National University of Computer and Emerging Sciences, Lahore Campus

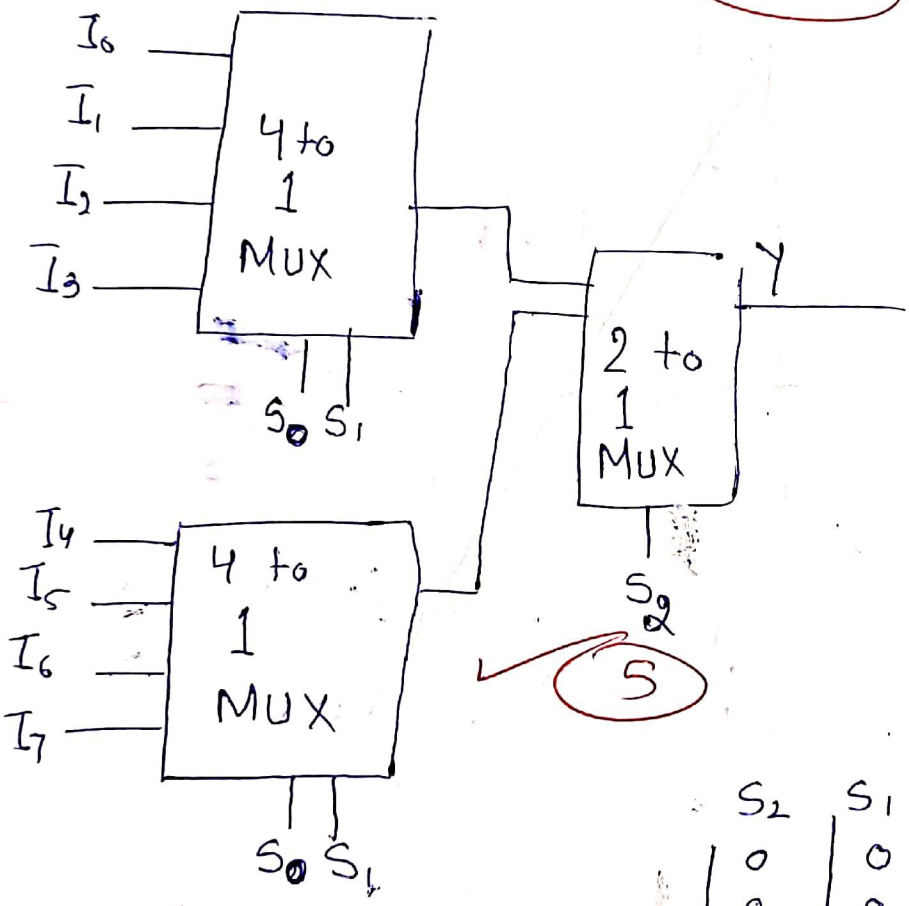
Course:	Digital Logic Design	Course Code:	EE-227
Program:	BS (Computer Science)	Semester:	Spring-2022
Duration:	15 Minutes	Total Marks:	10
Paper Date:	09/04/2022	Weight	
Section:	2N	Page(s):	3
Exam:	Quiz 3	Roll No.	

Instruction/Notes: Calculators are strictly not allowed in all exams
Plagiarism will be dealt seriously causing an F in (

Question 01: [5 M]

Design an 8–to–1-line multiplexer using two 4–to–1-line multiplexers and one 2-to-1-line multiplexer.

9.5 to 9 = 10



S_2	S_1	S_0
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

Question 02: [5M]

Implement the Boolean function $F(A, B, C, D) = \sum m(1, 3, 4, 11, 12, 13, 14, 15)$ with a 4–to–1-line multiplexer and external gates. Connect inputs *A* and *B* to the selection lines. The input requirements for the four data lines will be a function of the variables *C* and *D*. The values of these variables are obtained by expressing *F* as a function of *C* and *D* for each of the four cases when *AB* = 00, 01, 10 and 11. These functions must be implemented with external gates.

Selection lines.

