King Saud University
College of Computer and Information Sciences
Computer Science Department

Course Code	CSC 220		
Course Title	Computer Organization		
Semester	S1 – 1443 (Fall-2021)		
Exam	Midterm 1		
Date	24/10/2021	**Duration**	**90 minutes**
Student Name			
Student ID			
Section No.			

Course Learning Outcomes		**Relevant question**	**Full mark**	**Student mark**
CLO 1.1	*Data Representation*	**1**	**8**	
CLO 1.2	*Digital circuit design and simplification*	**2**	**6**	
CLO 1.2	*Digital circuit design and simplification*	**3**	**5**	
CLO 2.1	*Combinational and sequential circuits design*	**4**	**6**	
Total			**25**	

Feedback/Comments:

Question 1. (8 Marks)

Q#1.a Marks 4

1) Write octal number corresponds to the hexadecimal number EF.C

$(357.6)_8$

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2) Write Binary number that corresponds to the decimal number 45.125

$(101101.001)_2$

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3) Write BCD code corresponds to the binary number 1101.1

$(0001\ 0011\ .\ 0101)_{BCD}$

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4) Write The decimal number corresponds to the octal number 21.4

$(17.5)_{10}$

Q#1.b

Write smallest and largest Positive and negative number represented in 6 bits representation in 2's complement. Mark 1

Ans: Largest: +31

Smallest: -32

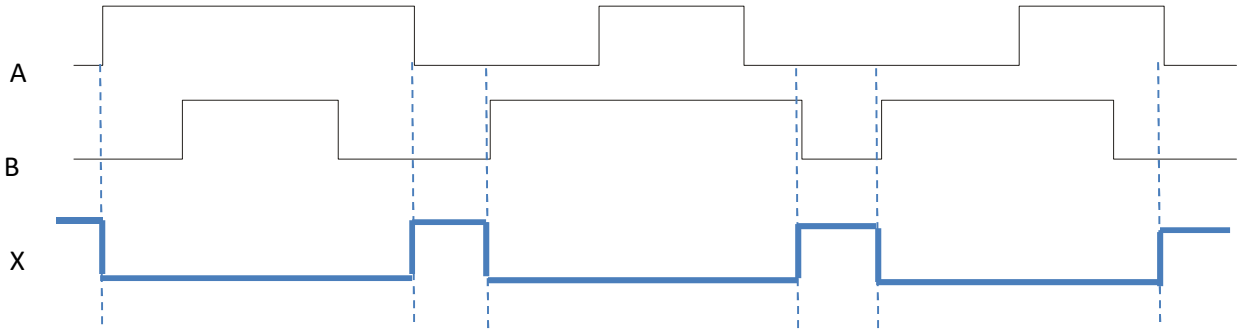
Q#1.C

Complete following Table Marks 3

A	A in Sign Magnitude (8 bits)	A in 1's Comp. (8 bits)	A in 2's comp. (8 bits)
10	00001010	00001010	00001010
-1	10000001	11111110	11111111
-7	10000111	11111000	11111001

Question 2 (6 Marks: 2+2+2)

(a) Suppose A and B are input waveform for a NOR Gate, show the output waveform X



(b) Suppose a combinational circuit accepts a 3-bit binary number and generate a 4-bit binary output equal to double of the input number (e.g. if input is 011 the output is 0110).

i. Write the truth table for the function

ii. Represent the functions in SOP form (without simplification).

Answer of Question 2 (b)

A	B	C	w	x	y	z
0	0	0	0	0	0	0
0	0	1	0	0	1	0
0	1	0	0	1	0	0
0	1	1	0	1	1	0
1	0	0	1	0	0	0
1	0	1	1	0	1	0
1	1	0	1	1	0	0
1	1	1	1	1	1	0

w = ∑m (4, 5, 6, 7)

x = ∑m (2, 3, 6 7)

y = ∑m (1, 3, 5, 7)

z = 0

Question 3 (5 Marks: 2+1+2)

(a) Find the Simplified function of Boolean function F together with the don't-care conditions *d* in sum-of-products form

