IN1006 Systems Architecture (PRD1 A 2022/23)

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State	Finished
Completed on	Thursday, 1 December 2022, 3:54 PM
Time taken	5 mins 29 secs
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

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

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 **2**

Correct

Mark 1.00 out of 1.00

What is the difference when executing instructions `LOAD x` and `LOADI x` ?

Select one:

- a. There is no difference if x is the current value of MBR
- b. LOAD loads the value at address x to the AC; LOADI loads the value 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. 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 ✔

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 **3**

Correct

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

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 **4**

Correct

Mark 1.00 out of 1.00

Which MARIE instruction is being carried out by the microoperation that follows?

$PC \leftarrow X$

Select one:

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

The correct answer is: Jump X

Question **5**

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 and store it in Sum before ending. ✔
- b. The program will compute the expression 4+2+0 before ending.
- c. The program will output the values 4, 3, 2, 1 and 0 before ending.
- d. The program will halt immediately after reaching the Skipcond instruction for the first time.
- e. The program will compute the sum 4+3+2+1+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.

Question **6**

Correct

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. ADD AC+Y
- b. ADDI Y ✔
- c. LOADI Y
- d. LOADI Y+Y
- e. There is no MARIE instruction that corresponds to the above sequence of micro operations or a subsequence of it.

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 **7**

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. 1111 0011 1010
- d. Don't know/no answer
- e. 1110 1110 1101 ✔
- f. 1110 0100 1000

Your answer is correct.

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 **8**

Correct

Mark 1.00 out of 1.00

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

Select one:

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

Your answer is correct.

The correct answer is: 1 component

Question **9**

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

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

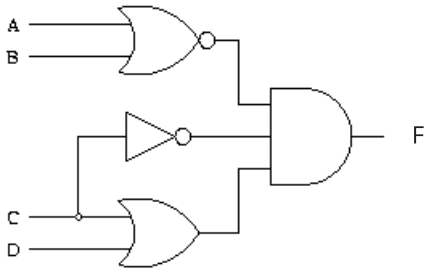
The correct answer is: 1110 1110 1101

Question **10**

Correct

Mark 1.00 out of 1.00

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



Select one:

- a. F= (A+B)'C(C+D)
- b. F= (A+B)'C'(C+D) ✔
- c. Don't know/no answer
- d. F= A+B'C'(C+D)
- e. F= (A+B)'C'(C+D)'

The output is one if all three of its inputs are one (AND). The first of these is NOR of inputs A, B. The second NOT C and there third C OR D. This gives the expression: F= (A+B)'C'(C+D)

The correct answer is: F= (A+B)'C'(C+D)

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