Programs: BC (CS), BS(SE), BS(TELC)

Subject: Digital Logic Design

Major Assignment Mid-Term

Course Code: CSC-201

EDP Code: 102007016

Summer Semester 2020

Q.1 Convert each of the following:

a. $45.25_{10} = (\ ?\ )_{2}$

b. $10000000.1010_{2} = (\ ?\ )_{10}$

c. $4D7F_{16} = (\ ?\ )_{10}$

d. $128_{10} = (\ ?\ )_{16}$

e. $3A6F_{16} = (\ ?\ )_{2}$

f. $1100001111100101_{2} = (\ ?\ )_{16}$

g. $6173_{8} = (\ ?\ )_{10}$

h. $169_{10} = (\ ?\ )_{8}$

i. $2A7D_{16} = (\ ?\ )_{8}$

j. $11111111_{2} = \pm (\ ?\ )_{10}$ hint: [use 2's complement form]

k. $-12_{10} = (\ ?\ )_{2}$ hint: [use 2's complement form] l. $198 = (\ ?\ )_{BCD}$

m. $100001110000_{BCD} = (\ ?\ )_{10}$

n. $1001010_{2} = (\ ?\ )_{Gray}$

o. $10101111_{Gray} = (\ ?\ )_{2}$

p. $0100\ 0001 = (\ ?\ )_{ASCII}$

q. $111000 = (?111000)_{Even\ parity}$

Major Assignment Mid-Term.
ID # 12938
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Q1) Convert each of the following:

a: $45.25_{10} = (?)_2$

2	45
2	22 — 1
2	11 — 0
2	5 — 1
2	2 — 1
2	1 — 0

Happend $45_{10} = 101101_2$

Now .25

0	.25
.	2
0	5
	2
1	0

$0.25_{10} = 0.01_2$

$= 101101_2 + 0.01_2$

$= 101101.01_2$

b: $10000000.1010_2 = (?)_{10}$

Weight : $2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0\ 2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4}$

Binary : 10000000.1010

$10000000.1010 = 2^7 + 2^{-1} + 2^{-3}$

$= 128 + 0.5 + 0.125$

$= 128.625$

c: $4D7F_{16} = (?)_{10}$

$4D7F_{16} = 4.16^3 + 13.16^2 + 7.16^1 + 15.16^0$

$= 16384 + 3328 + 112 + 15$

$= 19839_{10}$

d: $128_{10} = (?)_{16}$

$\frac{128}{16} = 8$

$8/16 = 0.5$

$0.5 \times 16 = 8$

$128_{16} = (88)_{16}$

e: $3A6F_{16} = (?)_2$

3 A 6 F

0011 1010 0110 1111

$3A6F_{16} = (0011\ 1010\ 0110\ 1111)_2$

f: $1100001111100101_2 = (?)_{16}$

1100 , 0011 , 1110 , 0101

↓ ↓ ↓ ↓

C 3 E 5

$= (C3E5)$

g: $6173_8 = (?)_{10}$

$6173_8 = (6\times8^3)+(1\times8^2)+(7\times8)+(3\times8^0)$

$= (6\times512)+(1\times64)+(7\times8)+(3\times1)$

$= 3072+64+56+3$

$= 3195_{10}$

h: $169_{10} = (?)_8$

$169/8 = 21.125 = 0.125\times8 = 1$

$21/8 = 2.625$

$= 0.625\times8 = 5$

$2/8 = 0.25$

$= 0.25\times8 = 2$

251

$169_{10} = (251)_8$

i: $2A7D_{16} = (?)_8$

$2A7D_{16} = (25175)_8$

j: $11111111_2 = (?)_{10}$

Finding weight : $2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0$

$1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 1\ \ 1$

$= 2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1$

$= (255)_{10}$

K: $-12_{10} = (?)_2$

$-12_{10} = (?)_2$

$-12_{10} = 0000000000001100$

L: $198 = (?)_{BSD}$

1	9	8
0001	1001	1000

$198 = (0001\ \ 1001\ \ 1000)_{BCD}$

(5)

M. $1000011110000_{BCD} = (?)_{10}$

Answer

$1000011110000_{BCD} = (870)_{10}$

N: $1001010_2 = (?)_{Gray}$

Answer

$1001010_2 = (1101111)_{Gray}$

O: $10101111_{Gray} = (?)_2$

Answer

$10101111_{Gray} = (11001010)_2$

P: $01000001 = (?)_{ASCII}$

$01000001 = (?)$ Answer is $(A)_{ASCII}$

Q: $111000 = (?111000)$ Even parity

Yes it is even parity number because it is divisible by 2 and its remainder $= 0$, when divided by 2

Q.2 Calculate each of the following:

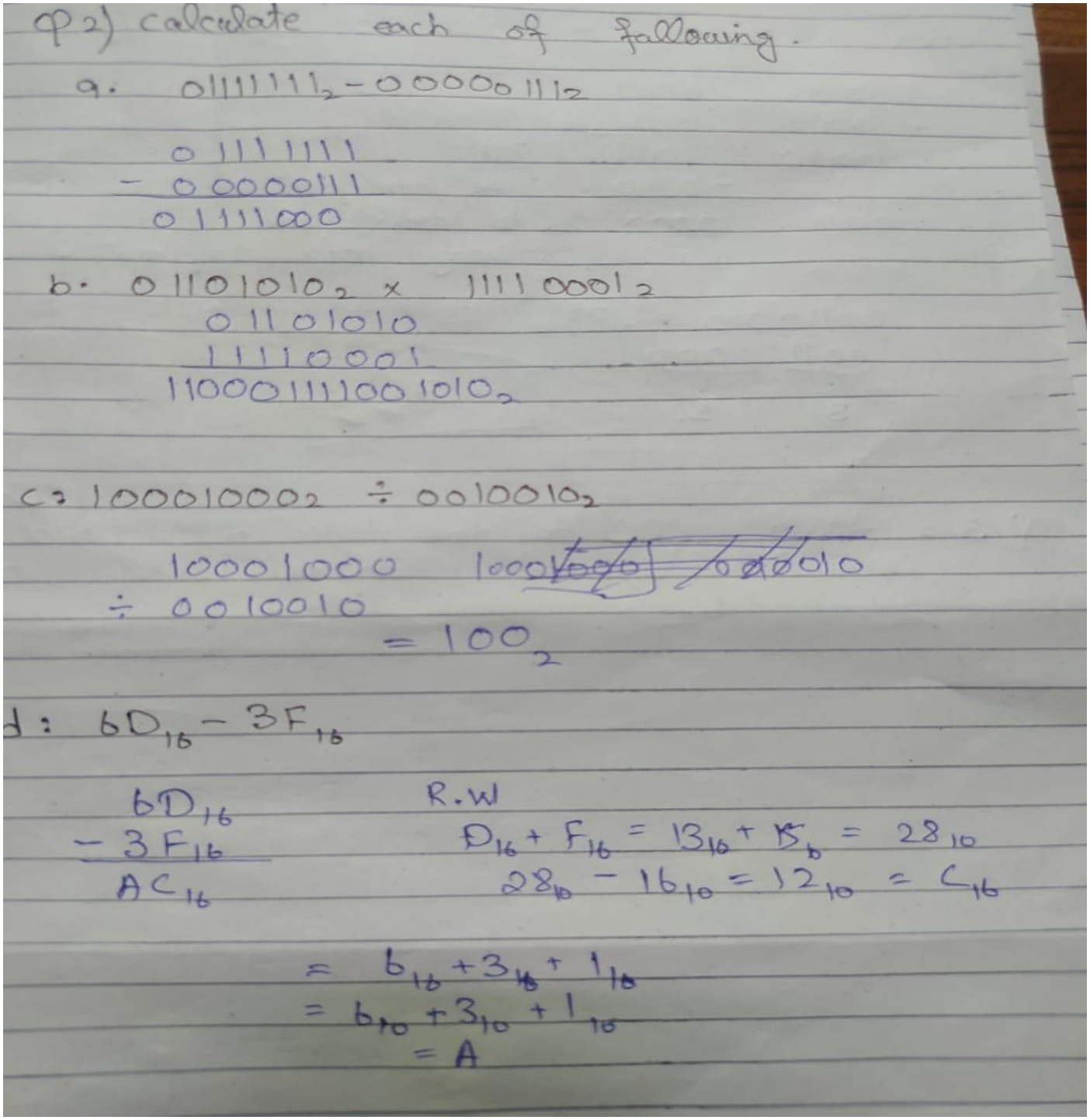
a. $01111111_2 - 00000111_2$ hint: [use 2's complement form]

