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Objectives:

The objective for this week will be to do detailed discussion on following concepts:

- Application of binary codes
- Encryption and decryption
- Logic gates
- Combinational Circuit Analysis

LECTURE-5

Application of Binary Codes:

- Assigning Unique Codes
- Encryption And Decryption
- Secret Conversations

Lets understand the concept of encryption and decryption and make use of binary codes to perform secret communication.

1- **Using Excess-3 codes:**

FOR NUMBERS:

1	1+3	**4**
2	2+3	**5**
3	3+3	**6**
4	4+3	**7**
5	5+3	**8**
6	6+3	**9**
7	7+3	**10**
8	8+3	**11**
9	9+3	**12**

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For ALPHABETS:

A **A+3** **D**	**B** **B+3** **E**	**C** **C+3** **F**	**D** **D+3** **G**	**E** **E+3** **H**	**F** **F+3** **I**	**G** **G+3** **J**	**H** **H+3** **K**	**I** **I+3** **L**	**J** **J+3** **M**
K **K+3** **N**	**L** **L+3** **O**	**M** **M+3** **P**	**N** **N+3** **Q**	**O** **O+3** **R**	**P** **P+3** **S**	**Q** **Q+3** **T**	**R** **R+3** **U**	**S** **S+3** **V**	**T** **T+3** **W**
U **U+3** **X**	**V** **V+3** **Y**	**W** **W+3** **Z**	**X** **X+3** **A**	**Y** **Y+3** **B**	**Z** **Z+3** **C**				

Lets encrypt following sentence Using Excess-3:

CS-430

Encrypt: FV-763

Decrypt: CS-430

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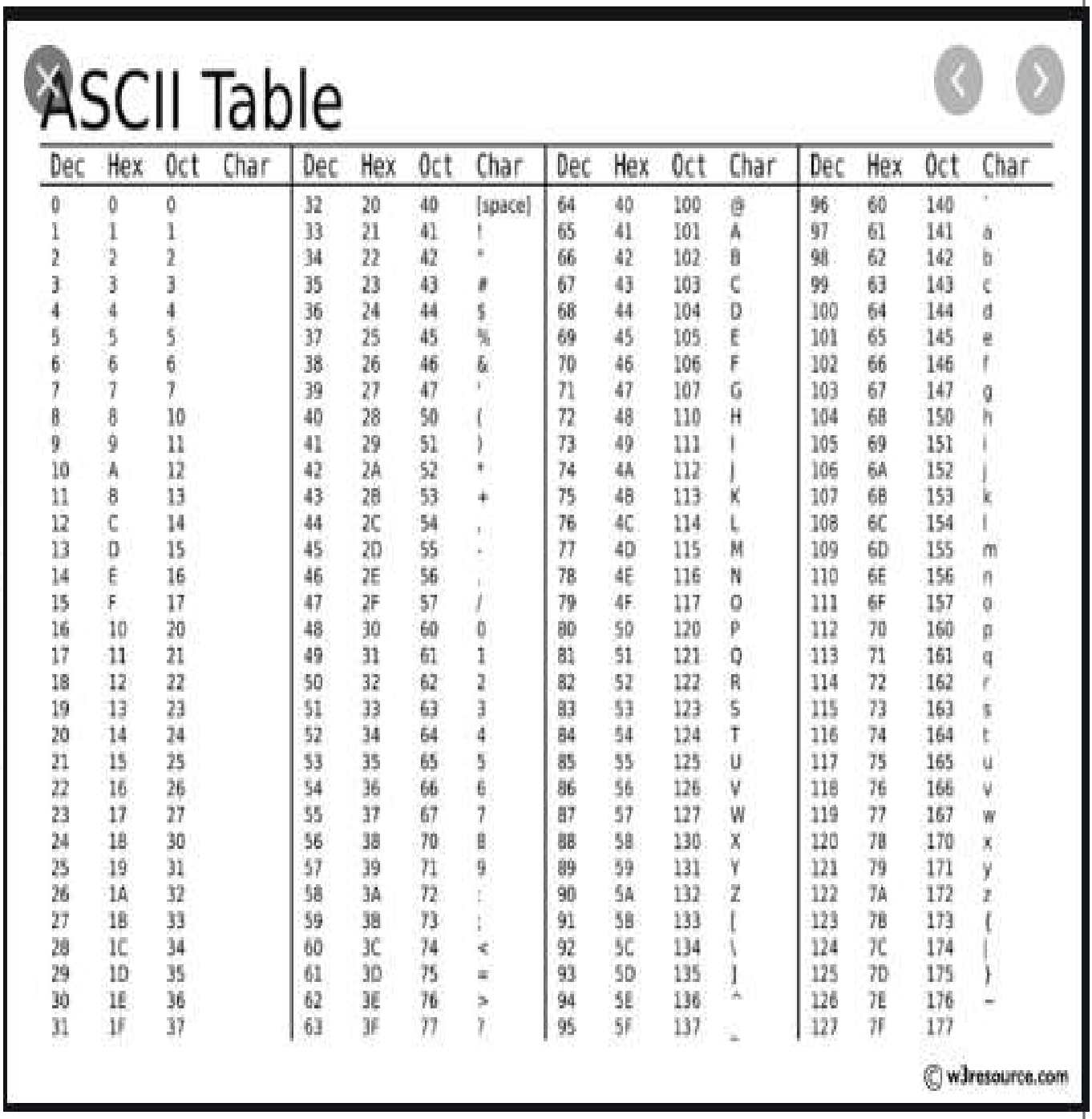
2- Encrypt using ASCII codes:



ASCII Table

Dec	Hex	Oct	Char	Dec	Hex	Oct	Char	Dec	Hex	Oct	Char	Dec	Hex	Oct	Char
0	0	0		32	20	40	[space]	64	40	100	@	96	60	140	`
1	1	1		33	21	41	!	65	41	101	A	97	61	141	a
2	2	2		34	22	42	"	66	42	102	B	98	62	142	b
3	3	3		35	23	43	#	67	43	103	C	99	63	143	c
4	4	4		36	24	44	$	68	44	104	D	100	64	144	d
5	5	5		37	25	45	%	69	45	105	E	101	65	145	e
6	6	6		38	26	46	&	70	46	106	F	102	66	146	f
7	7	7		39	27	47	'	71	47	107	G	103	67	147	g
8	8	10		40	28	50	(	72	48	110	H	104	68	150	h
9	9	11		41	29	51	)	73	49	111	I	105	69	151	i
10	A	12		42	2A	52	*	74	4A	112	J	106	6A	152	j
11	B	13		43	2B	53	+	75	4B	113	K	107	6B	153	k
12	C	14		44	2C	54	,	76	4C	114	L	108	6C	154	l
13	D	15		45	2D	55	-	77	4D	115	M	109	6D	155	m
14	E	16		46	2E	56	.	78	4E	116	N	110	6E	156	n
15	F	17		47	2F	57	/	79	4F	117	O	111	6F	157	o
16	10	20		48	30	60	0	80	50	120	P	112	70	160	p
17	11	21		49	31	61	1	81	51	121	Q	113	71	161	q
18	12	22		50	32	62	2	82	52	122	R	114	72	162	r
19	13	23		51	33	63	3	83	53	123	S	115	73	163	s
20	14	24		52	34	64	4	84	54	124	T	116	74	164	t
21	15	25		53	35	65	5	85	55	125	U	117	75	165	u
22	16	26		54	36	66	6	86	56	126	V	118	76	166	v
23	17	27		55	37	67	7	87	57	127	W	119	77	167	w
24	18	30		56	38	70	8	88	58	130	X	120	78	170	x
25	19	31		57	39	71	9	89	59	131	Y	121	79	171	y
26	1A	32		58	3A	72	:	90	5A	132	Z	122	7A	172	z
27	1B	33		59	3B	73	;	91	5B	133	[	123	7B	173	{
28	1C	34		60	3C	74	<	92	5C	134	\	124	7C	174	|
29	1D	35		61	3D	75	=	93	5D	135	]	125	7D	175	}
30	1E	36		62	3E	76	>	94	5E	136	^	126	7E	176	~
31	1F	37		63	3F	77	?	95	5F	137	_	127	7F	177	

