IN1006 Systems Architecture (PRD1 A 2022/23)

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State	Finished
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Time taken	18 mins 54 secs
Grade	**8.90** out of 10.00 (**89**%)

Question **1**

Correct

Mark 1.00 out of 1.00

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

```
        Load X
        Store Sum
LoopC,  Skipcond 800
        Jump LoopEnd
Loop,   Subt Y
        Store W
        Add Sum
        Store Sum
        Load W
        Jump LoopC
LoopEnd, Halt
X,      Dec 4
Y,      Dec 1
Sum,    Dec 0
W,      Dec 0
```

Select one:

- a. The program will halt immediately after reaching the Skipcond instruction for the first time.
- b. The program will compute the expression 4+2+0 before ending.
- c. The program will compute the sum 4+3+2+1+0 and store it in Sum before ending. ✔
- d. The program will compute the sum 4+3+2+1+0 before ending.
- e. The program will output the values 4, 3, 2, 1 and 0 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 4 (>0) and the value 4 will be stored in Sum. Thus the instruction at the position "Loop" will be executed subtracting 1 from AC, adding its value to Sum and storing the updated value to Sum (this will make the value of Sum equal to 7, i.e., 4+3). Then the execution will continue from LoopC (due to the "Jump LoopC" instruction). This time the AC will be 3 so the evaluation of Skipcond will make the program continue from "Loop" again, this time subtracting 1 first from AC and then adding its value (i.e., 2) to Sum. 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 find the sum of values 4+3+2+1+0 and store it in the memory position Sum before halting.

The correct answer is: The program will compute the sum 4+3+2+1+0 and store it in Sum before ending.

Question **2**

Correct

Mark 1.00 out of 1.00

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

```
If,     Load 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 5
```

Select one:

- a. It will output the hexadecimal value -5 and terminate.
- b. It will store the octal value 5 and terminate.
- c. It will store the hexadecimal value -5 in the memory address X and terminate.
- d. It will compute the decimal value -5, store it in Y and terminate. ✔
- e. It will compute and store the decimal value 5.

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 two statements, AC will be 5, so the "Else" part of the code will be executed. So the program will compute Y-X=-5, store this value in Y and terminate.

The correct answer is: It will compute the decimal value -5, store it in Y and terminate.

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 output the hexadecimal value 2 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 compute and store the decimal value 3 and terminate.
- e. It will store the decimal value 12 in the memory position X 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

Does the following sequence of microoperations or any subsequence of it correspond to any MARIE instruction and if so which?

$$MAR \leftarrow Y$$
$$MBR \leftarrow M[MAR]$$
$$MAR \leftarrow MBR$$
$$MBR \leftarrow M[MAR]$$
$$AC \leftarrow AC + MBR$$

Select one:

- a. ADDI Y ✔
- b. There is no MARIE instruction that corresponds to the above sequence of micro operations or a subsequence of it.
- c. LOADI Y
- d. ADD AC+Y
- e. LOADI Y+Y

The first microoperation assigns Y to MAR. The next 3 microoperations load the value of the memory word whose address is the value of the memory word with address Y to MBR. And the final microoperation adds the value of MBR to AC. Hence given microoperations correspond to the MARIE instruction ADDI Y.

The correct answer is: ADDI Y

Question **5**

Correct

Mark 1.00 out of 1.00

What is the difference in operation between a LOAD x and a LOADI x instruction?

Select one:

- a. LOAD loads the value x to the AC; LOADI loads the value found at x to the AC
- b. The LOAD loads the value at address x to the AC; the LOADI loads the value found in the location addressed by the value in x to the AC ✔
- c. The LOAD loads the value at address x to the AC; the LOADI loads the value x to the AC
- d. Don't know/No answer
- e. There is no difference if x is the same

Your answer is correct.

The correct answer is: The LOAD loads the value at address x to the AC; the LOADI loads the value found in the location addressed by the value in x to the AC

Question **6**

Correct

Mark 1.00 out of 1.00

Which MARIE instruction is being carried out by the microoperations that follow?

$MAR \leftarrow X$
$MBR \leftarrow M[MAR]$
$AC \leftarrow AC - MBR$

Select one:

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

The correct answer is: Subt X

Question **7**

Correct

Mark 1.00 out of 1.00

Which MARIE instruction is being carried out by the microoperations that follow?

$MAR \leftarrow X$
$MBR \leftarrow M[MAR]$
$AC \leftarrow AC + MBR$

Select one:

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

The correct answer is: Add X

Question **8**

Incorrect

Mark -0.10 out of 1.00

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

Select one:

- a. ADD x loads the value at address x to the AC; ADDI x loads the value x to the AC ✖
- b. 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
- c. There is no difference between the two instructions if x is the current value of MBR
- d. ADD x loads the value of MBR to AC; ADDI x adds the value of IR to AC.
- e. 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

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 **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 output the decimal numbers 10, 8, 6, 4 and 2 before ending. ✔
- b. The program will output 2 for five consecutive times before ending.
- c. The program will output the decimal numbers 10, 8, 6, 4, 2 and 0 before ending.
- d. The program will compute the expression 10+8+6+4+2 (i.e., 30) before ending.
- e. The program will compute the expression 10, 9, 8, 7 and 6 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 MARIE instruction is being carried out by the microoperation that follows?

$PC \leftarrow X$

Select one:

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

The correct answer is: Jump X

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