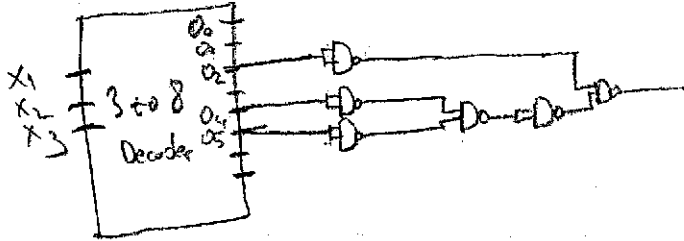


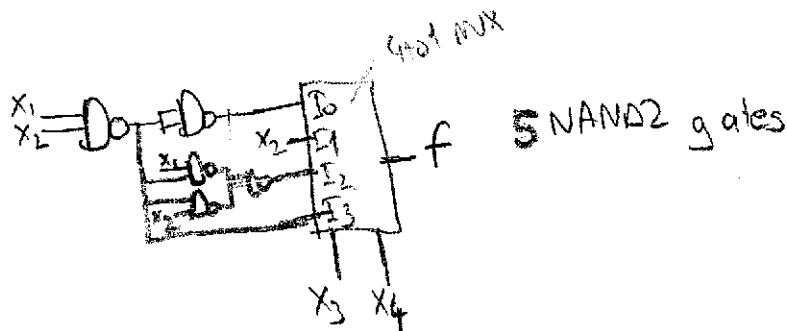
$$1) a) f(x_1, x_2, x_3) = \underbrace{(x_1 + x_2 + x_3)}_7 \cdot \underbrace{(x_1 + x_2 + x_3)}_6 \cdot \underbrace{(x_1 + x_2 + x_3)}_3 \cdot \underbrace{(x_1 + x_2 + x_3)}_1 \cdot \underbrace{(x_1 + x_2 + x_3)}_0$$

$$= \underbrace{\bar{x}_1 \cdot x_2 \cdot \bar{x}_3}_2 + \underbrace{x_1 \cdot \bar{x}_2 \cdot \bar{x}_3}_4 + \underbrace{x_1 \cdot \bar{x}_2 \cdot x_3}_5$$



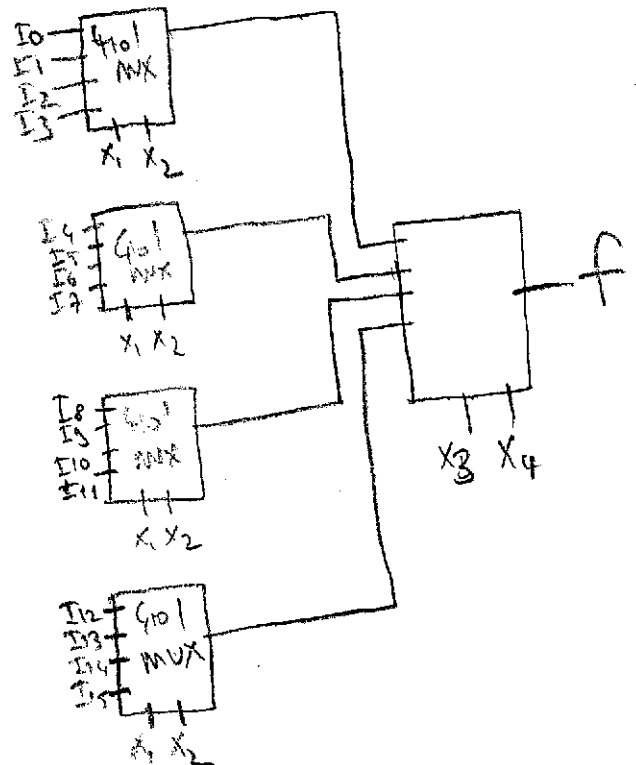
6 NAND2 gates

$x_1$	$x_2$	$x_3$	$x_4$	$f$
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

