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

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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:

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1

$E \rightarrow 14 \rightarrow 1110$
$F \rightarrow 15 \rightarrow 1111$
$C \rightarrow 12 \rightarrow 1100$

$(EF.C)_{Hex}$

$(1110 \ 1111 . 1100)_2$

$(357.6)_8$

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

$(101101.001)_2$

التوضيح في الخلف

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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 $+(2^{n-1}-1) = +2^5-1 = +31$

Smallest: -32 $\rightarrow$ $-2^{n-1} = -2^5 = -32$

Q#1.C

Complete following Table   Marks 3

$+1 = \overset{+}{0}000 \ 0001$

$+7 = \overset{+}{0}000 \ 0111$

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

الحالة الوحيدة التي يكون

NOR الـ 1 تكون

NOR

A
B

A	B	A+B	$\overline{A+B}$
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

2

The waveform shows signals A, B, X with handwritten values:
A: 0 1 1 1 0 0 1 0 0 0 1 1 0
B: 0 0 1 0 0 1 1 1 0 1 1 0 0
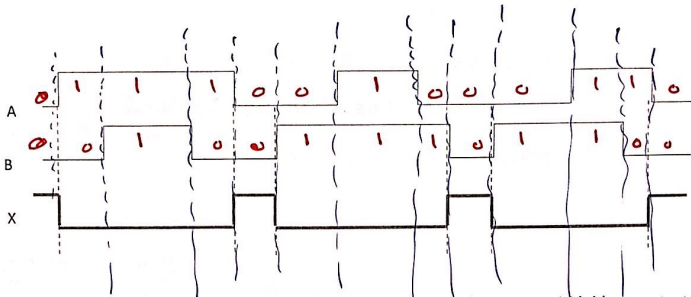
(b) Suppose a combinational circuit accepts a 3-bit binary number and generate a 4-bit binary output equal to double of the input number (e.g. if input is 011 the output is 0110).

  i. Write the truth table for the function

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

Answer of Question 2 (b)

output

	A	B	C	w	x	y	z	
0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0	2
2	0	1	0	0	1	0	0	4
3	0	1	1	0	1	1	0	6
4	1	0	0	1	0	0	0	8
5	1	0	1	1	0	1	0	10
6	1	1	0	1	1	0	0	12
7	1	1	1	1	1	1	0	14

Inputs | outputs

$w = \sum m (4, 5, 6, 7)$

$x = \sum m (2, 3, 6\ 7)$

$y = \sum m (1, 3, 5, 7)$

$z = 0$

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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

$$F(w, x, y, z) = \sum (0, 1, 2, 3, 7, 8, 10)$$
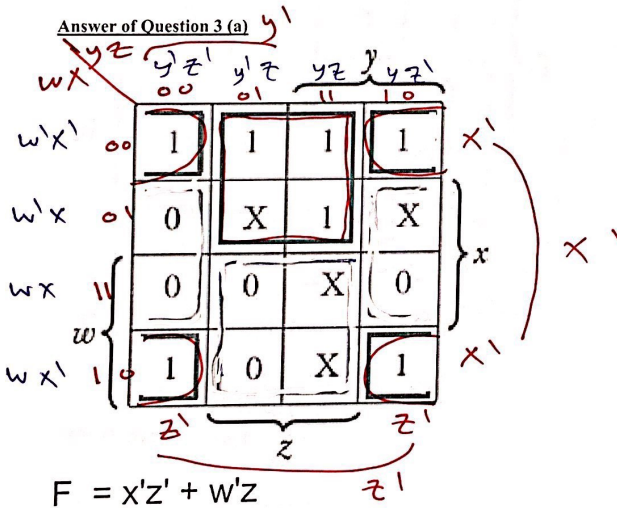$$d(w, x, y, z) = \sum (5, 6, 11, 15)$$

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

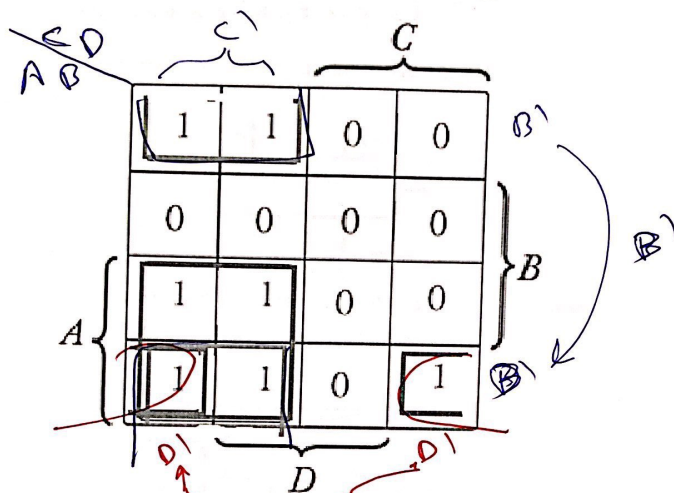$F(w, x, y, z) = \sum m (0, 1, 8, 9, 10, 12, 13)$

