NAME: TWAAMBO CHOOPA

COMP NO: 2018207369

SCHOOL: MINES

COURSE: MEC 3102 ASSIGNMENT 3

LECTURER: MR MUNKOMBWE BOYD

Question 1

a) $(23)_{10} = 16+4+2+1$

$23-16 = 7$

$7-4 = 3$

$3-2 = 1$

$1-1 = 0$

$(23)_{10} \Rightarrow \underline{(10111)_2}$

ii) $(31)_{10} = 16+8+4+2+1$

$31-16=15$

$15-8 = 7$

$7-4 = 3$

$3-2 = 1$

$1-1 = 0$

$(31)_{10} \Rightarrow \underline{(11111)_2}$

b) $(01010)_2 = (??)_{10}$

$= (2^0 \times 0) + (2^1 \times 1) + (2^2 \times 0) + (2^3 \times 1) + (2^4 \times 0)$

$= 0 + 2 + 0 + 8 + 0$

$= \underline{10}$

ii) $(10101)_2 = (??)_{10}$

$= (2^0 \times 1) + (2^1 \times 0) + (2^2 \times 1) + (2^3 \times 0) + (2^4 \times 1)$

$= 1 + 0 + 4 + 0 + 16$

$= \underline{21}$

c) $82.75 \rightarrow$ Hexadecimal

$\cancel{82 \div 16 = (5.125 - 5) \times 16 = 2}$

$82 \div 16 = 5.125 \quad 5 \text{ R } 2$

$5 \div 16 = 0.3125 \quad 0 \text{ R } 5$

$0.75 \times 16 = 12$

$\underline{(52.C)_{16}}$

QUESTION 2

a) $(25)_{10} = 16+8+1$

$25-16=9$
$9-8=1$
$1-1=0$

$(25)_{10} = (11001)_2$

11001 ~~are~~ 1's are swapped for 0's and vice versa

00110 This is 1's compliment, we add 1 to take it to 2's compliment

$$\begin{array}{r} 00110 \\ +\quad 1 \\ \hline 00111 \end{array}$$

= 00000111

ii) $(121)_{10} = 64+32+16+8+1$

$121-64 = ~~43~~ 57$
$57 ~~43~~ - 32 = 25$
$25-16 = 9$
$9-8 = 1$
$1-1 = 0$

$(121)_{10} = (~~1111~~ (1111001)_2$

$$\begin{array}{r} 0000110 \\ +\quad 1 \\ \hline 0000111 \end{array}$$

= 00000111

iii) $(-17)_{10} = 16+1$

$17-16 = 1$
$1-1=0$

$(17)_{10} = (10001)_2$

$$\begin{array}{r} 101110 \\ +\quad 1 \\ \hline 101111 \end{array}$$

= 1110111

iv) $-96 = 64+32$

$96-64 = 32$
$32-32 = 0$

$(96)_{10} = 1100000$

$$\begin{array}{r} 10011111 \\ +\quad 1 \\ \hline 10100000 \end{array}$$

= 10100000

Scanned with CamScanner

QUESTION 2

b) 121 - 25

$$
\begin{array}{r}
1111001 \\
- \quad 11001 \\
\hline
1100000 \\
\hline
\end{array}
$$

ii) 25 + (-17)

$$
\begin{array}{r}
00011001 \\
+ \; 11101111 \\
\hline
\end{array}
$$

iii) 25 - 96

$$
\begin{array}{r}
00011001 \\
10100000 \\
\hline
\end{array}
$$

c) The 2's compliment of the subtrahend is first found. The complement number is added with the minuend number. If we get a carry by adding both the numbers, then we discard this carry and the result is positive else take 2's compliment of the result which will be negative.

Question 3

a) $(13.5)_{10} \times (2.5)_{10} = (33.75)_{10}$

$(1101.1)_2 \times (10.1)_2$

$$\begin{array}{r} 1101.1 \\ 10.1 \\ \hline 11011 \\ 00000 \\ 11011 \\ \hline 100001.11 \end{array}$$

