IN1006 Systems Architecture (PRD1 A 2022/23)

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State	Finished
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Time taken	6 mins 3 secs
Grade	10.00 out of 10.00 (100%)

Question 1

Correct

Mark 1.00 out of 1.00

What is the effect of a bitwise-NOR operation on the following two 12-bit words: 1000 1010 1101, 0110 1110 0101?

Select one:

- a. 1111 0011 1010
- b. 0000 1100 0101
- c. Don't know/no answers
- d. 1110 0100 1000
- e. 0001 0001 0010 ✔
- f. 1110 1110 1101

The NOR 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: 0001 0001 0010

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

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

Mark 1.00 out of 1.00

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

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

Select one:

- a. There is no MARIE instruction that corresponds to the above sequence of micro operations or a subsequence of it.
- b. LOADI Y+Y
- c. ADDI Y ✔
- d. ADD AC+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 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. Store X
- b. Add X ✔
- c. Jump X
- d. Load X
- e. Don't know/No answer

The correct answer is: Add X

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, 6 and 2 before ending. ✔
- b. The program will compute the expression 10+6+2 (i.e., 18) before ending.
- c. The program will output 4 for three consecutive times before ending.
- d. The program will compute the expression 10, 8, 6, 4 and 2 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 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.

Mark 1.00 out of 1.00

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

Select one:

- a. 0001 0001 0010
- b. 1111 0011 1010
- c. 1110 0100 1000 ✔
- d. 1110 1110 1101
- e. 0000 1100 0101
- f. Don't know/no answer

The XOR 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: 1110 0100 1000

Question 7

Correct

Mark 1.00 out of 1.00

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

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

Select one:

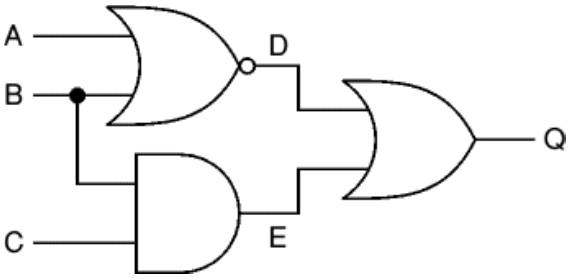
- a. Don't know/No answer
- b. Jump X
- c. Add X
- d. Load X ✔
- e. Store X

Your answer is correct.

The correct answer is: Load X

Mark 1.00 out of 1.00

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



Select one:

- a. Don't know/no answer
- b. Q = (A+B)' + (BC)
- c. Q = (A+B)'(BC)
- d. Q = (AB)' + (B+C)
- e. Q = (A+B) + (BC)

Output Q is OR of a NOR-gate (D) with inputs A, B and an AND-gate (E) with inputs B, C. This gives the expression:
Q = (A+B)' + (BC)

The correct answer is: Q = (A+B)' + (BC)

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 output the decimal value 20 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.

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

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