The University of Alabama in Huntsville
ECE Department
CPE 431 01
Test 1
October 6, 2015

Name: _____

1. (1 point) A _____ is a computer used for running larger programs for multiple users, often simultaneously, and typically accessed only via a network.
2. (1 point) An _____ is a word constructed by taking the initial letters of a string of words.
3. (1 point) The _____ is the field that denotes the operation and format of an instruction.
4. (1 point) Hiding details from the higher level is an example of the great idea of _____.
5. (1 point) _____ is an approach whereby the compiler or processor guesses the outcome of an instruction to remove it as a dependence in executing other instructions.
6. Extra Credit (1 point) If at first you don't succeed, _____.
7. (15 points Write down the hexadecimal representation of the decimal number -25.1 assuming the IEEE 754 double precision format.

8. (15 points) For the MIPS assembly instructions below, what is the corresponding C statement? Assume that the variables `f`, `g`, `h`, `i`, and `j` are assigned to registers `$s0`, `$s1`, `$s2`, `$s3`, and `$s4`, respectively. Assume that the base address of the arrays `A` and `B` are in registers `$s6 and $s7`, respectively.

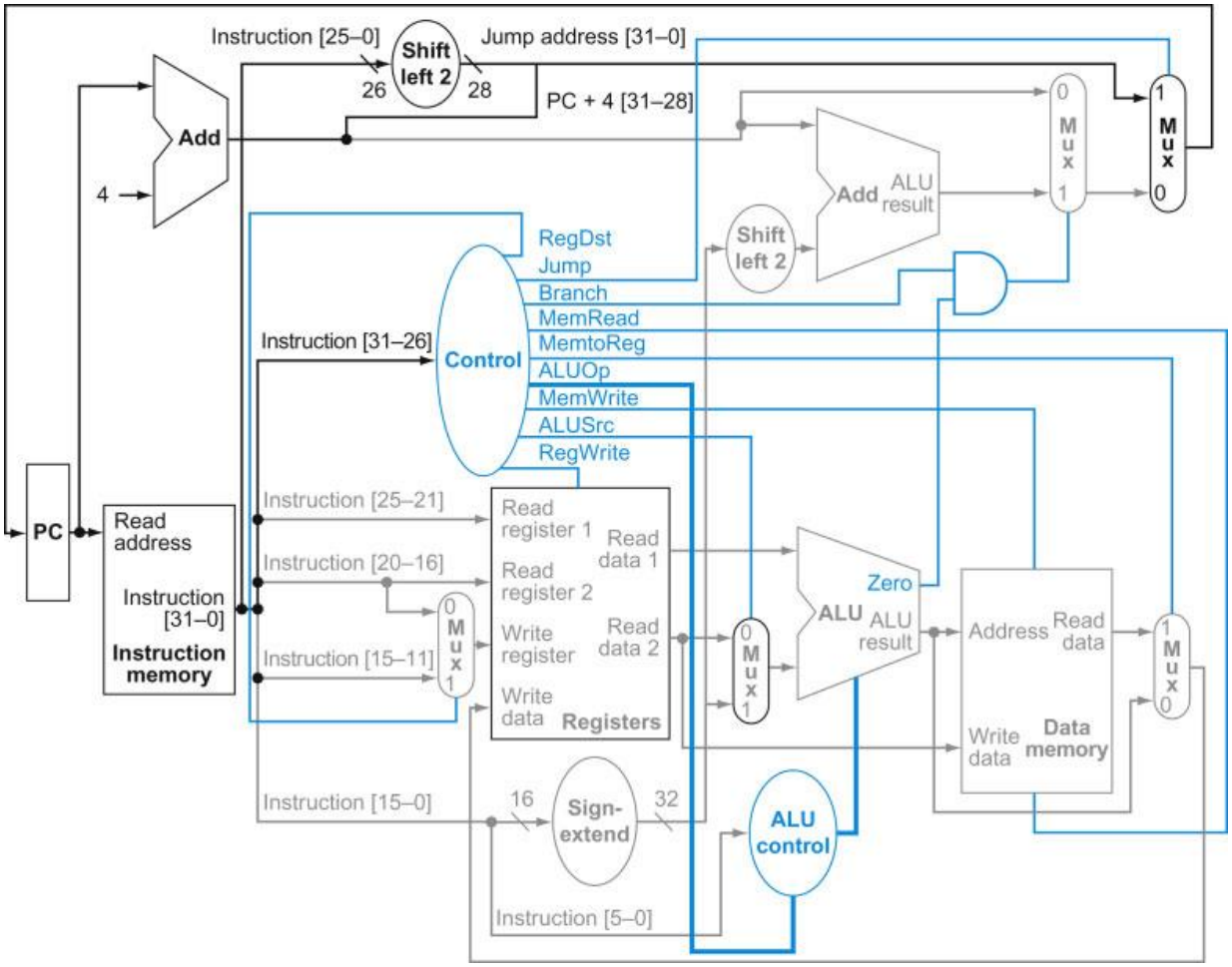
Statement	Comment
`sll $t0, $s0, 2`	
`add $t0, $s6, $t0`	
`sll $t1, $s1, 2`	
`add $t1, $s7, $t1`	
`lw $t3, 0($t0)`	
`addi $t2, $t0, 8`	
`lw $t2, 0($t2)`	
`sub $t0, $t3, $t2`	
`sw $t0, 0($t1)`	

9. (10 points) Provide the type and hexadecimal representation of the following instruction:
`addu $s3, $s1, $a3`

10. (15 points) When processor designers consider a possible improvement to the processor datapath, the decision usually depends on the cost/performance trade-off. In the following three problems, assume that we are starting with the datapath shown.

Element	I-Mem	Add	Mux	ALU	Regs	D-Mem	Control	ALU Control	Sign Extend	Shift Left 2
Latency (ps)	300 ps	100	40	120	150	300	100	85	15	30

a. (10 points) What is the clock cycle time for this datapath?
b. (5 points) How would it change if the control time was 300 ps rather than 100 ps?



11. (20 points) Consider three different processors P1, P2, and P3 executing the same instruction set. P1 has a 2.8 GHz clock rate and a CPI of 1.5. P2 has a 2.5 GHz clock rate and a CPI of 1.2. P3 has a 4.0 GHz clock rate and has a CPI of 2.5.
    a. (12 points) Which processor has the highest performance?
    b. (4 points) If P2 executes this program in 10 seconds, find the number of cycles and the number of instructions for P2.
    c. (4 points) We are trying to reduce the execution time for P2 by 30% but this leads to an increase of 20% in the CPI. What clock rate should we have to get this time reduction for P2?

12. (20 points) Consider the following code executing on a MIPS five stage pipeline that has full forwarding and in which branches are resolved in the MEM stage. Neglecting pipeline fill, how many cycles does it take to execute this code, given the branch taken/not taken information given in the comments?

```
         add   $t1, $t1, $t0
         lw    $t2, 0($t1)
label1:  beq   $t2, $zero, label2    # not taken once, then taken
         lw    $t3, 0($t2)
         sw    $t3, 0($t1)
         beq   $t3, $zero, label1    # taken
         add   $t1, $t3, $t1
label2:  sw    $t1, 0($t2)
```

Cycle	IF	ID	EX	MEM	WB
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					