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

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 4
Sum,    Dec 0
```

Select one:

a. The program will output the decimal numbers 10, 8, 6, 4, 2 and 0 before ending.

b. The program will output the decimal numbers 10, 6 and 2 before ending. ✔

c. The program will compute the expression 10+6+2 (i.e., 18) before ending.

d. The program will compute the expression 10, 8, 6, 4 and 2 before ending.

e. The program will output 4 for three consecutive times 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 4 will be subtracted from AC and the execution will continue from LoopC (due to the "Jump LoopC" instruction). This time the AC will be 6 so the evaluation of Skipcond will make the program continue from "Loop" again, this time outputing 6 first and then subtracting 4 from it. This will continue until AC becomes -2, at which point the program execution will jump to "LoopEnd" and will be halted. Thus, the program will output the values 10, 6, and 2 before halting.

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

Question **2**

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 compute the expression 10+8+6+4+2 (i.e., 30) 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, 2 and 0 before ending.
- e. The program will output the decimal numbers 10, 8, 6, 4 and 2 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 **3**

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

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 **4**

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. Store X
- c. Add X ✔
- d. Jump X
- e. Load X

The correct answer is: Add X

Question **5**

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 store the octal value 5 and terminate.
- b. It will compute the decimal value -5, store it in Y and terminate. ✔
- c. It will store the hexadecimal value -5 in the memory address X and terminate.
- d. It will compute and store the decimal value 5.
- e. It will output the hexadecimal value -5 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 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 **6**

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 10
```

Select one:

- a. It will compute and store the decimal value 20 and terminate.
- b. It will output the decimal value 20 and terminate. ✔
- c. It will outputs the hexadecimal value 10 and terminate.
- d. It will store the hexadecimal value 5 and terminates.
- e. It will store the hexadecimal value 20 in the memory address 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 two statements, AC will be 0, so the "Then" part of the code will be executed. So the program will compute X+X=20, will output this value and will terminate.

The correct answer is: It will output the decimal value 20 and terminate.

Question **7**

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 compute and store the decimal value 3 and terminate.
- b. It will store the decimal value 12 in the memory position X and terminate.
- c. It will output the hexadecimal value 2 and terminate.
- d. It will output the decimal value 2 and terminate.
- e. It will store the decimal value 2 in the memory address Y 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 **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. InREG ✔ Not used for anything but input (Input instruction)
- c. PC
- d. MAR

The correct answer is: InREG

Question **9**

Correct

Mark 1.00 out of 1.00

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

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

Select one:

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

The correct answer is: Store X

Question **10**

Correct

Mark 1.00 out of 1.00

Which of the following best describes the composition of a 32-bit register.

Select one:

- a. 32 D flip-flops ✔
- b. 32 SR flip-flips
- c. Don't know/no answer
- d. 32 D flip-flops and 32 SR flip-flops
- e. 16 D flip-flops and 16 SR flip-flops.
- f. 64 D flip-flops.

A n-bit register is built from n-D flip-flips connected by a bus.

The correct answer is: 32 D flip-flops

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