IN1006 Systems Architecture (PRD1 A 2022/23)

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Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

What is the difference when executing instructions `ADD x` and `ADDI x` ?

Select one:

- a. There is no difference between the two instructions if x is the current value of MBR
- b. ADD x loads the value of PC to the AC; ADDI loads the value found at x to the MBR and adds the value of MBR to the AC
- c. ADD x adds the value at address x to the AC; ADDI x adds the value found in the location addressed by the value in location x to the AC ✔
- d. ADD x loads the value at address x to the AC; ADDI x loads the value x to the AC
- e. ADD x loads the value of MBR to AC; ADDI x adds the value of IR to AC.

ADD x adds the value of the memory word with address x to the AC, whereas ADDI x adds the value of the memory word whose address is the value of the memory word with address x to the AC.

The correct answer is: ADD x adds the value at address x to the AC; ADDI x adds the value found in the location addressed by the value in location x to the AC

Question **2**

Correct

Mark 1.00 out of 1.00

Consider the MARIE instructions Skipcond and Clear. Which of the following CPU registers are not used in the execution of any these instructions?

Select one:

- a. MAR, MBR, InReg, OutReg ✔
- b. Don't know/No answer
- c. MAR and MBR
- d. InReg, OutReg
- e. MAR, MBR, InReg, OutReg and PC

The execution of the instruction Skipcond uses only the registers AC and PC. The execution of the instruction Clear uses only the register AC.

The correct answer is: MAR, MBR, InReg, OutReg

Question **3**

Correct

Mark 1.00 out of 1.00

Consider the following MARIE code. What does this code do?

```
If,     Load X
        Add X
        Subt Y
        Skipcond 400
        Jump Else
Then,   Load X
        Add X
        Output
        Jump Endif
Else,   Load Y
        Subt X
        Store Y
Endif,  Halt
X,      Dec 10
Y,      Dec 12
```

Select one:

- a. It will store the decimal value 12 in the memory position X and terminate.
- b. It will store the decimal value 2 in the memory address Y and terminate. ✔
- c. It will output the decimal value 2 and terminate.
- d. It will output the hexadecimal value 2 and terminate.
- e. It will compute and store the decimal value 3 and terminate.

This program executes an "If, then, else" statement using the Skipcond instruction. In this case, the condition in Skipcond is 01. So, PC will become PC+1 if AC=0 and the "Then" part of the code will be executed. If AC <> 0 then the "Else" part of the code will be executed. After the execution of the first three statements, AC will be 8, so the "Else" part of the code will be executed. So the program will compute Y-X=2, store this value in memory position Y and will terminate.

The correct answer is: It will store the decimal value 2 in the memory address Y and terminate.

Question **4**

Correct

Mark 1.00 out of 1.00

Consider the following MARIE code. The code starts at address 000: the first instruction is saved at address 000.

After the execution of this code what is the value (in decimal) stored in the OutREG register?

```
If,     Load X
        Subt Y
        Skipcond 400
        Jump Else
Then,   Load X
        Add Z
        Output
        Jump Endif
Else,   Load X
        Subt Z
        Output
Endif,  Halt
X,      Dec 7
Y,      Dec 5
Z,      Dec 2
```

Select one:

- a. 5 ✔
- b. Don't know/No answer
- c. 3
- d. 7
- e. 1

This program executes the "If, then, else" statement using the Skipcond instruction. In this case, the condition in Skipcond is set to 400 and so IR[11-10] is 01. So, the statement (if AC=0 then PC=PC+1) is evaluated and the "Else" part of the code is executed since AC equals to 2. The program then continues to execute and the "Output" instruction outputs the value of OutREG and OutREG=AC and AC is X-Z=5 and terminates at "Halt". So the answer is 5.

The correct answer is: 5

Question **5**

Correct

Mark 1.00 out of 1.00

How many components of MARIE architecture can use the bus simultaneously?

Select one:

- a. 3 components
- b. 2 components
- c. 1 component ✔
- d. All components
- e. Don't Know/No answer

Your answer is correct.

