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

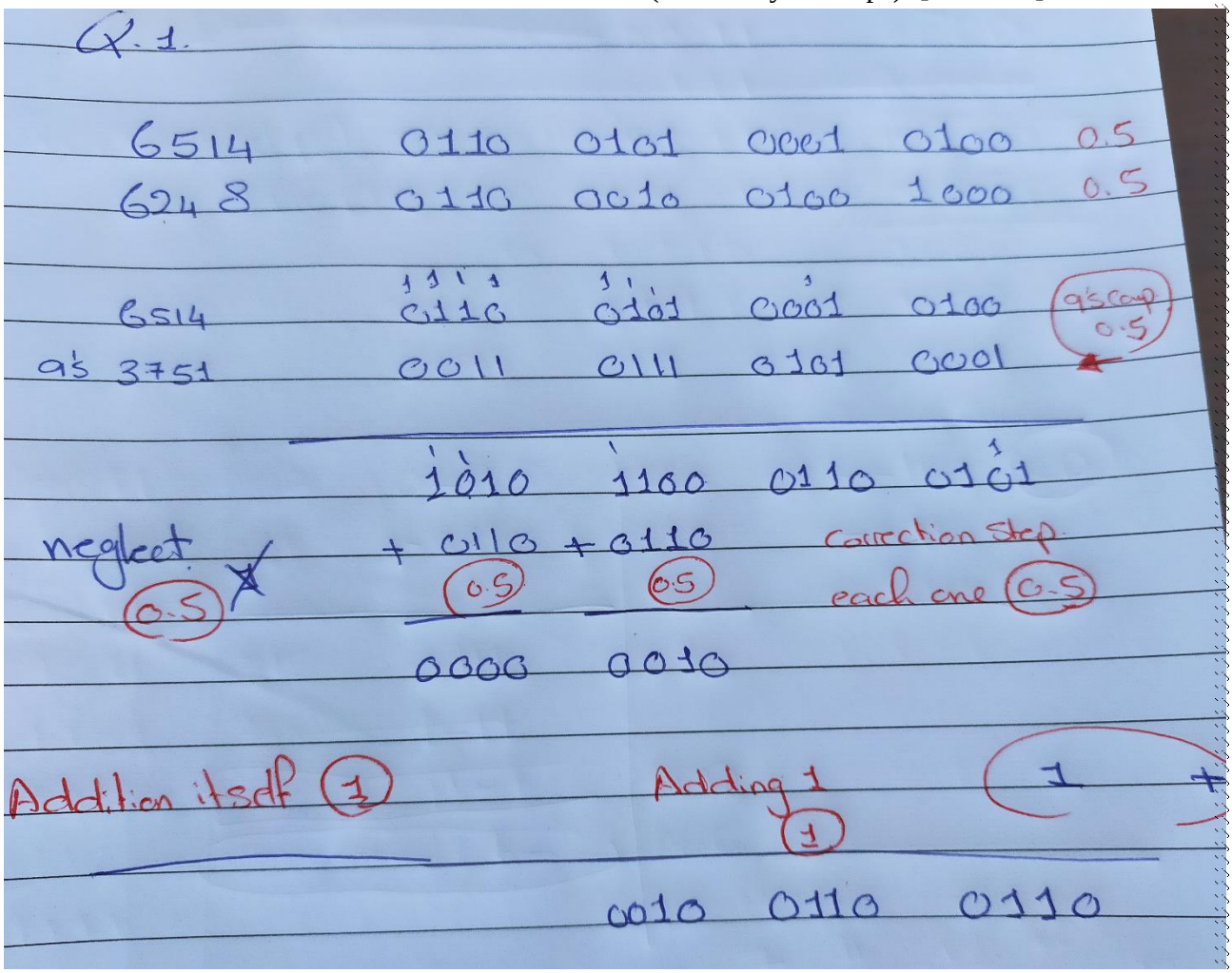
Midterm

(13/4/2022)

Name: _____ Id: _____

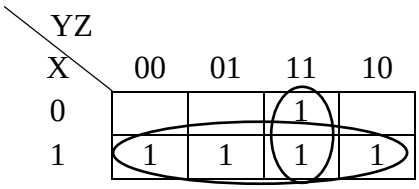
(Sum=20)

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]**

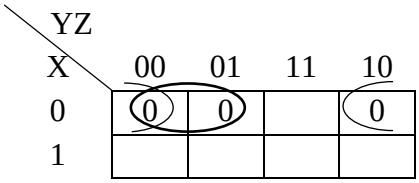


2. Having the Boolean function $F(X,Y,Z) = XY + YZ + X\bar{Y}$
   a. Using truth table to get F **[2 marks]**
   b. Get the simplified F as SoP (using k-map) **[0.75 mark]**
   c. Get the simplified F as PoS (using another k-map) **[0.75 mark]**
   d. Is it better to build the function as SoP or PoS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