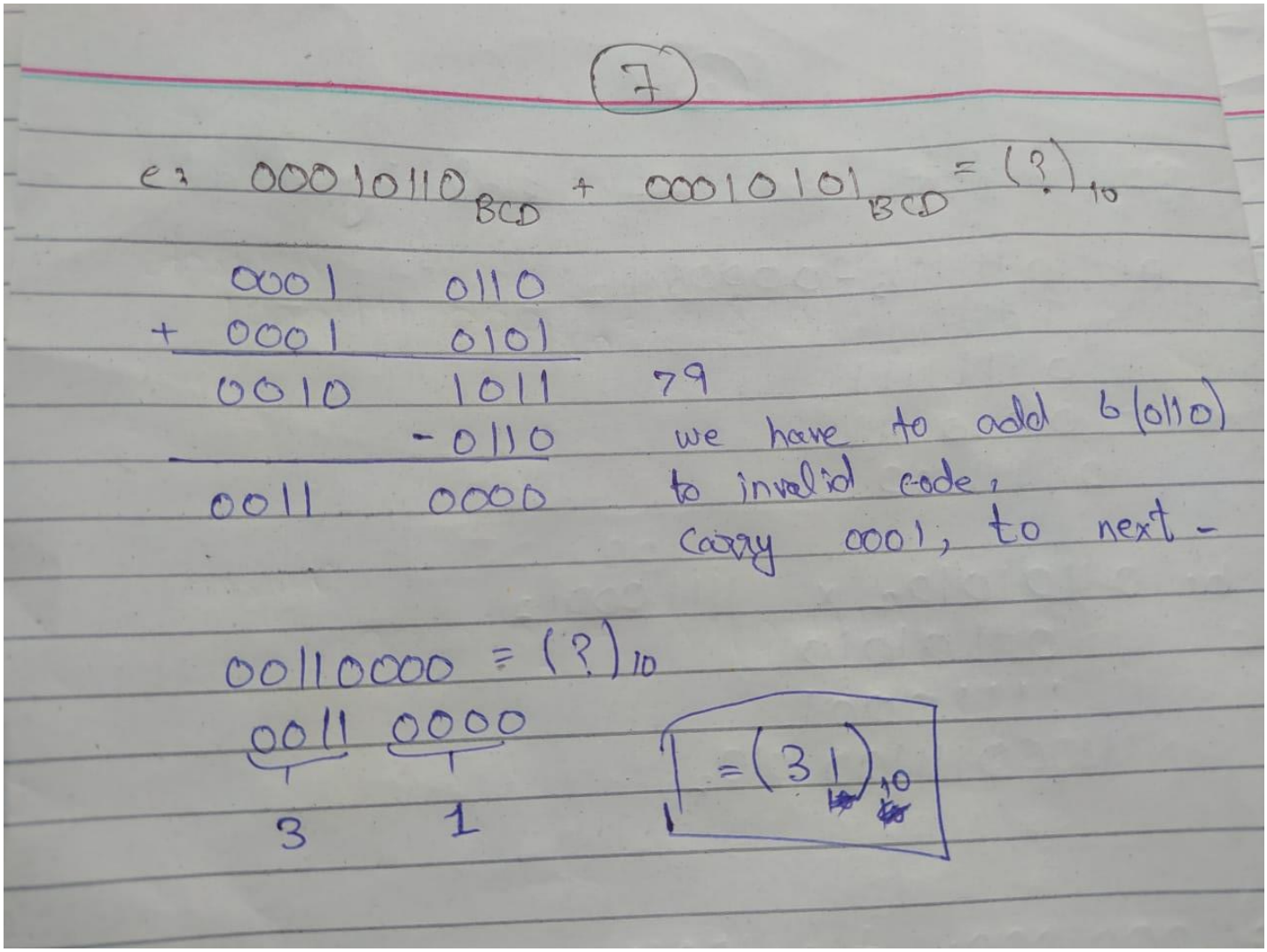
b. $01101010_2 \times 11110001_2$ hint: [use 2's complement form]

c. $10001000_2 \div 00100010_2$ hint: [use 2's complement form]

d. $6D_{16} - 3F_{16}$ hint: [use 2's complement form]

e. $00010110_{BCD} + 0001\ 0101_{BCD} = (\ ?\ )_{10}$ hint: [take care of invalid BCD code]





Q.3 Apply CRC to the data bits 11010011_2 using the generator code 1010_2 to produce the transmitted CRC code.

Answer:

Binary form: 11010011 divided by 1010

x*7+x6+x*4+x+1

x**3+x

Binary form (added zeros): 11010011000 divided by 1010

Result is 11101001

Remainder is 010

Working is

```
  11101001
------------------
11010011000
1010
-------------------
 1110011000
 1010
 ------------------
  100011000
  1010
  -----------------
   01011000
   0000
   ---------------
    1011000
    1010
    ---------------
     001000
     0000
     ---------------
      01000
```

0000

1000

1010

010

Transmitted value is: 11010011010

Q.4 Assume that the code produced in problem Q.3 incurs an error in the most significant bit during transmission. Apply CRC to detect the error.

Q.5 The input waveforms in Figure 1 is applied to a 3-input AND gate. Show the output waveform in proper relation to the inputs with a timing diagram.

