CS/ECE 752: Advanced Computer Architecture I

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TERM PROJECT

Proposal due in Class Monday, 7 November 1994.
Talks 5-14 December 1994.
Report due Noon Monday, 19 December 1994.
Weight: 30%

The default project is to do some original research in a group of three students. For example, you could examine a modest extension to a paper studied in class or simply re-validate the data in some paper by writing your own simulator.

You will be graded on how well you define your problem, survey previous work, design and conduct experiments, and present your results. The goal to shoot for is *conference paper*, like the ones in your reader. Since time is limited, however, the above goal is hard to reach, and I will reward those that aim high even if they do not completely succeed. The key is insuring that some aspects of your work are completely done; it is very hard to grade a project where the simulator did not quite work. This type of project is especially recommended for students considering a Ph.D.

Alternatively, you may work in a group of two to write a paper that surveys an area within computer architecture. The paper should: (1) summarize work in an area, giving extensive references, (2) present opinions of others for and against various options (with references), and (3) conclude with *your opinion* of the strengths and weaknesses of arguments presented above. You will be graded on the completeness of your survey, the accuracy of your summaries, the support you give for your opinions, and the quality of your presentation. Since a survey paper is "safer" than a research project, I will hold survey papers to a higher standard of completeness and analysis of the literature.

I normally accept no late assignments. For this project, reports turned up to 24 hours late will be accepted with a 25% penalty. Don’t avail yourself of this option; your hard work deserves full credit.

Proposal

Proposals turned in earlier will get earlier feedback. Proposals should be about one-two pages long. They should include: (1) a description of your topic , (2) a statement of why you think the topic is interesting or important, (3) (for projects with original research) a description of the methods you will use to evaluate your ideas, and (4) a references to at least three papers you have obtained. The text and the papers we’ve read point to many papers. See also Proceedings of the International Symposium on Computer Architecture, Proceedings of the conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), IEEE Transactions on Computers, ACM Transactions on Computer Systems, IEEE Computer IEEE Micro, and Microprocessor Report.

Project Talks

We will divide up the last four or five lectures into 20-minute-ish conference-style talks. All group members should deliver part of the talk. The talk should give highlights of the final report, including the problem, motivation, results, conclusions, and possible future work. Time limits will be enforced to let everyone present. Please, practice your talk to make it better and see how long it is. Have a plan for what slides to skip if you get behind.

Report

Reports should consist of an abstract, body and optional appendices. The abstract should summarize the contributions of the report in one or two paragraphs. The length of the body should be the equivalent of 15-20 pages at double-spaced 10-point. Additional supporting material of any length can be put in appendices. I will read the body and only skim appendices.

Some Possible Research Topics

I encourage you to come up with your own topic. I also like topic that apply your own research strengths to architecture. If you are a database student, for example, you could study the interaction between a database and an architecture, and propose changes to one or both to improve performance or cost.

Study and conduct experiments (we have the SPEC92 int and fp benchmarks) to evaluate alternatives in:

- cache designs for the proposed SPEC95 benchmarks, databases, or other commercial workloads,
- proposed DRAM interfaces (e.g., Synchronous DRAM, RamBus and RamLink),
- instruction set enhancements (e.g., update-mode addressing, conditional register-to-register moves, and multiply-add instruction),
- speculative execution,
- static or dynamic branch prediction,
- non-blocking caches (with trace-driven simulation or by implementing them with the Mentor Graphics CAD tools,
- victim caches, stream buffers, and hashing,
- architectural support of operating systems (e.g., user-level traps for threads)
- study a specific aspect of a survey topic (below), and
- even better, talk to me and come up with your own topic.

Some Possible Survey Topics

Describe, compare and contrast (generally broader than the above research topics):

- compiler transformations to improve memory behavior,
- superscalar & pipelined vs. VLIW,
- effect on architecture of changing technology (e.g., Flash memories and fiber optics),
- high-performance I/O (e.g., RAIDs and ATM networks),
- the history of some aspect of computer architecture (e.g., stored-programs, caches, virtual memory, pipelining, microcode, protection, dataflow machines), and
- even better, talk to me and come up with your own topic.