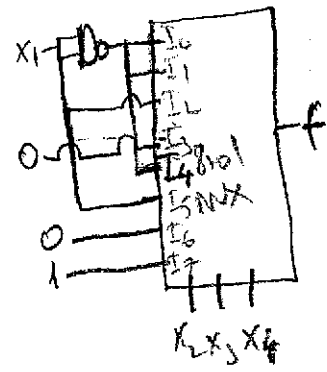


5 NAND2 gates

d)



$x_1$	$x_2$	$x_3$	$x_4$	$f$
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1



2)  $A_1, A_0, B_1, B_0, P_3, P_2, P_1, P_0$

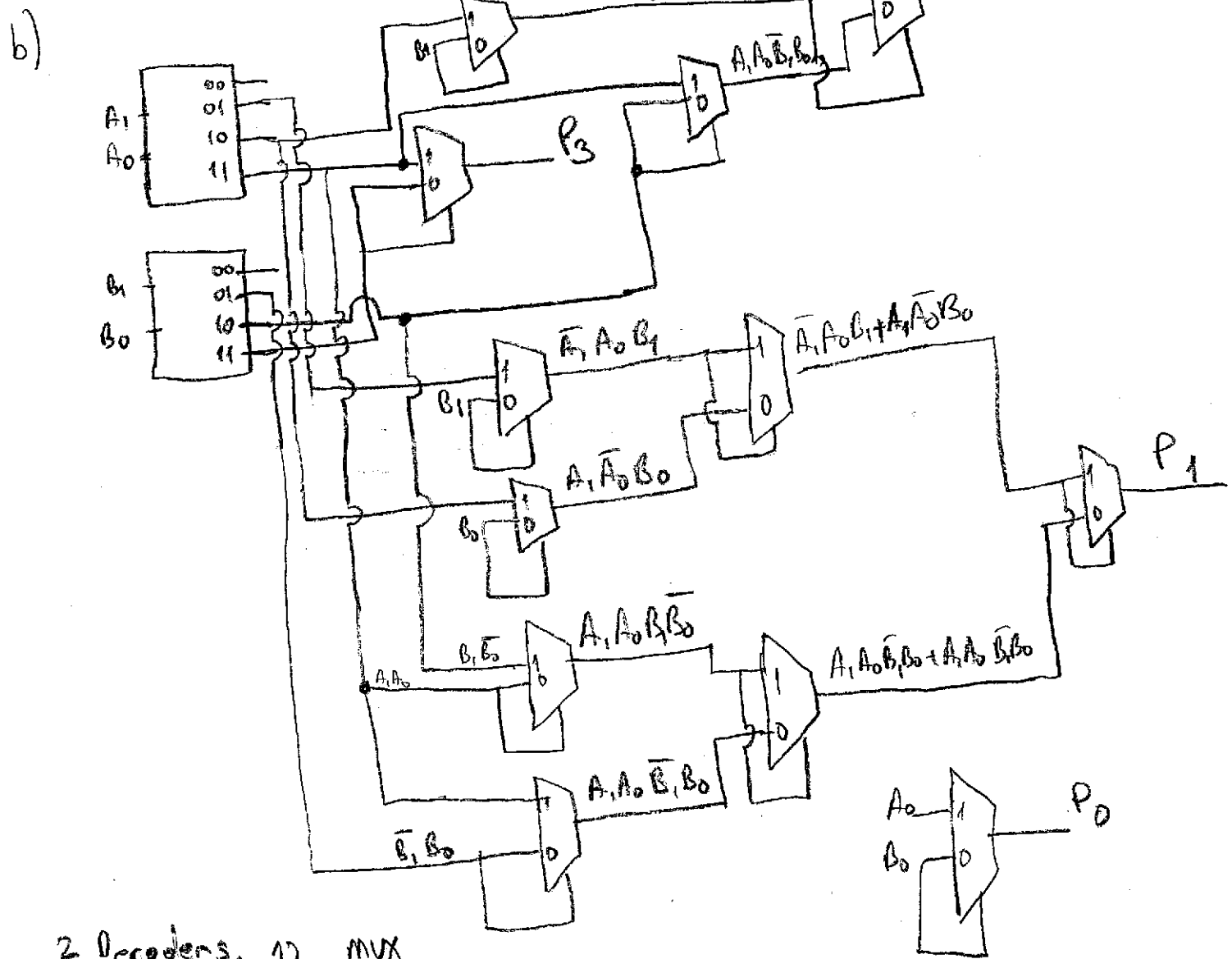
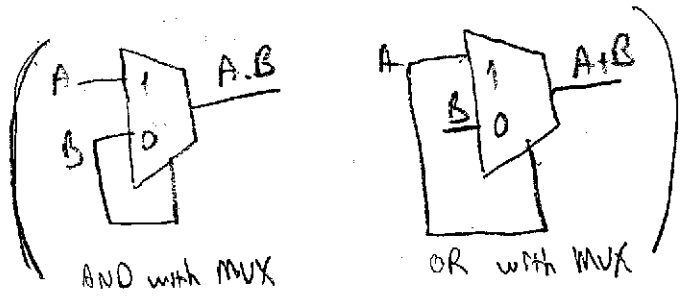
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	1	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	1	1	0
1	1	1	1	1	0	0	1

