

IN1006 Systems Architecture (PRD1 A 2022/23)

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Started on Thursday, 1 December 2022, 4:49 PM

State Finished

Completed on Thursday, 1 December 2022, 4:55 PM

Time taken 6 mins 11 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-OR operation on the following 12-bit words: 1000 1010 1101, 0110 1110 0101?

Select one:

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



The OR 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 1110 1101

Question 2

Correct

Mark 1.00 out of 1.00

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. 7
- ☐ b. Don't know/No answer
- ☐ c. 3
- ☐ d. 1
- ☒ e. 5



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

Question 3

Correct

Mark 1.00 out of 1.00

How many components of MARIE architecture can use the bus simultaneously?

Select one:

- ☒ a. 1 component
- ☐ b. All components
- ☐ c. 3 components
- ☐ d. 2 components
- ☐ e. Don't Know/No answer



Your answer is correct.

The correct answer is: 1 component

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. Jump X
- ☐ c. Add X
- ☐ d. Load X
- ☒ e. Store X



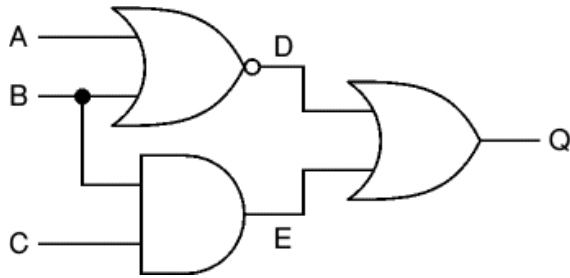
The correct answer is: Store X

Question 5

Correct

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. $Q = (AB)' + (B+C)$
- ☒ b. $Q = (A+B)' + (BC)$
- ☐ c. Don't know/no answer
- ☐ d. $Q = (A+B) + (BC)$
- ☐ 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:

$$Q = (A+B)' + (BC)$$

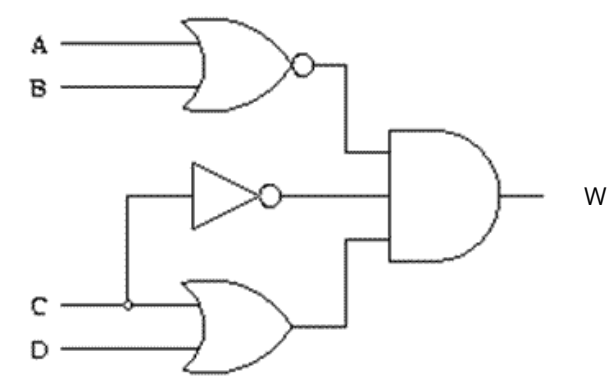
The correct answer is: $Q = (A+B)' + (BC)$

Question 6

Correct

Mark 1.00 out of 1.00

Given the logic circuit (with output W) and table below, which line of the table does *not* correspond with the behaviour of the logic circuit?



Row	A	B	C	D	Z
1	0	0	0	0	0
2	0	0	0	1	1
3	0	0	1	0	0
4	0	0	1	1	0
5	0	1	0	0	0
6	0	1	0	1	0
7	0	1	1	0	0
8	0	1	1	1	1
9	1	0	0	0	0
10	1	0	0	1	0
11	1	0	1	0	0
12	1	0	1	1	0
13	1	1	0	0	0
14	1	1	0	1	0
15	1	1	1	0	0
16	1	1	1	1	0

Select one:

- ☐ a. Row 12
- ☒ b. Row 8
- ☐ c. Row 1
- ☐ d. Row 3
- ☐ e. Row 7
- ☐ f. Row 5
- ☐ g. Row 15
- ☐ h. Row 10
- ☐ i. Don't know/no answer



Row 8 is in error as all inputs to the AND gate must be one for W to be one, and this only occurs when the conditions in row two are met.

The correct answer is: Row 8

Question 7

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



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

Question 8

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



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

Question 9

Correct

Mark 1.00 out of 1.00

Consider the following MARIE program. What is the outcome of the program?

```
Load X
Store Sum
LoopC, Skipcond 800
      Jump LoopEnd
Loop,  Subt Y
      Store W
      Add Sum
      Store Sum
      Load W
      Jump LoopC
LoopEnd, Halt
X,      Dec 4
Y,      Dec 1
Sum,    Dec 0
W,      Dec 0
```

Select one:

- ☐ a. The program will compute the sum $4+3+2+1+0$ before ending.
- ☐ b. The program will halt immediately after reaching the Skipcond instruction for the first time.
- ☒ c. The program will compute the sum $4+3+2+1+0$ and store it in Sum before ending. ✓
- ☐ d. The program will compute the expression $4+2+0$ before ending.
- ☐ e. The program will output the values 4, 3, 2, 1 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 4 (> 0) and the value 4 will be stored in Sum. Thus the instruction at the position "Loop" will be executed subtracting 1 from AC, adding its value to Sum and storing the updated value to Sum (this will make the value of Sum equal to 7, i.e., $4+3$). Then the execution will continue from LoopC (due to the "Jump LoopC" instruction). This time the AC will be 3 so the evaluation of Skipcond will make the program continue from "Loop" again, this time subtracting 1 first from AC and then adding its value (i.e., 2) to Sum. 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 find the sum of values $4+3+2+1+0$ and store it in the memory position Sum before halting.

The correct answer is: The program will compute the sum $4+3+2+1+0$ and store it in Sum before ending.

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 the decimal numbers 10, 8, 6, 4, 2 and 0 before ending.
- ☒ b. The program will output the decimal numbers 10, 8, 6, 4 and 2 before ending.
- ☐ c. The program will output 2 for five consecutive times before ending.
- ☐ d. The program will compute the expression 10, 9, 8, 7 and 6 before ending.
- ☐ e. The program will compute the expression 10+8+6+4+2 (i.e., 30) 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 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 outputting 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.

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