$$F(w, x, y, z) = \sum (0, 1, 2, 3, 7, 8, 10)$$

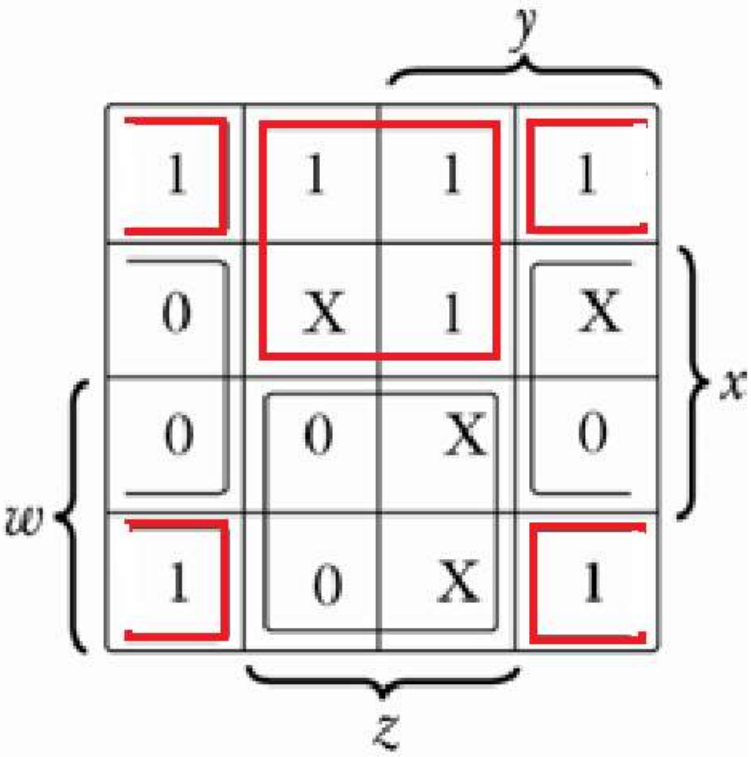
$$d(w, x, y, z) = \sum (5, 6, 11, 15)$$

(b) Find the Simplified function of the following Boolean function in sum-of-products form by means of a four-variable k-map.

$F(w, x, y, z) = \Sigma m(0, 1, 8, 9, 10, 12, 13)$

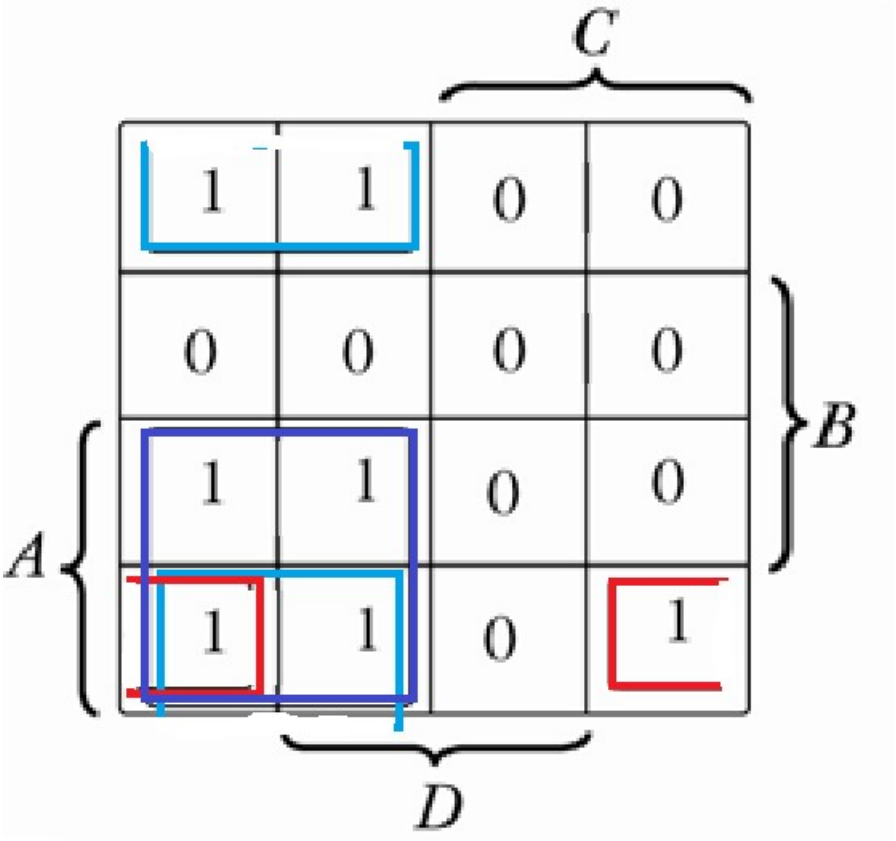
(c) Draw the logic diagram of simplified function of (b) with NAND gates only.

Answer of Question 3 (a)