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Lets encrypt:

CS-430

Encrypt: 678345525148

Decrypt:CS-430

3- **Encryption using Binary values:**

Hint:see the alphabets and numbers, assign them values in decimal or any other number system and then convert those numbers into binary, but make sure to use same number of bits for every number to make the secret communication possible.

LECTURE-6

Logic Gates:

- All the mathematical operations at hardware level are peformed with the help of gates.
- So whenever you want to design hardware of any function, you have to write its equation and then convert that equation to a hardware circuit using gates.
- This lecture will teach you all the basic and extensive use in the form of their symbol, equation and truth table. Lets get started:

NOT GATE:

Symbol:

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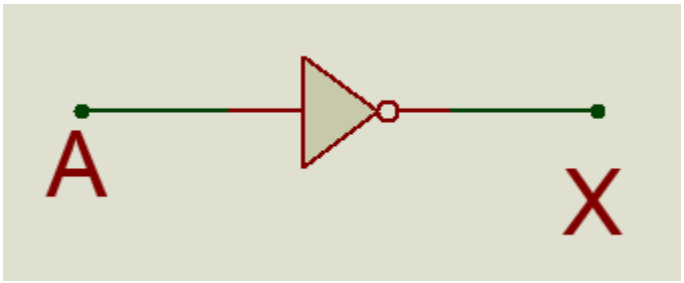


Equation:

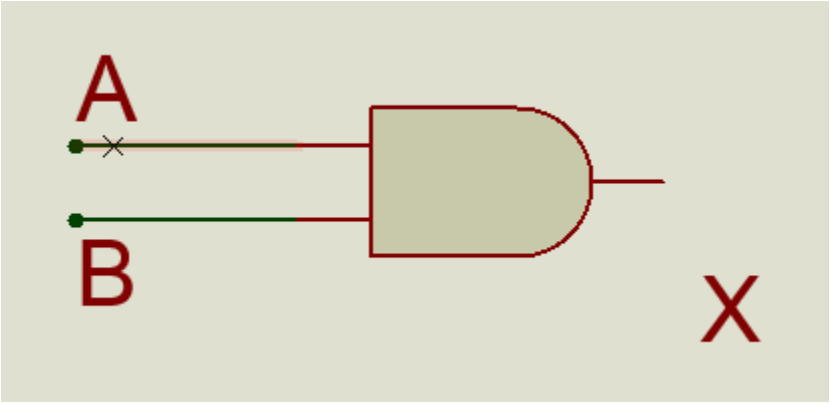
X=A’

Truth Table:

A	X
0	1
1	0

AND GATE:

Symbol:



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Equation:

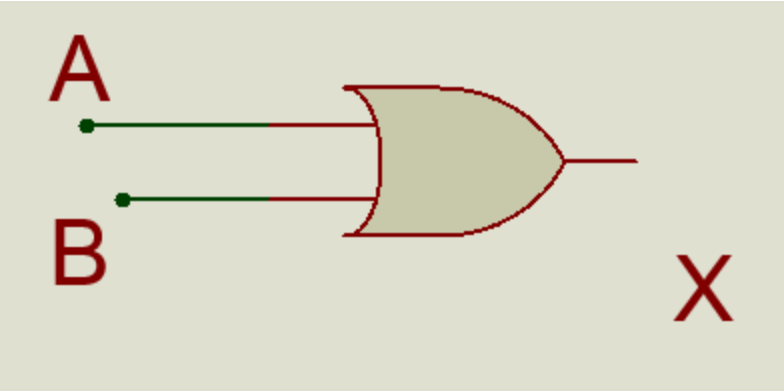
X=AB

Truth table:

A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

OR GATE:

Symbol:



Equation:

X=A+B

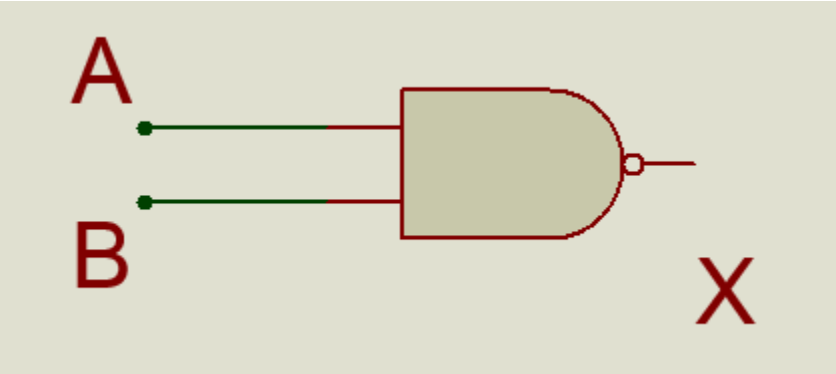
Truth table:

A	B	X
0	0	0

0	1	1
1	0	1
1	1	1

NAND GATE:

Symbol:



Equation:

X=(AB)’

Truth table:

A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

NOR GATE:

Symbol:

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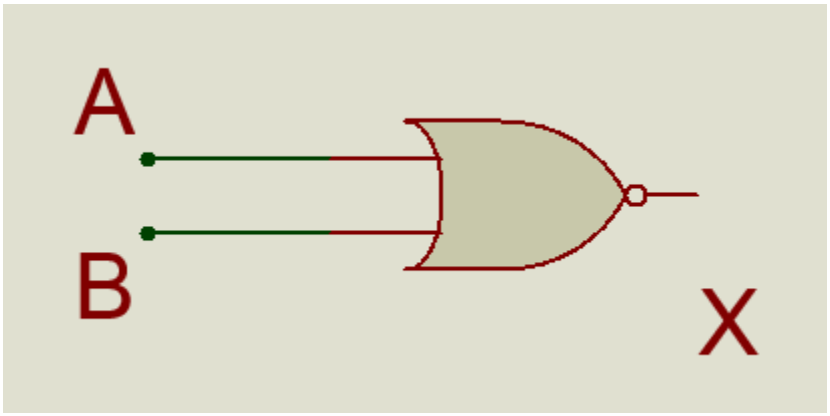

