Derrick Subnaik
Computer Architecture
Homework 3

1)

a) $39 = (100111)_2$

$39-32 = 7-4 = 3-2 = 1-1 = 0$

$2^5 \quad 2^2 \quad 2^1 \quad 2^0$

b) $(BA)_{16} = (186)_{10}$

$11 \times 16^1 + 10 \times 16^0$

$176 + 10$

c) $(10|0101)_2 = (55)_{16}$

0101 0101

5 5

d) $(1011)_2$ 4-bit unsigned $= (11)_{10}$

$2^3 + 2^1 + 2^0$

$8 + 2 + 1$

e) $-4 = (1100)_2$ 4-bit signed 2's compliment

$-8 + \_\_ = -4$

$-8 + 4 = -4$

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

2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128
2^8	256
2^9	512

2)

a) 4-bit unsigned: $14+6=4$

$$\begin{array}{r} {\scriptstyle 1\,1\,1\,0} \\ 1110 \\ +0110 \\ \hline 10100 \end{array}$$

b) 4-bit unsigned: $4-7=13$

$$\begin{array}{r} 0100 \\ +1001 \\ \hline 1101 \end{array}$$

c) 8-bit unsigned: $236+34=14$

$236-128 = 108-64 = 44-32 = 12-8 = 4-4 = 0$

$2^7 \quad 2^6 \quad 2^5 \quad 2^3 \quad 2^2$

$34-32 = 2-2 = 0$

$2^5 \quad 2^1$

$$\begin{array}{r} {\scriptstyle 1\,1} \\ (11101100)_2 \\ +(00100010)_2 \\ \hline 100001110 \end{array}$$

$8+4+2$

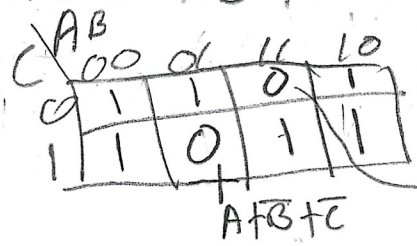
d) 4-bit signed 2's comp: $6+6=-4$

$$\begin{array}{r} 0110 \\ +0110 \\ \hline 1100 \end{array}$$

e) 4-bit signed 2's comp: $-7-7=2$

$$\begin{array}{r} {\scriptstyle 1\,\,\,\,} \\ 1001 \\ +1001 \\ \hline 10010 \end{array}$$

(3) Give all the maxterms of the Boolean Function $Y = \bar{A}\bar{C} + \bar{A}B + AC + A\bar{B} + \bar{B}\bar{C}$

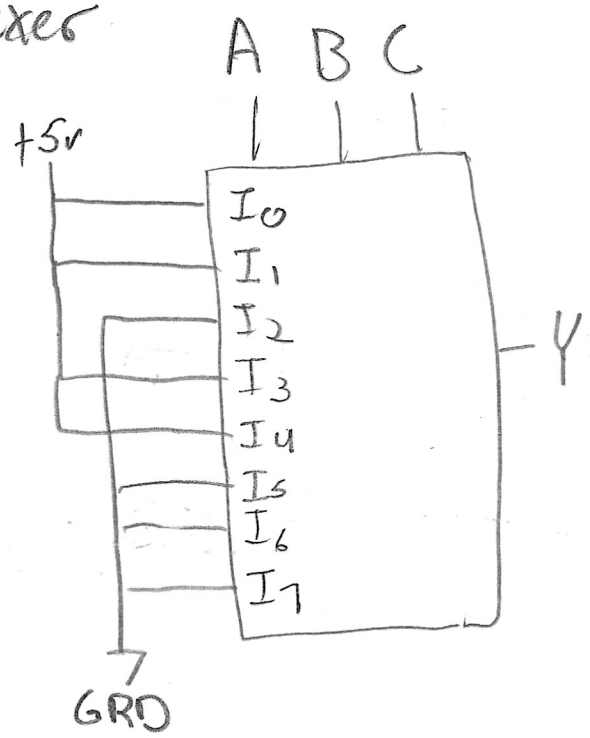


$Y = (\bar{A}+\bar{B}+C)(A+\bar{B}+\bar{C})$

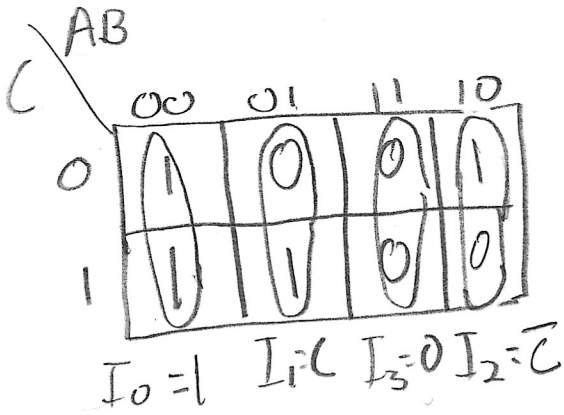
(4)