$= (100001.11)_2 \Rightarrow (33.75)_{10}$

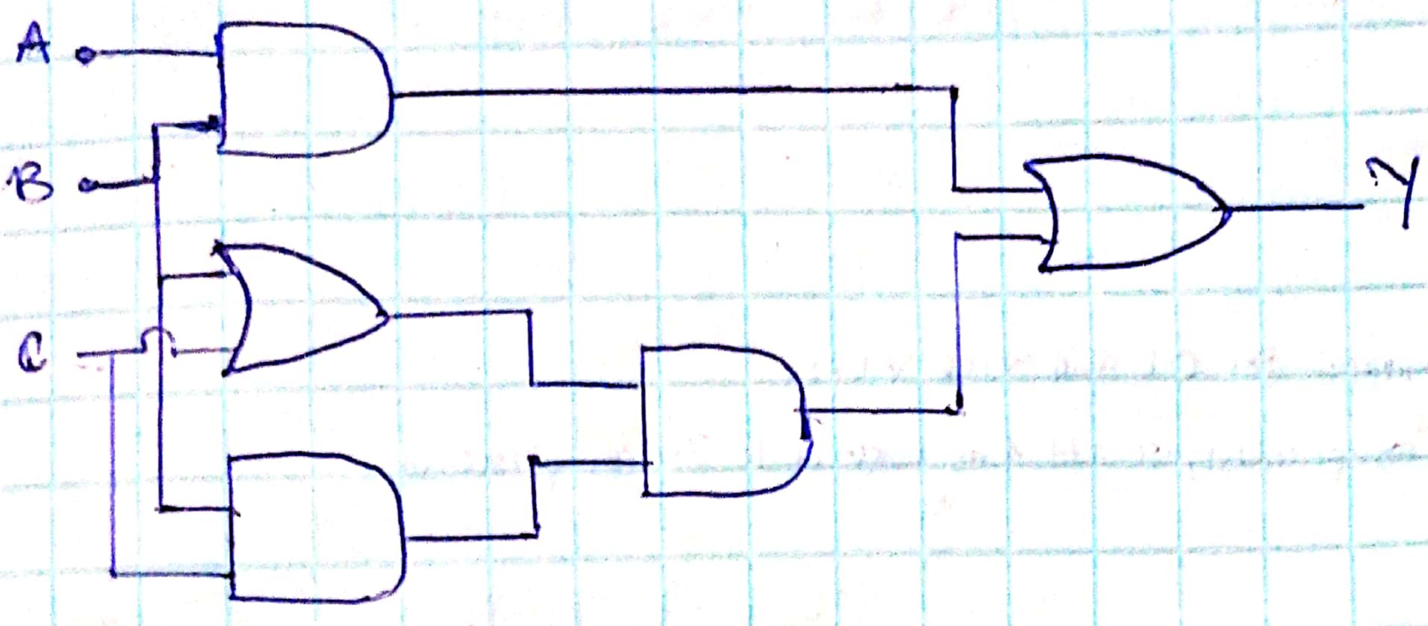
b) $(100.0001)_2 \div (10.1)_2$

$$\begin{array}{r} 1101 \\ 101 \overline{)1000001} \\ -101 \\ \hline 110 \\ 101 \\ \hline 101 \\ 101 \\ \hline 0 \end{array}$$

$\frac{1000001}{101} \times 2^{-3} \Rightarrow 1101 \times 2^{-3}$

$= (1.101)_2$ up to two binary places

QUESTION 4



$F_1 = A \cdot B$,

$F_2 = B + C$

$F_3 = B \cdot C$

$f_4 = F_2 \cdot f_3 = (B + C)(BC)$

$= BC + BC = BC$

$f = f_4 + f_1$

$= BC + AB$

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

QUESTION 5

a)

