

EXAM I

110 MINUTES

WORK ALL PROBLEMS

OPEN BOOK

(35 pts)

1) Consider the following piece of EMY mnemonic machine language program :

```

400000    LW      R9, 0(R8)          # R8 initially has 10000000
400004    SLT    R10, R9, R0
400008    BEQ    R10, R0, 2
40000C    SUB    R9, R0, R9
400010    SW     R9, 0(R8)
400014    SLL   R9, R9, 1
400018    SW     R9, 4000(R8)
-----
10000000  7
-----
10004000  ?
    
```

a) **Obtain** a table that shows the values of registers and memory locations used by the above piece of EMY code as shown in class. Also **show** the number of memory accesses made for each instruction. Determine what this piece of code does. That is, what is its **purpose** ?

b) **Invent** a new EMY instruction that implements the first **five** instructions in locations 400000-400010 in the above code : Indicate **only** the following : Its syntax, semantics, format and the memory accesses made. Then, rewrite the above code starting at 400000 so that the **new** EMY instruction is used.

(55 pts)

2) Consider the following piece of EMY mnemonic machine language program :

```

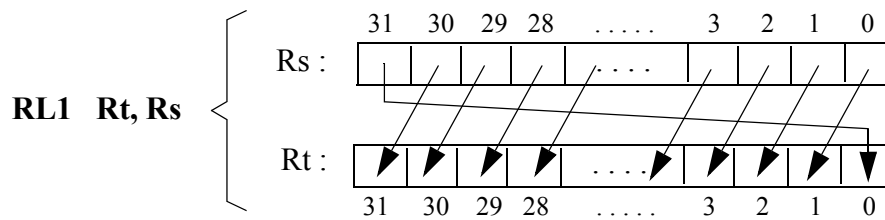
400000    SLT    R9, R8, R0          # R8 initially has F0F0F0F0
400004    SLL   R10, R8, 1
400008    ???   ???
40000C    ORI   R10, R10, 1
    
```

Assume that the above piece of code implements the following **pseudoinstruction** :

- The **syntax** of the pseudoinstruction : RL1 Rt, Rs

- The **semantics** of the pseudoinstruction : Rt ← Rotate Rs Left by 1

The pseudoinstruction rotates Rs to the left by 1 and then stores on Rt, hence the name “RL1.”



Above, the pseudoinstruction is used as follows : RL1 R10, R8

a) **Determine** the instruction in location 400008 in the code. **Explain** your decision. **Add** comments to each instruction of the code above.

b) Then, **Obtain** a table that shows the values of registers and memory locations used by the new piece of EMY code as shown in class. Also **show** the number of memory accesses made for each instruction.

c) Assume that the RL1 instruction is added to the EMY instruction set. **Indicate** the instruction format, arguments, addressing modes, memory accesses made, etc. of the new instruction. If there is a **new** addressing mode **not** discussed in class, indicate so.

d) Consider the following piece of EMY mnemonic machine language code that uses the **new** instruction :

```

400000  ADD      R9, R8, R0          # R8 has 4 initially
400004  RL1     R9, R9
400008  ADDI    R10, R10, (-1)10   # R10 has 3 initially
40000C  BNE    R10, R0, (-3)10

```

Obtain a table that shows the values of registers and memory locations used by this piece of EMY code as shown in class. Also **show** the number of memory accesses made for each instruction. **Determine** what this piece of code does ! That is, what is its **purpose** ?

(10 pts)

3) Consider the following sequence of 32 bits :

1100 0000 1011 0000 0000 0000 0000 0000

Assume that this 32-bit sequence is a single-precision IEEE-754 format floating-point number. **Determine** the value in decimal as shown in class.

Make sure to show the intermediate steps.