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Q1 a) $F = (A'+B)(A'+BC')'$

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

$= (A'+B)(A)(BC')'$ (DeMorgan's law)

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

$= (A.A' + A.B)(B'+C)$ $(A.A' = 0)$

$= AB(B'+C)$

$= ABB' + ABC$ $(B.B' = 0)$

$= ABC$

b) $(627)_{10} + (267)_{10}$ in BCD

$(627)_{10} = (0110\ 0010\ 0111)_{BCD}$

$(267)_{10} = (0010\ 0110\ 0111)_{BCD}$

$$\begin{array}{r} {\scriptstyle 1}\ \ {\scriptstyle 1}\ \ {\scriptstyle 1}\ \ \ {\scriptstyle 1\ 1} \\ 0110 \quad 0010 \quad 0111 \\ +\ 0010 \quad 0110 \quad 0111 \\ \hline {\scriptstyle 1}\ \ {\scriptstyle 1\ 1\ 1\ 0} \\ +\ \ \ 110 \\ \hline 1000 \quad 1001 \quad 0100 \end{array}$$

Sum $= (1000\ 1001\ 0100)_{BCD}$

$= (894)_{10}$

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Q2 a) $(65.25)_8$ to binary

Steps: For octal to binary, take each digit and write its equivalent binary form.

So, $6 \equiv (110)_2$, $5 \equiv (101)_2$, $2 \equiv (010)_2$

$$(65.25)_8 = (110\ 101.\ 010\ 101)_2$$

b) $(6A.26)_{16}$ to octal

Step1: Convert $(6A.26)_{16}$ to decimal

$$(6A.26)_{16} \equiv (6\times 16) + (10\times 16^0) + (2\times 16^{-1}) + (6\times 16^{-2})$$

$$= 106 + 0.023 = (106.023)_{10}$$

~~$= (106.02)_{10}$~~

Step 2: Decimal to octal by division (and multiplication by 8.

8	106	
8	13	2
8	1	5
	0	1 ↑

$0.023 \times 8 = 0.184 + 0$

$0.184 \times 8 = 0.472 + 1$

$0.472 \times 8 = 0.776 \quad 3$

$$\Rightarrow (106.023)_{10} \equiv (152.013)_8 \equiv (6A.26)_{16}$$

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Q3 a) $F_1 = P + Q$, b) $F_2 = P \cdot Q$

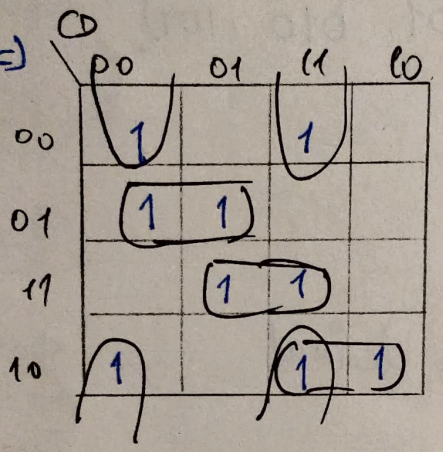
P	Q	F_1
0	0	0
0	1	1
1	0	1
1	1	1

$P = \Sigma(0, 3, 4, 5, 8, 10, 11, 13, 15)$

$Q = \Sigma(1, 2, 4, 5, 6, 8, 9, 10, 11, 12, 14)$

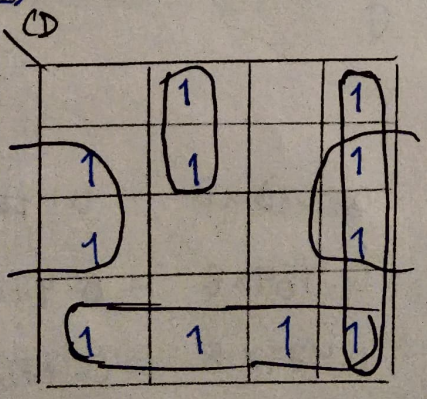
Say both P and Q come from A, B, C and D variables

