



Midterm. Exam

Academic Year 1447 - First Semester

Model
Ans

Exam Information معلومات الامتحان		
Course name	تصميم المنطق الرقمي	اسم المقرر
Course Code	COE 211	رمز المقرر
Exam Date	7 / 10 / 2025	تاريخ الامتحان
Exam Time	12:00 – 13:00	وقت الامتحان
Exam Duration	1 Hour	مدة الامتحان
Classroom No.	GF 1	رقم قاعة الاختبار
Instructor Name	Prof. Dr. Mostafa Elhosseini	اسم استاذ المقرر

Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions:

تعليمات عامة:

- Your Exam consists of 2 PAGES (except this paper) (عدد صفحات الامتحان 2 صفحة. (باستثناء هذه الورقة)
- Phones and smart devices are forbidden inside the hall. (يمنع استخدام الهواتف والأجهزة الذكية داخل القاعة.

هذا الجزء خاص باستاذ المادة

This section is ONLY for instructors.

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	Write numbers in various number systems.	Q1 – Part A	3	
2	Recognize the basics of Boolean algebra.	Q1 – Part B	3	
3	Describe the basic concept of sequential circuit.	Q4 – Part A	3	
4	Analyze small- and medium-scale logic functions as building blocks.	Q3	6	
5	Analyze and design the behavior of sequential circuits.	Q4 – Part B	6	
6	Simplify Boolean functions using Boolean algebra and the Karnaugh map.	Q2	6	
7	Communicate effectively in oral and written form	Q1 – Part C	3	

Question 1: Points: 9

CLO #1, 2, 7

Part A: Points 3

CLO #1

Convert the **signed** decimal number -13 to binary equivalent.

$$\begin{array}{r} 13 \quad 1101 \quad -13 \\ +13 \quad 01101 \\ \hline \end{array} \quad \begin{array}{c} y \\ \boxed{10011} \end{array}$$

What is the **largest signed decimal number** that can be expressed with 5-bits?

$$\begin{array}{r} -16 \quad 8 \quad 4 \quad 2 \quad 1 \\ \boxed{0} \quad 1 \quad 1 \quad 1 \quad 1 \\ \hline \end{array} \Rightarrow \boxed{15}$$

Represent decimal number 17 in BCD

$$0001 \quad 0111$$

Part B: Points 3

CLO #2

Simplify For the Boolean equation

$$F(A, B) = AB + B$$

$$\begin{aligned} &= (A + \bar{B})(B + \bar{B}) \\ &= \boxed{A + B} \end{aligned}$$

1. simplify the expression $(A + B)(A + B')$. Write the final simplified result.

$$\begin{aligned} &= AA + A\bar{B} + AB + B\bar{B} \\ &= A + A\bar{B} + AB = A(1 + B + \bar{B}) \\ &= \boxed{A} \end{aligned}$$

Part C: Points 3

CLO #7

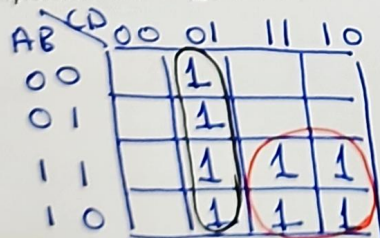
Convert BCD number 11001 to decimal number

$$19_{BCD}$$

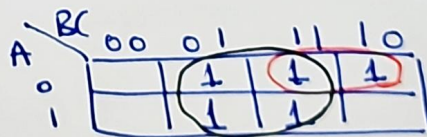
$$\begin{array}{r} 0001 \quad 1001 \\ \hline 19 \end{array}$$

Question 2: Points: 6

CLO #6

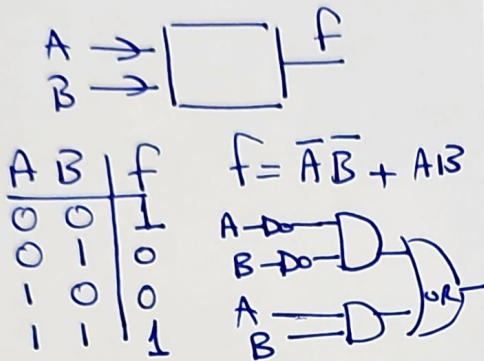
Use the Karnaugh map to obtain the minimal expression of $F = \sum(1, 5, 9, 10, 11, 13, 14, 15)$ 

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

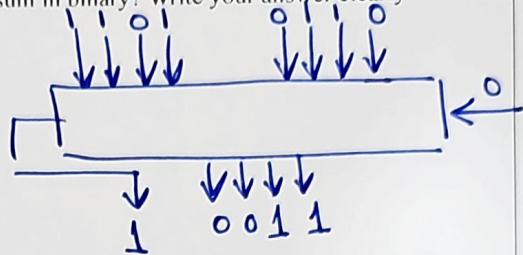
Simplify the Boolean function using a 3-variable Karnaugh map: $F(A, B, C) = \sum(1, 2, 3, 5, 7)$ 

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

Design a digital circuit that compares two 1-bit numbers. The circuit should output 1 if the numbers are equal and 0 otherwise

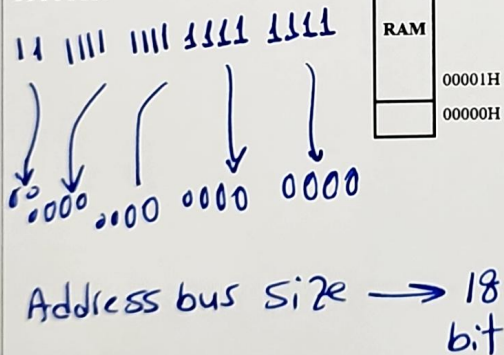


If the binary inputs $A = 1101$ and $B = 0110$ are fed into a 4-bit binary adder, what will be the resulting sum in binary? Write your answer clearly



Part A: Points 3 CLO #3

What is the required size of the address bus to address the memory range from 00000H to 3FFFFH?



Part B: Points 6 CLO #5

Determine the total memory capacity of the system if the address range extends from 00000H to 3FFFFH

if each row store 1 byte

Memory Capacity = 2^{18} byte

$= 2^8 \times 2^{10} = 256 \text{ kbyte}$

Best Wishes

Dr. Mostafa Elhosseini
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