A	B	C	D	F
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

$F = D$

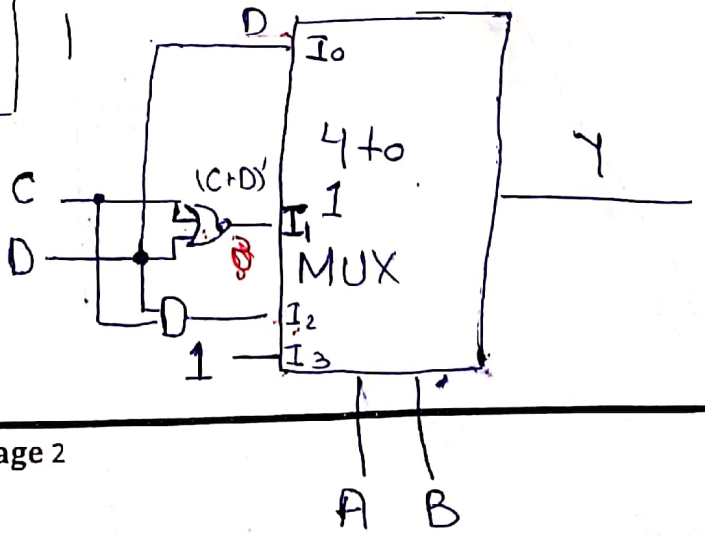
$F = (C+D)'$

NOR

$F = CD$

4.5+0.5

$F = 1$



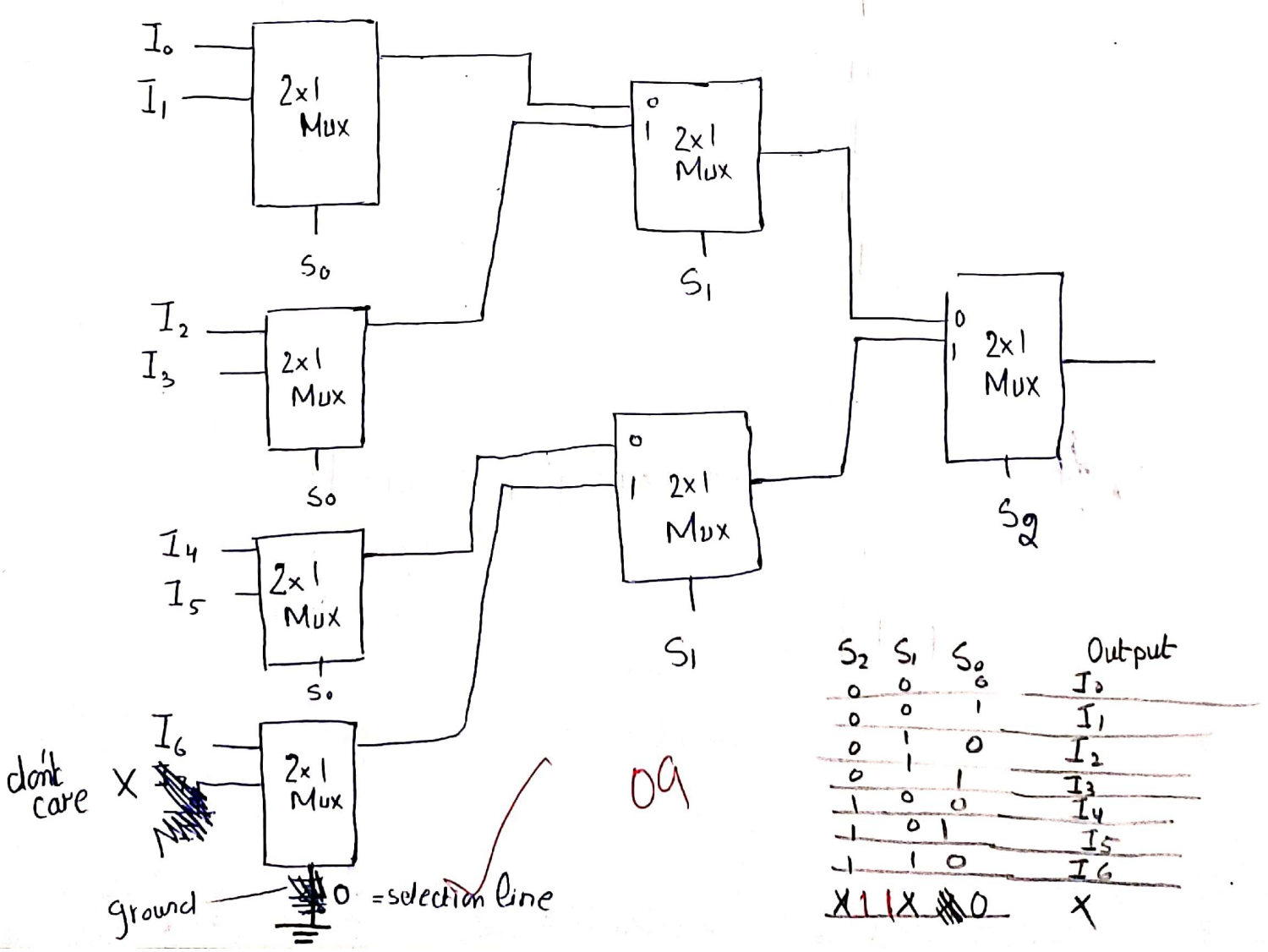
National University of Computer and Emerging Sciences, Lahore Campus

