

Digital Logic Design

Sessional-I Exam

(EE1005)

Date: March 1, 2025

Course Instructor(s)

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Total Time: 1 Hours

Total Marks: 50

Total Questions: 03

Semester: SP-2025

Campus: Lahore

Dept: Computer Science

Student Name

Roll No

Section

Student Signature

Vetted by

Vetter Signature

Instructions:

Calculators are not allowed. Please provide your final answer in the space provided.

Show full working for each question. Page-4 is for rough work which will not be checked/marked.

CLO #1: Understand different number systems and their conversion.

Q1: $(82A.25)_{12} \times (210)_3 = ($ $)_{12}$

[10 marks]

Firstly,

$$(210)_3 = 2 \times 3^2 + 1 \times 3^1 + 0 \times 3^0 = 18 + 3 + 0 = (21)_{10}$$

$$(21)_{10} = (19)_{12} \quad \checkmark$$

Now

$$\begin{array}{r} \textcircled{2}8\textcircled{2} \textcircled{A} \cdot \textcircled{2}5 \\ \times \quad \quad \quad 19 \\ \hline \end{array}$$

$$621799$$

$$+ 82A25 \times$$

$$(124BA.29)_{12}$$

$$\begin{array}{r} 12 \overline{) 21} \\ \underline{1-9} \end{array}$$

CLO # 2: Construct optimized combinational circuit design

Q2: A) Prove that the following statement holds using Boolean algebra properties [10 +10 marks]

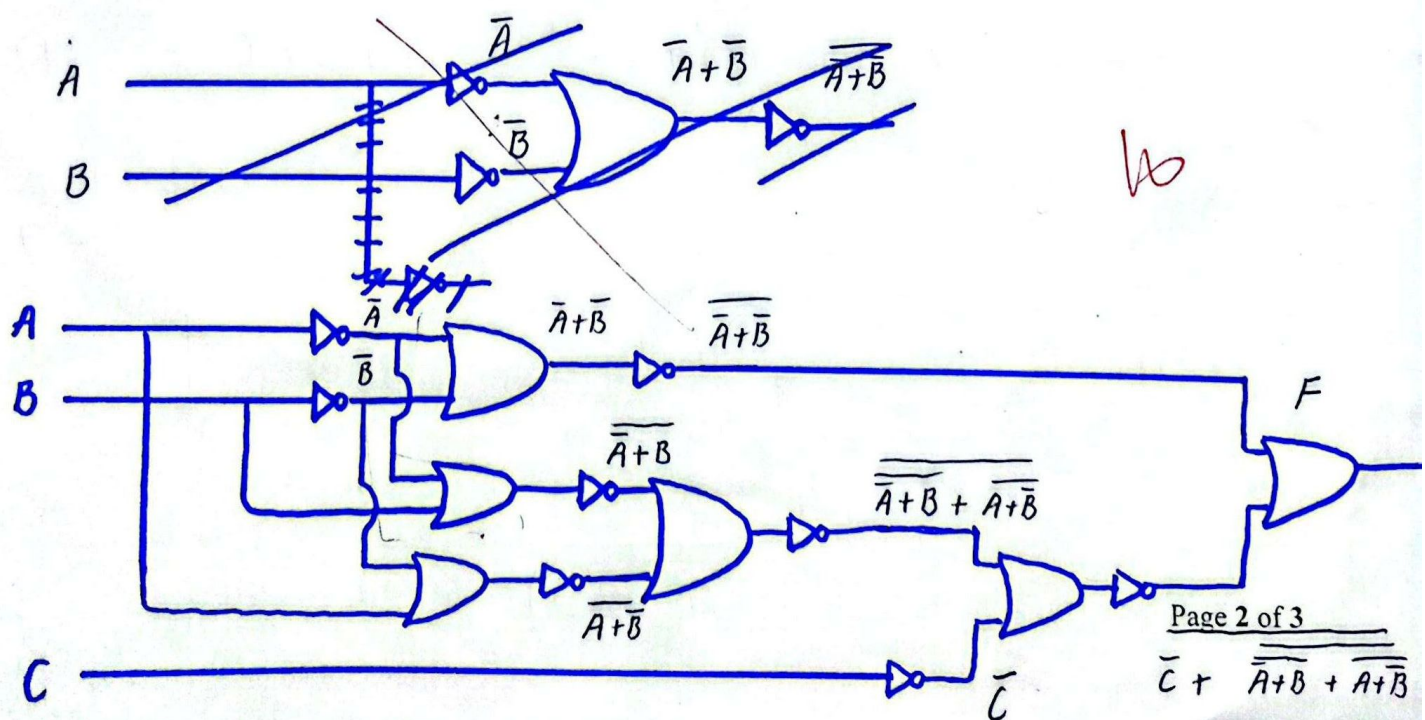
Let LHS = $AB + \bar{A}BC + ABD + A\bar{B}C + ABC = AB + C(A \oplus B)$

$$\begin{aligned}
 &AB + \bar{A}BC + ABD + A\bar{B}C + ABC \\
 &= AB(1+D) + \bar{A}BC + A\bar{B}C + ABC \\
 &= AB + AB\bar{C} + \bar{A}BC + A\bar{B}C \quad \because 1+D = 1 \\
 &= AB(1+C) + \bar{A}BC + A\bar{B}C \\
 &= AB + (\bar{A}B + A\bar{B})C \\
 &\text{Since } \bar{A}B + A\bar{B} = A \oplus B \text{ (XOR)} \\
 &= AB + C(A \oplus B)
 \end{aligned}$$

Hence proved!

B) Draw the following function with OR and NOT gates only

$$F = AB + C(A \oplus B)$$



CLO # 2: Construct optimized combinational circuit design

Q3: A Boolean function is given as follows:

[10+10 marks]

$$F(A, B, C, D) = \prod M(1, 2, 3, 8)$$

$$d(A, B, C, D) = AB\bar{C}\bar{D} + \bar{A}B\bar{C}\bar{D} = \sum m(12, 4)$$

1100 + 0100

Minimize the function **F** in **Product of Sums** form using K-maps shown below:

(Note: No marks will be given if K-map is not properly filled.)

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

A B \ CD		CD			
		00	01	11	10
00	0		0	0	0
	1				
01	4	X			
	5				
11	12	X			/
	13				
10	8	0			
	9				

Minimize the same function **F** in **Sum of Products** form using K-maps shown below:

$$F(A, B, C, D) = \bar{A}\bar{C}\bar{D} + B + AD + AC$$

A B \ CD		CD			
		00	01	11	10
00	0	1			
	1				
01	4	X	1	1	1
	5				
11	12	X	1	1	1
	13				
10	8		1	1	1
	9				