The correct answer is: 1 component

Question **6**

Correct

Mark 1.00 out of 1.00

Consider the following MARIE program. What is the outcome of the program?

```
        Clear
        Add X
LoopC,  Skipcond 800
        Jump LoopEnd
Loop,   Output
        Subt Y
        Jump LoopC
LoopEnd, Halt
X,      Dec 5
Y,      Dec 1
```

Select one:

- a. The program will output the decimal numbers 5, 4, 3, 2 and 1 before ending. ✔
- b. The program will output the decimal numbers 5, 4, 3, 2, 1 and 0 before ending.
- c. The program will do nothing.
- d. The program will compute the expression 5 + 4 + 3 + 2 +1 (i.e., 15) before ending.
- e. The program will compute the expression 5 - 4 - 3 -2 -1 (i.e., - 5) before ending.

This program executes a "Loop" using the Skipcond instruction. In this case, the condition in Skipcond is set to 10 and so IR[11-10] is 10. Thus, if AC>0 then PC will become PC+1 and the execution will continue from "Loop" . Otherwise, the execution will continue from "LoopEnd". Initially (after the execution of the first two statements) the AC will be 5 (>0) and thus the instruction at the position "Loop" will be executed outputing 5 (i.e., the current value of AC). Then 1 will be subtracted from AC and the execution will continue from LoopC (due to the "Jump LoopC" instruction). This time the AC will be 4 so the evaluation of Skipcond will make the program continue from "Loop" again, this time outputing 4 first and then subtracting 1 from it. This will continue until AC becomes 0, at which point the program execution will jump to "LoopEnd" and will be halted. Thus, the program will output the values 5, 4, 3, 2 and 1 before halting.

The correct answer is: The program will output the decimal numbers 5, 4, 3, 2 and 1 before ending.

Question **7**

Correct

Mark 1.00 out of 1.00

Which MARIE instruction is being carried out by the microoperation that follows?

$PC \leftarrow X$

Select one:

- a. Load X
- b. Store X
- c. Don't know/No answer
- d. Jump X ✔
- e. Add X

The correct answer is: Jump X

Question **8**

Correct

Mark 1.00 out of 1.00

Consider the next MARIE instructions: Load, Add, Store, Subt, Input and Output. Which of the following MARIE registers is not always used in the FDE cycle of the above instructions?

Select one:

- a. AC
- b. MAR
- c. InREG ✔ Not used for anything but input (Input instruction)
- d. PC

The correct answer is: InREG

Question **9**

Correct

Mark 1.00 out of 1.00

Consider the following MARIE program. What is the outcome of the program?

```
            Clear
            Add X
            Store Sum
LoopC,      Skipcond 800
            Jump LoopEnd
Loop,       Output
            Subt Y
            Jump LoopC
LoopEnd,    Halt
X,          Dec 10
Y,          Dec 2
Sum,        Dec 0
```

Select one:

- a. The program will compute the expression 10, 9, 8, 7 and 6 before ending.
- b. The program will output the decimal numbers 10, 8, 6, 4, 2 and 0 before ending.
- c. The program will output 2 for five consecutive times before ending.
- d. The program will output the decimal numbers 10, 8, 6, 4 and 2 before ending. ✔
- e. The program will compute the expression 10+8+6+4+2 (i.e., 30) before ending.

This program executes a "Loop" using the Skipcond instruction. In this case, the condition in Skipcond is set to 10 and so IR[11-10] is 10. Thus, if AC>0 then PC will become PC+1 and the execution will continue from "Loop" . Otherwise, the execution will continue from "LoopEnd". Initially (after the execution of the first two statements) the AC will be 10 (>0) and thus the instruction at the position "Loop" will be executed outputing 10 (i.e., the current value of AC). Then 2 will be subtracted from AC and the execution will continue from LoopC (due to the "Jump LoopC" instruction). This time the AC will be 8 so the evaluation of Skipcond will make the program continue from "Loop" again, this time outputing 8 first and then subtracting 2 from it. This will continue until AC becomes 0, at which point the program execution will jump to "LoopEnd" and will be halted. Thus, the program will output the values 10, 8, 6, 4 and 2 before halting.

The correct answer is: The program will output the decimal numbers 10, 8, 6, 4 and 2 before ending.

Question **10**

Correct

Mark 1.00 out of 1.00

Which of the following pair of values usually make up an instruction in a simple instruction set?

Select one:

- a. Operand, Address
- b. Operation, FDE
- c. Operation, Instruction Length
- d. Don't know/No answer
- e. OpCode, Address ✔

Your answer is correct.

The correct answer is: OpCode, Address

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