Course:	Digital Logic Design	Course Code:	EE227
Program:	BS(Computer Science, Data Science)	Semester:	Spring 2022
Duration:	60 Minutes	Total Marks:	50
Paper Date:	09 – May – 2020	Weight	15%
Section:	ALL	Page(s):	5
Exam:	Midterm-II	Section:	
Name:		Roll No.	

Instruction/Notes:
- *Attempt all the questions on this answer booklet. You can use extra sheets for your scratch work but **these will not be collected and marked.***
- *Make sure you write your roll # on EVERY sheet of the booklet.*

Question Number:	Q. 1	Q. 2	Q. 3	Total
Marks:	10	20	20	50
Marks Obtained:	09	20	20	49

Question 1: Construct a 7-to-1-line multiplexer with as many 2-to-1-line multiplexers as are needed. [10]



Question 2:

A new type of flip-flop, **GH flip-flop** (GH F/F) has been introduced that has four operations as shown in Table 1.

Use the given space to

(a) Tabulate the characteristic table. [5]

(b) Derive the characteristic equation [5]

(c) Tabulate the excitation table. [10]

G	H	Function
0	0	Clear to 0
0	1	No change
1	0	Complement
1	1	Set to 1

Table 1: Function table of GH F/F

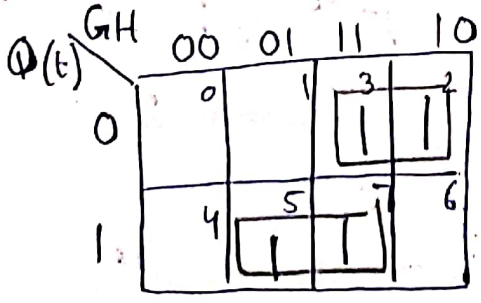
Q(t)	G	H	Q(t+1)	
0	0	0	0	0
0	0	1	0	1
0	1	0	1	2
0	1	1	1	3
1	0	0	0	4
1	0	1	1	5
1	1	0	0	6
1	1	1	1	7

Table 2: Characteristic table of GH F/F

Q(t)	Q(t+1)	G	H
0	0	0	X
0	1	1	X
1	0	X	0
1	1	X	1

Table 3: Excitation table of GH F/F

Derivation of Characteristic Equation:



$Q(t+1) = Q(t)'G + Q(t)H$

Question 3: Two Boolean functions F and G are described as

$F(A, B, C, D) = \Sigma m\,(0, 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 15)$

$G(A, B, C, D) = \Pi M\,(1, 2, 3, 7, 8, 12, 13, 15)$

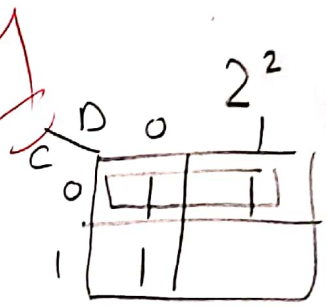
20

(a) Fill-in the entries in the table below for F and G. [4]

	Inputs				Outputs	
	A	B	C	D	F	G
0	0	0	0	0	1	1
1	0	0	0	1	1	0
2	0	0	1	0	1	0
3	0	0	1	1	0	0
4	0	1	0	0	1	1
5	0	1	0	1	1	1
6	0	1	1	0	0	1
7	0	1	1	1	1	0
8	1	0	0	0	1	0
9	1	0	0	1	0	1
10	1	0	1	0	1	1
11	1	0	1	1	1	1
12	1	1	0	0	0	0
13	1	1	0	1	1	0
14	1	1	1	0	1	1
15	1	1	1	1	1	0