A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

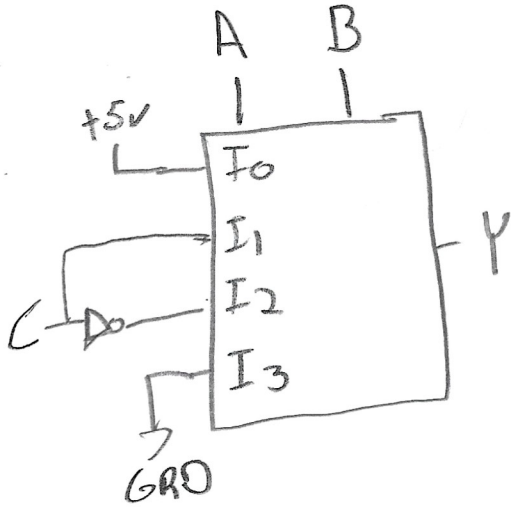
a) 8:1 Multiplexer



b) 4:1 Multiplexer



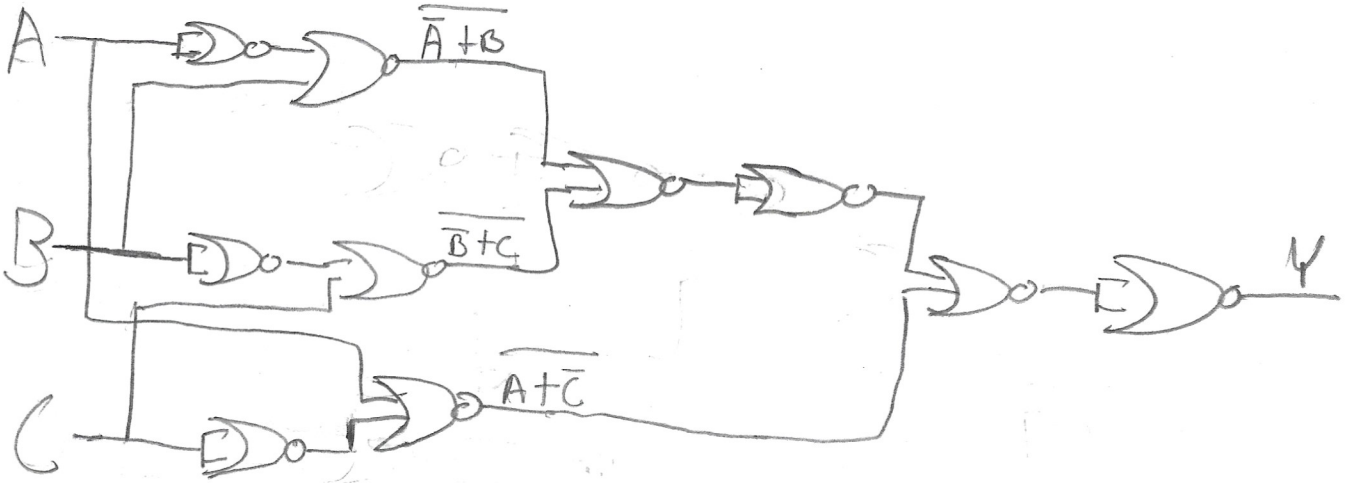
$I_0 = 1$ $I_1 = C$ $I_3 = 0$ $I_2 = \bar{C}$



(5)

