

**Overview of Computer Architecture 2022**

## Progress tests

Review Test Submission: Practice test - 1

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Course	Overview of Computer Architecture 2022
Test	Practice test - 1
Started	29/10/22 21:01
Submitted	29/10/22 21:57
Status	Completed
Attempt Score	16 out of 27 points
Time Elapsed	56 minutes
Results Displayed	All Answers, Feedback

**Question 1**

2 out of 2 points

What is the base-10 value of 0xE0 using 2's complement representation?

Response Feedback: Well done!

**Question 2**

0 out of 2 points

What is the base-10 value -10 when converted to base-2? Use 6 digits and 2's complement signed representation.

Response Feedback: To find out the value of -10 in 2's complement, we first find the 1's complement of 10 then we add one.

10 in binary = 0b1010

First, we notice we need five digits to represent -10 in 2's complement. To convince yourself, what is the smallest negative number that can be represented with 4 bits in 2's complement?

we add one more zero to 1010 to make it 01010.

1's complement 0b10101

2's complement = 0b10110 = -10 in 2's complement.

← OK

However, 0b10110 has only 5 digits, whereas the question asks for six digits. Thus, we sign extend 0b10110 to make it 0b110110, which is also equal to -10.

### Question 3

2 out of 2 points

Using 2's complement, what is the octal representation of the hexadecimal value A9?

Response Feedback: Well done!

### Question 4

2 out of 2 points

Assuming 6-bit inputs and an 8-bit output, which of the following numbers represents the sum of the two **unsigned** binary numbers 0b101001 and 0b011011 ?

Answers:    0x44  
                 0xC4  
                 0d196  
                 0x3C  
                 not listed here

### Question 5

2 out of 2 points

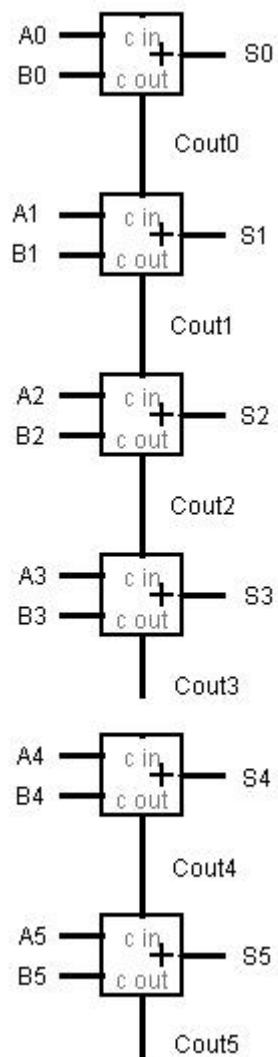
Assume 6-bit representation. The sum of the two **unsigned** binary numbers 0b111010 and 0b100101 is:

Answers:    0o27  
                 0xD7  
                 0x17  
                 0d215  
                 not listed here

Response Feedback: Well done!

### Question 6

1.5 out of 2 points



For the above circuit diagram, complete the following table:

Adder Number	A	B	Cout	S
0	1	1	[c0]	[s0]
1	0	0	[c1]	[s1]
2	1	0	[c2]	[s2]
3	1	1	[c3]	[s3]
4	0	1	[c4]	[s4]
5	0	0	[c5]	[s5]

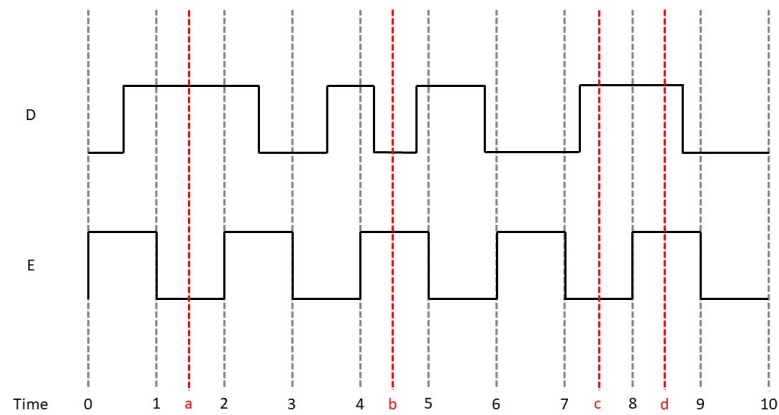
Response  
Feedback:

As seen on the answer diagram, the values for Cout and S are as follows:

Adder Number	A	B	Cout	S
0	1	1	1	0
1	0	0	0	1
2	1	0	0	1
3	1	1	1	0
4	0	1	0	1
5	0	0	0	0

## Question 7

2 out of 2 points



For the above active-high D latch waveform, complete the following table for the output Q at the highlighted points in time a, b, c, and d:

Time	Q
a	<b>[a]</b>
b	<b>[b]</b>
c	<b>[c]</b>
d	<b>[d]</b>

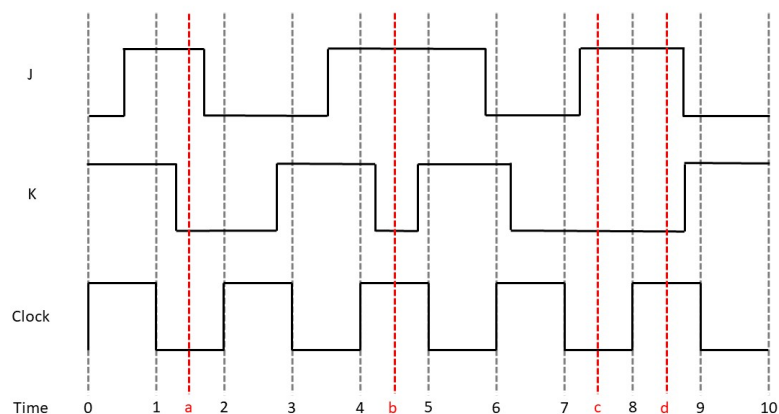
Answers:

- high
- low

Response Feedback: Well done!

## Question 8

1.5 out of 2 points



For the above rising edge JK Flip Flop waveform, complete the following table for the output Q at the highlighted points in time a, b, c, and d:

Time	Q
a	<b>[a]</b>
b	<b>[b]</b>
c	<b>[c]</b>
d	<b>[d]</b>

Answers:

- high
- low

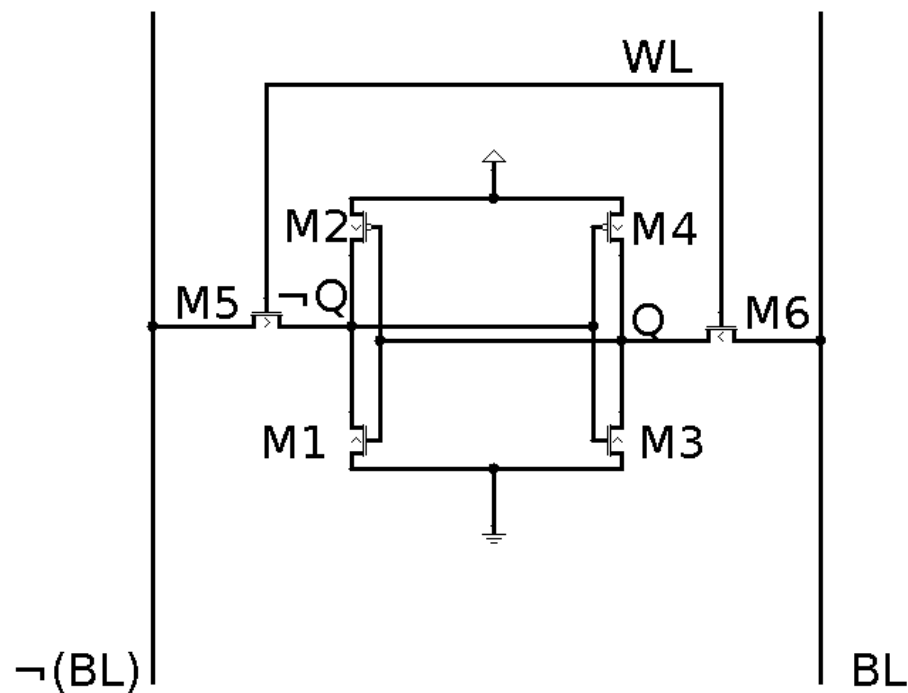
Response Feedback: As seen on the waveform answer image:

Time	Q
a	low
b	high
c	low
d	high

[JK Flip Flop Waveform Answer.jpg](#)

### Question 9

0 out of 2 points



Assume  $Q = 0$ ,  $\neg Q = 1$ . What are the status of each transistor and the signals WL and BL in the above 6T SRAM circuit when we are writing 1 to Q and after  $\neg Q$  has become 0?

