Department of Computer Science
Design Logic

Component 2: Simulation

$(A'B+C')\,(AB'C'+B)'\,(AB'+C')$

Truth table.

A	B	C	$A'B$	$A'B+C'$	AB'	$AB'+C'$	$AB'C'+B$	[illegible]
0	0	0	0	1	0	1	1	1
0	0	1	0	1	0	0	1	0
0	1	0	1	1	0	1	0	0
0	1	1	1	0	0	0	0	0
1	0	0	0	0	1	0	0	0
1	0	1	0	1	1	1	1	0
1	1	0	0	0	0	1	0	0
1	1	1	0	1	0	0	0	0

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Component 2: Simulation

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

Truth table.

A	B	C	A'B	A'B + C'	AB'	AB' + C'	AB'C' + B'	9e
0	0	0	0	1	0	1	1	1
0	0	1	0	1	0	0	1	0
0	1	0	1	1	0	1	0	0
0	1	1	1	0	0	0	0	0
1	0	0	0	0	1	0	0	0
1	0	1	0	1	1	1	1	0
1	1	0	0	0	0	1	0	0
1	1	1	0	1	0	0	0	0

Component 3:

1) (a) Converting to Binary $4C_{16} \times F_{16}$

$4C \rightarrow 0100\ 1100$

$4C_{16} \rightarrow 01001100_2$

$F \rightarrow 1111$

Scanned with CamScanner

Binary multiplication of $4C_{16} \times F_{16}$

~~0100 X~~

$$
\begin{array}{r}
0100\ 1100 \times 1111 \\
\hline
0\,1\,0\,0\ 1\,1\,0\,0 \\
0\,1\,0\,0\,1\ 1\,0\,0\,\times \\
0\ 1\,0\,0\,1\,1\ 0\,0\,\times\,\times \\
0\ 1\ 0\,0\,1\,1\,0\,0\,\times\,\times\,\times \\
\hline
1\ 0\ 0\ 0\,1\,1\,1\,0\,1\,0\,0
\end{array}
$$

$\therefore (10001110100)_2$

4 7 4

(iii) BCD arithmetic operation

$\underset{A}{287} - \underset{B}{331}$ [Using 10's complement]

10's complement of a number is 1 added to its 9's comple number

9's comp of 331 $\rightarrow$

$$
\begin{array}{r}
999 \\
-\,331 \\
\hline
668
\end{array}
$$

adding : $668 + 1 = 669$.

Scanned with CamScanner

1) Adding 10's complement to 287

$$\begin{array}{r} 287 \\ +\ 669 \\ \hline 956 \\ \hline \end{array}$$

as there is no carry answer is (-ve)

$$\begin{array}{r} 999 \\ -\ 956 \\ \hline 43 \\ \hline \end{array}$$

adding 1 $= 43+1 = 44$

$\therefore\ 287 - 331 = -44$ using 10's complement Method.

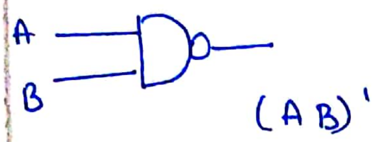
2) De Morgan's theorem

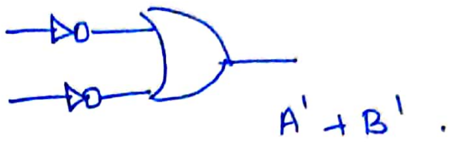
$(AB)' = A' + B'$

Complement of product of two variables is equal to ~~sum pro~~ sum of variables is equal to sum of complements of individual variables

Circuit diagram

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





Truth table.

A	B	A B	(A B)'	A'	B'	A' + B'
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0
			(1)			(2) .

Hence proved,

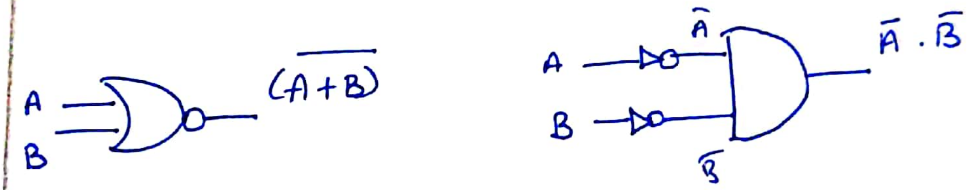
$$(AB)' = A' + B'$$

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

Complement of sum of two variables is equal to the product of complement of individual variables.

Circuit diagram:

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



Truth table.

A	B	A+B	$(A+B)'$	A'	B'	$A'.B'$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

1 2.

Hence proved LHS = RHS

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

4) $F(A, B, C, D) = \Pi(0, 1, 2, 4, 5, 7, 11, 15)$

AB \ CD	00	01	11	10
00	0_0	0_1	1_3	0_2
01	0_4	0_5	0_7	1_6
11	1_{12}	1_{13}	0_{15}	1_{14}
10	1_8	1_9	0_{11}	1_{10}

$(0\ 1\ 2\ 4\ 5) \rightarrow \bar{A}.\bar{C}$

$(0, 2) \rightarrow \bar{A}\bar{B}\bar{D}$

$(5, 7) \rightarrow \bar{A}BD$

$(11, 15) \rightarrow A.CD.$

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

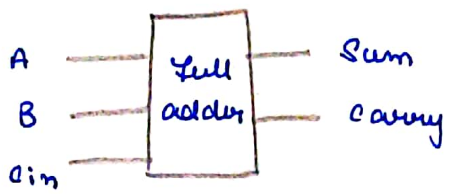
$$\overline{\bar{Y}} = \overline{\bar{A}.\bar{C} + \bar{A}.\bar{B}.\bar{D} + \bar{A}.BD + A.CD}.$$

$$Y = (A+C)(A+B+D).(A+B'+D')$$
$$(A'+C'+D')$$

5) Full Adder using Half adder.

Block diagram, Ckt, Expression, TT

Block diagram:



Truth table:

A	B	Cin	Sum	carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

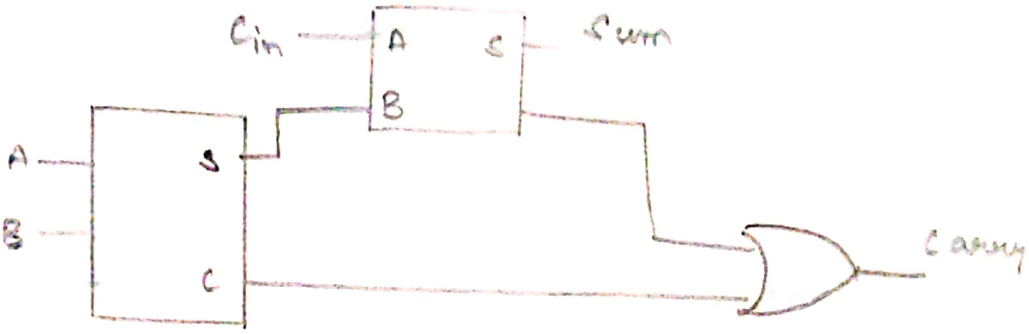
$$Sum = A'B'C + A'BC + AB'C' + ABC$$

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

$$C \text{ XOR } (A \text{ XOR } B)$$

Carry = A' B C + AB' C + ABC + ABC.

= AB + BC + AC.



Using NAND only