A	B	C	Light (L)
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

1 indicates ON and 0 indicates Off
If A and B are same light will be ON

b) $L = A'B'C' + A'B'C + ABC' + ABC$

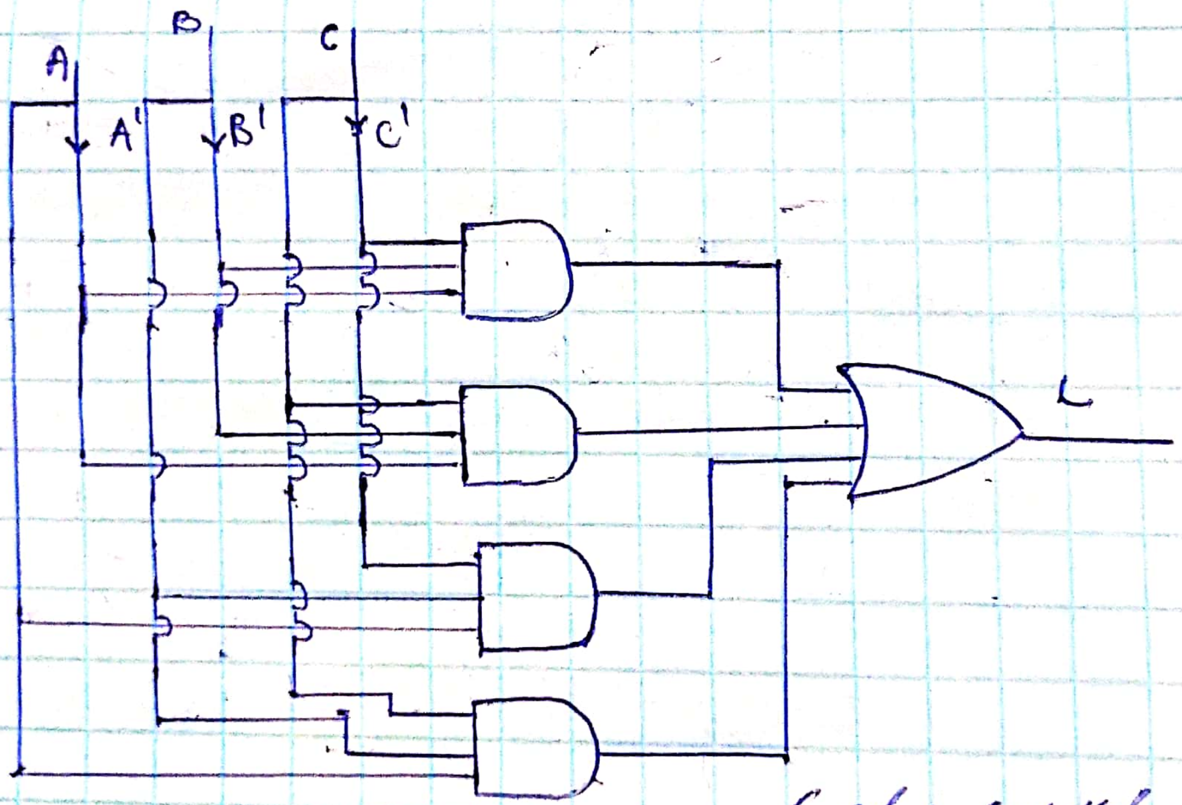
c) from Karnaugh map

A \ BC	$B'C'$	$B'C$	BC	BC'
A'	1	1	3	2
A	4	5	7	6

Output

$L = ⓐ + ⓑ$

$L = A'B' + AB$



C act as controlled input

QUESTION 6

a) $Y = ABC + AB\bar{C} + A\bar{B}C + A\bar{B}\bar{C} + \bar{A}BC + \bar{A}B\bar{C} + \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C$

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

$Y = AB + A\bar{B} + \bar{A}B + \bar{A}\bar{B}$

$Y = A(B+\bar{B}) + \bar{A}(B+\bar{B})$ $\quad \therefore A+\bar{A}=1,\ B+\bar{B}=1,\ C+\bar{C}=1$

$Y = A + \bar{A}$

$Y = 1$

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

$Y = (\bar{A}+B+\bar{C}\cdot C)((C+D)+(C+D)E)$ $\quad \therefore A+AB=A,\ (A+B)(A+C)=A+BC,\ C\bar{C}=0$

$Y = (\bar{A}+B)(C+D)(1+E)$

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

c $Y = A\cdot\bar{B}\cdot C + A\cdot\bar{B}\cdot\bar{C} + A\cdot B\cdot C + A\cdot B\cdot\bar{C} + A\cdot B\cdot C$

$Y = \Sigma m(5,4,7,6,3)$

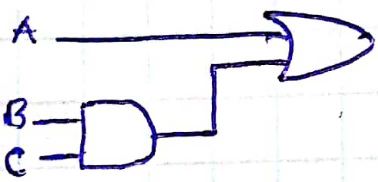
$Y = \Sigma m(3,4,5,6,7)$

Karnaugh Map for y

A \ BC	00	01	11	10
0	0	1	1 3	2
1	1 4	1 5	1 7	1 6

$Y = A + BC$

Simplified logic circuit.



Question 7

$f = A\bar{B}CD + \bar{A}BC + \bar{A}\bar{B}C + BCD$

$f = \Sigma m(11, 6, 2, 7)$

CD \ AB	00	01	10	11
00				
01				
10	1	1		
11		1	1	

step one

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

step two

Variables	Minterms
A B C D	SSOP
1 0 1 1	$A\bar{B}CD - m_{11}$
0 1 1 0	$ABC - m_6$
0 0 1 0	$\bar{A}\bar{B}C - m_2$
0 1 1 1	$BCD - m_7$

minterm after Kmap Step three

for $AC\bar{D} + CD$

minterm of $f = \Sigma m(m_2, m_3)$

minterm of $f = \Sigma m(2, 3)$