

# IN1006 Systems Architecture (PRD1 A 2022/23)

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**Started on** Thursday, 1 December 2022, 3:44 PM

**State** Finished

**Completed on** Thursday, 1 December 2022, 4:04 PM

**Time taken** 20 mins 4 secs

**Grade** 10.00 out of 10.00 (100%)

## Question 1


Correct

Mark 1.00 out of 1.00

Which of the following statements is *the most accurate* description for the sum-of-products expression below?

$$F = A'B'C + A'BC' + AB'C'$$

Select one:

- ☐ a. The truth table has two rows where  $F = 1$  and  $C$  must be zero to return one.
- ☒ b. The truth table has three rows where  $F = 1$  and no more than two zeros must be in the inputs to return one. 
- ☐ c. Don't know/no answer
- ☐ d. The truth table has three rows where  $F = 1$  and  $C$  must be one to return one.
- ☐ e. The truth table has four rows where  $F = 1$  and no more than two zeros must be in the inputs to return one.
- ☐ f. The truth table has three rows where  $F = 1$ , and no zeros need to be in the inputs to return one.

The number of OR-ed terms above specifies the number of input cases that lead to a true expression (rows of truth table that give  $F = 1$ ). Each of the barred variables shows where the input needs to be zero for that input case.

The correct answer is: The truth table has three rows where  $F = 1$  and no more than two zeros must be in the inputs to return one.

Question **2**

Correct

Mark 1.00 out of 1.00

Which of the following equations correctly reflects the truth table shown below? A, B and C are inputs and F is the output.

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Select one:

- ☐ a.  $F = A'B'C' + A'BC + AB'C' + ABC'$
- ☒ b.  $F = A'B'C + A'BC' + AB'C + ABC$
- ☐ c.  $F = A'B'C' + A'BC + AB'C' + ABC'$
- ☐ d. Don't know/no answer
- ☐ e. None of these expressions
- ☐ f.  $F = (A'B'C + A'BC' + AB'C + A'B'C + ABC)'$



The F output is given as a sum-of-products expression where each product (AND) should correspond to a row where F = 1.

The correct answer is:  $F = A'B'C + A'BC' + AB'C + ABC$

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 and PC
- ☐ c. MAR and MBR
- ☒ d. MAR, MBR, InReg, OutReg
- ☐ 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*  $\leftarrow$  *AC*

*M* [*MAR*]  $\leftarrow$  *MBR*

Select one:

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



The correct answer is: Store X

Question **5**

Correct

Mark 1.00 out of 1.00

What is the effect of a bitwise-NAND operation on the following two 12-bit words: 1000 1010 1101, 0110 1110 0101 ?

Select one:

- ☐ a. Don't know/no answer
- ☐ b. 1110 0100 1000
- ☐ c. 0001 0001 0010
- ☒ d. 1111 0101 1010
- ☐ e. 1110 1110 1101
- ☐ f. 0000 1100 0101



Your answer is correct.

The NAND operation is applied to each of the pairs of bits at the same position in each word, moving from left to right.

The correct answer is: 1111 0101 1010

Which of the following equations correctly reflects the truth table shown below? A,B and C are inputs and F is the output.

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Select one:

- ☐ a. Don't know/no answer
- ☒ b.  $F = A'BC' + A'BC + AB'C' + ABC' + ABC$
- ☐ c.  $F = (A'BC' + A'BC + AB'C' + ABC' + ABC)'$
- ☐ d.  $F = (AB'C + A'BC' + A'BC' + A'B'C + A'B'C)'$
- ☐ e. None of these expressions
- ☐ f.  $F = AB'C + A'BC' + A'BC' + A'B'C + A'B'C'$



Your answer is correct.

The F output is given as a sum-of-products expression where each product (AND) should correspond to a row where F = 1.

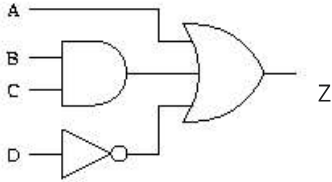
The correct answer is:  $F = A'BC' + A'BC + AB'C' + ABC' + ABC$

## Question 7

Correct

Mark 1.00 out of 1.00

Which of the following is the correct Boolean expression for the logic circuit below (with output Z).



Select one:

- ☐ a. Don't know/no answer
- ☐ b.  $Z = A + (BC) + D$
- ☐ c.  $Z = A + (B+C)D'$
- ☐ d.  $Z = A' + (BC) + D'$
- ☒ e.  $Z = A + (B \bullet C) + D'$



Input D feeds directly into a NOT gate so is inverted to  $D'$ . Inputs B and C are AND-ed together. Then all are OR-ed together with A to give the expression:

$$Z = A + (BC) + D'$$

The correct answer is:  $Z = A + (B \bullet C) + D'$

## 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 and store the decimal value 5.
- ☐ b. It will output the hexadecimal value -5 and terminate.
- ☐ c. It will store the octal value 5 and terminate.
- ☒ d. It will compute the decimal value -5, store it in Y and terminate.
- ☐ e. It will store the hexadecimal value -5 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 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

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

Select one:

- ☒ a. 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
- ☐ b. There is no difference if x is the same
- ☐ 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. LOAD loads the value x to the AC; LOADI loads the value found at 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

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 store the hexadecimal value 20 in the memory address X and terminate.
- ☐ d. It will outputs the hexadecimal value 10 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.

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