IN1006 Systems Architecture (PRD1 A 2022/23)

Started on	Thursday, 24 November 2022, 4:57 PM
State	Finished
Completed on	Thursday, 24 November 2022, 5:12 PM
Time taken	14 mins 57 secs
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

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

The correct answer is: Subt X

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

Select one:

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

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

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

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 **4**

Correct

Mark 1.00 out of 1.00

Which MARIE instruction is being carried out by the following microoperations?

MAR ← Y
MBR ← AC
M [MAR] ← MBR

Select one:

○ a.   LOAD Y

○ b.   STORE AC+MAR

○ c.   ADD Y

◉ d.   STORE Y   ✔   Correct

○ e.   Neither the above sequence nor any subsequence of it corresponds to a MARIE instruction.

Your answer is correct.

The first microoperation assigns Y to MAR. The second microoperation assigns the value of AC to MBR, and the last microoperation stores the value of MBR to the memory word with the address indicated by MAR. Hence given microoperations correspond to the MARIE instruction STORE Y.

The correct answer is: STORE Y

Question **5**

Correct

Mark 1.00 out of 1.00

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 x loads the value of MBR to AC; LOADI loads the value of MAR to AC.

○ c.   There is no difference if x is the current value of MBR

○ d.   LOAD loads the value x to the AC; LOADI loads the value found at x to the AC

◉ e.   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

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

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. There is no difference if x is the same
- ○ d. The LOAD loads the value at address x to the AC; the LOADI loads the value x to the AC
- ● e. 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

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

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

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

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 do nothing.

○ b. The program will output the decimal numbers 5, 4, 3, 2, 1 and 0 before ending.

○ c. The program will compute the expression 5 + 4 + 3 + 2 +1 (i.e., 15) before ending.

◉ d. The program will output the decimal numbers 5, 4, 3, 2 and 1 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.

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

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

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