**New York University Tandon School of Engineering**

Electrical and Computer Engineering

Course Outline ECE 6913 [Computing Systems Architecture]

**Fall 2019**

**Professor Siddharth Garg**

Thu 12.25 PM - 2.55 PM at JABS 474

Fri 12.25 PM - 2.55 PM at 370 Jay 202

To contact professor: **sg175@nyu.edu**

370 Jay St, Office 1006

Office hours: **Wednesday 3PM-4PM** or by appointment

Course Pre-requisites Basic knowledge of digital logic and computer organization is assumed. ***Class projects/programming exams will require knowledge of C/C++***. If you do not have *any* prior programming experience, the class is not recommended.

Course Description  A uniprocessor computer is built from the blocks developed. An assembly language and an instruction set are presented. Processor implementation with a data path and hardwired and microprogrammed control is introduced. Performance evaluation of computers is studied. Basic pipelining is introduced to improve system performance. Memory-hierarchy alternatives are introduced to improve the capacity of the computing system. Techniques to exploit instruction level parallelism will be studied.

**Detailed Syllabus**

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| Week | Content | Notes |
| L1:  05/09  06/09 | Introduction: ISAs and their evolution. ISA features and impact on architecture |  |
| L2:  12/09  13/09 | Lab 0 to be completed in-class with TA assistance | Lab 0: Functional ISA Simulator  Note: Ungraded. |
| L3:  19/09  20/09 | Basics of MIPS ISA |  |
| L4:  26/09  27/09 | Single-cycle MIPS design |  |
| L5:  03/10  04/10 | 5-stage MIPS pipeline: basic |  |
| L6:  10/10  11/10 | 5-stage MIPS pipeline: handling dependencies |  |
| L7:  17/10  18/10 | Memory subsystem: Caches |  |
| L8:  24/10  25/10 | Advanced Cache concepts and Virtual Memory |  |
| L9:  31/10  01/11 | Out-of-order execution: Tomasulo’s algorithm |  |
| L10:  07/11  08/11 | MIDTERM | 07/11: Programming Exam  08/11: Written Exam  *Note: both exams will be held outside regular class hours* |
| 14/11  15/11 | NO CLASS | We will make up for this lecture using an extra lecture Saturday 23/11 |
| L11:  21/11  22/11 | Out-of-order execution: advanced concepts |  |
| L12:  23/11 | Branch prediction | *Extra lecture in Pfizer Auditorium 1PM-4PM* |
| L13:  5/12  6/12 | Main memories and prefetching |  |
| 7/12 | SPARE LECTURE | *Pfizer Auditorium 1PM-4PM (the spare lecture will be only used in case any other lectures are cancelled for any reason)* |
| L14:  **12/12**  **13/12** | Data-flow Architectures: Hardware to Accelerate Machine Learning 期末不考 |  |
| L15:  **14/12** | Final Examination | *Note: the date of the final exam is not as per the regular schedule.* |

Readings

There is no required textbook for the course, but students might find the following book useful for reference:

John L. Hennesy and David A. Patterson, “Computer Architecture: A Quantitative Approach” [5th Edition], Morgan Kaufmann.

Course structure

Your performance in the course will be assessed via two graded labs (10% of the total grade), programming midterm (20% of the total grade), a written midterm (30% of total grade) and a final (40% of total grade).

In addition, there will be ungraded in-class quizzes and take-home HW assignments. Participation in these activities is highly encouraged.

**Policy on Academic Honesty**

In pursuing these goals, NYU expects and requires its students to adhere to the highest standards of scholarship, research and academic conduct. Essential to the process of teaching and learning is the periodic assessment of students' academic progress through measures such as papers, examinations, presentations, and other projects. Academic dishonesty compromises the validity of these assessments as well as the relationship of trust within the community.  Students who engage in such behavior will be subject to review and the possible imposition of penalties in accordance with the standards, practices, and procedures of NYU and its colleges and schools. Violations may result in failure on a particular assignment, failure in a course, suspension or expulsion from the University, or other penalties.

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