M1 is **[M1-on]**.

M2 is **[M2-off]**.

M3 is **[M3-off]**.

M4 is **[M4-on]**.

M5 is **[M5-on]**.

M6 is **[M6-on]**.

BL is **[BL-high]**.

WL is **[WL-high]**.

Answers:

- ON
- OFF
- HIGH
- LOW

Response  
Feedback: To write 1 to Q, the BL line has to be set to high i.e. to 1.  
Also,  $\neg$ BL has to be set to Low, i.e. 0.

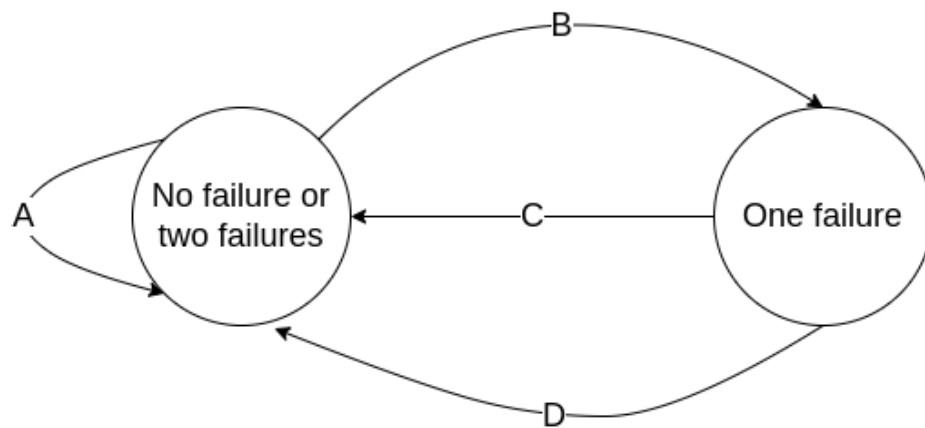
The word line WL has to be set to 1 to enable writing to the SRAM cell. Thus M5 and M6 will be on.

Because  $\neg$ Q becomes zero when WL is high and  $\neg$ BL is low, M3 will be off, and M4 will be on. Hence Q will be equal to one.

Q is one. Hence M1 is on, and M2 is off. Therefore  $\neg$ Q = 0.

## Question 10

3 out of 3 points



Never fail to do a task twice in a row.

This FSM diagram depicts a system that receives "1" as an input to indicate the user failed to do their task and "0" to mean the user did not fail to do their task.

If the user fails to do two tasks in a row, the output should be "1". On the other hand, the output should be "0" for any other scenarios.

Suppose the user failed to do two tasks in a row, and the system produced "1" as an output; the first subsequent output should be "0" regardless of the input.

Complete the sentences that describe the inputs and outputs of the transitions A, B, C and D in this FSM with either value 0 or 1.

The input that triggers transition A is **[A\_in]**, and the output produced by transition A is **[A\_out]**.

The input that triggers transition B is **[B\_in]**, and the output produced by transition B is **[B\_out]**.

