האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

COMPUTER ARCHTECTURE - 67200

Last update 06-08-2019

HU Credits: *5*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *Computer Sciences*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Ohad Falik*

Coordinator Email: *ohadf1@cs.huji.ac.il*

Coordinator Office Hours: *Sunday 13-14, Coordinate in Advance*

Teaching Staff:

Mr. Ohad Falik
Mr.
Mr. David Freud

Course/Module description:

The course is an introdcution to digital hardware design and computer architecture concepts and design. The following topics will be covered:
1. Introduction to computer Architecture :
[Computer Elements, Moors' law, ISA, Performance, Amdahl law]
2. Number Representation [Integer, fix point and Floating Point – conversion, range and arithmetic]

3. Introduction to semiconductors and transistor as switch. Building logic functions from transistors.

4. Boolean algebra and combinatorial functions. Function minimization. Elementary and advanced logic functions.

5. Combinatorial circuits. State machine taxonomy and concepts. Sequential Circuits and memory elements (latches and flip-flops). Synthesis of state machines.

6. Timing of combinatorial and sequential circuits.

7. HW description language fundamentals

8. Introduction to processor architecture (C to assembly and binary, Van-Neumann vs. Harvard, CISC vs. RISC, architecture compatibility visible-ISA vs. mico-architectural point of views).
Execution steps and MIPS Instruction set

9. MIPS Implementation: Single cycle, Multi-cycle, Pipeline (including pipeline principals and hazards). Focus points : performance estimation, trade off understanding, circuit frequency, pipeline hazard elimination), Interrupts

10. Memory hierarchy : problem, terms, taxonomy of misses, cache design, cache behavior under program examples, types of caches (direct, set-associative, fully associative).

11. Virtual Memory : why do we need virtual memory, concepts, page mapping [flat and hierarchical], problems, memory management and TLB issues.

12. Modern Computer Architectures: Parallelization methods, Super pipelining, Vector Machines, Cache Coherency
13. Selected topics of : prediction methods, IO Operation.

Course/Module aims:

Familiarity with numbers representation methods, hardware elements and hardware design methods.
Understanding the principles of computer architecture and implementation of a simple processor.
Familiarity with advanced topics in architecture.

Learning outcomes - On successful completion of this module, students should be able to:

Design simple hardware systems .
Analyze systems and processors computing systems having different microarchitectures.
Analyze and make optimization to software to match different architectures.
Understand the trade off of different architectural solutions.

Attendance requirements(%):

0

Teaching arrangement and method of instruction: Frontal Lecture + Frontal exersize lesson, home assignemnts.

Course/Module Content:

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[Computer Elements, Moors' law, ISA, Performance, Amdahl law]
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13. Selected topics of : prediction methods, Interrupts and IO Operation.

Required Reading:
N.A

Additional Reading Material:
"מערכות ספרתיות" – האוניברסיטה הפתוחה –
– Computer Architecture and Design. The Hardware / Software Interface - Hennessy & Patterson
– Computer Architecture a Quantitative Approach - Hennessy & Patterson
– Hennessy, J. L., and D. A. Patterson. Computer Architecture: A Quantitative Approach, 3rd ed. San Mateo, CA: Morgan Kaufman, 2002. ISBN: 1558605967.

Course/Module evaluation:
End of year written/oral examination 70 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 20 %
Reports 0 %
Research project 0 %
Quizzes 10 %
Other 0 %

Additional information:

Minimum requirement of assignments and exam.

The Quiz will be taken into account only if higher than exam grade (in which case the exam is 80% of final grade).