	X	Y	Z	$\bar{Y}$	XY	YZ	$X\bar{Y}$	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)			Each column ***(0.25 mark)*** So all ***(1 mark)***				***(0.5 mark)***



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



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

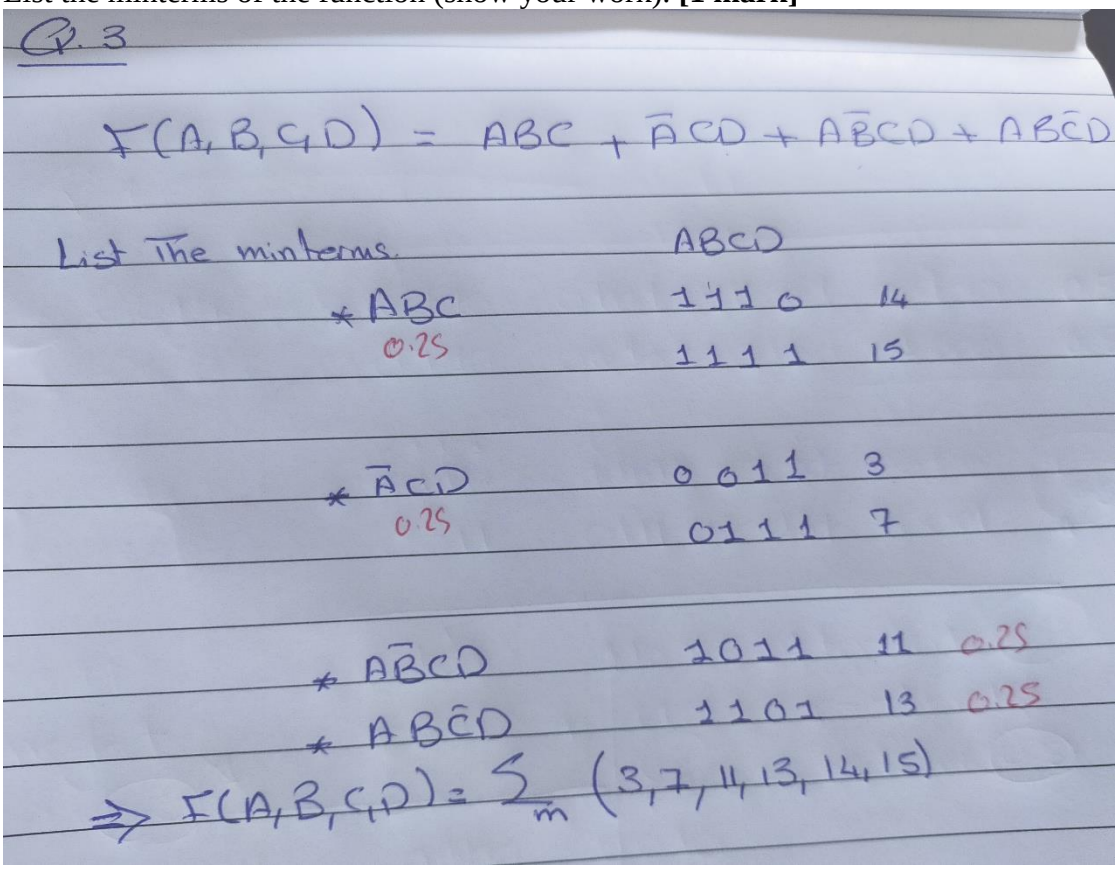
For the k-map if all/some the correct terms are mentioned + added unneeded terms, so each added unneeded term gets -0.25 mark (min grade of this part of the question =zero)

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)***.