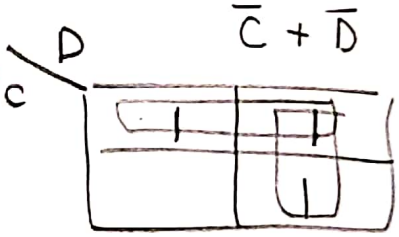
$F = \overline{C}\,\overline{D}$

$F = \overline{C}\,\overline{D}$



$F = C' + D$

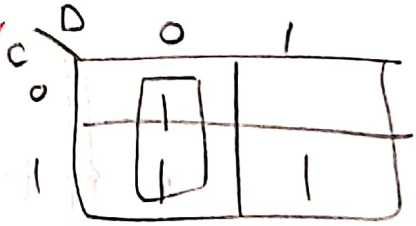
$F = C' + D$



$C' + D$

$F = C + D'$

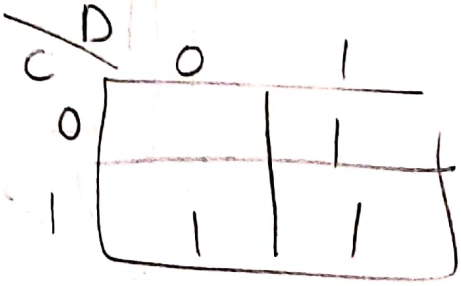
$F = C + D'$



$D' + C$

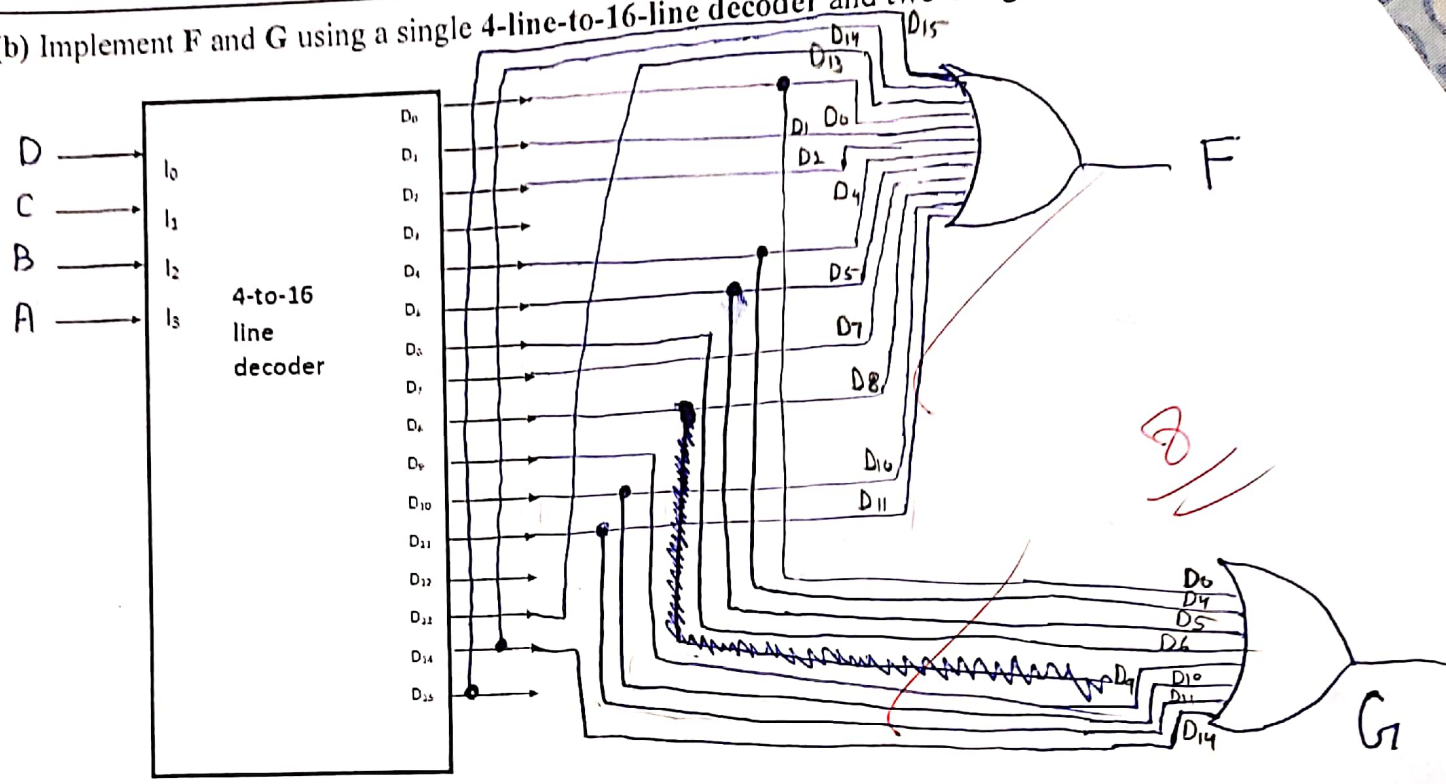
$F = C + D$

$F = C + D$



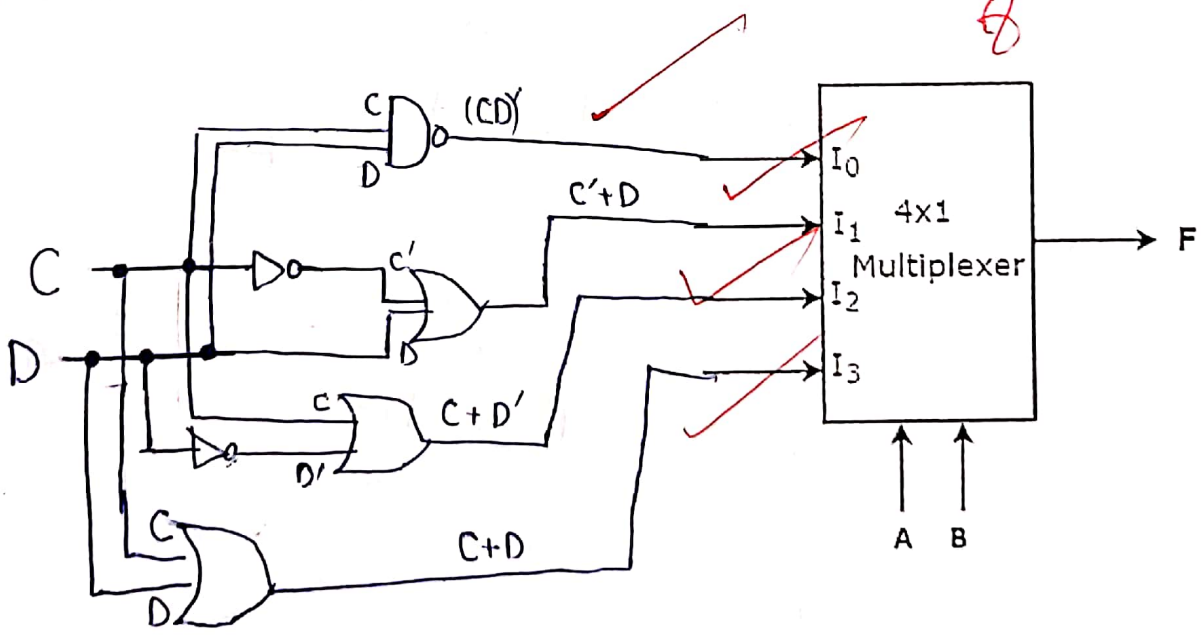
$C + D$

(b) Implement F and G using a single **4-line-to-16-line decoder** and two OR gates. [8]



(c) Implement the function F using 4 x1 MUX and additional gates. [8]

[Note: you are not allowed to change the variables on the selection line]



National University of Computer and Emerging Sciences, Lahore Campus

Course:	Digital Logic Design	Course Code:	EE1005
Program:	BS(Computer Science/ Data Science)	Semester:	Spring 2022
Duration:	60 Minutes	Total Marks:	50
Paper Date:	24/03/2022	Weight	15%
Section:	ALL	Page(s):	4
Exam:	Midterm-I	Roll No.	
		Section:	

3/5 -(2.5 = 34

Instruction/Notes:
- *Attempt all the questions on this answer booklet.*
- *Make sure to write down your roll # on EVERY sheet in the given space.*
- ***Use of calculator is not allowed.***

Question 1 [10 Marks]: Determine the value of the radix r if $(112)_r = (1012)_3$