$f(A, B, C, D) =$

م سب بطبعها، في قول الـ

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

<u>Answer of Question 3 (a)</u>
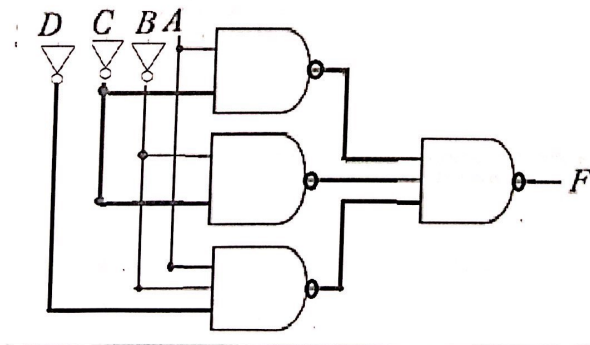

$F = x'z' + w'z$

<u>Answer of Question 3 (b)</u>
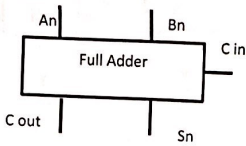
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$$F = AC' + B'C' + AB'D'$$

Answer of Question 3 (c)

Question 4 (6 Marks: 2+2+2) ch 5

(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.

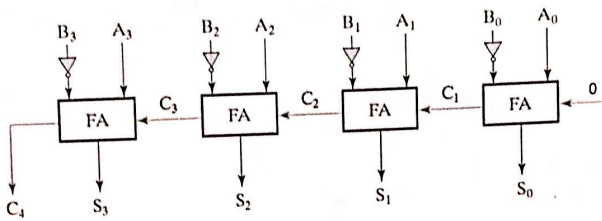| An	Bn	Cin	Sn	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

قطف

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

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

(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.

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

Sign overflow bit
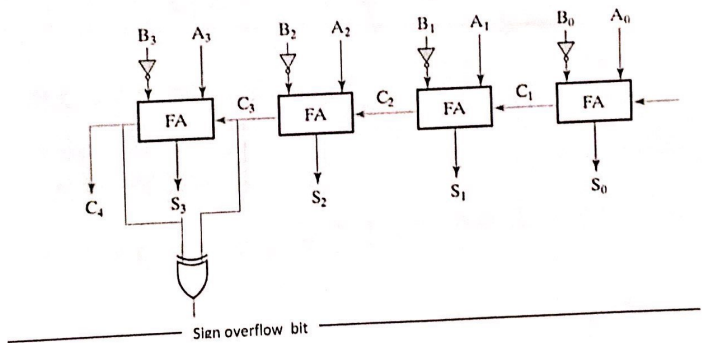
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THE END

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$\underline{Q_1 - b-2}$

$(45 \cdot 1250)_{10} = ($? $)_2$

يوجد /ها طريقتان للحل :

الطريقة الأولى بالجدول

	32	16	8	4	2	1	0.5000	0.2500	0.1250	
	1	0	1	1	0	1	0	0	1	

$45 - 32 = 13$
$13 - 8 = 5$
$5 - 4 = 1$

$\therefore (45 \cdot 125)_{10} = (101101 \cdot 001)_2$

الطريقة الثانية : بالقسمة للجزء الصحيح و الضرب للكسري:

$\begin{array}{c|cc}
2 & 45 & 1 \\
2 & 22 & 0 \\
2 & 11 & 1 \\
2 & 5 & 1 \\
2 & 2 & 0 \\
2 & 1 & 1 \\
 & 0 &
\end{array}$

$0.250 = 2 \times 0.125$
$0.500 = 2 \times 0.250$
$1 \cdot 0 = 2 \times 0.500$

$\therefore (45 \cdot 125)_{10} = (101101 \cdot 001)_2$

$$\underline{\varphi_1 - a - 3}$$

$$(1101.1)_2 = (\quad ? \quad)_{BCD}$$

ندخل العشري كوسيط ↑
$$(\quad)_{10}$$

① حوّل الباينري لعشري   ② حول العشري لـ BCD

تذكر ان ار BCD لايقبل نظام م تحول له إلا العشري

⑬

8	4	2	1	.	0.5000
1	1	0	1	.	1

$$8 + 4 + 1 + 0.5 = (13.5)_{10}$$

$$(0001\ 0011 . 0101)_{BCD}$$ ②

$$\boxed{\varphi_1 - a - 4}\qquad (21.4)_8 = (\quad)_{10}$$

ويمكن ايضا للحل : او لاتحول لـ Binary كوسيط ثم لعشري

$$(21.4)_8 = (010\ 001 . 100)_2$$

16	8	4	2	1	.	0.5000
		1	0	0	.	0 1 1

$$= 16 + 1 + 0.5 = (17.5)_{10}$$

الطريقة الثانية :

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بالضرب في قوى العدد 8

$$(21.4)_8 = 2 \times 8^1 + 1 \times 8^0 + 4 \times 8^{-1}$$
$$= 16 + 1 + \frac{4}{8} = (17.5)$$

المسوحة ضوئيا بـ CamScanner