İZMİR UNIVERSITY
OF ECONOMICS

IZMIR UNIVERSITY OF ECONOMICS
Faculty of Engineering

Term	**: 2024-2025 Fall**
Course ID	**: EEE 242**
Exam	**: Midterm Exam**
Date	**: 12 Nov 2024**
Duration	**: 90 min**
Instructor	**: Assoc. Prof. Mehmet Turkan, Asst. Prof. Faezeh Yeganli**

Full Name : ..... SOLUTION KEY .....

Student ID : .....

Classroom : ..... **Section** : .....

Information on exam rules

Electronic devices such as laptops, mobile phones, and smartwatches are generally prohibited in the examination room. However, exceptions can be made for individuals with special needs, provided they have valid medical documentation. Requests for exceptions must be submitted with prior written approval from the academic advisor, and they should include details on the necessary measures to maintain the integrity and security of the examination.

Please refrain from engaging in cheating or any other prohibited activities during the examination. Suspected cheating may result in a score of zero on your exam, and any students found cheating may face disciplinary actions in accordance with law #2547. This includes actions such as using unauthorized electronic devices, communicating with classmates, exchanging exam or formula sheets, or using unauthorized written materials during the exam, all of which qualify as attempted cheating.

This is a closed-book and closed-notes exam. Calculators, laptops, mobile phones are not permitted.

Declaration

I affirm that the activities and assessments completed as part of this examination are entirely my own work and comply with all relevant rules regarding copyright, plagiarism, and cheating. I acknowledge that if there is any question regarding the authenticity of any portion of my assessment, I may be subject to oral examination. The signatory of evidence records may also be contacted, or a disciplinary process may be initiated as per law #2547.

Signature of Student:

Question	1	2	3	4	5	6	7	8
Score	/ 33	/ 27	/ 40	-	-	-	-	-
Total	/ 100							

Q1. Convert the given numbers from the given base to other bases and BCD Code in each row of the table. **Show your work for full credit.**

Decimal	Binary	Hexadecimal	Octal	BCD
13.25	(a) = ?	(b) = ?	(c) = ?	(d) = ?
(e) = ?	100101.10	(f) = ?	(g) = ?	(h) = ?
(i) = ?	(j) = ?	CD	(k) = ?	(l) = ?
(m) = ?	(n) = ?	(o) = ?	34	(p) = ?

$13 \mid 2$, $12\ 6 \mid 2$, $1\ \ 6\ \ 3 \mid 2$, $0\ \ 2\ \ 1$, 1

$0.25 \times 2 = 0.5$ 0
$0.5 \times 2 = 1$ 1

each one (2) + (1)

a) $(1101.01)_2$ b) $(D.4)_{16}$ c) $(15.2)_8$

d) $(00010011.00100101)_{BCD}$

e) $2^0 + 2^2 + 2^5 + 2^{-1} = (37.5)_{10}$ f) $(25.8)_{16}$

g) $(45.4)_8$ h) $(00110111.0101)_{BCD}$

i) $\underbrace{13}_{D} + 16.\underbrace{12}_{C} = (205)_{10}$ j) $(11001101)_2$

k) $(315)_8$ l) $(001000000101)_{BCD}$

m) $4 + 3.8 = (28)_{10}$ n) $(011100)_2$

o) $(1C)_{16}$ p) $(00101000)_{BCD}$

Q2. Simplify the given expressions using **Boolean Algebra.**
Show your work for full credit.

a) $\mathbf{F}(A, B, C) = ABC + \overline{A} + A\overline{B}C$
b) $\mathbf{F}(A, B, C) = AB + \overline{AC} + A\overline{B}C(AB + C)$
c) $\mathbf{F}(A, B, C) = \overline{A}B + B\overline{C} + BC + A\overline{B}\,\overline{C}$

2)

a) $F = ABC + \bar{A} + A\bar{B}C$

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

$= AC + \bar{A} = (A+\bar{A})(\bar{A}+C) = \underline{\bar{A}+C}$

b) $F = AB + \overline{\bar{A}C} + A\bar{B}C(AB+C)$

$= AB + \bar{A} + \bar{C} + A\bar{B}CAB + A\bar{B}CC$

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

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

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

$= A\bar{B}C + A\bar{B}C = T$ // (1)

c) $F = \bar{A}B + B\bar{C} + BC + A\bar{B}\bar{C}$

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

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

$= B(\bar{A}+1) + A\bar{B}\bar{C} = B + A\bar{B}\bar{C}$

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

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

Q3. For a given Boolean function **F** in **product-of-maxterms (POM)** form:

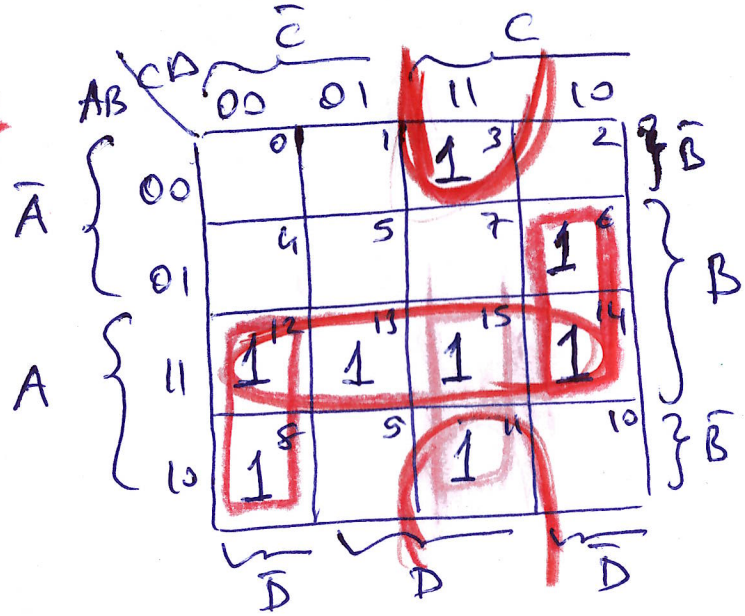
$$F(A, B, C, D) = \prod_M (0, 1, 2, 4, 5, 7, 9, 10)$$

8 **(a)** Using **K-maps**, simplify **F** in the **sum-of-products (SOP)** form. Calculate **Gate Input (G) cost.**
8 **(b)** Using simplified SOP form, draw the circuit with **elementary gates (AND, OR, NOT).**
8 **(c)** Using **K-maps**, simplify **F** in the **product-of-sums (POS)** form. Calculate **Gate Input (G) cost.**
8 **(d)** Using simplified POS form, draw the circuit with **elementary gates (AND, OR, NOT).**
8 **(e)** Which solution (SOP or POS) is the best in terms of **G cost?**

Show your work for full credit.

$F = \Sigma_m(3,6,8,11,12,13,14,15)$

a)