Equation:

X=(A+B)'

Truth table:

A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

XOR GATE:

Symbol:

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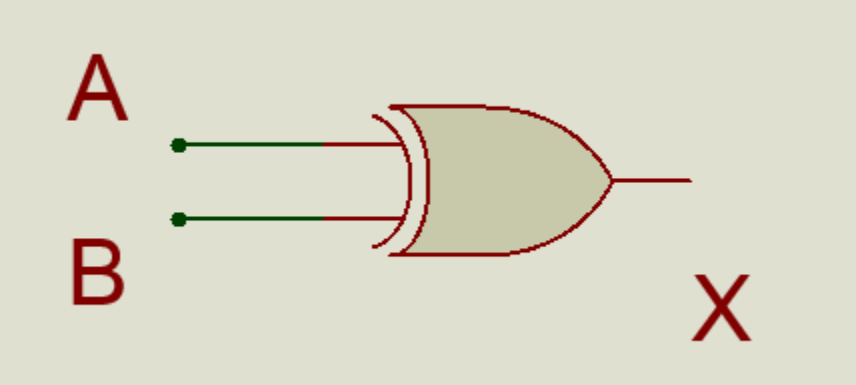

Equation:

$X=A \oplus B$

Truth table:

A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

XNOR GATE:

Symbol:

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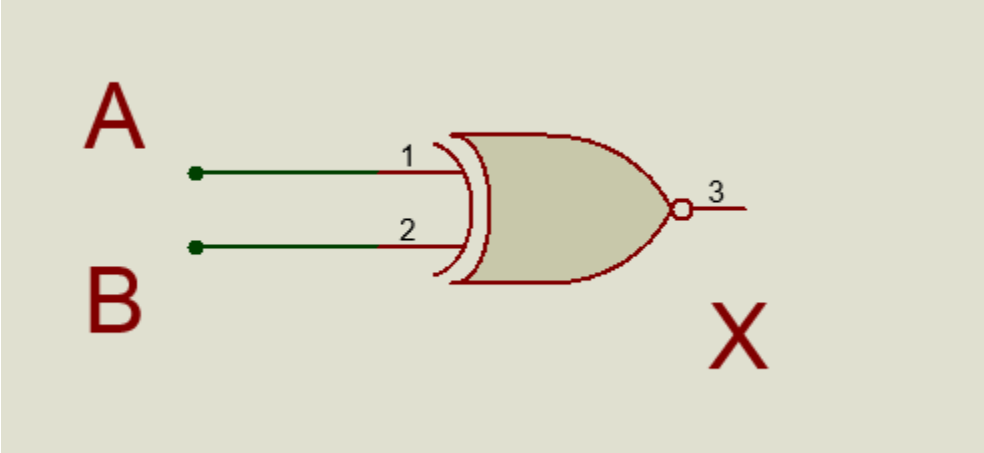

Equation:

$X=(A \oplus B)'$

OR

$X=A \odot B$

Truth table:

A	B	X
0	0	1
0	1	0
1	0	0
1	1	1

BUFFER:

Symbol:

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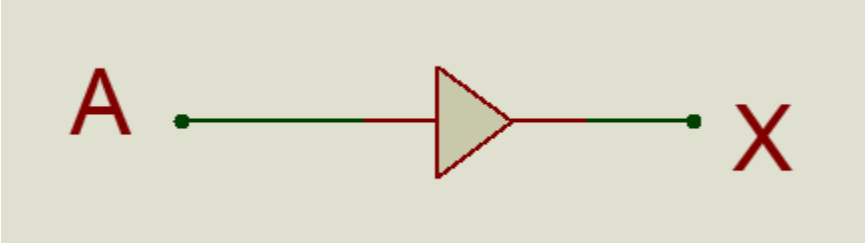


Equation:

X=A

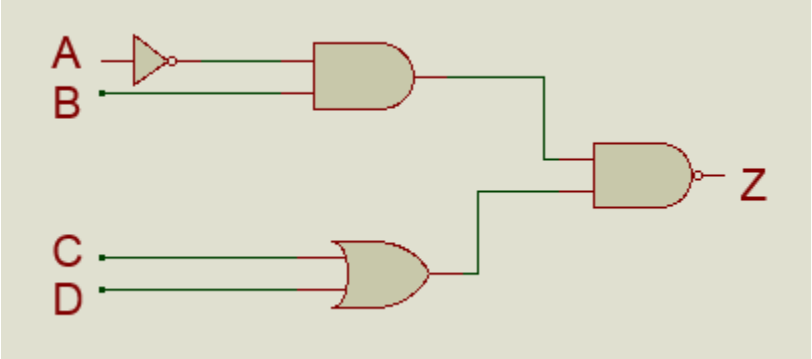
Truth Table:

A	X
0	0
1	1

COMBINATIONAL CIRCUIT ANALYSIS

In the previous lectures, we discussed logic gates in detail. This lecture is an application of logic gates where we will see that if we have a combinational circuit, how can we analyze to tell the functioning of a circuit.

Circuit#1



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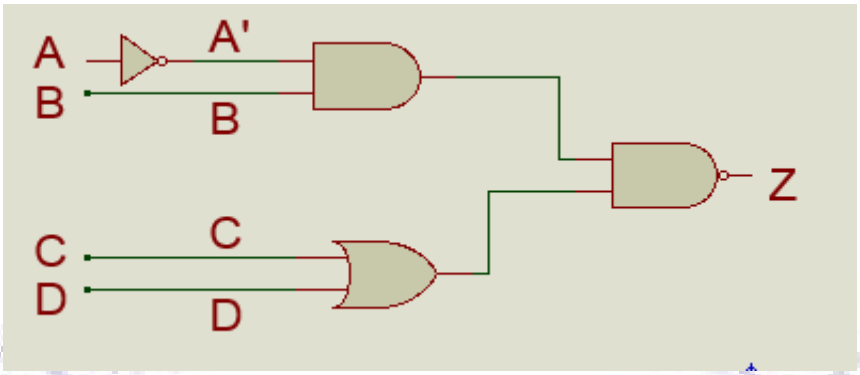
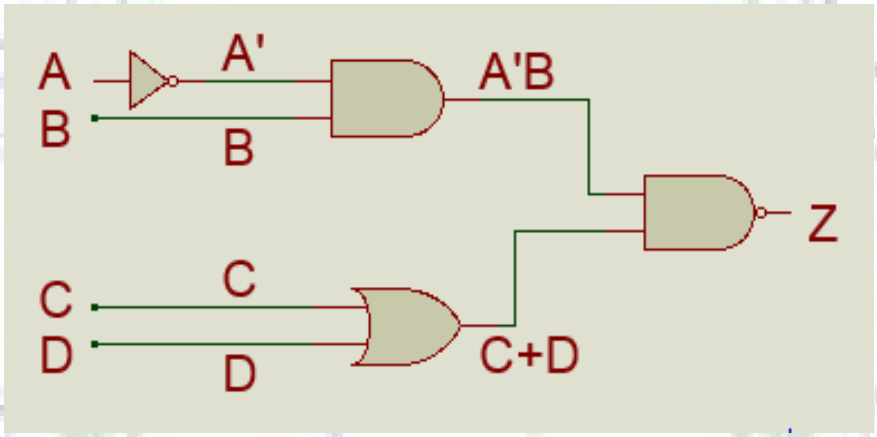
Starting from the inputs, solve each gate step by step