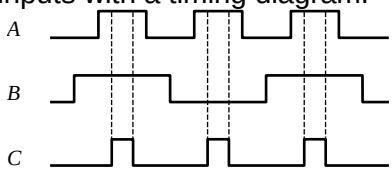


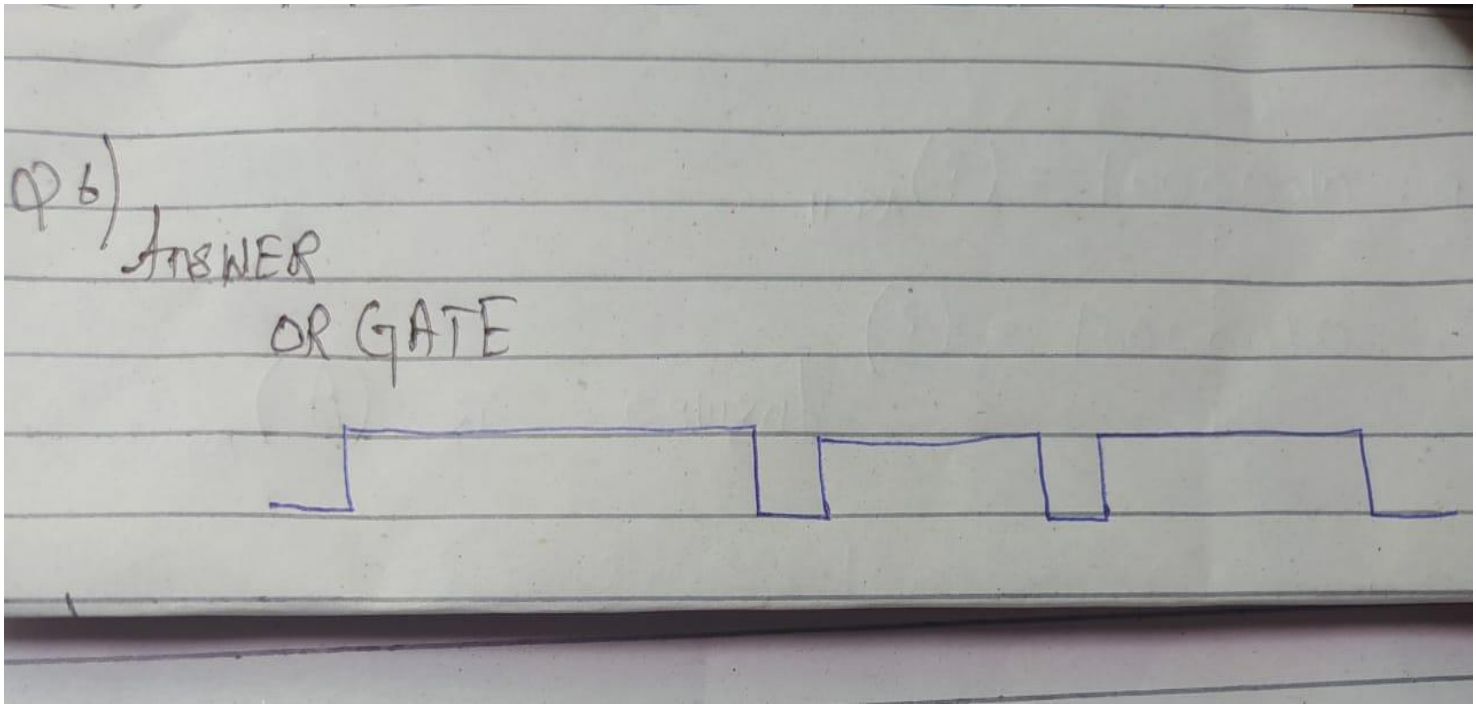
FIGURE 1

Q5) Answer :