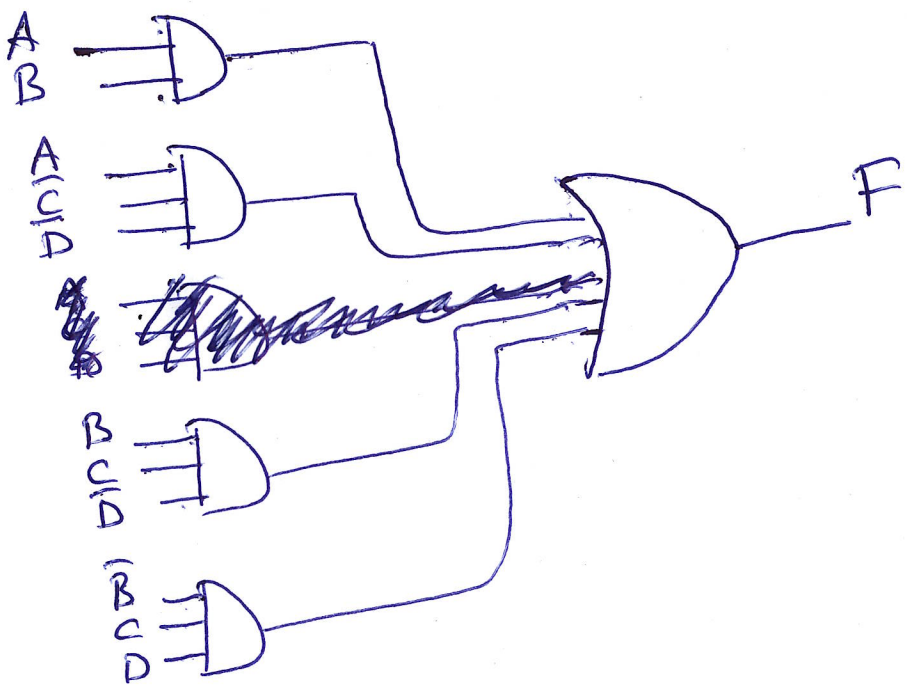


SoP

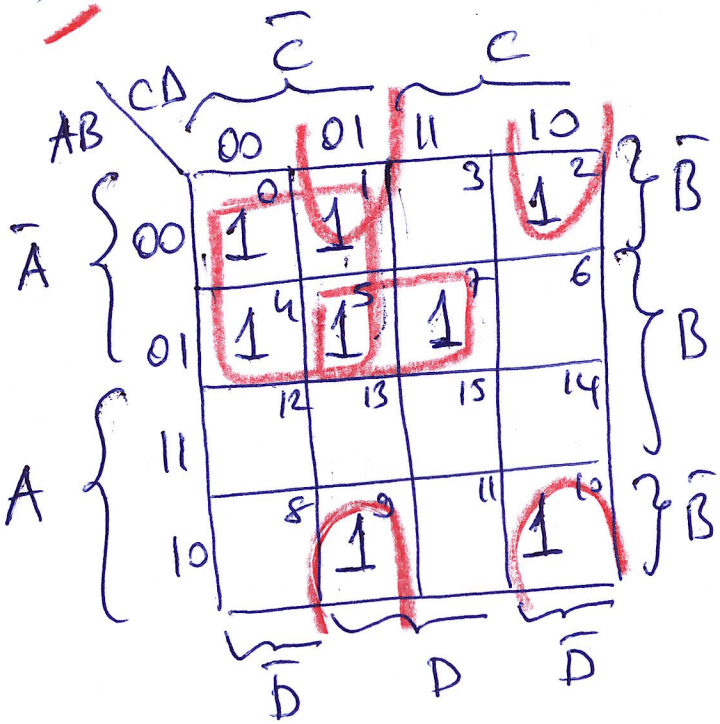
$F = AB + A\bar{C}\bar{D} + B\bar{C}\bar{D} + \bar{B}CD$

$G = 15$ (cost)

b)



c) $\overline{F} = \Sigma_m(0,1,2,4,5,7,9,10)$



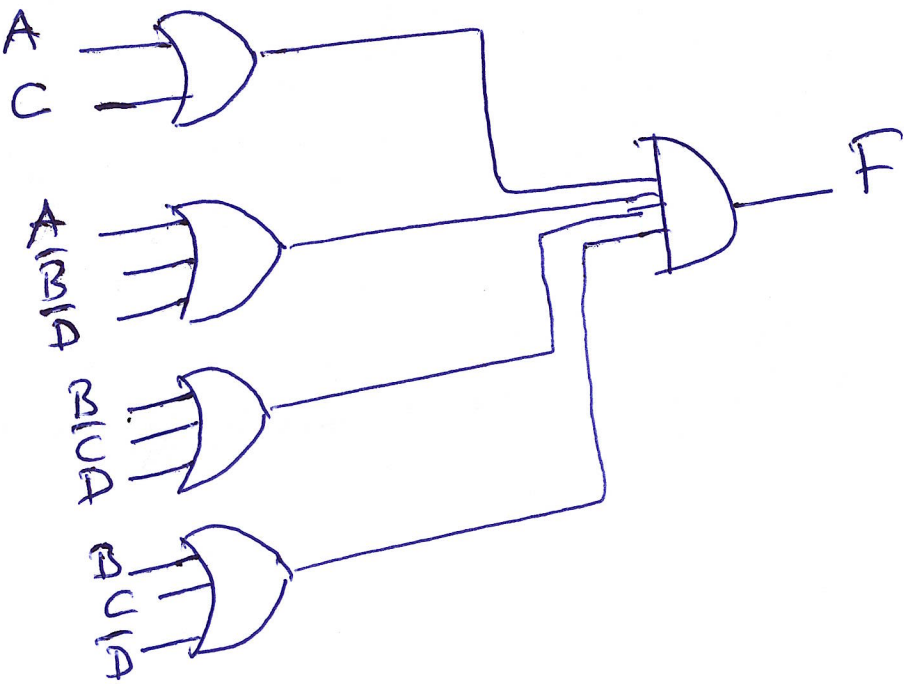
POS

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

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

G = 15 (cost)

d)



e) ~~POS solution is the best in terms of G cost~~

POS and SOP solutions have the same G cost.