$$P_3 = A_1 A_0 B_1 B_0$$

$$P_2 = A_1 \bar{A}_0 B_1 + A_1 A_0 \bar{B}_1 B_0$$

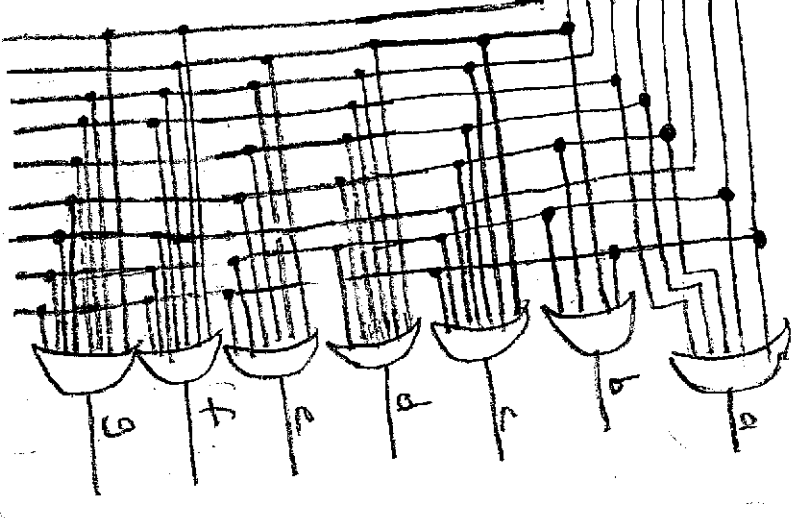
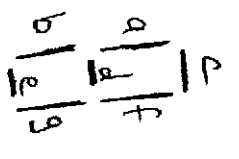
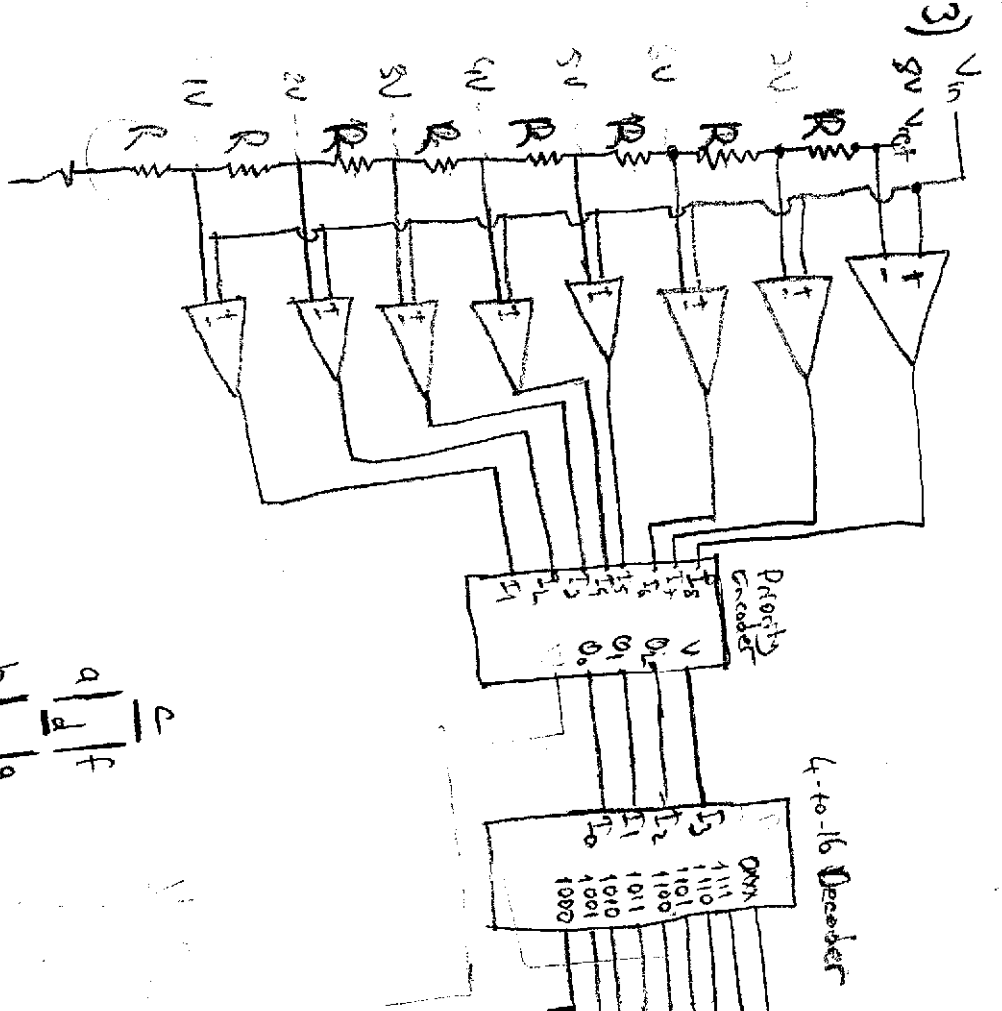
$$P_0 = A_0 B_0$$

