

Portland State University – ECE 587/687

Homework 2

Due: April 22nd

Use the SimpleScalar “sim-outorder” model and the “gcc” benchmark to evaluate the performance impact of the following configuration parameters:

- a) Out of order issue (compare in-order vs. out-of-order)
- b) Pipeline width (compare 1-wide, 2-wide, 4-wide, 6-wide, and 8-wide)
- c) Pipeline length (compare lengths of 5, 10, 15, and 30)
- d) Branch prediction strategies (compare always not taken, always taken, bimodal, and 2-level adaptive predictors)
- e) Instruction cache size (compare 4KB, 16KB, 32 KB and 64KB)
- f) Data cache size (compare 4KB, 8KB, 16KB, and 32KB, all 4-way set associative)
- g) Data cache associativity (compare 1-way, 2-way, 4-way, 8-way, all 32KB)
- h) L2 cache size (compare 128KB, 256KB, 512KB, and 1MB)

For each of a) to h) above, you should run the simulator using the default parameters except for the parameter under study. You should run the “gcc” benchmark for 10 million instructions after skipping 100 million instructions. The results should be compared using the number of instructions per cycle (IPC) for the executed program. For each of these studies, you should generate a table containing the IPC of each configuration as well as the speedup of each configuration over the default configuration. Speedup is computed as the IPC of the current configuration divided by the IPC of the default configuration. For example, the table for a) may be:

Configuration	IPC	Speedup
In-order	0.3	0.25
Out-of-order	1.2	1.0

(Values in the table are for illustration only and not from actual simulations. The default configuration is out-of-order, so its speedup is 1.0. The speedup of in-order = $0.3/1.2 = 0.25$)