Faculty of Computers and Artificial Intelligence Information Technology Department IT212-SIT213-CS221 Logic Design Prof. Imane Aly Saroit /Dr. Shaimaa Mosaad Four pages 60 minutes

Midterm (13/4/2022)

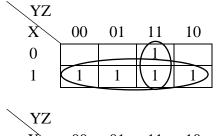
Name:	Id:	
		(Sum=20)

- 1. For the following two decimal numbers: 6514 and 6248:
 - Convert the two numbers into BCD code [1 mark]
 - Calculate the subtraction of the two numbers (show all your steps). [4 marks]

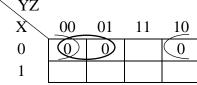
Q. J.	tion of the two h	anicers (sno ;;	an your step	,5,, [1 1141 115	
X.1.					
6514	0110	0101	ocet	0100	0.5
6248	0110	0010	0100	1000	0.5
		<u> </u>			
6514	0110	tótó	0001	0100	(95cm)
95 3751	0011	0111	1010	0001	-
	1010	1100	0110	0101	
neglect	+ 0110	+ 0110	Coll	rection Ste	P.
GSX	(0.5)	65)		ch one (0.5
	0,000	0000		4	
2 1 1 1 1 1 P C		244	ling 1		1
Addition itself (3	1.00	(E)		
			0410	01	10
THE RESERVE		0010	0110	03	70

- 2. Having the Boolean function $F(X, Y, Z) = XY + YZ + X\overline{Y}$
 - a. Using truth table to get F [2 marks]
 - b. Get the simplified F as SoP (using k-map) [0.75 mark]
 - c. Get the simplified F as PoS (using another k-map) [0.75 mark]
 - d. Is it better to build the function as SoP or PoS and why? [0.5 mark]

	X	Y	Z	\bar{Y}	XY	YZ	$X\overline{Y}$	F
0	0	0	0	1	0	0	0	0
1	0	0	1	1	0	0	0	0
2	0	1	0	0	0	0	0	0
3	0	1	1	0	0	1	0	1
4	1	0	0	1	0	0	1	1
5	1	0	1	1	0	0	1	1
6	1	1	0	0	1	0	0	1
7	1	1	1	0	1	1	0	1
	(0.5 mark)		1	(0.5				
				(0.25 mark)				mark)
				So all (1 mark)				



$$F(X,Y,Z)=X+YZ$$
 (0.75 mark)



$$F(X,Y,Z) = (X+Y)(X+Z)$$
(0.75 mark)

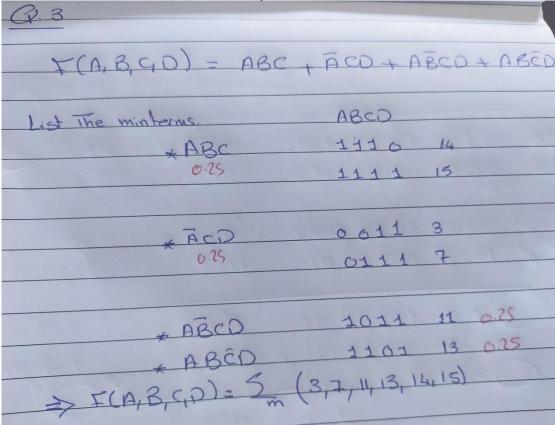
For the k-map if all/some the correct terms are mentioned + added unneeded terms, so each added unneeded term gets -0.25 mark (min grade of this part of the question =zero)

It is better to build the function as SoP as it needs one AND and one OR, while building the function using PoS needs two ORs and one AND. (0.5 mark).

3. For the following Boolean Function

$$F(A,B,C,D) = ABC + \overline{A}CD + A\overline{B}CD + AB\overline{C}D + d(0,8,9)$$

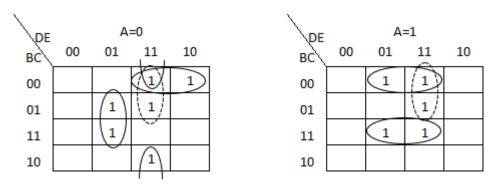
• List the minterms of the function (show your work). [1 mark]



• Using tabular method simply the function (show your work). [4 marks]

Using tabular		A 000	
0 0000 0 0000	0,8	_000	350 4 10/19 BEO Par
3 0011 8 1000			mill Deal O.S
20111		700-	ABC
8 1000 3 001H		7/101	11 2 11 X
9 1001 9 1001			3/4/15 11 CD
11 1011		-011	9,11,15,15 1-1 AD
13 1101 7 0111	Million		M 05
14 1110 11 1011-		1-01	
15 1111 13 1 101-		-	
14 1110		-111	
	1415		
15 1111			
	14,15	Do-5	LABC+CD
incorrect points 5	L 11	-	
	- 11	15	14 15 + AD
BED.			
ARC -			
BBC BC			* Covert
co * *	*		Grid
AO	*	*	- Wild
			1 (3)

4. Design a circuit with 5-input binary input (A,B,C,D,E). It produces a high output F for any prime number detected in the input. Using k-map, get the simplified function as SoP. (No need to put the truth table). Note that a prime number is an integer > 1 that has no positive integer divisors other than 1 and itself. [4 marks]

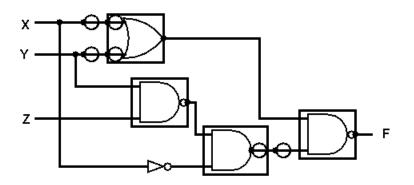


 $F(A,B,C,D,E) = \bar{B}DE + \bar{A}\bar{B}\bar{C}D + \bar{A}C\bar{D}E + \bar{A}\bar{C}DE + A\bar{B}\bar{C}E + ABCE$

1 mark to add the 1's on the k-map. Each term gets 0.5 mark (total =3 marks)

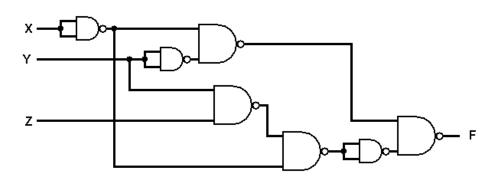
If all/some the correct terms are mentioned + added unneeded terms, so each added unneeded term gets -0.25 mark (min grade of this part of the question =zero)

5. If the propagation delay of NOT, AND, OR, NANDs are 2, 10, 10, 12 nsec respectively, get the propagation delay [0.5 mark] for the following logic circuit, then build it using only NANDs. [1.5 marks]



Propagation delay of the original circuit = 34 nsec

0.5 mark



The two already existing NANDs earns 0.25 mark together. Each new NAND earns 0.25 mark (total =1.5 marks).

Each unneeded gate gets -0.25 mark (min grade of this part of the question =zero)