ELL-782: Computer Architecture
Quiz 1
Time: 1 hour 30 minutes

Maximum Marks 30

Q1. Consider the following code snippet and select the correct option. (2 Marks)

```
movh r0, 0xFB12
movh r1, 0x1212
cmp r0, r1
```

1. SimpleRISC does not support these instructions.
2. Flags.GT=0 and Flags.E=0
3. Flags.GT=1 and Flags.E=1
4. Flags.GT=0 and Flags.E=1
5. Flags.GT=1 and Flags.E=0
6. Flags.GT=1 and Flags.E retains the previous value

Q2. Select the correct option to execute the code correctly in a SimpleRisc Pipeline: (3 Marks)

```
add r1, r2, r3
add r4, r1, 3
add r8, r5, r6
add r9, r8, r5
add r10, r11, 12
add r13, r10, 2
```

1.
```
add r1,r2,r3
add r8,r5,r6
add r10,r11,r12
add r4, r1, 3
nop
add r9, r8, r5
add r13, r10, 2
```

2.
```
add r1,r2,r3
add r8,r5,r6
add r10,r11,r12
add r9, r8, r5
add r4, r1, 3
add r13, r10, 2
```

3. add r1,r2,r3
   add r8,r5,r6
   add r10,r11,r12
   nop
   add r4, r1, 3
   add r9, r8, r5
   add r13, r10, 2

4. add r1,r2,r3
   add r8,r5,r6
   add r10,r11,r12
   add r4, r1, 3
   add r13, r10, 2
   add r9, r8, r5

Q3. Which of the following SimpleRISC codes will find the LCM of two positive numbers:
(3 Marks)

1. mov r1, 12
   mov r2, 14
   mov r3, 1
   mov r4, r1
   .loop:
      mod r5, r4, r2
      cmp r5,0
      beq .lcm
      add r3,r3,r2
      mul r4,r1,r3
      b .loop
   .lcm:
       mov r0,r4
2. mov r1, 12
   mov r2, 14
   mov r3, 1
   mov r4, r1
   .loop:
      div r5, r4, r2
      cmp r5,1
      beq .lcm
      add r3,r3,1
      mul r4,r1,r3
      b .loop
   .lcm:
       mov r0,r4
3. mov r1, 12
   mov r2, 14
   mov r3, 1
   mov r4, r1

```
.loop:
   mod r5, r4, r2
   cmp r5,0
   beq .lcm
   add r3,r3,1
   mul r4,r1,r3
   b .loop
.lcm:
    mov r0,r4
```

4. None of the above

Q4. Select the incorrect statement. **(2 Marks)**

A: The stack pointer maintains a pointer to the bottom of the stack.
B: 'Call' and 'ret' change the PC value.
C: The performance of a processor is dependent on the manufacturing technology, architecture, and compiler optimizations.
D: An in-order processor can execute instructions in an order that is not consistent with the program order.

1. Only A
2. Both A and D
3. Both A and C
4. All statements are correct

Q5. Consider the following SimpleRISC code. What is the minimum number of stalls required in this code? Assume that for a 5-stage pipeline, the *beq* instruction is a taken branch and no delayed branches are supported, there is no forwarding and no code rearrangement is allowed? **(3 Marks)**

```
add r1,r2,r3
sub r4,r4,r3
mul r2,r1,r2
beq .foo
.next:
   add r5,r2,r1
   ld r6, 8[r5]
   mul r8,r6,r10
   ….
   ….
.foo
   ld r1, 0[r3]
   b .next
```

1. 13
2. 14
3. 12
4. 8

Q6. You are given a 32-bit number ‘n’ stored in the register ‘r0’, you need to write a **one-line SimpleRISC code** to set the odd numbered bits from 1 to 16 to zero, and the most significant bits from 16 to 32 to 0. Store the final result in the register ‘r1’.
Convention: The LSB is numbered as bit 1 and the MSB is numbered as bit 32. **(2 Marks)**

Q.7. Write an iterative program to compute the factorial of a number stored in the register ‘r0’. Save the final result in the register ‘r1’. **(4 Marks)**

Q.8. You are given two programs P1 and P2. For P1, 10% of the instructions have a load-use hazard, and 15% of its instructions are the taken branches. For P2, 20% of the instructions have a load use hazard, and 5% of its instructions are the taken branches. What will be the CPI of the two programs? Assume that the ideal CPI is 1. Assume forwarding. There are no delayed branches. **(3 Marks)**

1. CPI of P1=1.4 and CPI of P2=1.4
2. CPI of P1=1.3 and CPI of P2=1.4
3. CPI of P1=1.3 and CPI of P2=1.3
4. None of the above

Q.9. Write a SimpleRISC program to compute x^n. where *x* and n are the natural numbers. Assume that x is passed through r0, n through r1, and the return value is passed back to the original program via r0.
(4 Marks)

Q.10. Write a SimpleRISC program to test if a number stored in r0 is prime or not. Save the result in r1. If the number is prime, set r1 to 1, otherwise set it to 0.

(4 Marks)