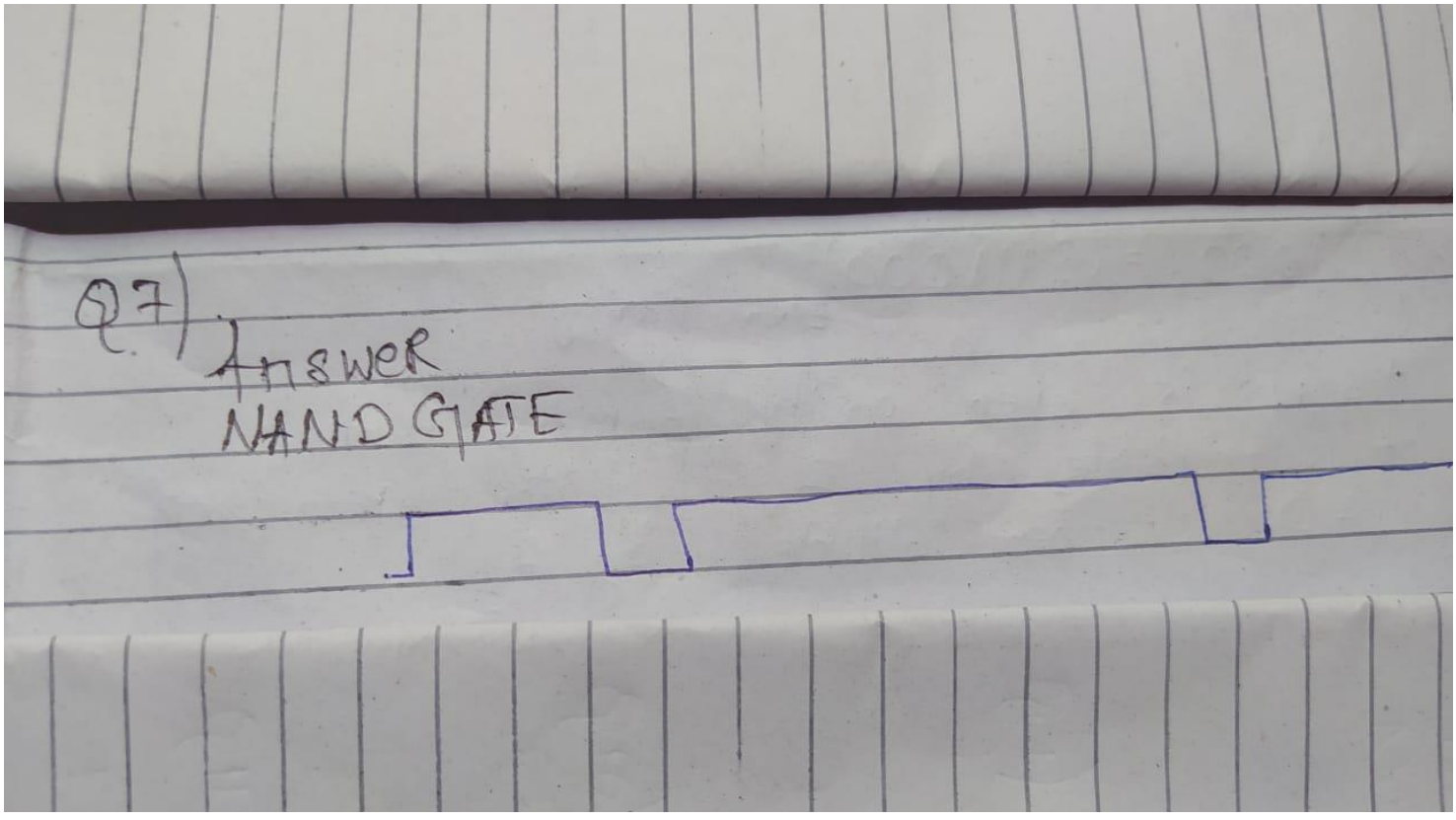
AND GATE

X = 000 11 0000000 11 00

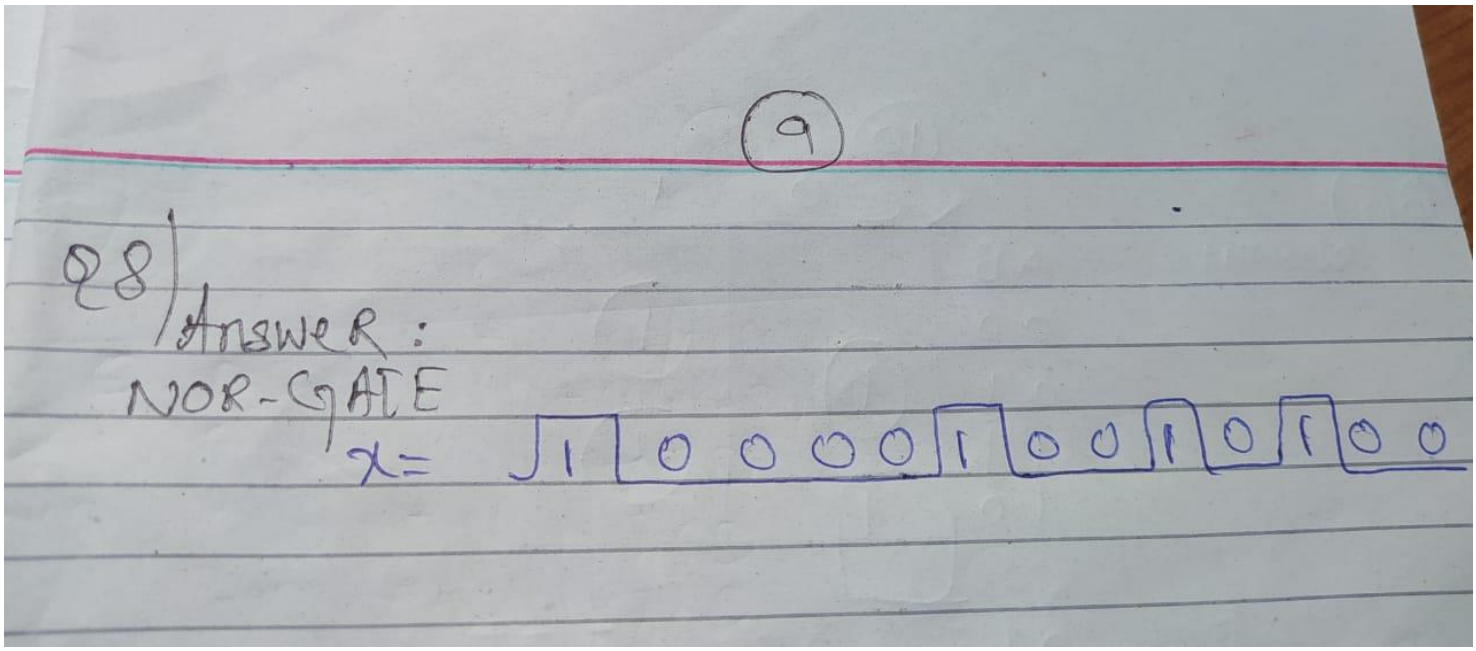
Q.6 Repeat Q.5 for a 3-input OR gate.



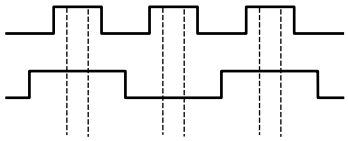
Q.7 Repeat Q.5 for a 3-input NAND gate.



Q.8 Repeat Q.5 for a 3-input NOR gate.



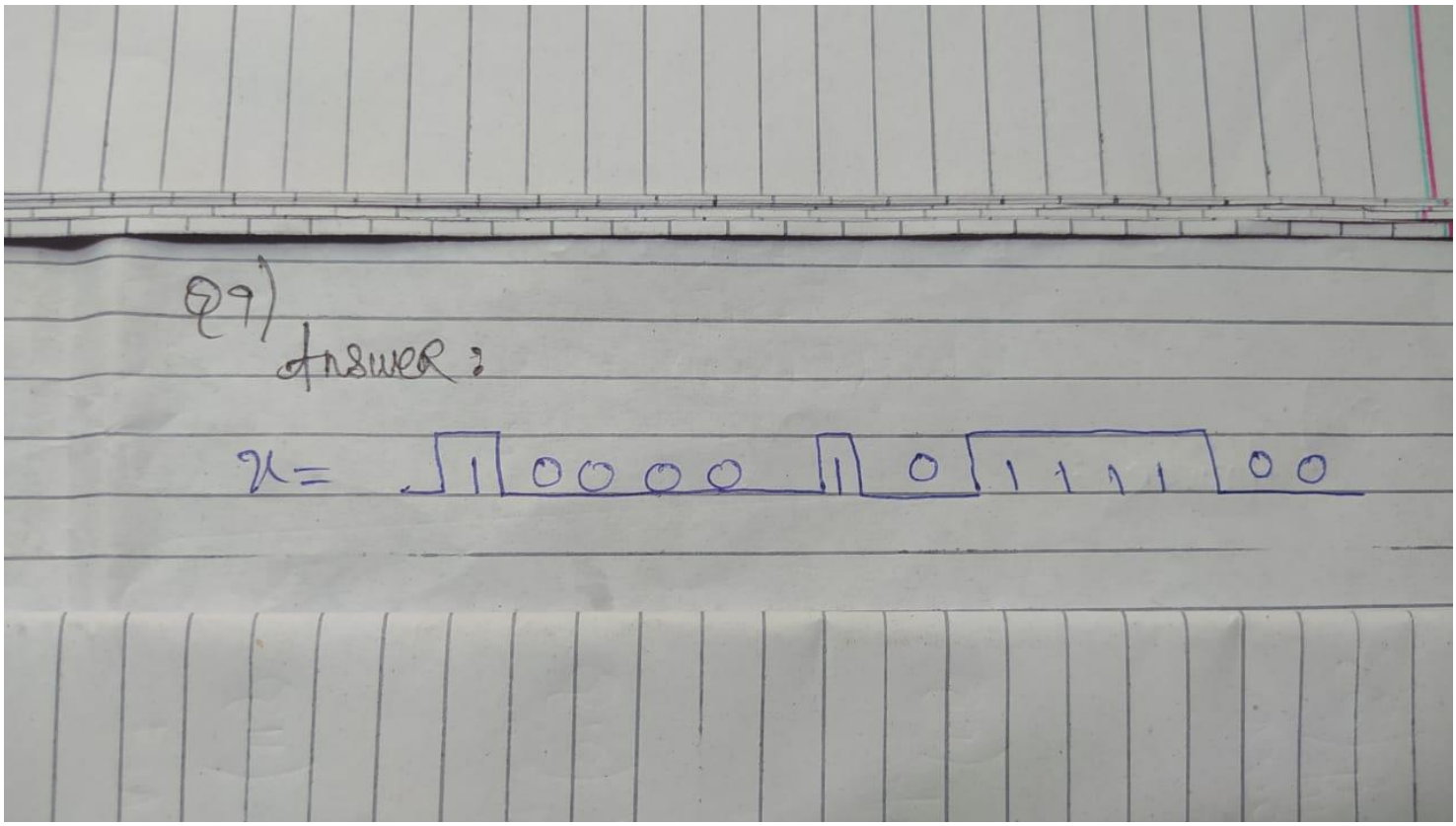
Q.9 The input waveforms in Figure 2 is applied to a XOR gate. Show the output waveform in proper relation to the inputs with a timing diagram.



