The University of Alabama in Huntsville
Electrical and Computer Engineering Department
CPE 221 01
Fall 2012
Test 1
October 16, 2012

This test is closed book, closed notes. You may not use a calculator. You should have the reference packet that includes Figure 2.10 and Appendix B. You must show your work to receive full credit.

Name: _____

1. (1 point) The _____ contains information about the location of the next instruction.

2. (1 point) The design of the storage cells and the interconnections between them is known as the _____.

3. (1 point) A _____ is the address to which control is transferred as a result of a branch instruction.

4. (1 point) A _____ is used to control what is allowed to drive a bus.

5. (1 point) _____ RTN is implementation independent.

6. (5 points) The PowerPC 601 processor addresses a maximum of 2^{48} bytes of memory. What is the maximum number of 32-bit words that can be stored in this memory?

7. (10 points) Represent 154 and -199 as signed 16-bit numbers

8. (20 points) Consider the following SRC program. Trace the values of the registers shown as they change during program execution. Also, trace the writes to memory by the st instruction. There may be unused columns or rows in the tables. If you need to add columns or rows, you may do so. dc 1 reserves one word of storage and sets it equal to 1.

```
cnt:  .equ   5
      .org   0
seq:  .dc 1
next: .dc 1
ans:  .dw  cnt
      .org 0x1000
      lar  r31, loop
      la   r0, cnt
      la   r1, seq
loop: ld   r2, 0(r1)
      ld   r3, 4(r1)
      add  r2, r2, r3
      st   r2, 8(r1)
      addi r1, r1, 4
      addi r0, r0, -1
      brnz r31, r0
```

	Initial Value	Second Value	Third Value	Fourth Value	Fifth Value	Sixth Value	Seventh Value
r0							
r1							
r2							
r3							
r4							
r5							

Results of the `st` instruction.

Memory Address	Contents

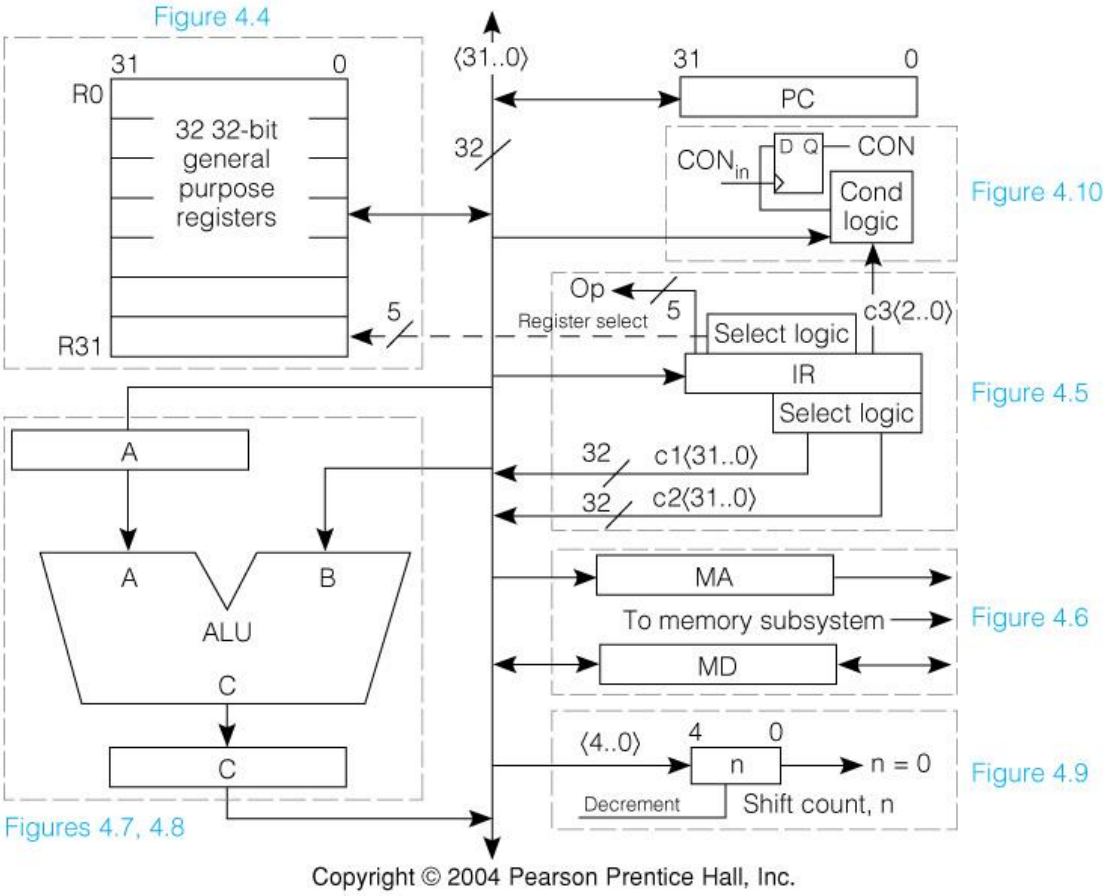
9. (15 points) Encode the selected statements from the SRC program shown below in hexadecimal.

```
cnt:    .equ 8
        .org 0
seq:    .dc 1
next:   .dc 1
ans:    .dw cnt
        .org 0x1000
         lar   r31, loop
         la    r0, cnt
         la    r1, seq
loop:    ld    r2, 0(r1)
         ld    r3, 4(r1)
         add   r2, r2, r3
         st    r2, 8(r1)
         addi  r1, r1, 4
         addi  r0, r0, -1
         brnz  r31, r0
```

Address	Label	Instruction	op	ra	rb	rc	c1	c2	c3	Hexadecimal
		`la   r0. cnt`								
		`st   r2, ans(r1)`								
		`addi r1, r1, 4`								

10. (25 points) Write the code to implement the expression A = (((B * C) + D) * E)/F) on 3-, 2-, 1-, and 0-address machines. Do not rearrange the expression. In accordance with programming language practice, computing the expression should not change the values of its operands.

11. (20 points) Write concrete RTN steps for the SRC instruction ldr using the 1-bus SRC microarchitecture shown.



T0	
T1	
T2	
T3	
T4	
T5	
T6	
T7	