points, and the scale is linear between grades 1.0 and 4.0. The grading scheme will be modified at the instructor's discretion if the average grade of the class becomes very low.

When and Where

Please visit https://oakland.edu/registrar/important-dates/ for many important dates of the semester. A tentative schedule of different activities of the course is as follows:

- *Homework Assignments:* Will be assigned about six days before the due dates.
- *Design Project & Term Paper:* TBA.
- *Midterm:* Will be held on 2/16 in the classroom during lecture hours. Please bring a calculator.
- *Final Exam:* Will be held on 4/23 in the classroom starting at 8:00 AM. Please bring a calculator.

If the class cannot meet on any of the scheduled days, the missed activity will be held at the same time during the next class meeting.

Homework Assignments

Understanding of the design principles and concepts discussed in the course can only be reinforced by solving problems. Students are expected to solve all the homework problems and to submit on the due dates. LATE HOMEWORK WILL NOT BE GRADED.

Homework solutions must be neatly prepared on one side of the loose-leaf letter-size white paper with appropriate margins; use of ripped out notebook paper is discouraged. All the pages should be sequentially numbered and securely stapled with student's name, course number, and homework number written at the top of the first page. Handwritten solutions are acceptable.

Homework will be *spot* graded, i.e., the points a student will receive for a set will be determined by the completeness of the submission and by the correctness of only a selected few problems from the set.

Design Project

The course emphasizes on design, and each student will be expected to work independently on a design project. A handout to this regard will be provided at a later date. Project will be evaluated based on proper definition of the problem and specification of the design constraints, appropriate analysis and use of engineering principles, correctness of the design, and quality of the communication.

Report should be professional in quality and appearance. It must have a cover page. Write them as a series of paragraphs, subsections, and sections. Please make the best use of the flowcharts, block diagrams, tables, and figures in your writing. Leave a one-inch margin all around the pages, and write about 30 lines per page. Texts should be formatted in 11 to 12 points Roman-like fonts.

PROJECTS SUBMITTED LATE WILL BE PENALIZED. The penalty will be 10% decrease in points for a delay of each working day. Projects submitted after five working days of the due date will not be graded. Submission of the report in ring binder is discouraged; instead, binding methods that do not significantly increase the thickness of the reports should be considered. Evaluated report will not be returned, but it will be made available for your review. If you like to have a copy, please make one before submitting.

Term Paper

Students will do an independent research in a small group (e.g., team of two) and write a term paper, which may cover any topic under the broad area of computer organization and architecture. It needs not to be a topic discussed in the class. The goal of the term paper is to conduct an in-depth study of a particular topic and present the topic in a cohesive manner. A report and a presentation will be due at the end of the semester. The paper should be roughly five pages in length when list of references is excluded. Format of the paper: two-column, 1/2" margin, single spaced lines, 10 point times roman font. You are encouraged to start thinking of topics of interest early. Be ambitious!

Exams

Exams will be closed books and notes; no crib sheets are allowed. Calculators that can store texts and diagrams will be disallowed. All the materials covered by the lecture till the day of a test will be included in the test, and the final exam will cover all the materials introduced in the class. Graded test paper will be recollected immediately after returning. THERE WILL BE NO MAKE UP TEST OR EXAM, unless such a request is supported by a valid and verifiable reason such as a medical emergency.

Class Attendance

Everyone is recommended to actively participate in the class. The instructor will not monitor class attendance; but it is students' advantage to attend the lectures. If anyone has to miss any classes, he/she is advised to collect a copy of the lecture notes from a colleague and to make arrangements with a colleague for picking-up any materials distributed on those days. Late arrival is strongly discouraged. Students are responsible for knowing all the verbal and written information provided by the instructor, including those are provided through electronic means.

Use of Electronic Devices

Students who want to use electronic devices such as iPad, laptop computer, etc. to take class notes should sit in the center area of the very front rows. They should prepare in advance so that the devices can be used without being connected to an electrical outlet. Anyone who wants to use electronic devices for any other purpose should step out of the classroom. Electronic devices such

as smartphones or other texting devices should be put in vibration mode and kept out of sight of the student. Internet connections to all electronic devices should be turned off during the lecture. If you require an exception of this policy please talk to the instructor.

ADA Notice

Students with disabilities who may require reasonable accommodations should contact Oakland University's Disability Support Services office for assistance. DSS office is located at 121 NFH, and their contact information is as follows. Phone: (248) 370-3266; TTY: (248) 370-3268; Fax: (248) 370-4989; E-mail: dss@oakland.edu.

Academic Conduct and Classroom Policy

Students are expected to comply with the Academic Conduct Policy of the Oakland University. Suspected breaches of academic honesty will be taken before the Academic Conduct Committee. Academic misconduct includes—but not limited to—cheating in quizzes and exams, unauthorized collaborations in assignments, and plagiarizing the work of others. Students found guilty of academic misconduct in this course will receive a grade 0.0 for the course in addition to any penalties imposed by the conduct committee. Please refer to the undergraduate catalog as well as on-line Academic Conduct Regulations from http://www.oakland.edu/studentcodeofconduct for details. Violations of classroom policy will be reported to the Dean of Students.

ABET Student Outcomes: Computer Science

Student outcomes are a set of skills that prepare graduates to attain the program educational objectives which are consistent with the mission of the institution and the needs of the program's various constituencies.

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
c. An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.
d. An ability to function effectively on teams to accomplish a common goal.
e. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
f. An ability to communicate effectively with a range of audiences.
g. An ability to analyze the local and global impact of computing on individuals, organizations and society.
h. Recognition of the need for, and an ability to engage in, continuing professional development.
i. An ability to use current techniques, skills, and tools necessary for computing practice.
j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
k. An ability to apply design and development principles in the construction of software systems of varying complexity.