$(1 \times r^2) + (1 \times r^1) + (2 \times r^0) = (1 \times 3^3) + (0 \times 3^2) + (1 \times 3^1) + (2 \times 3^0)$

$r^2 + r + 2 = 27 + 0 + 3 + 2$

$r^2 + r + 2 = 32$

$r^2 + r + 2 - 32 = 0$

$r^2 + r - 30 = 0$

$r = \frac{-1 \pm \sqrt{1^2 - 4(30)}}{2}$

$r = \frac{-1 \pm 11}{2}$

$r = \frac{11 - 1}{2} = 5$

10 ✓

Question 2 [10 + 6 = 16 Marks]: Design a combinational circuit with a 4-bit input. The 4-bit input represents the month number, 0001 for January, 0010 for February, 0011 for March and so on. The circuit has three outputs F_2, F_1, F_0 as shown in Figure 1.

25+5+2 (32)

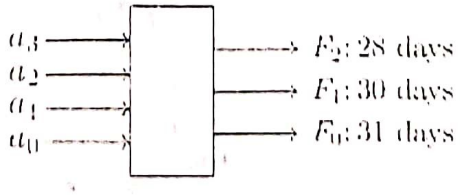


Figure 1: Number of days calculator.

1/4

The output F_2 is 1 if the input month has 28 days.

The output F_1 is 1 if the input month has 30 days,

and output F_0 is 1 if the input month has 31 days. Ignore the leap year.

For invalid inputs, it doesn't matter what's the output.

(a) Fill-in the entries for the outputs in the truth table shown below:

	Inputs				Outputs		
	a_3	a_2	a_1	a_0	F_2	F_1	F_0
	0	0	0	0	X	X	X
Jan	0	0	0	1	0	0	1
Feb	0	0	1	0	0	1	0
March	0	0	1	1	0	0	1
April	0	1	0	0	1	0	0
M	0	1	0	1	0	0	1
J	0	1	1	0	1	0	0
J	0	1	1	1	0	0	1
A	1	0	0	0	0	0	1
S	1	0	0	1	1	0	0
O	1	0	1	0	0	0	1
N	1	0	1	1	1	0	0
Dec	1	1	0	0	0	0	1
13	1	1	0	1	X	X	X
14	1	1	1	0	X	X	X
15	1	1	1	1	X	X	X

7.5+2.5

J — 1
F
M — 1
A —
M — 1
J —
J — 1
A — 1
S
O — 1
N
D — 1

(b) Write the function F_2 and F_0 in Sum of Minterms form and F1 in Product of Maxterm form.

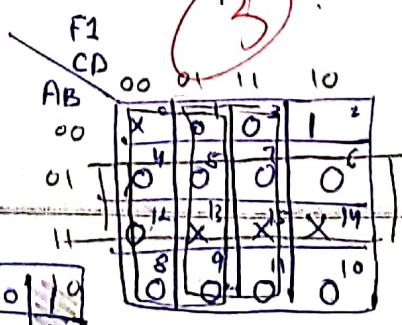
$F_2(a_3, a_2, a_1, a_0) = \Sigma m(4,6,9,11)$ $\bar{A}\bar{D}+AD$ +2

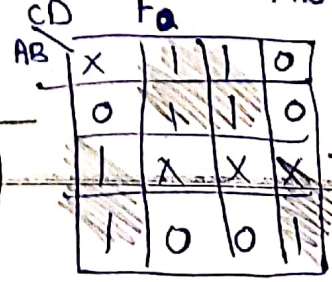
$F_1(a_3, a_2, a_1, a_0) = \Pi M(0,1,3,4,5,6,7,8,9,10,11,12)$ $C+\bar{D}+\bar{B}+\bar{A}$

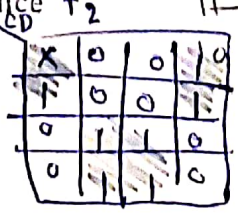
$F_0(a_3, a_2, a_1, a_0) = \Sigma m(1,3,5,7,8,10,12)$ $\bar{A}D+A\bar{D}$ +2

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

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







CDBA

Roll #

Question 3 [4 +10 +10 = 24 Marks]: A Boolean function is given as follows:

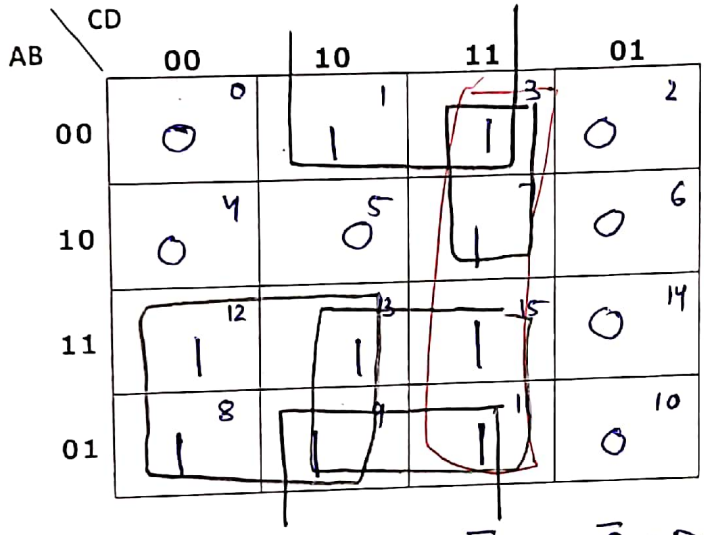
$$F(A, B, C, D) = AC' + B'D + A'CD + ABCD$$

a) Write down the function F in Sum of Minterms and Product of Maxterm form.

$$F(A, B, C, D) = \Sigma m(1, 3, 7, 8, 9, 11, 12, 13, 15)$$

$$F(A, B, C, D) = \Pi M(0, 2, 4, 5, 6, 10, 14)$$

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



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

$AC' + B'D + A'CD + ABCD$

$A'CD(B+B') + 1111$

$A'CDB + A'B'CD + 15$

0111 $A'BCD$ 0011

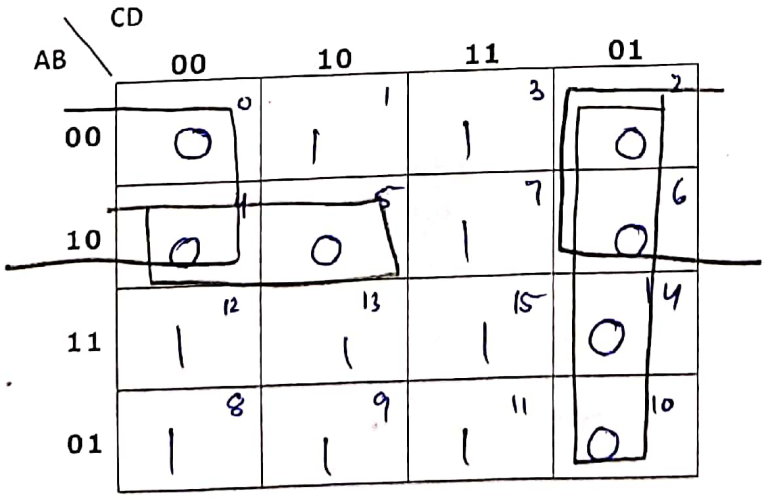
0111

$AC'(B+B')(D+D')$

$(AC'B + AB'C')(D+D')$

$AB\bar{C}D + AB\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D}$ (1000) $+ \bar{A}\bar{B}CD$ (1001)

