IN1006 Systems Architecture (PRD1 A 2022/23)

Started on	Thursday, 24 November 2022, 4:30 PM
State	Finished
Completed on	Thursday, 24 November 2022, 4:37 PM
Time taken	7 mins 45 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?

```
            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 2 for five consecutive times before ending.

○ b. The program will compute the expression 10, 9, 8, 7 and 6 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 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.

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

MAR ← Y
MBR ← M [MAR]
MAR ← MBR
MBR ← M [MAR]
AC ← AC + MBR

Select one:

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

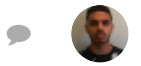The correct answer is: ADDI Y

Question **3**
Incorrect
Mark -0.10 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. InREG
- b. PC ✖ Used to fetch the next instruction
- c. MAR
- d. AC

The correct answer is: InREG

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 compute the expression 5 - 4 - 3 -2 -1 (i.e., - 5) before ending.
- c.   The program will do nothing.
- d.   The program will output the decimal numbers 5, 4, 3, 2, 1 and 0 before ending.
- e.   The program will compute the expression 5 + 4 + 3 + 2 +1 (i.e., 15) 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.
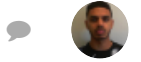
What is the difference when executing instructions `LOAD x` and `LOADI x` ?

Select one:

- a.   LOAD loads the value at address x to the AC; LOADI loads the value x to the AC
- b.   LOAD loads the value x to the AC; LOADI loads the value found at x to the AC
- c.   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
- d.   LOAD x loads the value of MBR to AC; LOADI loads the value of MAR to AC.
- e.   There is no difference if x is the current value of MBR

LOAD x loads the value of the memory word with address x to the AC whereas LOADI x loads 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: 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 microoperation that follows?

$PC \leftarrow X$

Select one:

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

The correct answer is: Jump X

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

The correct answer is: Store X

Question **8**

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 store the hexadecimal value 20 in the memory address X and terminate.
- b.   It will outputs the hexadecimal value 10 and terminate.
- c.   It will store the hexadecimal value 5 and terminates.
- d.   It will compute and store the decimal value 20 and terminate.
- e.   It will output the decimal value 20 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.

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. Don't know/No answer
- c. The LOAD loads the value at address x to the AC; the LOADI loads the value x to the AC
- d. 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 ✔
- 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 **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. OpCode, Address ✔
- b. Don't know/No answer
- c. Operation, FDE
- d. Operand, Address
- e. Operation, Instruction Length

Your answer is correct.

The correct answer is: OpCode, Address

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