CSEE W3827

Fundamentals of Computer Systems

Homework Assignment 5

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Due Apr 12, 2016 by 5:00 PM

- Write your name **and UNI** on each page of your solutions.
- Note your collaborators.
- Turn in to the CSEE 3827 dropbox in the TA room.

1. (30 pts.) Using the single cycle MIPS implementation (mips-uarch.pdf, slide 14) as a reference, indicate the value on the wires listed in the table below for each of the three instructions. Use use as specific a descriptor as possible. For example the value in memory at address A could be indicated with "Mem[A]" or the value of register $ra might be "Reg[ra]".

	`beq $0, $0, 8`	`lw $s1, 12($sp)`	`add $t0, $t3, $t0`
SrcA			
SrcB			
ALUControl			
WriteReg			
SignImm			
PCBranch			
WriteData			
PCSrc			
Result			

2. (20 pts.) Explain why the instructions listed below *must be* pseudo instructions (i.e., why they *cannot be* non-psdeudo).

   - `bge`
   - `b`
   - `mul`
   - `beqz`

3. (30 pts.) Assuming the single cycle datapath with the components and critical path described on the slides (mips-uarch.pdf, slide 17) as a baseline, analyze the impact of the following changes. In each case, indicate how much faster or slower the processor would be. E.g., 2x faster, or 0.3x slower.

   (a) If the ALU and adders were all made twice as slow, but the register file became twice as fast...

(b) If register setup times were increased by 5x...

(c) If the mux delay were reduced from 25ps to 5ps...

4. (20 pts.) A "stuck at" fault is a fabrication error where a wire is stuck at some constant value no matter what. Below, design a small MIPS function called `branchtest` to detect whether the `Branch` control wire is stuck at 1. Your function should take no arguments and return 1 if `Branch` is stuck at 1 and 0 otherwise.

   Note: The functon should respect calling conventions, and use only instructions supported by our single cycle processor (`lw, sw, beq, addi, add, slt, and, or, addu, subu`, plus `jr` to return from the function.