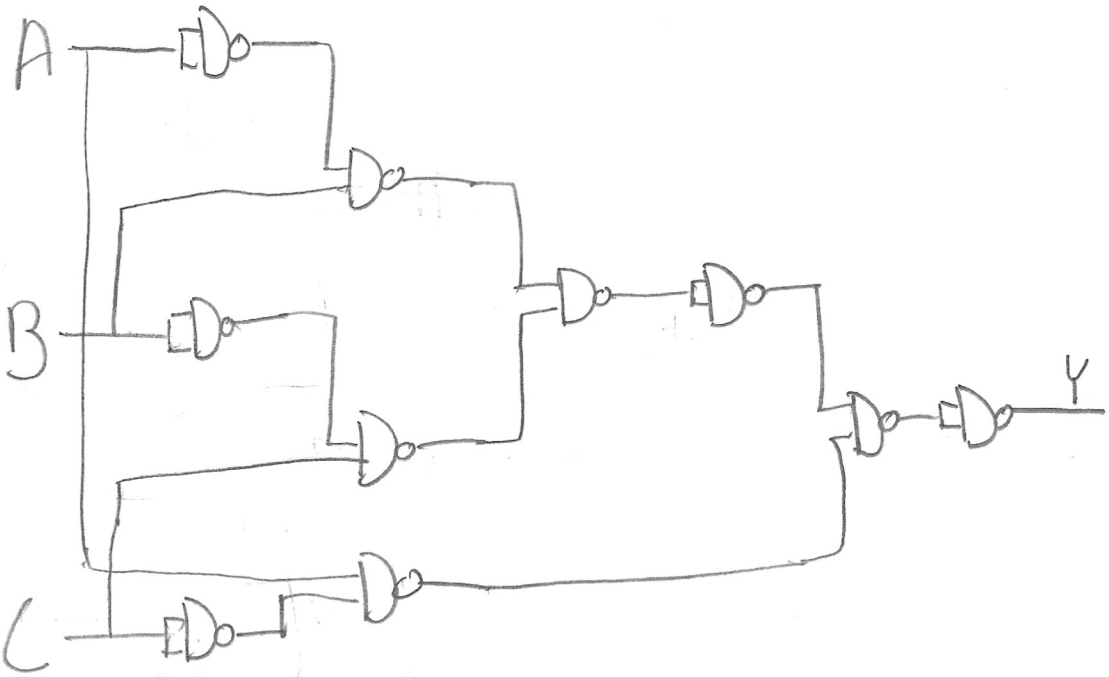
a) $Y = A\bar{B} + B\bar{C} + \bar{A}C$ using 2-input NOR gates only

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



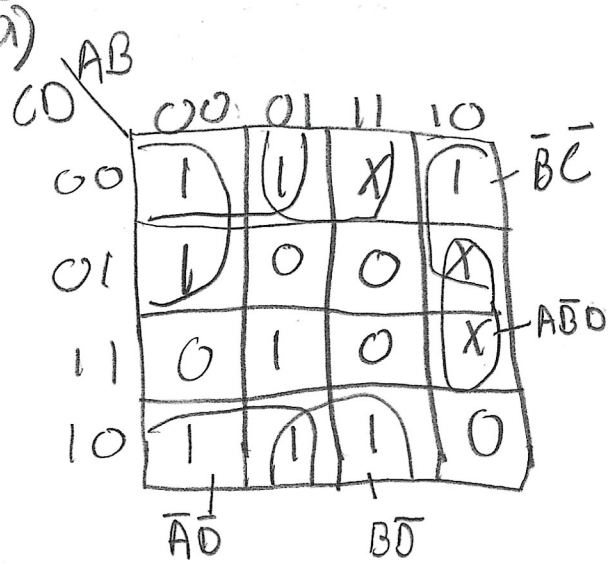
b) $Y = (A+\bar{B})(B+\bar{C})(\bar{A}+C)$ using 2-input NAND gates only

$$Y = \overline{\overline{(A+\bar{B})}\,\overline{(B+\bar{C})}\,\overline{(\bar{A}+C)}} \qquad Y = \overline{\overline{(\bar{A}B)}\,\overline{(\bar{B}C)}\,\overline{(A\bar{C})}}$$



(6)

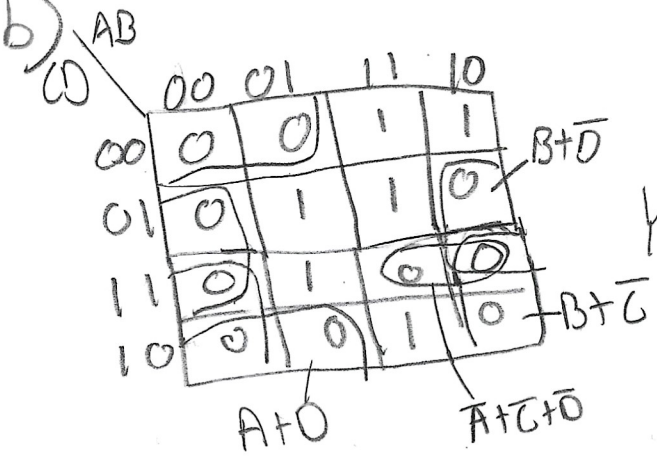
a)



Minterm grouping

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

b)



Maxterm grouping

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

7)

Control Signal $(F_{2:0})$	Function $Y(A,B)$
000	$\bar{A}$ or $\bar{B}$
101	$\bar{A}$ and B
110	$B-A$