

SCS 3013/ CS 3004 – Computer Systems Architecture

Learning Objectives: To recognize high performance computer architecture as the basis for ‘informed’ software engineering and as foundation for understanding in compiler and operating systems design and parallel processing.

Learning Outcomes: At the end of the course you will be able to make *informed judgments* about architectural effects on applications software, optimizing compilers and their role, *identify* future directions in advance architecture, and software and hardware approaches for parallelism.

Recommended Text: Computer Architecture, A Quantitative Approach, Hennessey and Patterson, 4th Edition, Morgan Kaufmann (pub)

Other resources: Computer Architecture books by William Stalling, Michael Flynn, A S Tannenbaum and others, Wiki, Numerous lecture notes websites (e.g., MIT Openweb, Prof David Brooks’ notes at Harvard University) and our past examination papers.

Course Evaluation: one in-class, one take home and one presentation + end of semester exam (70%)

Contents:

Foundations

Performance Metrics: CPI, flops and SPEC suites

Instruction Pipelining: hazards, branch prediction

Instruction Level Parallelism: dynamic instruction scheduling, speculation

Multiple instructions issue: super scaling

Cache design: allocation and replacement policies

Thread Level Parallelism: multithreading and hyper threading

Multiprocessors: Amdahl’s Law, shared memory and distributed memory alternatives

Cache coherency in shared memory multiprocessors