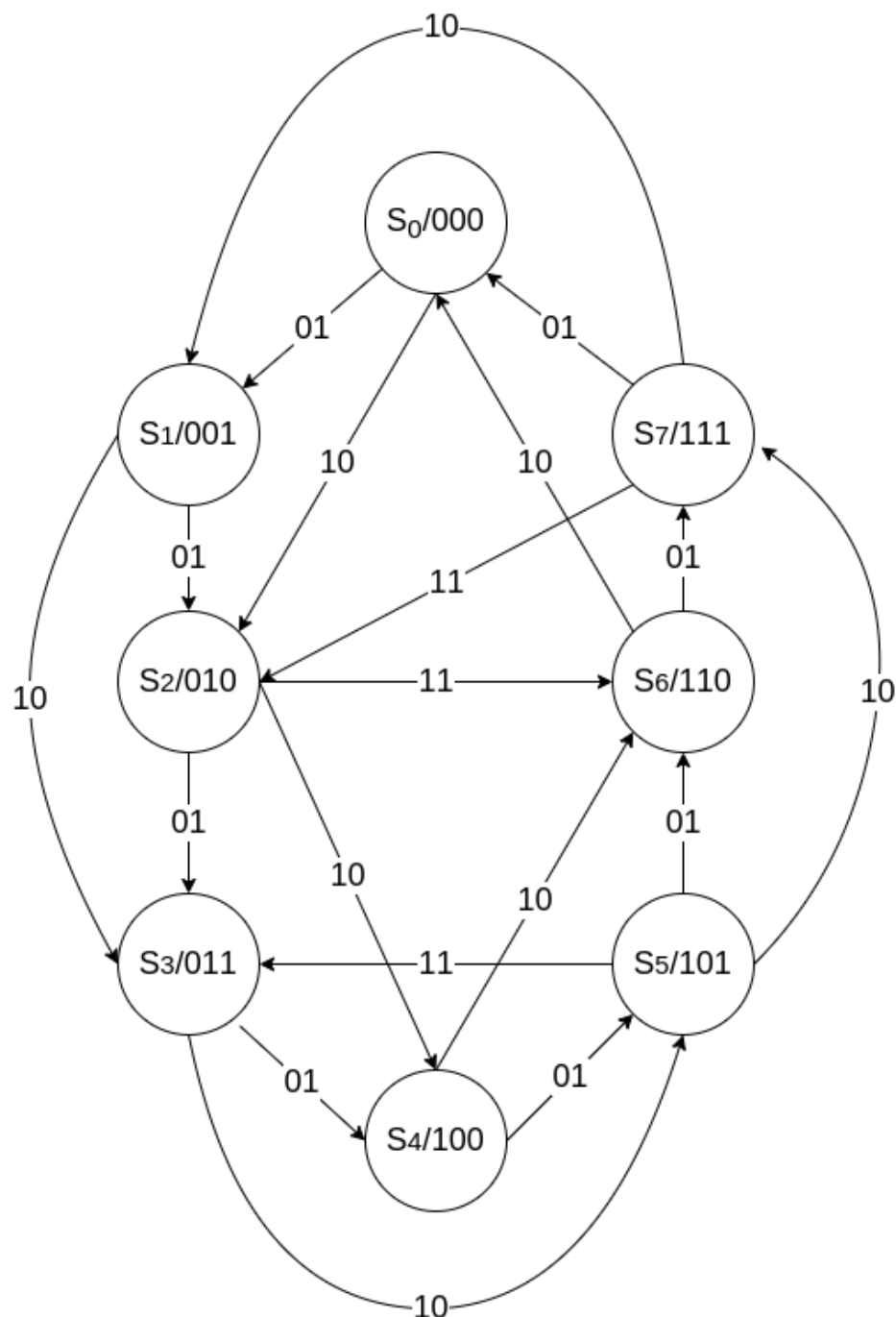
The input that triggers transition C is "0", and the output produced by transition C is **[C\_out]**.

The input that triggers transition D is **[D\_in]**, and the output produced by transition D is "1."

Response Feedback: Well done!

## Question 11

0 out of 3 points



Complete the transition table that captures the transitions of this FSM diagram. The empty cells are the inputs of row number 3, the bits of the current state and the inputs of row number 9, the bits of the next state of row number 12, and all the cells of row number 19.

No.	S2	S1	S0	Input1	Input0	S2'	S1'	S0'
1	0	0	0	0	1	0	0	1
2	0	0	1	1	0	0	1	1
3	0	0	1	[1-1-2-i1-0]	[1-1-2-i0-1]	0	1	0
4	0	1	1	1	0	1	0	1
5	0	1	0	0	1	0	1	1
6	0	1	0	1	0	1	0	0
7	0	1	0	1	1	1	1	0
8	0	0	0	1	0	0	1	0