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



1101 1100

$B'D(A+A')(C+C')$

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

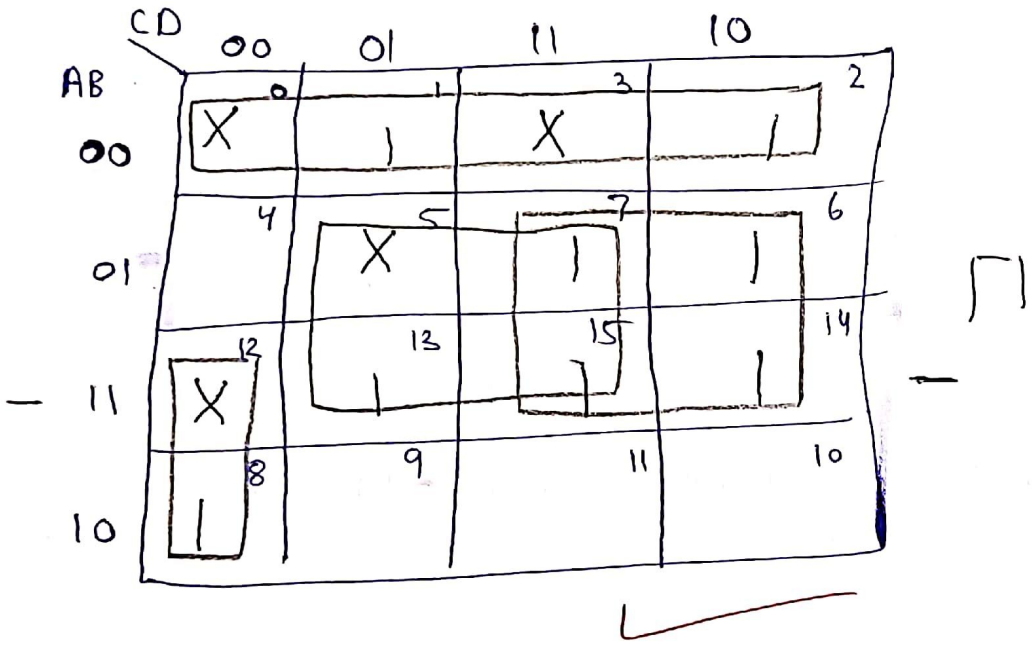
National University of Computer and Emerging Sciences, Lahore Campus

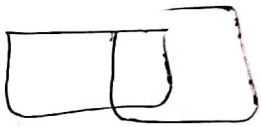
Course:	Digital Logic Design	Course Code:	EE1005
Program:	BS (Computer Science)	Semester:	Spring 2022
Duration:	10 Minutes	Total Marks:	10
Paper Date:	13-03-2022	Weight	
Section:	N	Page(s):	1
Exam:	Quiz 2	Reg. No.	

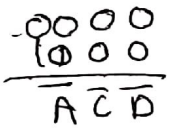
9.5

Instruction/Notes: Plagiarism will be dealt seriously causing an F in course

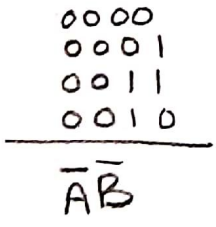
Q1.Minimise the following function in SOP minimal form using K-Maps:
F(A, B, C, D) = m(1, 2, 6, 7, 8, 13, 14, 15) + d(0, 3, 5, 12)

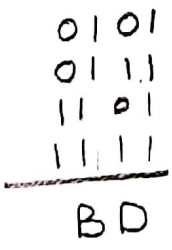


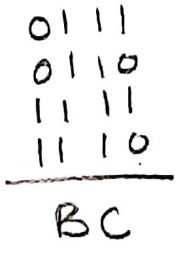




$AB + \bar{A}D + \bar{A}C + \bar{C}\bar{D}$







9.5

$\bar{A}\bar{B} + BD + BC + A\bar{C}\bar{D}$

National University of Computer and Emerging Sciences, Lahore Campus

Course:	Digital Logic Design	Course Code:	EE1005
Program:	BS (Computer Science)	Semester:	Spring 2022
Duration:	10 Minutes	Total Marks:	10
Paper Date:	07-03-2022	Weight	
Section:	N	Page(s):	1
Exam:	Quiz 1	Reg. No.	

16

Instruction/Notes: Plagiarism will be dealt seriously causing an F in course

Solve $(72)_8 \times (12)_8 = (\ 1104\ )_8$

$$\begin{array}{r} 72 \\ 12 \\ \hline 164 \\ 72\times \\ \hline 1104 \end{array}$$

5

8 | 14	
8 | 1	−6 ↑
0	1 ↑

(5)

8 | 8	
8 | 1	−0
0	−1

8 | 9	
8 | 1	−1
0	1

Solve $(27)_8 + (8)_{10} = (\ 1F\ )_{16}$ (5)

$(27)_8 = (2\times8^1) + (7\times8^0)$

$= (23)_{10}$ 5

$(2\times8^1) + (7\times8^0)$

$16 + 56 =$

$(72)_{10} + (8)_{10} = (80)_{10}$

$(23)_{10} + (8)_{10} = (31)_{10}$

16 | 576	
16 | 36	−0 ↑
16 | 2	−4 ↑
0	−2 ↑

(240)

16 | 80	
16 | 5	−0 ↑
0	−5 ↑

16 | 31	
16 | 1	−F
0	−1

9
A
B
C
D
E
f

16
1
23
8