



# Mid Term Exam

## Digital Design

Time Allowed: 1 hrs.

Dr: Ahmed Saleh

Total Marks: 25

BME Students.

2018 - 2019



Attempt the following:

• يسمح باستخدام القلم الرصاص (شرط وضوح الخط).

• الرجاء وضوح الرسم قدر المستطاع (ليس شرطا استخدام المسطرة)

• عدد الاسئلة = 2

### Question 1

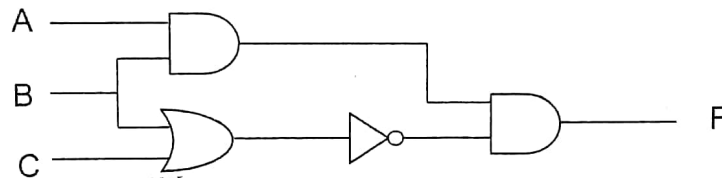
(A) Implement (Draw) the following functions Using NAND only.  
 $F = A'BC' + AC + A'B'C$

(B) Find the complement of the following function:  $F = B' + A'B'C' + AD + A'BC$

(C) Using Equations, simplify the following function:  $F(X,Y,Z) = XY + X'Z + YZ$

(D) Using Equations: Express the function:  $F(A,B,C) = A + B'C$  in **Sum of minterms**, what are the corresponding Maxterms?

(E) Find the output ONLY for the following circuit:



(20 marks)

### Question 2

(A) Using Map, simplify the following function:  $F(A,B,C,D) = BC + A'D' + A'B'D$

Use:

- Sum of product form.
- Product of sum form.

(B) Assuming four variables in the order (A, B, C, D), Simplify the following functions (F1, F2) using the shown maps

1	0	x	1
x	x	1	1
0	0	0	1
1	0	0	x

F1

1	1	x	1
x	1	1	x
0	x	0	1
x	0	0	x

F2

(10 marks)

*Note: the exam has more 5 degrees as OVER 😊*

----- End of Questions -----

With Best Wishes

**Dr: Ahmed Saleh**

Plz, send feedback about the exam to:

[aisaleh@yahoo.com](mailto:aisaleh@yahoo.com)

Q (1)