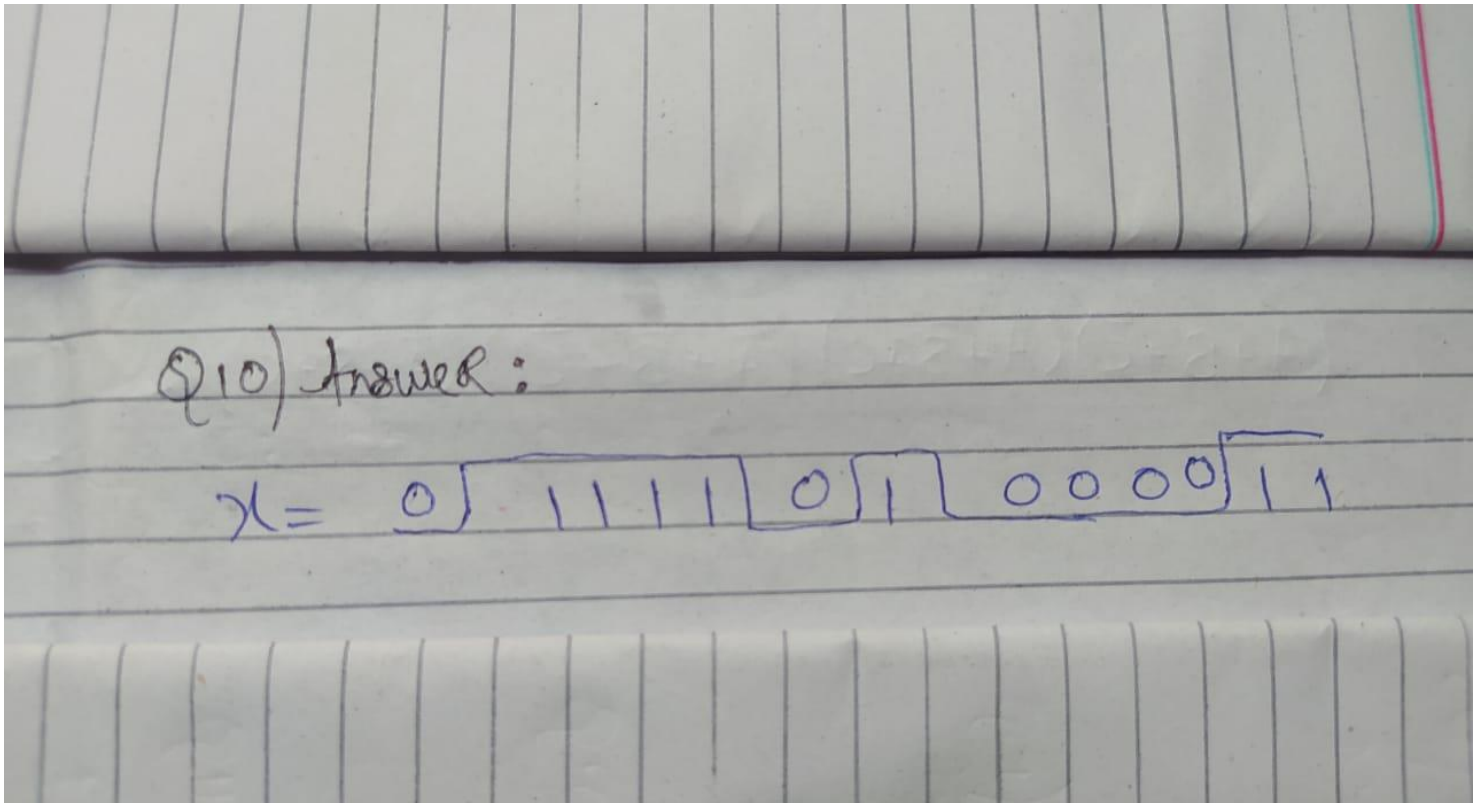
A

B

FIGURE 2

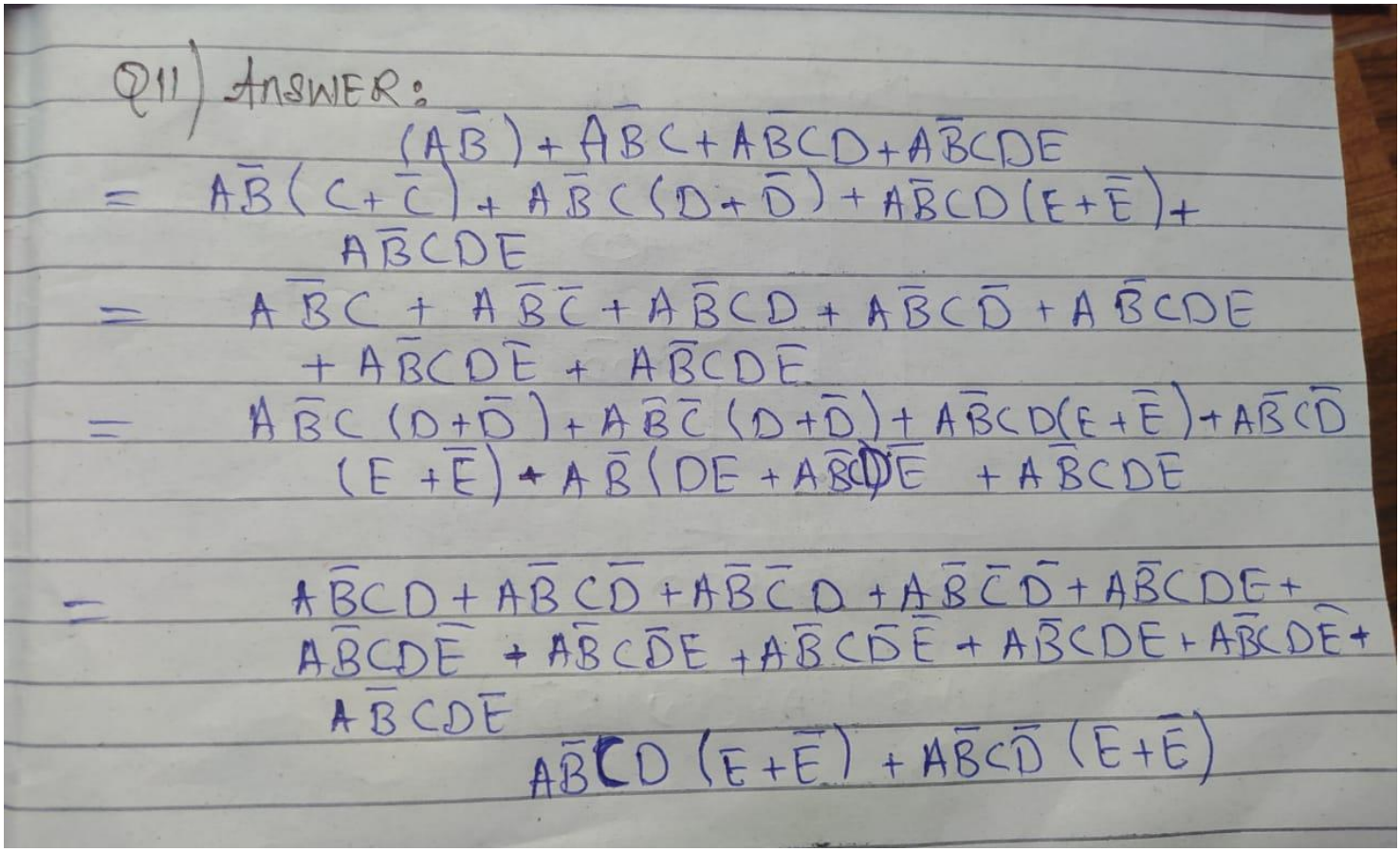


Q.10 Repeat Q.9 for XNOR gate.



Q.11 Using Boolean algebra techniques, simplify the following expressions as much as possible:

$$\overline{AB} + A\overline{BC} + AB\overline{CD} + ABC\overline{DE}$$



Q11) ANSWER:

$$(A\bar{B}) + A\bar{B}C + A\bar{B}CD + A\bar{B}CDE$$

$$= A\bar{B}(C+\bar{C}) + A\bar{B}C(D+\bar{D}) + A\bar{B}CD(E+\bar{E}) + A\bar{B}CDE$$

