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### CENG 450 - Computer Systems and Architecture

Term – Spring 2018 (201801)

#### Instructor

Dr. Nikitas Dimopoulos

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#### Office Hours

Days: MR

Time: 16:00-16:30

Location: EOW 437

I can be reached via email (please use "CENG450 question" as your subject)

If you need to see me in person at a different time, please make an appointment (via email).

If you need to see me urgently, please come to my office.

#### Course Objectives

The primary aim of this course is to explore computer architecture issues and their impact on the performance of a computer.

#### Learning Outcomes

The student will be able to

- Describe the benchmarking process and performance metrics
- Evaluate performance of a computer system
- Describe the control and data paths
- Analyze the use of pipelining in speeding-up computations
- Outline how a pipeline is controlled
- Assess the impact of branches and exceptions in pipeline processing
- Compare different dynamic scheduling techniques including Tomasulo and scoreboard
- Assess hierarchical memory organization
- Design and implement a simple pipelined CPU implementing a given instruction set.
- Demonstrate the ability to work in a group through a team-based project
- Demonstrate communication skills through a project report documenting team-based project work that designs and implements a simple pipelined CPU implementing a given Instruction Set.
- Use VHDL and Xilinx to implement a simple pipelined CPU

#### Syllabus

We shall study topics such as how we define and measure performance, the impact of choosing an instruction set, organizing the various parts of a CPU (i.e. the control path and the data path).

We shall study extensively how pipelining is used to speed-up computations, and what are the issues involved in controlling these pipelines.

We shall study the impact of exceptions, and how memory is organized so that it would keep-up with the data demand imposed by the "speedy" CPU.

The course includes as a project the design implementation and testing of a CPU.

In more detail, we shall study the following:

1. Performance metrics
2. Control and Data paths

3. Instruction set architectures and their impact on performance
4. Instruction and arithmetic pipelines
5. Pipeline hazards
6. Instruction level parallelism
7. Memory hierarchy

## LECTURES

A-Section(s): A01 / CRN 20417

Days: Mondays and Thursdays  
Time: 10:00 to 11:20

Location: DSB C128

## LAB

B01 TA: Ibrahim Hazmi  
(ihaz@uvic.ca)

Wednesdays  
15:30 to 18:20

ELW B328

## Required Text

Title: **Computer Architecture A Quantitative Approach**  
Author: **Hennessy & Patterson**  
Publisher: **Morgan Kaufmann**  
Year: 2012 (fifth edition)

## Optional Text

Title:  
Author:  
Publisher:  
Year:

**Course web site:** <http://www.ece.uvic.ca/~ceng450>

**Login:** ceng450

## References:

## Assessment:

Assignments:	2 %	Due Dates: TBA
Labs	30 %	
Midterm	20 %	<b>Monday, February 19, 2018</b>
Final Exam	48 %	

## Note:

- Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.
- Failure to pass the final exam will result in a failing grade for the course.
- Homework will be assigned and collected, but it will not be corrected.
- Solutions will be posted after the due dates.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/grading.html>

**Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.**

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/exams.html#>

**Note to students:** Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Assistant to set up an appointment.

**Accommodation of Religious Observance:**

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/religious-observanc.html>

**Policy on Inclusivity and Diversity:**

<https://web.uvic.ca/calendar2018-01/general/policies.html>

**Standards of Professional Behaviour:** You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

<https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/academic-integrity.html>

**Equality:** This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

**Course Lecture Notes:** Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.