For P =>



$P = \bar{A}B\bar{C} + ABD + A\bar{B}C + \bar{B}\bar{C}\bar{D} + \bar{B}CD$

For Q =>



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

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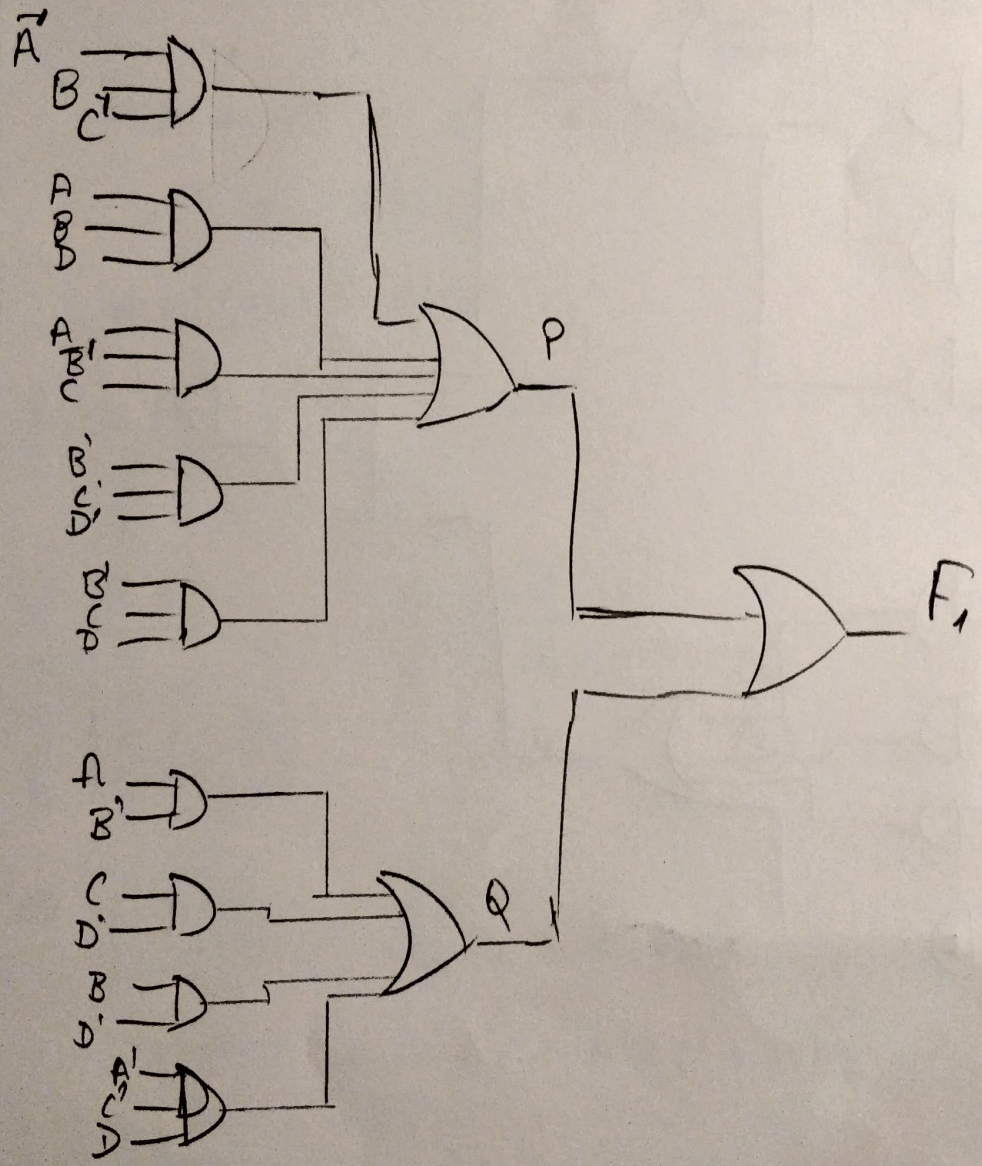
a) $F_1 = P + Q$