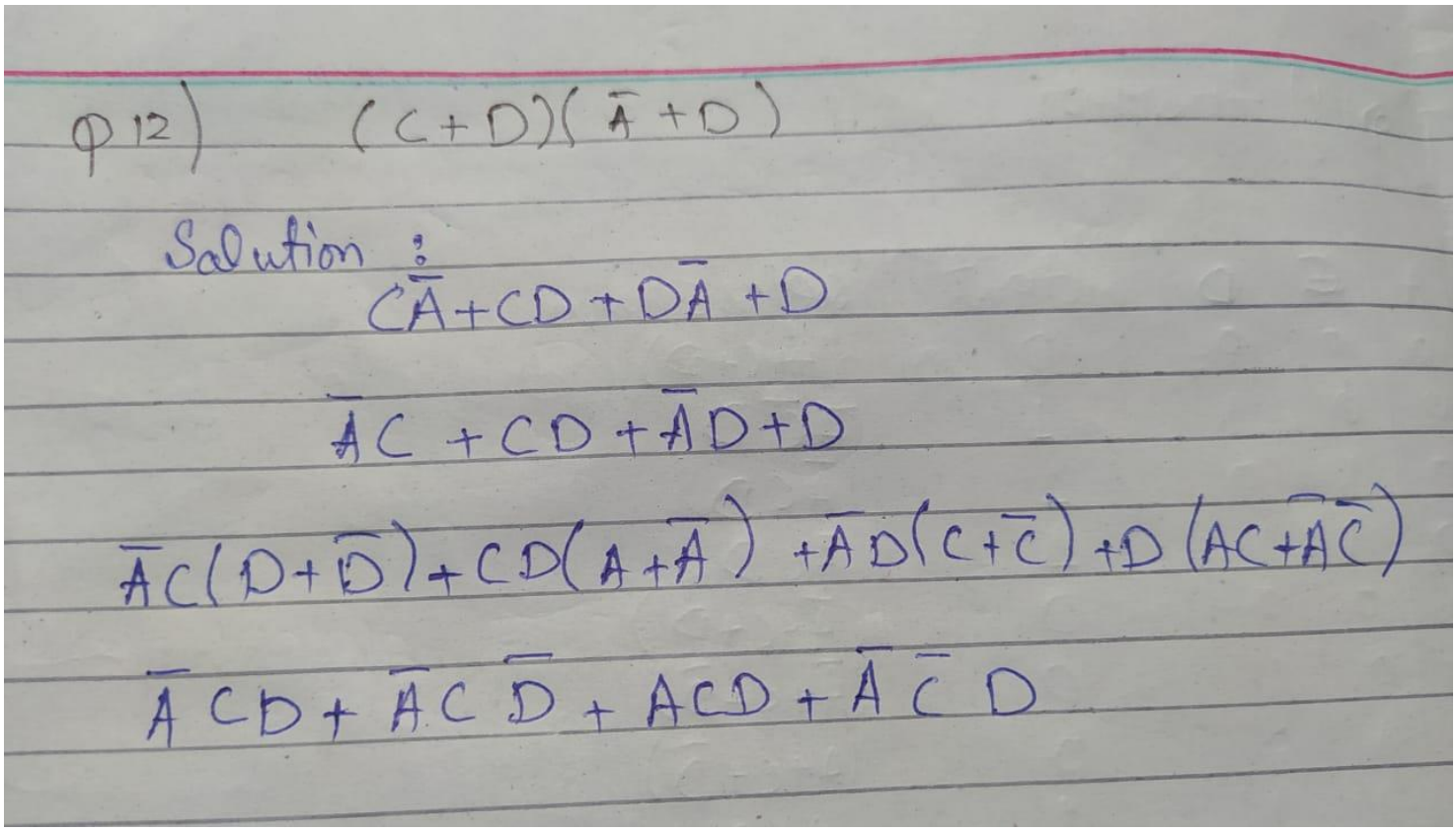
$$= A\bar{B}C + A\bar{B}\bar{C} + A\bar{B}CD + A\bar{B}C\bar{D} + A\bar{B}CDE + A\bar{B}CD\bar{E} + A\bar{B}CDE$$

$$= A\bar{B}C(D+\bar{D}) + A\bar{B}\bar{C}(D+\bar{D}) + A\bar{B}CD(E+\bar{E}) + A\bar{B}C\bar{D}(E+\bar{E}) + A\bar{B}(DE + A\bar{B}C\bar{D}\bar{E} + A\bar{B}CDE$$

$$= A\bar{B}CD + A\bar{B}C\bar{D} + A\bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D} + A\bar{B}CDE + A\bar{B}CD\bar{E} + A\bar{B}\bar{C}DE + A\bar{B}C\bar{D}\bar{E} + A\bar{B}CDE + A\bar{B}CDE$$

$$A\bar{B}CD(E+\bar{E}) + A\bar{B}C\bar{D}(E+\bar{E})$$

Q.12 Convert the following expressions to satndard SOP forms: $(C + D)(\bar{A} + D)$



Q12) $(C+D)(\bar{A}+D)$

Solution :

