EEL4747 - Reduced Instruction Set Computing Processors

Three Credits, One hour and fifteen minutes, Engineering Topic.

Instructor: Dr. Atoussa Tehrani.

Textbook: David Patterson, John Hennessy, Computer Organization and Design, The Hardware/Software Interface, Sixth edition, ISBN: 978-0-12-820109-1, 2021 Fifth Edition, ISBN: 978-0-12-407726-3, 2014

Specific Course Information:

Design of interfacing schemes of RISC processors, and state-of-the-art hardware and software features of advanced RISC processor families.

Specific Goals for the Course

a. Specific outcomes of instruction

Upon successful completion of this course, the student will:

1.Define processor performance and learn methods used for processor performance assessment.

2.Understand how high-level language programs are translated to machine language, and how the hardware executes the resulting program.

3.Identify the interface between software and hardware, and how the software instructs the hardware to perform needed functions.

4.Learn MIPS processor instruction set and how it compares to ARMv7, ARMv8, and x86 instructions.

5.Understand the arithmetic for computers and the hardware that is used to implement it.

6.Identify the design of hardware used to implement MIPS instruction set.

7.Exploit the design of instruction set for pipelining and pipelined datapath and control.

8.Identify techniques used by hardware designers to improve performance and energy efficiency.

9.Exploit memory technologies and hierarchies for single and multicore processors.

10.Explain the reason to switch from sequential processing to parallel processing.

11.Describe hardware mechanisms to support parallelism.

12.Exploit characteristics of Graphical Processing Units (GPUs) and how they differ from CPUs.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

In this course the student will have to show

(a) an ability to apply knowledge of mathematics, science, and engineering (X)

(b) an ability to design and conduct experiments (simulations), as well as to analyze, interpret data (N/A)

(c) an ability to design a system, component, or process to meet desired needs (X)

(d) an ability to function in multi-disciplinary teams (N/A)

(e) an ability to identify, formulate, and solve engineering problems (homework) (X)

(f) an understanding of professional and ethical responsibility (N/A)

(g) an ability to communicate effectively (through project reports) (X)

(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context (N/A)

(i) a recognition of the need, and an ability to engage in life-long learning (N/A)

(j) a knowledge of contemporary issues (X)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (X)
(l) a knowledge of probability and statistics (X)

Brief list of the topics to be covered

1.Computer organization
2.Computer arithmetic
3.Computer instruction set
4.MIPS processor design and pipelining
5.Memory Hierarchy
6.Multicore processors
7.GPUs

GRADING:

Course Requirements	Weight
Exam 1	15%
Assignments	35%
Exam 2	15%
Final Exam	35%
Overall Grade	100%

Conversion of Numerical Grade to Letter Grade

92<=A<=100	82<=B<88	70<=C<78
90<=A-<92	80<=B-<82	60<=D<70
88<=B+<90	78<=C+<80	F: Below 60