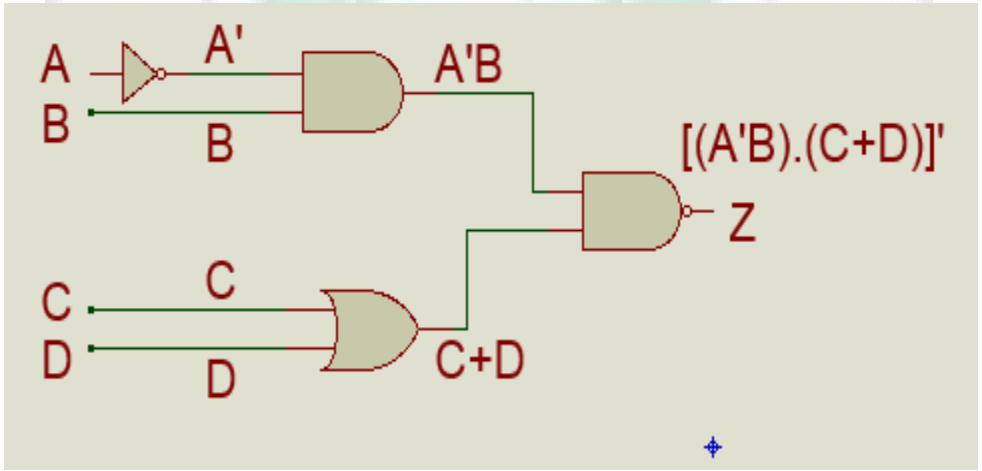
Step-1:



Step-2:



Step-3:



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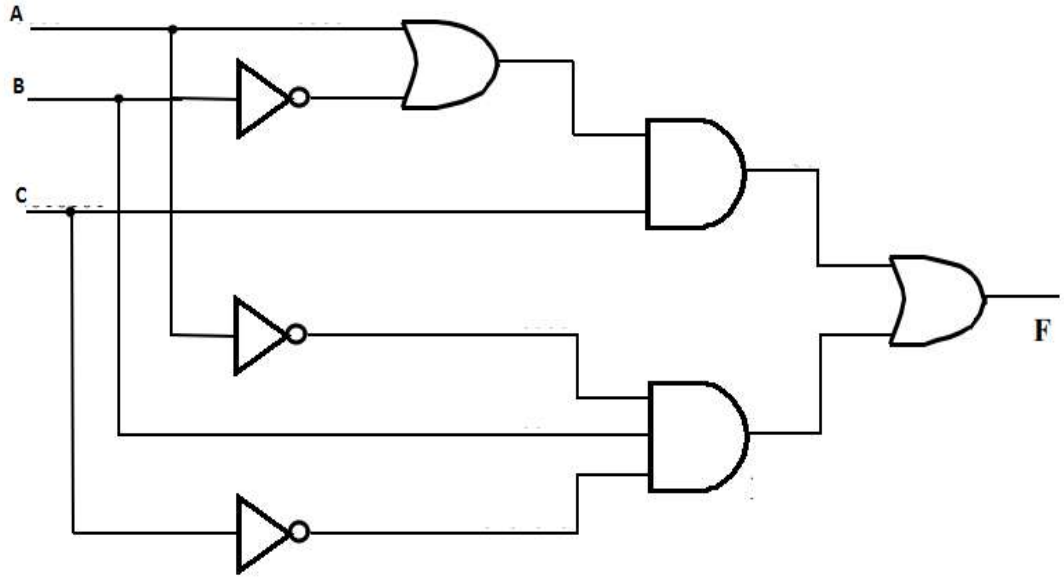
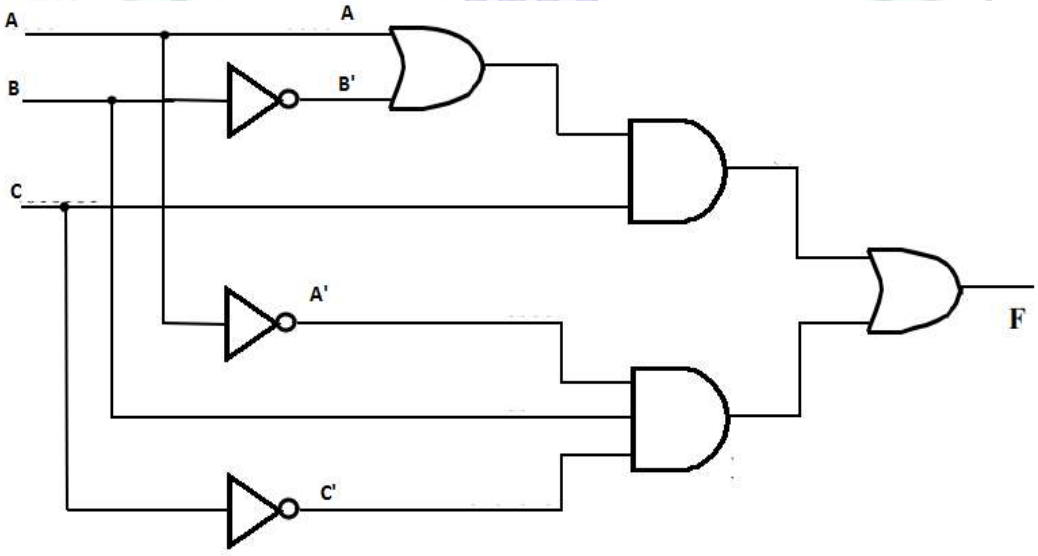
Circuit #2



Step-1:



Step-2:

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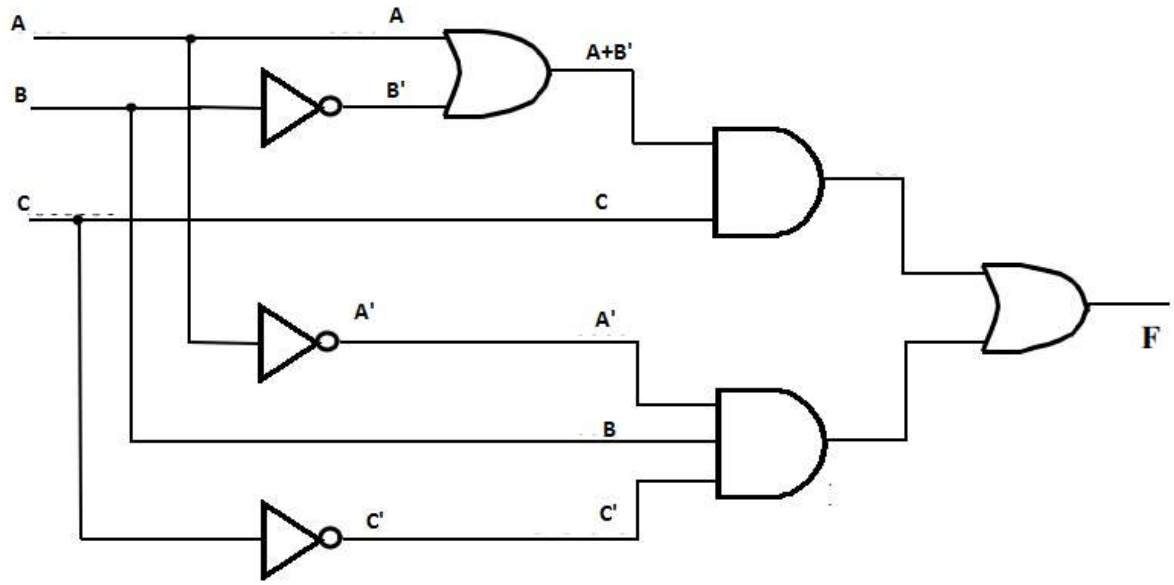
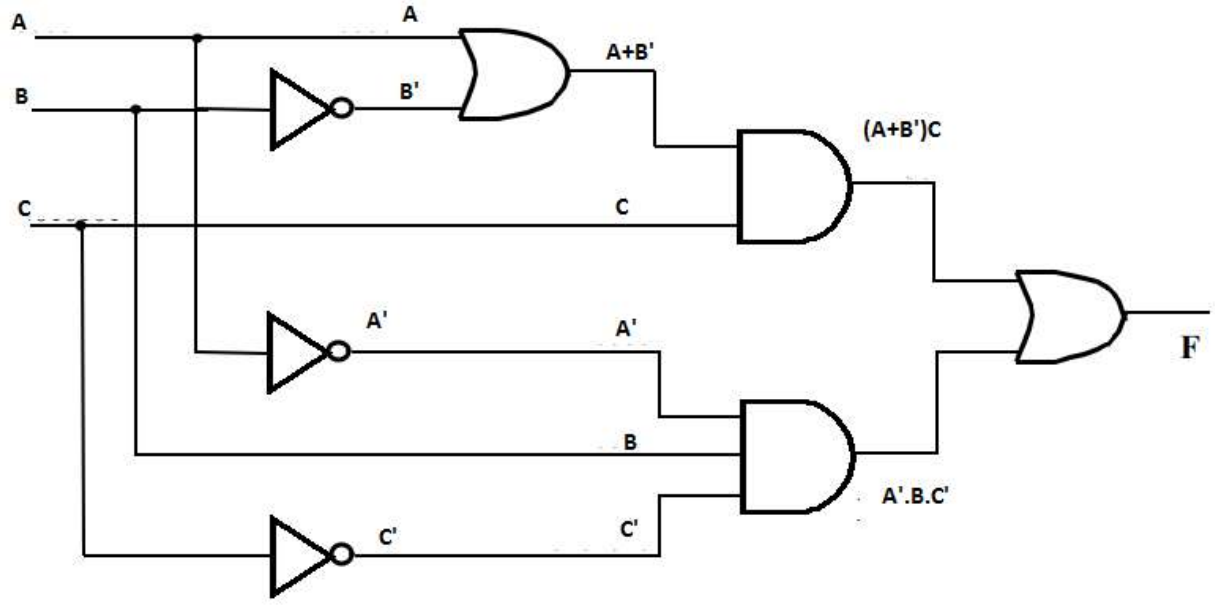


Step-3:



Step-4:

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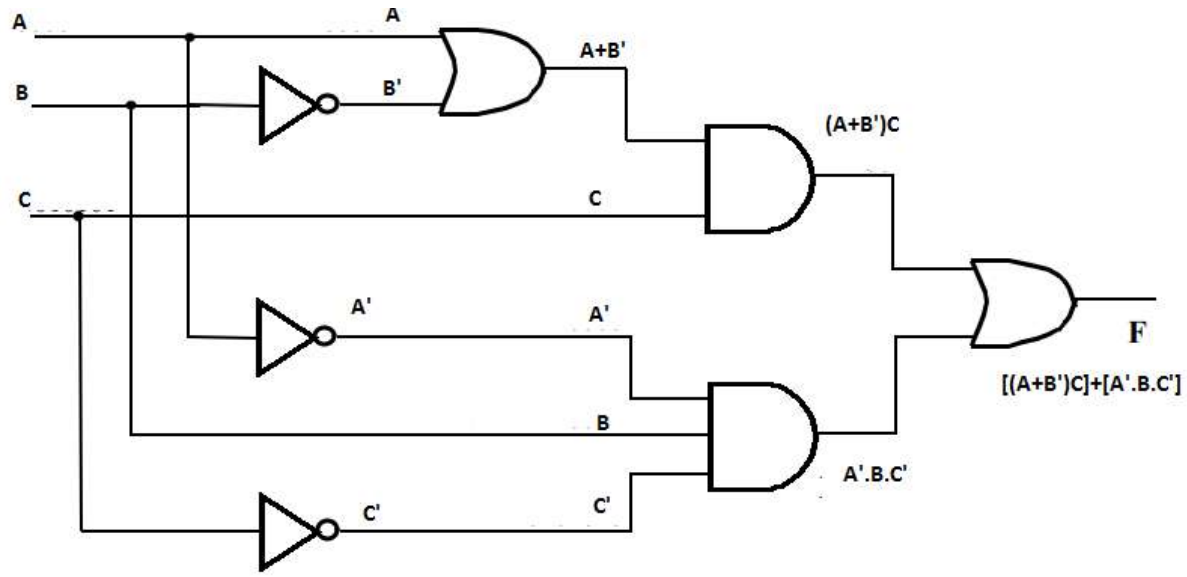
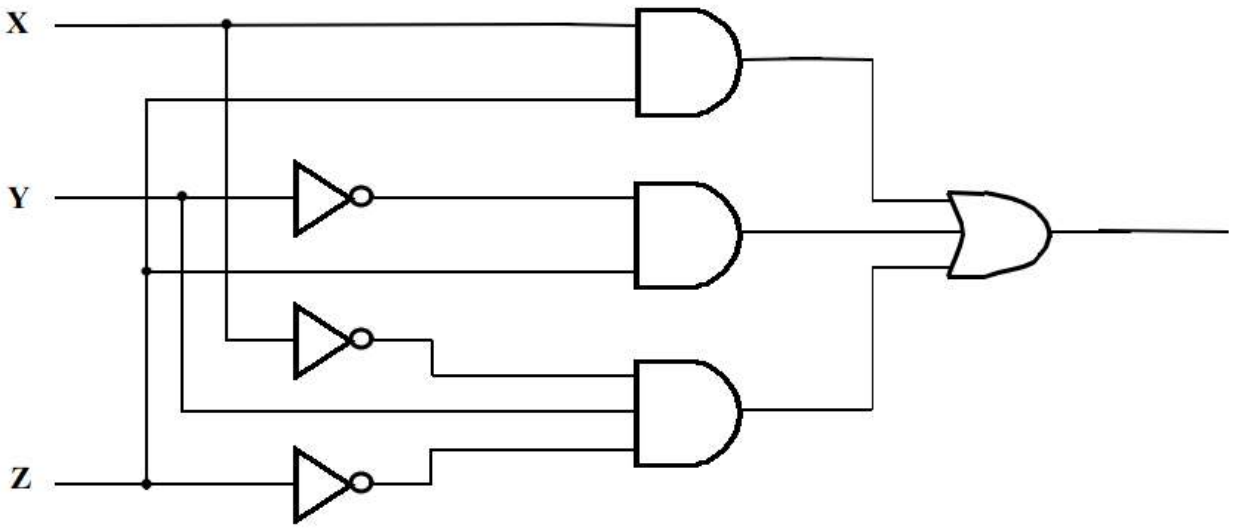