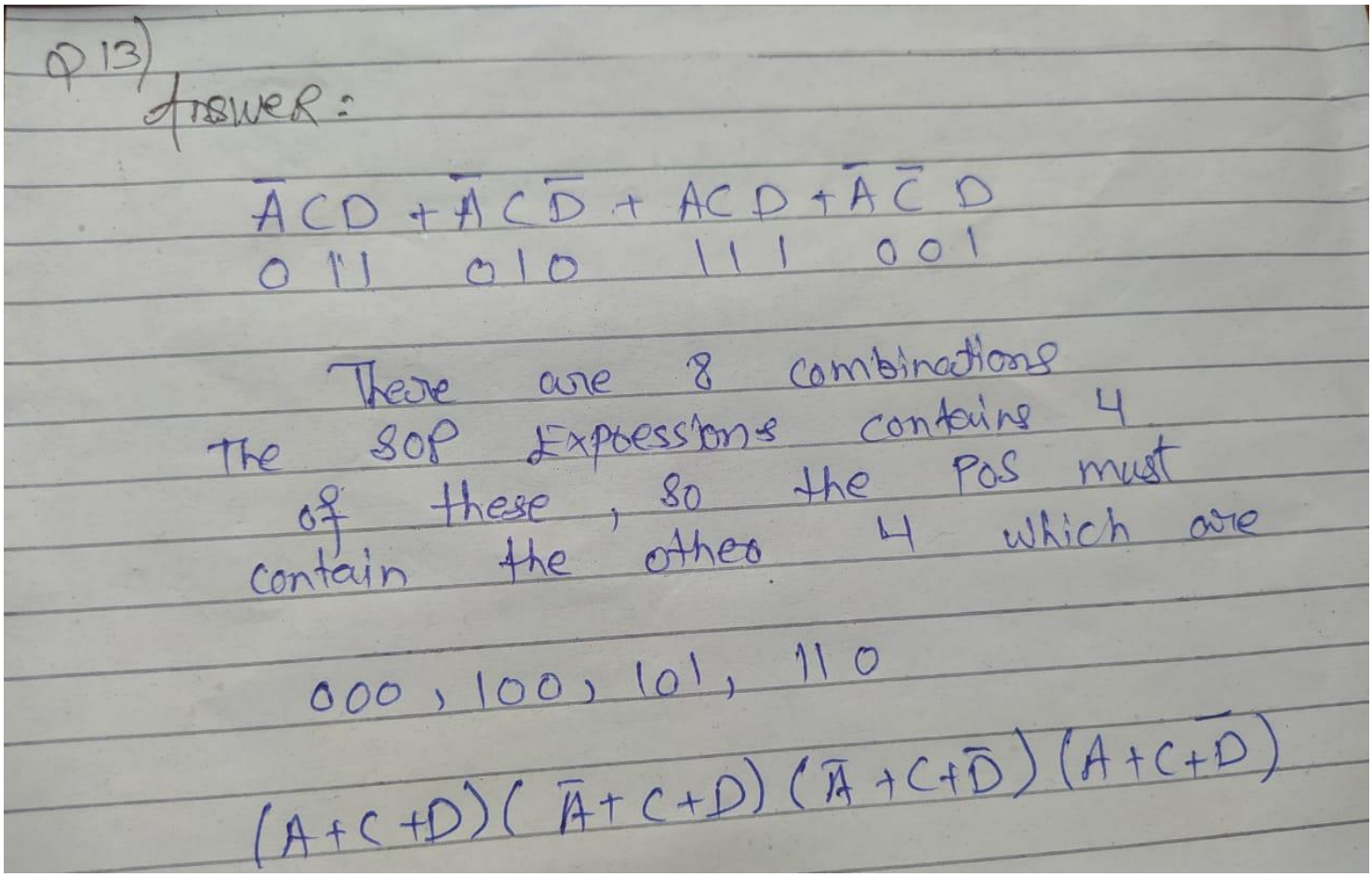
$C\bar{A}+CD+D\bar{A}+D$

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

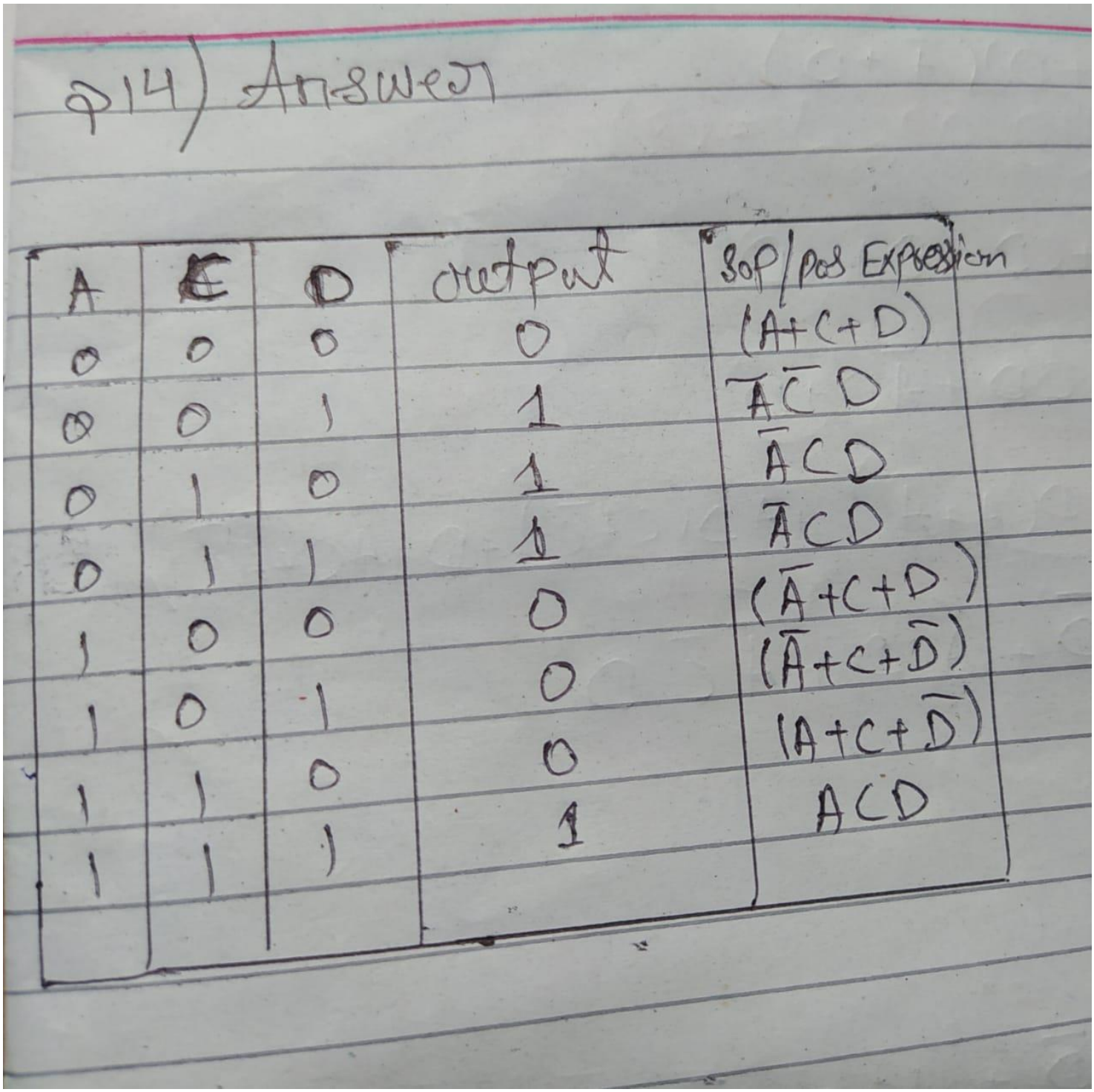
$\bar{A}C(D+\bar{D})+CD(A+\bar{A})+\bar{A}D(C+\bar{C})+D(AC+\bar{A}\bar{C})$

$\bar{A}CD+\bar{A}C\bar{D}+ACD+\bar{A}\bar{C}D$

Q.13 Write the standard POS expression using the standard SOP expression obtained in Q.12.



Q.14 Draw a single truth for both the standard POS and standard SOP expression obtained in Q.12 and Q.13.

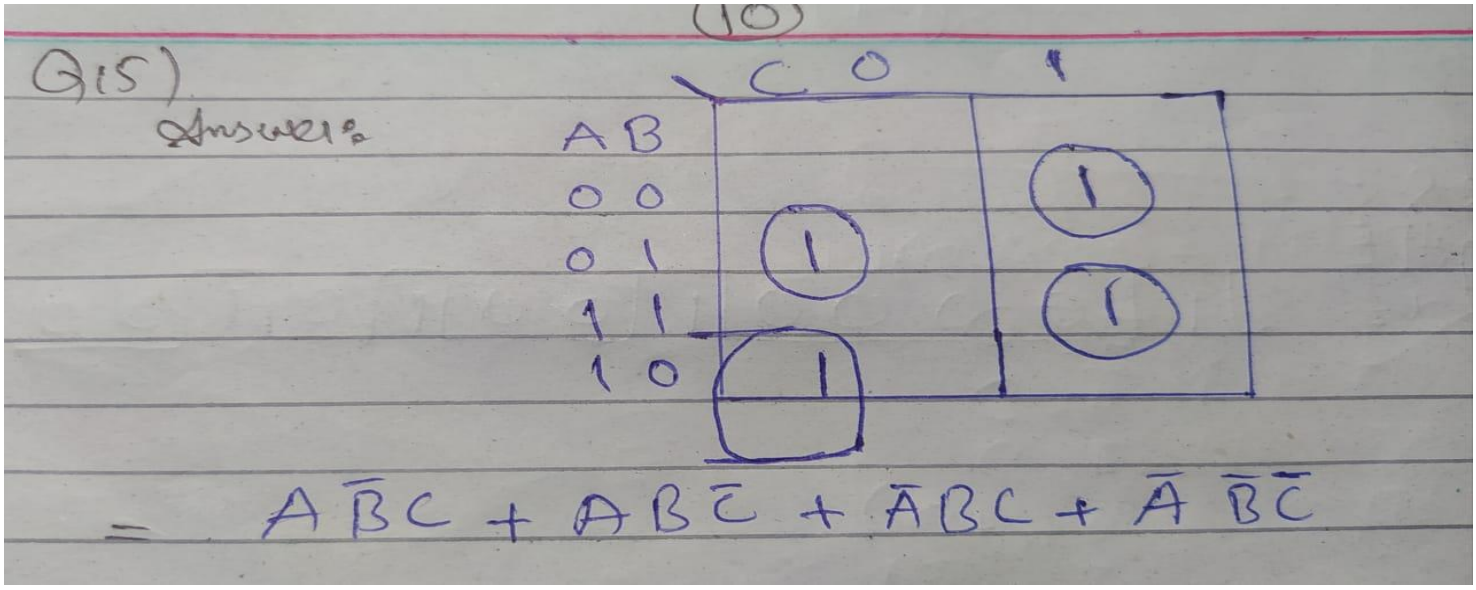


Q14) Answer

A	C	D	output	SOP/POS Expression
0	0	0	0	$(A+C+D)$
0	0	1	1	$\bar{A}\bar{C}D$
0	1	0	1	$\bar{A}CD$
0	1	1	1	$\bar{A}CD$
1	0	0	0	$(\bar{A}+C+D)$
1	0	1	0	$(\bar{A}+C+\bar{D})$
1	1	0	0	$(A+C+\bar{D})$
1	1	1	1	ACD

