

IN1006 Systems Architecture (PRD1 A 2022/23)

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Started on Thursday, 24 November 2022, 3:19 PM

State Finished

Completed on Thursday, 24 November 2022, 3:39 PM

Time taken 20 mins 14 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 4
Sum,    Dec 0
```

Select one:

- ☐ a. The program will compute the expression $10+6+2$ (i.e., 18) before ending.
- ☒ b. The program will output the decimal numbers 10, 6 and 2 before ending.
- ☐ c. The program will compute the expression 10, 8, 6, 4 and 2 before ending.
- ☐ d. The program will output 4 for three consecutive times before ending.
- ☐ e. The program will output the decimal numbers 10, 8, 6, 4, 2 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 10 (> 0) and thus the instruction at the position "Loop" will be executed outputting 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 outputting 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**

Incorrect

Mark -0.10 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 and MBR
- ☐ b. InReg, OutReg
- ☐ c. Don't know/No answer
- ☐ d. MAR, MBR, InReg, OutReg and PC
- ☐ e. MAR, MBR, InReg, OutReg



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

Which of the following statements best describes the FDE cycle? FDE cycle is ...

Select one:

- ☐ a. ...an important hardware technology used to build processors.
- ☐ b. ... part of the Input/Output subsystem of the von Neumann model.
- ☐ c. ... loop instruction in MARIE architecture.
- ☒ d. ...the series of steps that a computer carries out when it runs a program
is the series of steps that a computer carries out when it runs a program
is the series of steps that a computer carries out when it runs a program
.
- ☐ e. Don't know/No response



This is correct.

Your answer is correct.

The correct answer is: ...the series of steps that a computer carries out when it runs a program
is the series of steps that a computer carries out when it runs a program

is the series of steps that a computer carries out when it runs a program
.

Question **4**

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` 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. `LOAD` loads the value `x` to the AC; `LOADI` loads the value found at `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 **5**

Correct

Mark 1.00 out of 1.00

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

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

Select one:

- ☐ a. `ADD Y`
- ☒ b. `STORE Y`
- ☐ c. Neither the above sequence nor any subsequence of it corresponds to a MARIE instruction.
- ☐ d. `LOAD Y`
- ☐ e. `STORE AC+MAR`

✓ Correct

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 **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 compute the expression $5 + 4 + 3 + 2 + 1$ (i.e., 15) before ending.
- ☐ c. The program will output the decimal numbers 5, 4, 3, 2, 1 and 0 before ending.
- ☐ d. The program will do nothing.
- ☐ 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 outputting 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 outputting 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 microoperations that follow?

```
MAR ← X
MBR ← AC
M[MAR] ← MBR
```

Select one:

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



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 5
```

Select one:

- ☒ a. It will compute the decimal value -5, store it in Y 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 output the hexadecimal value -5 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 9

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 output the decimal value 20 and terminate.
- ☐ b. It will compute and store the decimal value 20 and terminate.
- ☐ c. It will store the hexadecimal value 5 and terminates.
- ☐ d. It will outputs the hexadecimal value 10 and terminate.
- ☐ 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.

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

Select one:

- ☐ a. `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
- ☐ b. `ADD x` loads the value of MBR to AC; `ADDI x` adds the value of IR to AC.
- ☐ c. `ADD x` loads the value at address `x` to the AC; `ADDI x` loads the value `x` to the AC
- ☒ d. `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 
- ☐ 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

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