

## Computer Design and Organization

### Tentative Outline

This document will be evolving during the course of the quarter. We won't have the time to look at everything! Also, I might add some new readings from time to time.

1. Review of pipelining, exceptions, cache organization, and common metrics for the performance of computer systems  
Reading: H&P. Appendix A pp A1-A47  
Chapter 5 Section 5.2 and almost all of Section 5.3, pp 392-410
2. Branch prediction. Static schemes. Dynamic branch prediction and branch-prediction buffers. Two-level branch prediction. Branch target buffers.  
Reading: H&P Chapter 3 Sections 3.4 and 3.5, pp 196-215
3. Instruction level parallelism - Introduction.  
Reading: H&P. Appendix A pp A47 - A57  
Chapter 3 Section 3.1 and beginning of Section 3.2 pp 172-184
4. Dynamic scheduling.
  - Scoreboard  
Reading: H&P. Appendix A pp A66 - A77
  - Tomasulo's algorithm.  
Reading: H&P Chapter 3 Sections 3.2 and 3.3 pp 181-196
5. Superscalar processors. Multiple instruction issue. Register renaming.  
Reading: H&P Chapter 3 Sections 3.6, 3.7 and 3.8 pp 215-253  
J.Smith and G. Sohi "The Architecture of Superscalar Microprocessors" Proc. IEEE, 83,12, Dec 1995.
6. VLIW and EPIC  
Reading: H&P Chapter 4 Sections 4.3, 4.5 and 4.7 pp 315-319, 340-350, 351-362
7. Multithreading. Coarse grain vs. fine grain. Simultaneous Multithreading (SMT).  
Reading: H&P Chapter 6 Section 6.9 pp 608-615
8. Cache hierarchies.  
Reading: H&P Chapter 5 Sections 5.3, 5.4 and 5.5 pp 406-435

9. Further cache optimizations (lock-up free caches, prefetching etc.)  
Readings: H&P Chapter 5 Sections 5.6 and 5.7 pp 435-448
10. Main memory (interleaving, synchronous memory, Rambus).  
Readings: H&P Chapter 5 Sections 5.8 and 5.9 pp 448-460
11. Virtual memory and TLB management  
Readings: H&P Chapter 5 Sections 5.10 and 5.11 pp 460-474
12. Shared-memory multiprocessors. Terminology (Shared-bus, SMP, NUMA).  
Readings: H&P Chapter 6 Section 6.1 pp 528-540
13. Cache coherence in SMP's  
Readings: H&P Chapter 6 Sections 6.3 and 6.4 pp 549-576
14. Synchronization  
Readings: H&P Chapter 6 Section 6.7 pp 590-604
15. Buses. Disks (RAID)  
Readings: H&P Chapter 7 Sections 7.3 and 7.5 pp 692-702, 705-710