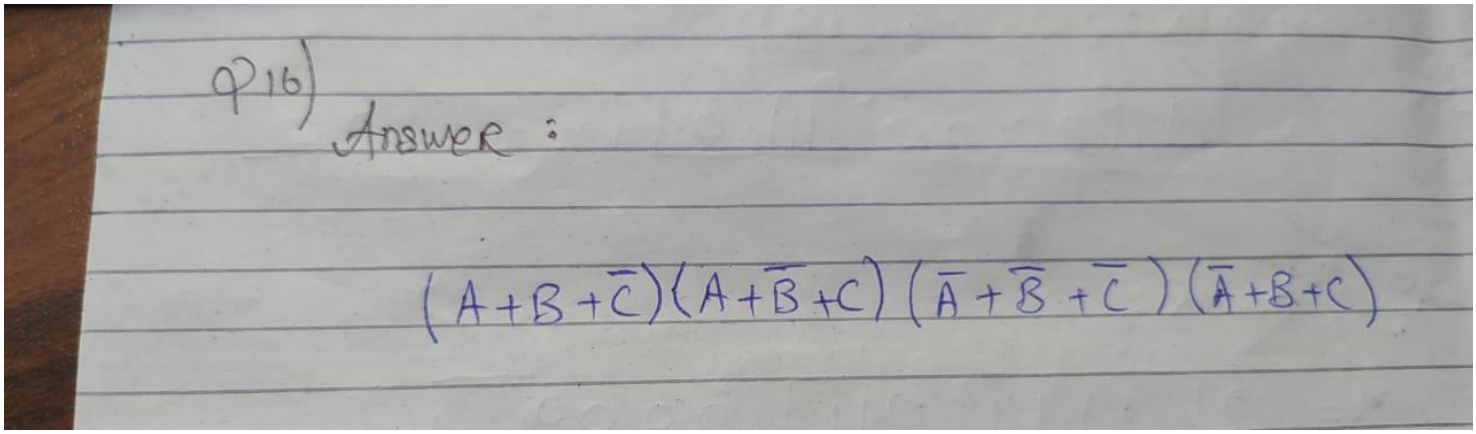
Q.15 Use a Karnaugh map to simplify the following expression to a minimum SOP form:

$\overline{A}\overline{B}\overline{C} + \overline{A}BC + A\overline{B}C + AB\overline{C}$



Q.16

Obtain the minimum POS expression form the Karnaugh map used in Q.15.



Q.17 Write the output expression for circuit in Figure 3.

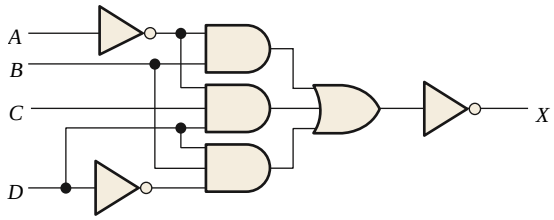
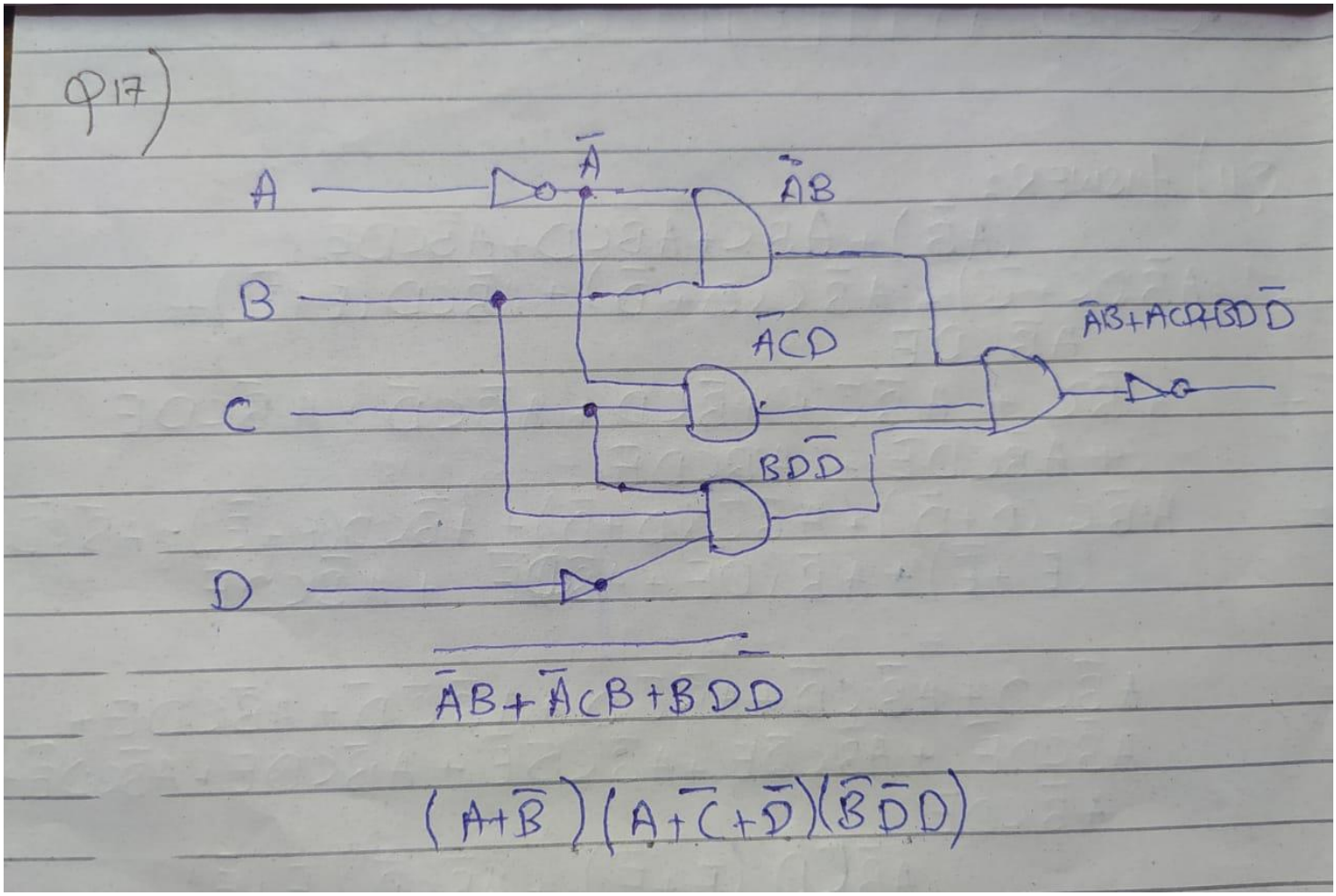


FIGURE 3



Q.18 Implement a logic circuit for the truth table in Table 1.

TABLE 1

Inputs				Output
A	***B***	***C***	***D***	***X***
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
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	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1