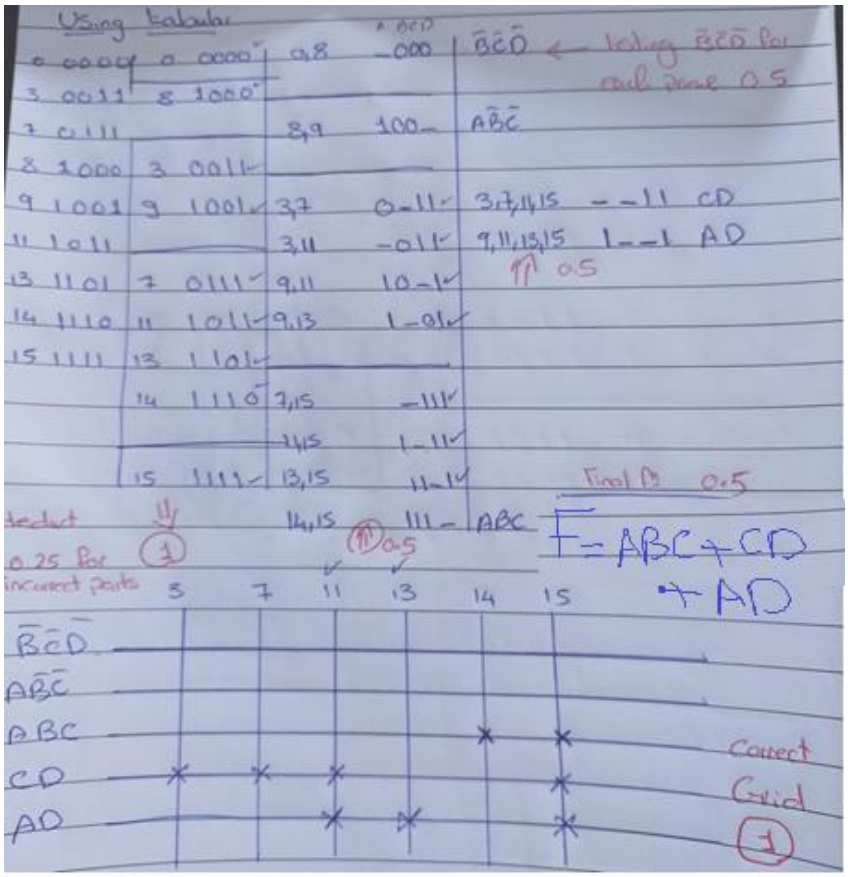
3. For the following Boolean Function

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

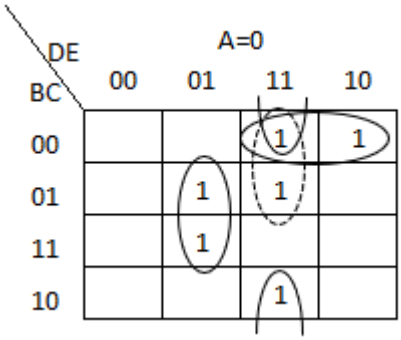
- List the minterms of the function (show your work). **[1 mark]**

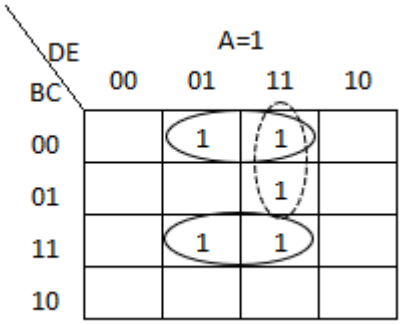


- Using tabular method simply the function (show your work). **[4 marks]**



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]**

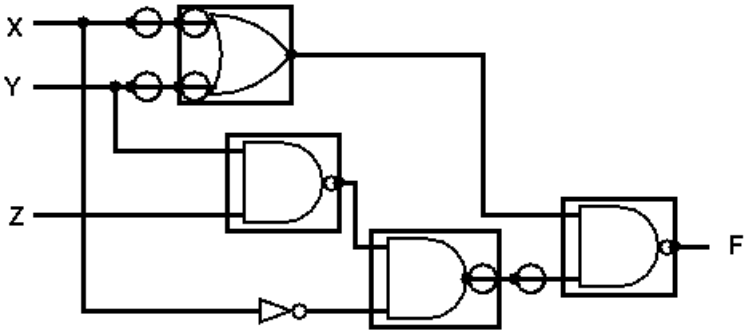




$$F(A,B,C,D,E) = \bar{B}DE + \bar{A}\bar{B}\bar{C}D + \bar{A}C\bar{D}E + \bar{A}\bar{C}DE + A\bar{B}\bar{C}E + ABCE$$

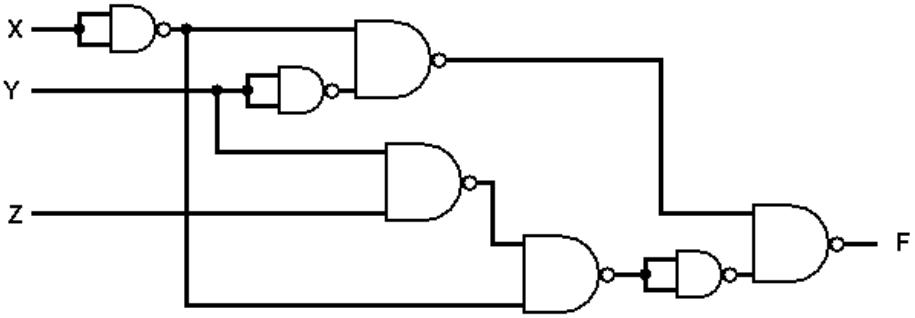
1 mark to add the 1's on the k-map.
Each term gets 0.5 mark (total =3 marks)
If all/some the correct terms are mentioned + added unneeded terms, so each added unneeded term gets -0.25 mark (min grade of this part of the question =zero)

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)