Circuit#3



Step-1:

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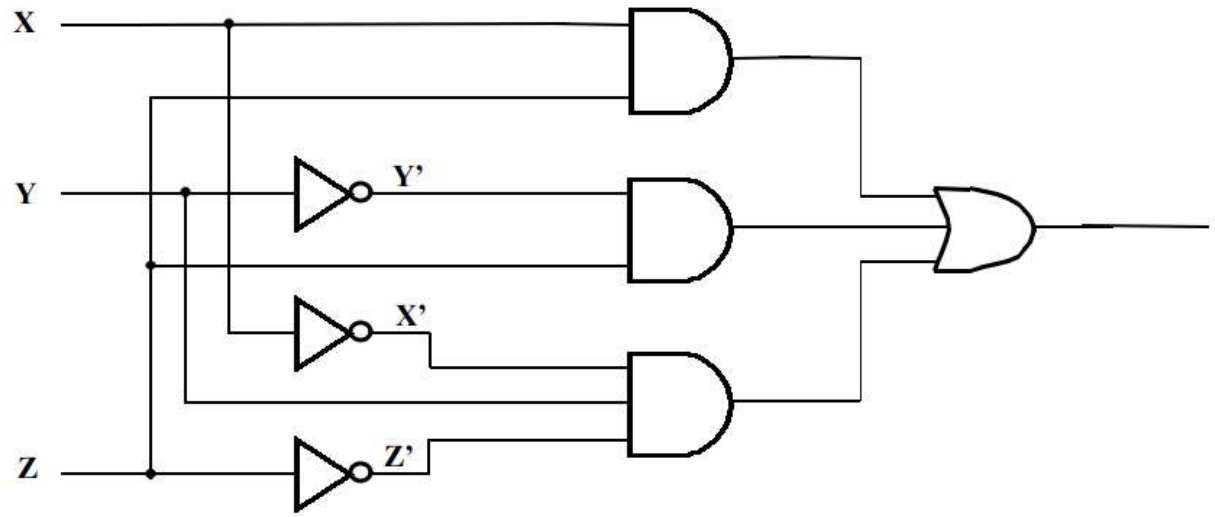
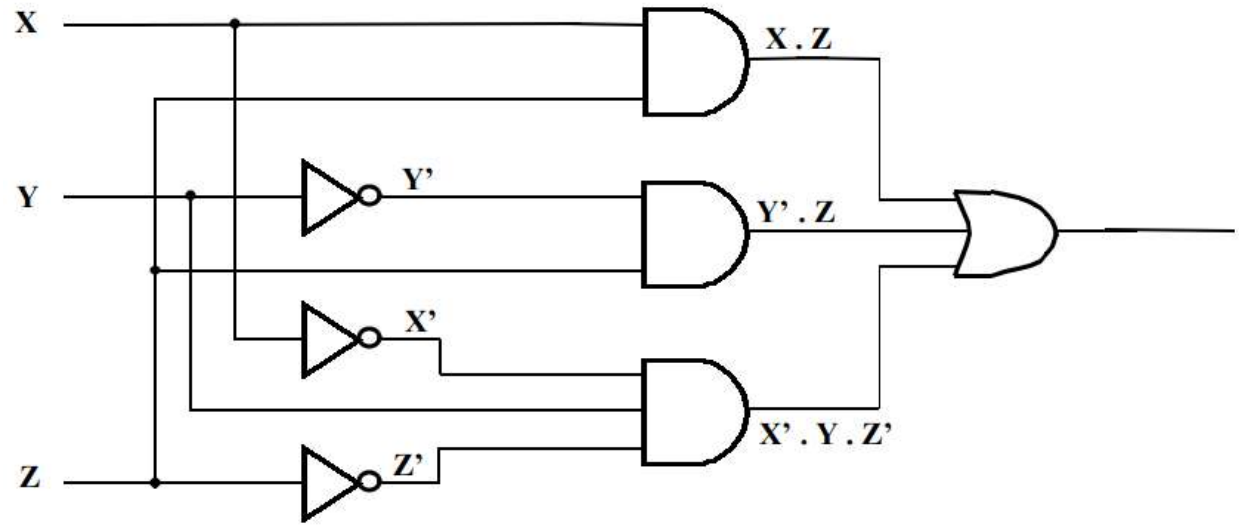


Step-2:



Step-3:

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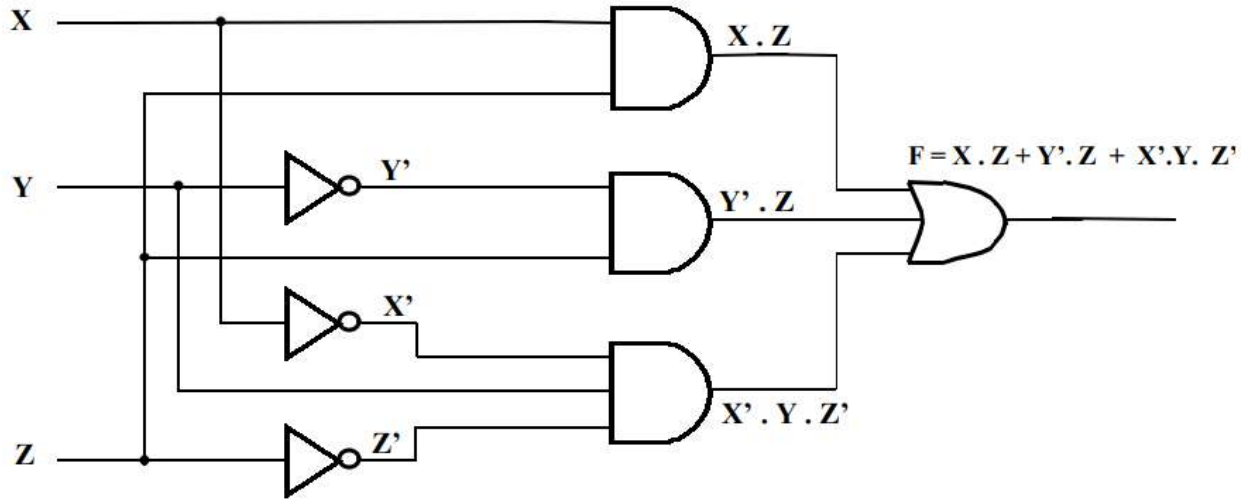
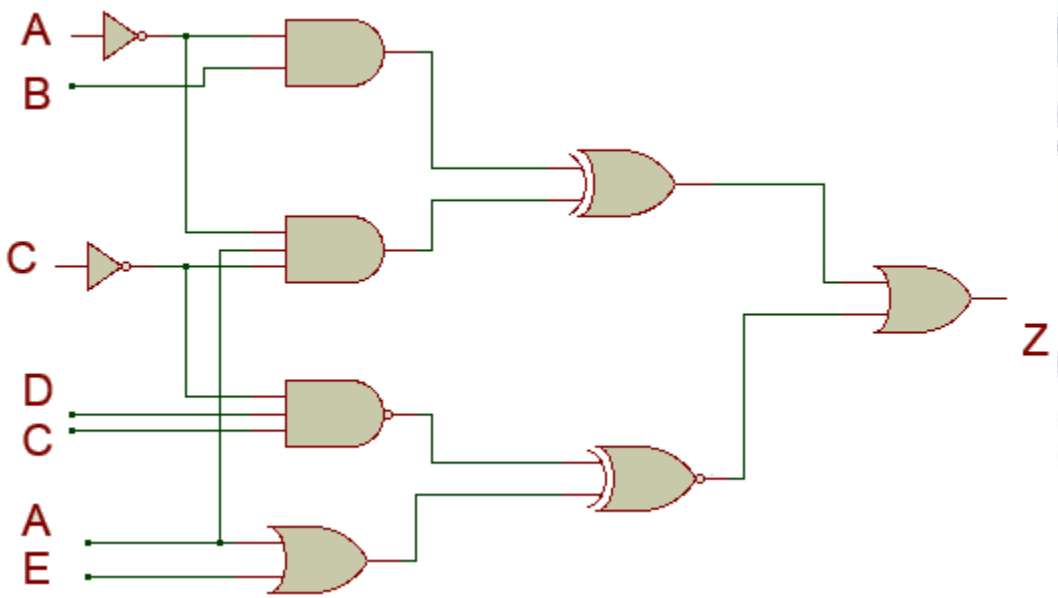


Circuit#4



Step-1:

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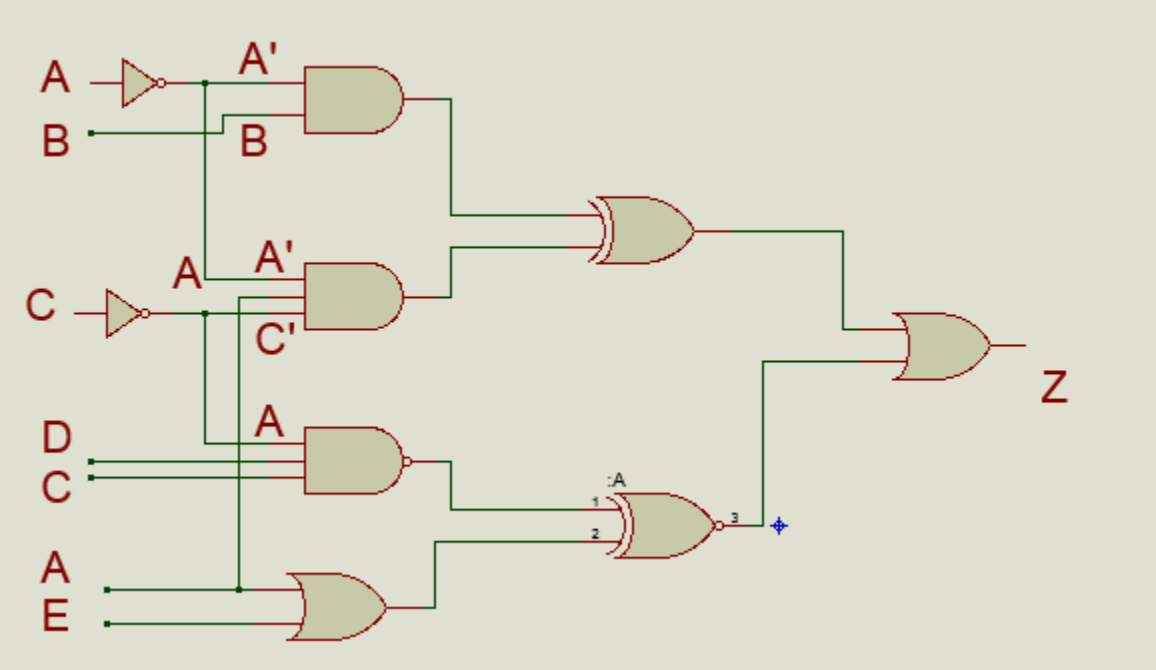
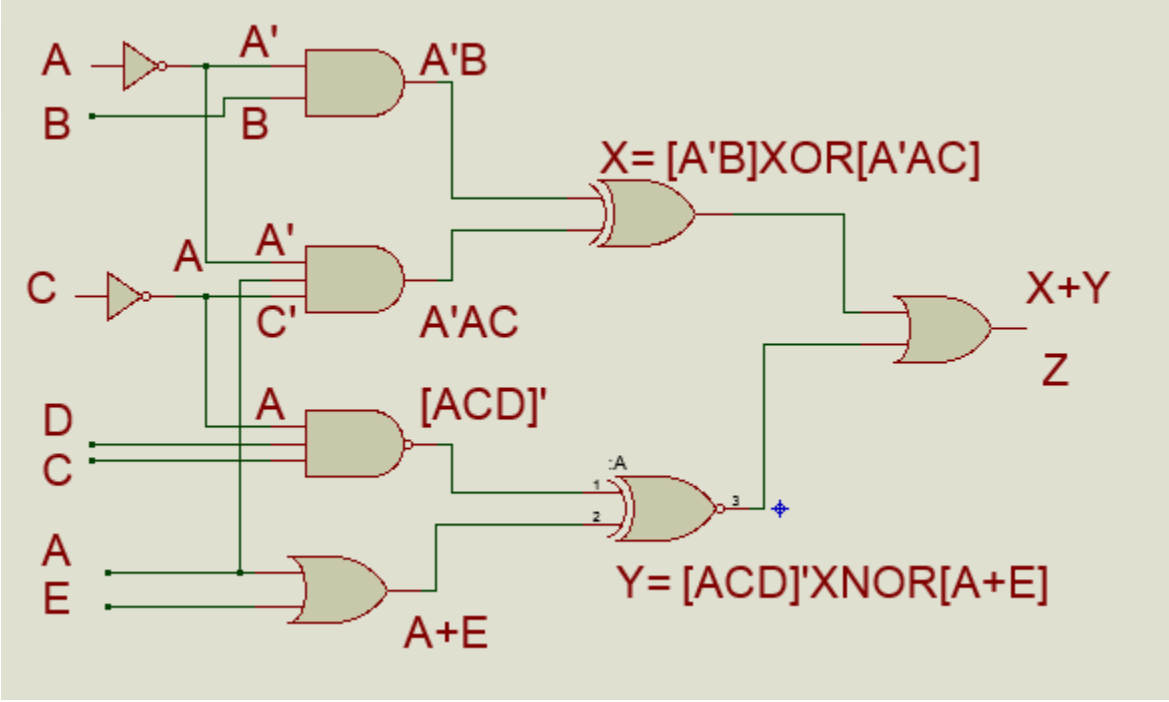


