

COMP 3370 - Computer Organization

Calendar Description: Principles of computer systems architecture, organization and design. Performance, instruction sets, processors, input/output, memory hierarchies.

Prerequisite: COMP 2280.

This course is a prerequisite for: COMP 4510, COMP 4550, and COMP 4690

Outline

1) Performance (2 weeks)

Introduction to proper performance calculations and comparisons, Issues with trying to improve performance by only changing one variable, the remainder of the material focuses on architectural designs that improve performance.

2) Memory (4 weeks)

Advanced memory organization via pre-fetch buffers and memory interleaving, Definition of the principal of locality and the memory hierarchy, Caching implementations and how memory (DDR RAM) is reorganized to optimize for caching, Include a discussion on how program performance can be affected by caching characteristics, Hardware support for virtual memory systems.

3) I/O (3 weeks)

Modern bus architectures, including bus signaling and timing diagrams, Basic I/O programming models: polling versus interrupts and special instructions versus memory mapped I/O, DMA architectures and programming, the affects of DMA on caching (i.e. cache snooping requirements and solutions).

4) Advanced CPUs (4 weeks)

The use of pipelines to provide concurrent execution of instruction streams, Pipeline hazards and techniques for dealing with such hazards (via hardware and compiler solutions). Improving basic pipelines: multiple pipelines, etc, Parallelism via multiple function units and hyper-threading architectures, Introduction to vector processing as seen in MMX, AltiVec, SSE, etc, Introduction to multi-processor and multi-core systems, Case study discussion of a modern (newly released) CPU.

Recommended Text: Patterson and Hennessy, Computer Organization and Design: The Hardware and Software Interface - Revised 4th edition published in 2011 by Morgan Kaufmann