IN1006 Systems Architecture (PRD1 A 2022/23)

Started on	Thursday, 1 December 2022, 3:50 PM
State	Finished
Completed on	Thursday, 1 December 2022, 4:09 PM
Time taken	19 mins 3 secs
Grade	**7.80** out of 10.00 (**78**%)

Question **1**

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

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 **2**

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'BC + ABC' + AB'C'

Select one:

- a. The truth table has three rows where F = 1 and B must be one to return one.
- b. The truth table has three rows where F = 1 and no zeros need to be in the inputs to return one.
- c. The truth table has four rows where F = 1 and no zeros need to be in the inputs to return one.
- d. The truth table has two rows where F = 1 and no zeros need to be in the inputs to return one.
- e. Don't know/no answer.
- f. The truth table has three rows where F = 1 and at least one zero must be in the inputs to return one. ✔

Your answer is correct.

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 inverted 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 at least one zero must be in the inputs to return one.

Question **3**

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
        Add X
        Subt Y
        Subt Z
        Output
Endif,   Halt
X,      Dec 9
Y,      Dec 5
Z,      Dec 2
```

Select one:

- a. 10
- b. 7
- c. 8
- d. 11 ✔
- e. 18

This program executes the "If, then, else" statement using the Skipcond instruction. In this case, the condition in Skipcond 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 4 after the execution of the first two instructions of the program. The program then continues to execute and the "Output" instruction outputs the value of OutREG and OutREG=AC and AC is X+X-Y-Z=11 and terminates at "Halt". So the answer is 11.

The correct answer is: 11

Question **4**

Correct

Mark 1.00 out of 1.00

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

Select one:

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

Your answer is correct.

The correct answer is: 1 component

Question **5**

Incorrect

Mark -0.10 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. 1110 0100 1000
- b. 0001 0001 0010
- c. Don't know/no answers
- d. 1111 0011 1010 ✖
- e. 1110 1110 1101
- f. 0000 1100 0101

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

Question **6**

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 x to the AC
- b. 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 ✔
- c. There is no difference if x is the same
- d. LOAD loads the value x to the AC; LOADI loads the value found at x to the AC
- e. Don't know/No answer

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

Question **7**

Incorrect

Mark -0.10 out of 1.00

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 store the decimal value 12 in the memory position X and terminate.

b. It will store the decimal value 2 in the memory address Y and terminate.

c. It will output the decimal value 2 and terminate.

d. It will output the hexadecimal value 2 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.

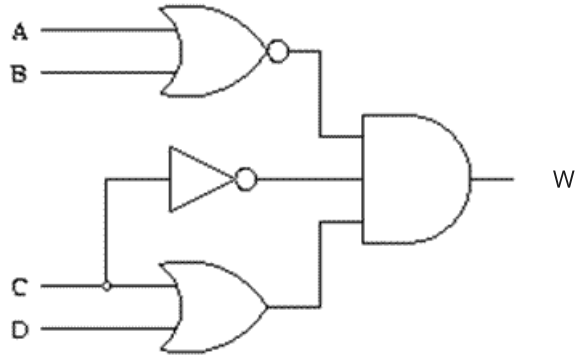
The correct answer is: It will store the decimal value 2 in the memory address Y and terminate.

Question **8**

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

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.

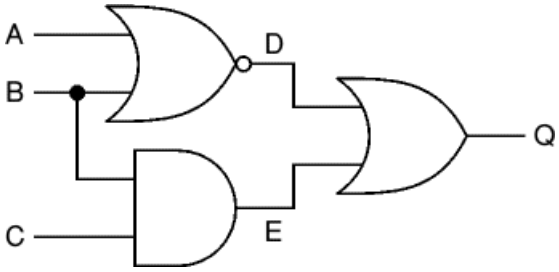
The correct answer is: Row 8

Question **9**

Correct

Mark 1.00 out of 1.00

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



Row	A	B	C	Q
1	0	0	0	1
2	0	0	1	1
3	0	1	0	1
4	0	1	1	1
5	1	0	0	0
6	1	0	1	0
7	1	1	0	0
8	1	1	1	1

Select one:

- a. All rows are correct
- b. Row 4
- c. Row 2
- d. Row 5
- e. Row 8
- f. Row 6
- g. Don't know/no answer
- h. Row 1
- i. Row 3 ✔
- j. Row 7

Row 3 is in error as the output of the NOR-gate (D) and AND-gate (E) are zero, leading to an output of the OR-gate (Q) of zero.

The correct answer is: Row 3

Question **10**

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 compute the expression 5 - 4 - 3 -2 -1 (i.e., - 5) before ending.
- b. The program will compute the expression 5 + 4 + 3 + 2 +1 (i.e., 15) before ending.
- c. The program will do nothing.
- d. The program will output the decimal numbers 5, 4, 3, 2 and 1 before ending. ✔
- e. The program will output the decimal numbers 5, 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 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.

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