Solve the rest by your self (in steps)

Complete Solution:



PRACTICE EXAMPLES:

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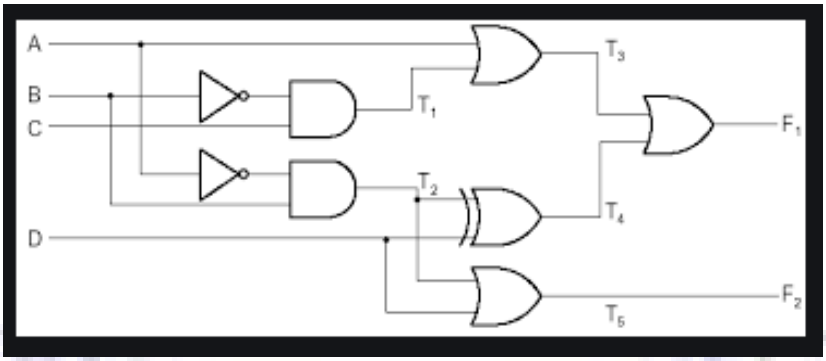
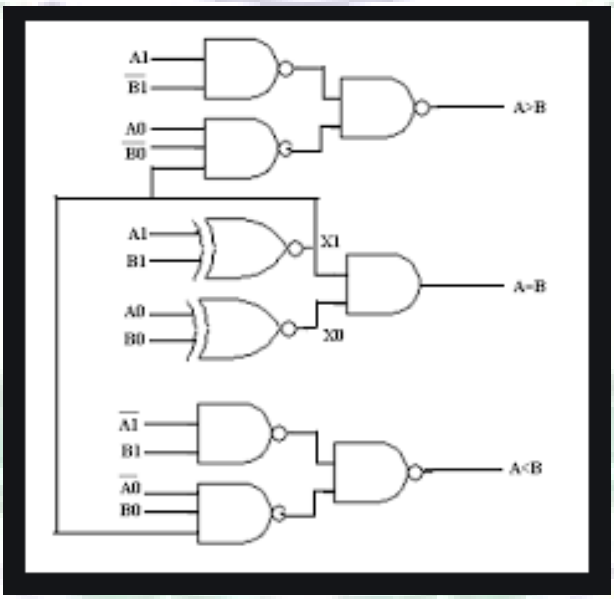
Example-1:



Example-2:



Example-3:

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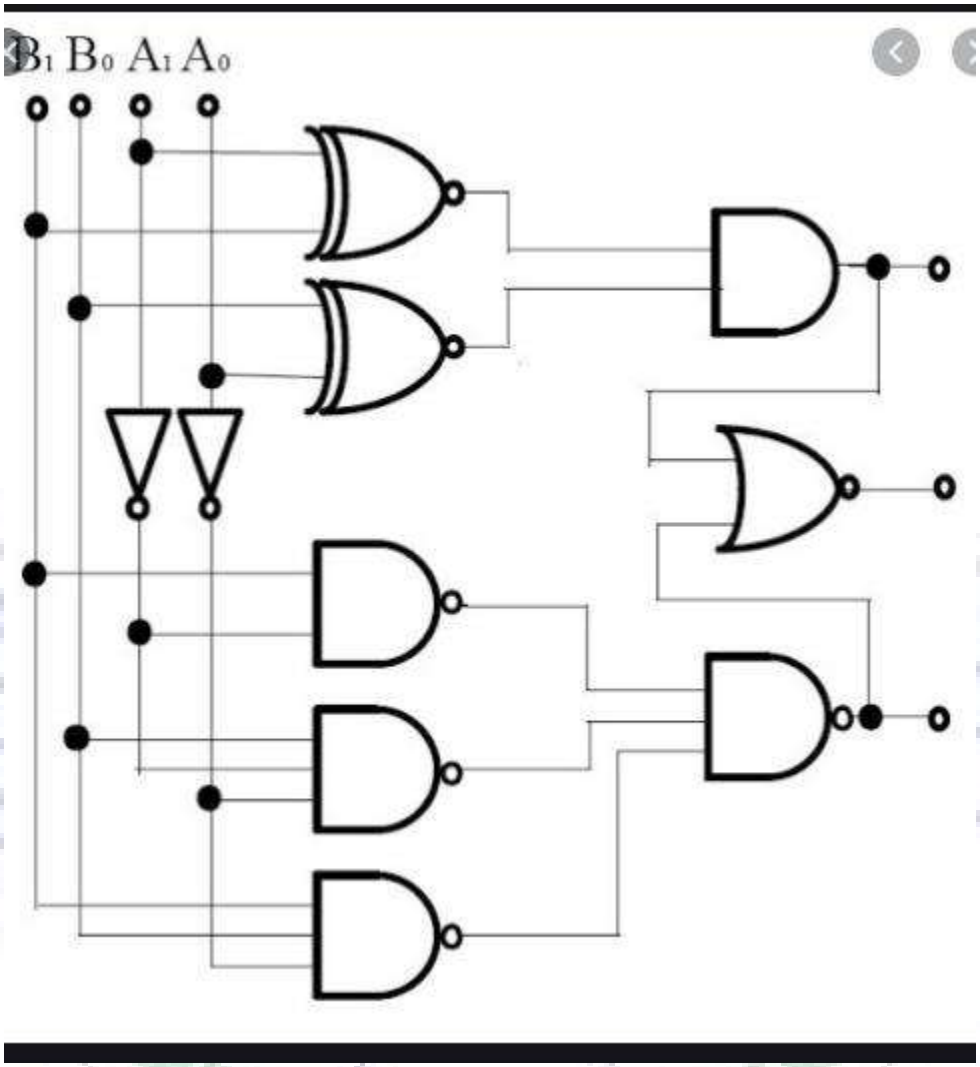

Task to do:

Design a unique encryption scheme and present it in the class:

Reference Material:

- Lesson plans
- Internet

Video Lecture Links:

Part-1: https://youtu.be/jfFjpa_M6iM

Digital Logic Design (ESC-151)

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Part-2:https://youtu.be/fRgz9zl2Y68