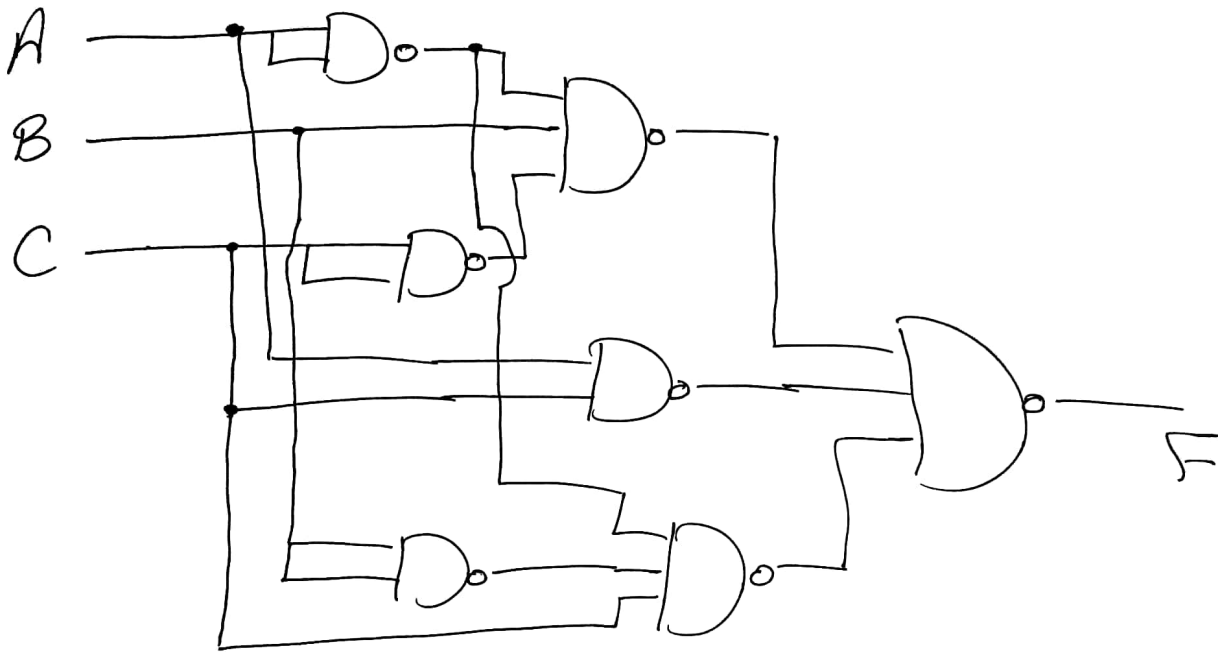
Mid. Term. Exam. Model Ans. 20/8/2019

[A]  $F = (\bar{A}B\bar{C} + AC + \bar{A}\bar{B}C)$

using NAND

$$F = (\bar{A}B\bar{C} + AC + \bar{A}\bar{B}C)''$$

$$F = ((\bar{A}B\bar{C})' \cdot (AC)' \cdot (\bar{A}\bar{B}C)')'$$



[B]  $F = (\bar{B} + \bar{A}\bar{B}\bar{C} + AD + \bar{A}BC)'$

Comp.

$$\bar{F} = B \cdot (A+B+C) \cdot (\bar{A}+\bar{D}) \cdot (A+\bar{B}+\bar{C})$$

[C]  $F(x,y,z) = xy + \bar{x}z + yz(\bar{x}+x)$

Simp.

$$= xy + \bar{x}z + \bar{x}y z + x y z$$

$$= xy(\underbrace{1+z}_1) + \bar{x}z(\underbrace{1+y}_1)$$

$$= xy + \bar{x}z$$

$$\boxed{D} \quad F(A, B, C, D) = A + \underset{\substack{\downarrow \\ B, C}}{\bar{B}C}$$

$$* A(B + \bar{B})(C + \bar{C}) = ABC + AB\bar{C} + A\bar{B}C + A\bar{B}\bar{C}$$

$$* \bar{B}C(A + \bar{A}) = A\bar{B}C + \bar{A}\bar{B}C$$

$$\text{Sum of Min.} = \underset{111}{ABC} + \underset{110}{AB\bar{C}} + \underset{101}{A\bar{B}C} + \underset{100}{A\bar{B}\bar{C}} + \underset{001}{\bar{A}\bar{B}C}$$

$$= m_7 + m_6 + m_5 + m_4 + m_1$$

$$= \sum (1, 4, 5, 6, 7)$$

$$\text{Prod. of Max.} = \prod (0, 2, 3)$$

$$= \underset{000}{M_0} \cdot \underset{010}{M_2} \cdot \underset{011}{M_3}$$

$$= (A+B+C) \cdot (A+\bar{B}+C) \cdot (A+\bar{B}+\bar{C})$$

$\boxed{E}$  From The draw Circuit.

$$x_1 = AB$$

$$x_2 = B + C$$

$$x_3 = \bar{x}_2 = (B + C)' = \bar{B}\bar{C}$$

$$F = x_1 \cdot x_3 = AB \cdot \bar{B}\bar{C} = \phi$$

Q(2)

[A]  $F = BC + \bar{A}\bar{D} + \bar{A}BD$

AB \ CD	00	01	11	10
00	1	1	1	1
01	1	0	1	1
11	0	0	1	1
10	0	0	0	0

Sum. of min.

AB \ CD	00	01	11	10
00	1	1	1	1
01	1		1	1
11			1	1
10				

$F = \bar{A}\bar{D} + BC + \bar{A}B$

Prod. of Max.

AB \ CD	00	01	11	10
00				
01		0		
11	0	0		
10	0	0	0	0

$\bar{F} = A\bar{B} + A\bar{C} + B\bar{C}D$

$F = (\bar{A} + B) \cdot (\bar{A} + C) \cdot (\bar{B} + D)$

[B]

AB \ CD	00	01	11	10
00	1	0	X	1
01	X	X	1	1
11	0	0	0	1
10	1	0	0	X

$F = \bar{A}C + C\bar{D} + \bar{B}\bar{D}$

AB \ CD	00	01	11	10
00	1	1	X	1
01	X	1	1	X
11	0	X	0	1
10	X	0	0	X

$F = \bar{A} + C\bar{D}$