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

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



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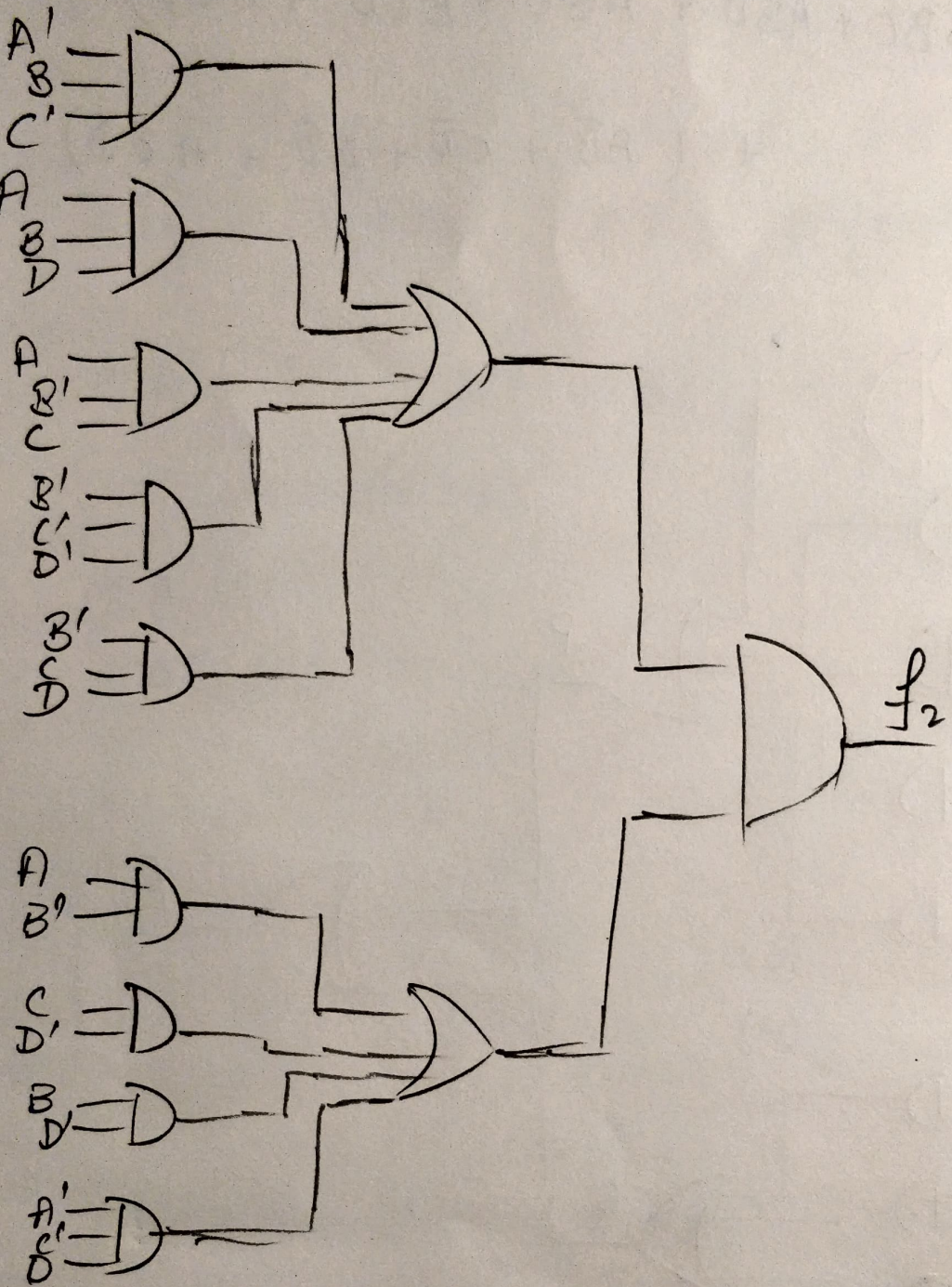
b) $f_2 = PQ$



Q4 a) $f = (A'+B+C')(A'+B')$

$= A'\cdot A' + A'B + A'C' + A'B' + BB' + B'C'$

$= A' + A'(B+B') + A'C' + \underset{0}{B'(B+C')} + B'C'$

$= A' + A' + A'C' + B'C'$

$= A' + A'C' + B'C'$

$= A'(1+C') + B'C'$

$f = A' + B'C'$ —(i)

(x.x=x) (x.x=0) (x+x'=1) (x+x=x) (1+x=1)

A'	B	C	
0	0	0	(0)
0	0	1	(1)
0	1	1	(3)
0	1	0	(2)

A	$B'C'$	
0	00	(0)
1	00	(4)

$\Rightarrow f = A'B'C' + \sum(0, 1, 2, 3, 4)$

$= A'B'C' + A'B'C + A'BC' + A'BC + AB'C'$

From (i) $\rightarrow f = A' + B'C' = [(A' + B'C')']'$

$= [A(B+C)]'$

$f = [A(B+C)]'$

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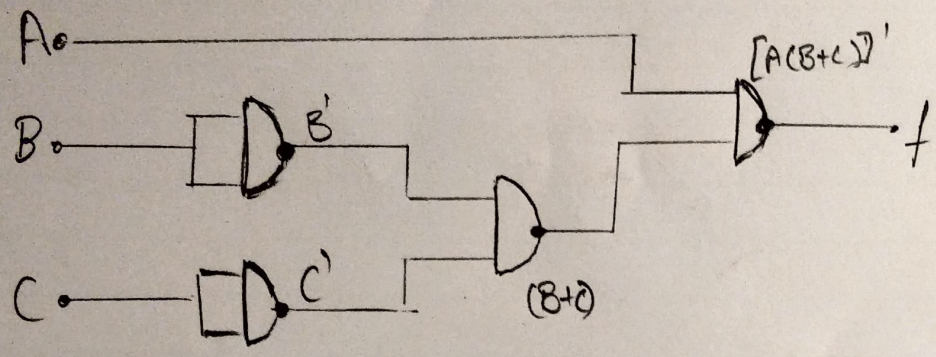

b) $f = C' + (A'B)'$

$= (C' + A + B')$ (DeMorgan's law)

$\Rightarrow f = \pi(3)$