9	[3-1-4-s2-0]	[3-1-4-s1-1]	[3-1-4-s0-1]	[3-1-4-i1-0]	[3-1-4-i0-1]	1	0	0
10	1	0	0	0	1	1	0	1
11	1	0	0	1	0	1	1	0
12	1	0	1	0	1	[5-1-6-s2-prime-1]	[5-1-6-s1-prime-1]	[5-1-6-s0-prime-0]
13	1	0	1	1	0	1	1	1
14	1	1	1	1	1	0	1	0
15	1	0	1	1	1	0	1	1
16	1	1	0	1	0	0	0	0
17	1	1	1	0	1	0	0	0
18	1	1	0	0	1	1	1	1
19	[7-2-1-s2-1]	[7-2-1-s1-1]	[7-2-1-s0-1]	[7-2-1-i1-1]	[7-2-1-i0-0]	[7-2-1-s2-prime-0]	[7-2-1-s1-prime-0]	[7-2-1-s0-prime-1]

Response  
Feedback:

This is the full transition table with the answers.

N o.	S2	S1	S0	Input 1	Input 0	S2'	S1'	S0'
1	0	0	0	0	1	0	0	1
2	0	0	1	1	0	0	1	1
3	0	0	1	0	1	0	1	0
4	0	1	1	1	0	1	0	1
5	0	1	0	0	1	0	1	1
6	0	1	0	1	0	1	0	0
7	0	1	0	1	1	1	1	0
8	0	0	0	1	0	0	1	0
9	0	1	1	0	1	1	0	0
10	1	0	0	0	1	1	0	1
11	1	0	0	1	0	1	1	0
12	1	0	1	0	1	1	1	0
13	1	0	1	1	0	1	1	1
14	1	1	1	1	1	0	1	0
15	1	0	1	1	1	0	1	1
16	1	1	0	1	0	0	0	0
17	1	1	1	0	1	0	0	0
18	1	1	0	0	1	1	1	1
19	1	1	1	1	0	0	0	1

Note that the above transition table is a scrambled version of the transition table below.

S2	S1	S0	Input 1	Input 0	S2'	S1'	S0'
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0	0	0	0	1	0	0	1
0	0	0	1	0	0	1	0
0	0	1	0	1	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	1	0	1	1
0	1	0	1	0	1	0	0
0	1	0	1	1	1	1	0
0	1	1	0	1	1	0	0
0	1	1	1	0	1	0	1
1	0	0	0	1	1	0	1
1	0	0	1	0	1	1	0
1	0	1	0	1	1	1	0
1	0	1	1	0	1	1	1
1	0	1	1	1	0	1	1
1	1	0	0	1	1	1	1
1	1	0	1	0	0	0	0
1	1	1	0	1	0	0	0
1	1	1	1	0	0	0	1
1	1	1	1	1	0	1	0

**Question 12**

0 out of 3 points

Which of the logic functions  $F$  listed below is the minimum DNF formula that represents the output  $F$  from the inputs  $a, b, c, d$ , and  $e$ . Use K-map to find the optimised output formula from the below truth table.

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>F</b>
0	0	1	0	0	1
0	1	0	1	0	1
0	1	1	1	0	1
1	1	0	1	0	1
1	1	1	1	0	1
1	0	0	1	0	1
1	0	1	1	0	1
1	0	1	0	0	1
0	0	1	0	1	1
0	1	0	1	1	1
0	1	1	1	1	1
1	1	0	1	1	1
1	1	1	1	1	1

Note that the entries which result in  $F$  being false have been omitted for brevity.

Answers:

$$F = bd + \bar{e}ad + \bar{e}\bar{b}\bar{c}d + \bar{a}\bar{b}\bar{c}d$$

$$F = \bar{e}bd + \bar{e}ad + \bar{e}\bar{b}\bar{c}d + ebd + \bar{a}\bar{b}\bar{c}d$$

$$F = \bar{e}bd + \bar{e}a\bar{b}d + \bar{e}\bar{b}\bar{c}d + ebd + \bar{a}\bar{b}\bar{c}d$$

$$F = bd + \bar{e}a\bar{b}d + \bar{e}\bar{b}\bar{c}d + \bar{a}\bar{b}\bar{c}d$$

$$F = \bar{e}bd + \bar{e}ad + \bar{e}\bar{b}\bar{c}d + ebd + e\bar{a}\bar{b}\bar{c}d$$

not listed here

Response  
Feedback: Please check the attached image, which describes the process of using K-maps to find the minimised DNF formula of F.

[k-map.drawio \(1\).png](#)

Tuesday, 8 November 2022 08:47:19 o'clock GMT