$$P_1 = \bar{A}_1 A_0 B_1 + A_1 \bar{A}_0 B_0 + A_1 A_0 B_1 \bar{B}_0 + A_1 A_0 \bar{B}_1 B_0$$



2 Decoders, 12 MUX

$$\text{Cost} = 2 \cdot 2 + 12 = 16$$



The output for  $O_3$  is not necessary for the complete solution, even so we included it in our solution.

8 to 3 Priority Encoder

$I_7$	$I_6$	$I_5$	$I_4$	$I_3$	$I_2$	$I_1$	$I_0$	$O_2$	$O_1$	$O_0$	$V$
0	0	0	0	0	0	0	0	X	X	X	0
0	0	0	0	0	0	0	1	X	X	X	0
0	0	0	0	1	X	X	X	X	X	X	0
0	0	0	1	X	X	X	X	X	X	X	0
0	0	1	X	X	X	X	X	X	X	X	0
0	1	X	X	X	X	X	X	X	X	X	0
1	X	X	X	X	X	X	X	X	X	X	0

1 to 4 decoder

$I_3$	$I_2$	$I_1$	$I_0$	$a$	$b$	$c$	$d$	$e$	$f$	$g$
0	X	X	X	0	0	0	0	0	0	0
0	0	X	X	0	0	1	1	1	1	0
0	0	0	X	0	1	1	1	1	1	1
0	0	0	0	1	1	1	1	1	1	1
1	0	1	1	1	0	0	1	1	0	1
1	0	0	1	1	0	1	1	1	0	1
1	1	0	1	1	0	0	1	0	0	1
1	1	1	1	1	0	0	1	0	0	1