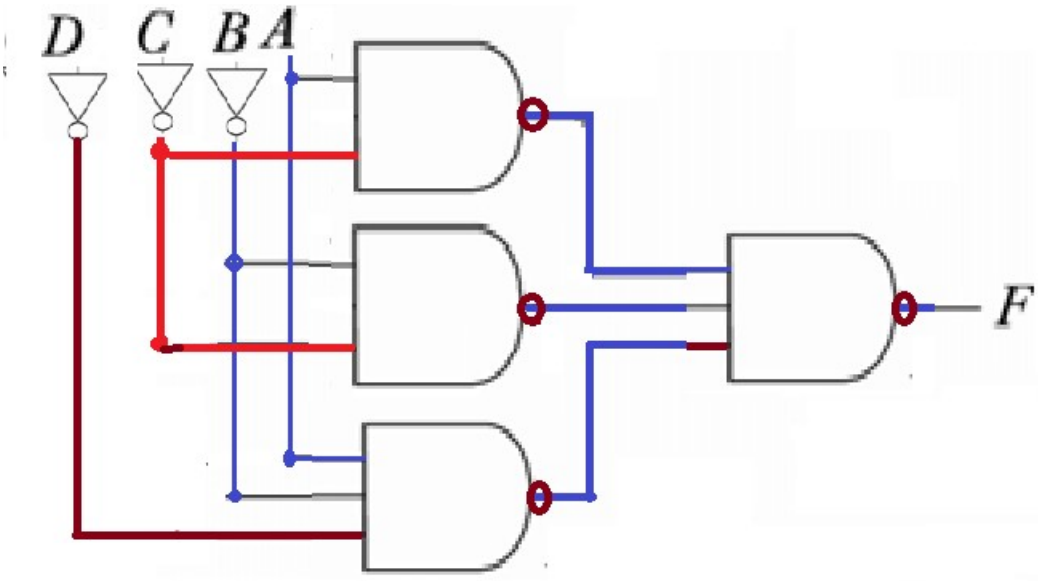
$F = x'z' + w'z$

Answer of Question 3 (b)



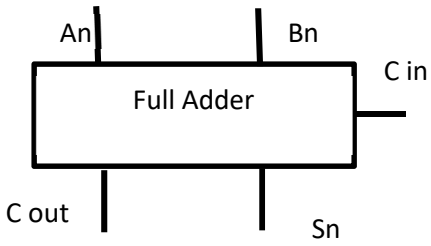
$$F = AC' + B'C' + AB'D'$$

Answer of Question 3 (c)



Question 4 (6 Marks: 2+2+2)

(a) Consider the following bloc diagram of a full-adder



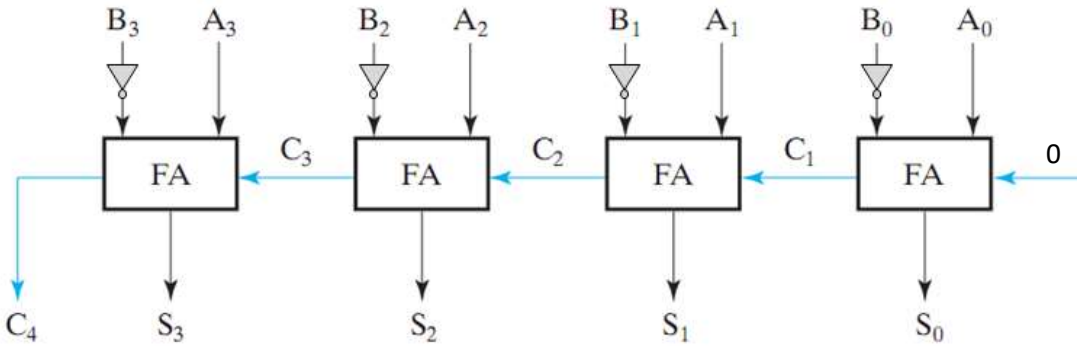
Give the truth table of the circuit and drive the output expressions of Sn and C out.

An	Bn	Cin	Sn	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

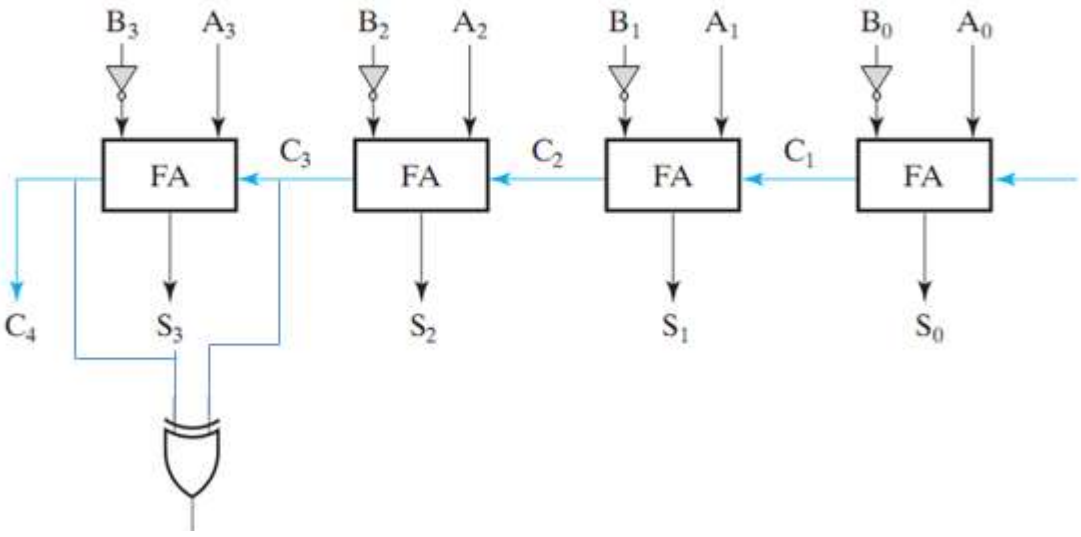
$$Cout = (An \oplus Bn)Cin + AnBn$$

$$S = An \oplus Bn \oplus Cin$$

(b) Using this circuit show how can we built a circuit capable of performing the subtraction, using 2's complement method, between two words A and B of 4 bits each one.



(c) Give a solution to detect sign overflow for the circuit that is proposed in (b)



Sign overflow bit

THE END