



CS-4515, Computer Architecture,
D-term 2015

Topics for Team Projects

Spring 2015

The following topics are recommended for team projects in D-Term 2015. Each project should consist of one-hour presentation to the class and written report of the same material the form of a document in Microsoft Word. Both the presentation and document should include diagrams, charts, performance data, and/or PowerPoint slides.

Teams must start work early by reading the relevant chapters of Hennessy & Patterson thoroughly and by researching more up-to-date material on the same subject. Each team should schedule a meeting with the Professor early in the term in order to define and refine that team's project.

Each team *must* schedule a meeting with the Professor again at least seven days before the presentation.

Team A

Research and present an update of material described in §2.6 (Intel *Core i7* Memory Hierarchy) for the latest generation of the *Core i7*, or an equivalent processor. Include new performance information to the extent that it can be obtained on the Internet. Describe what has changed in the various generations of the *Core i7* and what the performance impact has been of those changes

Team B

Research and present an update of the material described in §2.6 (ARM *Cortex-A8*) but for a more recent model of microprocessor for tablets and high-end smart phones. Describe the benchmarks for assessing performance of these kinds of microprocessors, and include performance information to the extent that it can be obtained from the Internet. Describe the principal differences between microprocessors for desktop/laptop computers and tablet/smartphone systems, and describe what has changed since the ARM *Cortex-A8* described in the textbook.

Team C

Prepare and present a graphic, visual demonstration and explanation of how Tomasulo's algorithm works. Show its applicability in processors of modern, high-performance computing facilities such as the IBM Blue Gene/Q dedicated to heavy-duty numerical computation. Support your presentation with benchmark information obtainable from the Internet.

Team D

Research and present an update of the material described in §3.13, particularly the *Intel Core i7*. Show how the computational pipeline has evolved since the textbook was written in 2011. Support your presentation with up-to-date benchmark information obtainable from the Internet. Note that this

topic and that of *Team A* are closely related. *Team A* should focus on the memory hierarchy, whereas *Team D* should focus on the computational pipeline.

Team E

Give a one-hour overview of GPUs, half of which explains how they are used and programmed, and half of which is discusses how they work and how they meet their performance goals. For illustration, select a GPU model *more recent than* the *NVidia* GPUs presented in §4.4 of the textbook.

Team F

Obtain a copy of the SPEC 2006 benchmarks from the Professor and run them on as many different processors that you can lay your hands on. Plot the changes in performance as a function of the changes to generations within each processor family.

Team G

Analyze the synchronization issues in a large distributed-memory multiprocessor running a Linux kernel. Obtain a copy of a 2014 MIT paper on the subject that addressed the performance of kernel operations involving data distributed across the processors of the cluster.

Team H

Give a one-hour overview of the Amazon EC2, updated from the textbook description. Show the principal issues of warehouse-scale computing as practiced in 2015. Include a discussion of virtualization, how it is used in a system like the EC2, and how it affects processor design.

Alternative topics

A team may propose an alternative topic to one of these eight. The topic must involve some advance aspect of computer architecture, and it must result in an interesting written and oral report relevant to the subject matter of this course.

The alternative topic should be proposed and approved within the first two weeks.