UNIVERSITY OF ASIA PACIFIC

Department of Computer Science & Engineering

Course Title – Digital Logic & System Design Lab

Course Code – CSE 210

Experiment No. – 08

Experiment name – Design & Implement 4-bit AU.

SUBMITTED BY

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PROBLEM STATEMENT:

a) Logic Expression and Diagram of T/C Circuit.
b) Design and implement 4 – bits AU includes function table.

OBJECTIVE: The objective of the experiment is to implement logic expression and diagram of T/C circuit. Design and implement 4-bit AU including function table

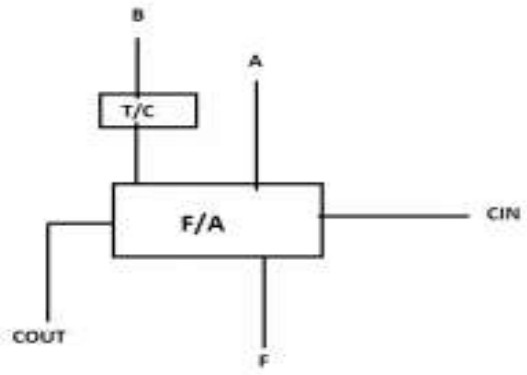
APPARATUS:

- IC-7408(AND Gate)
- IC-7432(OR Gate)
- IC-7404(NOT Gate)
- IC-7486(X-OR)
- Logic Display
- Logic Switch

INTRODUCTION:

An arithmetic logic unit (ALU) is a combination digital circuit that performs arithmetic and bitwise operation on integer binary numbers. ALU has two parts. First one is Logic unit using logic gates. And second part is Arithmetic unit using Full Adder.

For this experiment, we will design a logic circuit with full adder and T/C circuit. And that circuit willbe able to perform 4 – bit operation.

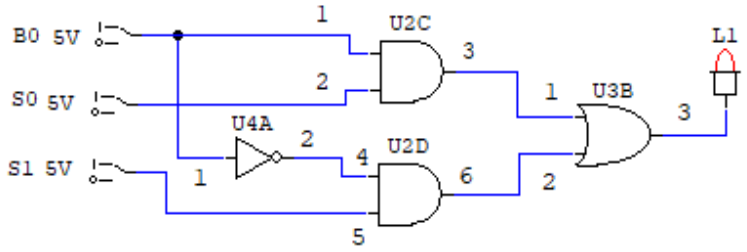


❖ LOGIC EXPRESSION & DIAGRAM OF T/C CIRCUIT.

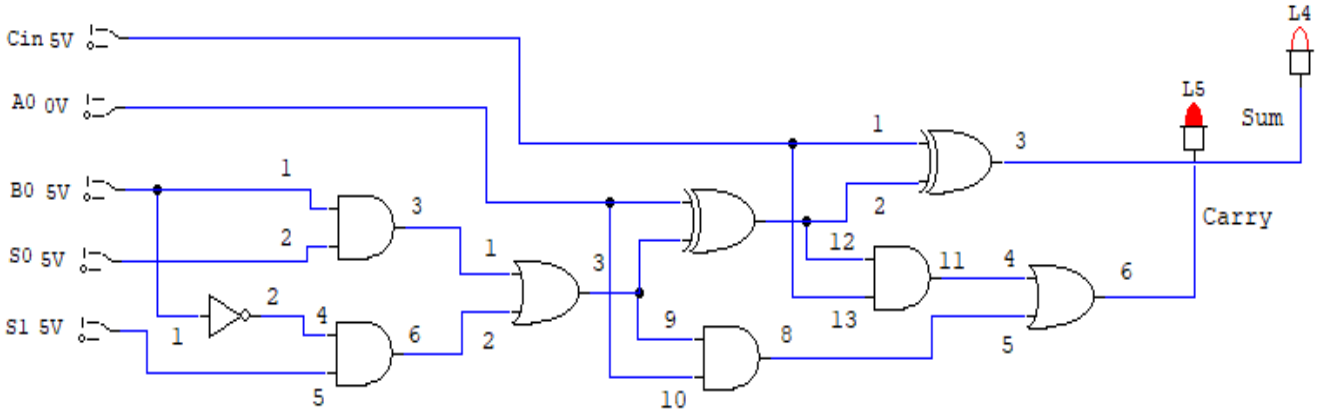
Function Table: T/C- Circuit.

S1	S0	Y = B
0	0	0
0	1	B
1	0	$\bar{B}$
1	1	1

LOGIC DIAGRAM OF T/C CIRCUIT:



LOGIC DIAGRAM OF 1-BIT AU:



❖ DESIGN & IMPLEMENT 4-BIT AU INCLUDES FUNCTION TABLE

First, we need to create an arithmetic function table perform by AU and have to mark all the inputand the output condition properly.

FUNCTION TABLE:

Function selectors		Input to Adders		Output	Output
S_1	**S_0**	**C_{in}**	**B**		
0	0	0	0	F = A	Transfer
0	0	1	0	F = A+1	Increment
0	1	0	B	F = A+B	Addition
0	1	1	B	F = A+B+1	Addition with Carry
1	0	0	$\bar{B}$	F = A+$\bar{B}$	Add 1's Complement of B to A
1	0	1	$\bar{B}$	F = A+$\bar{B}$+1 = A-B	Subtraction
1	1	0	1	F = A-1	Decrement (Output Carry Effect)
1	1	1	1	F = A	Transfer (Output Carry Effect)

VERIFICATION

INPUTS: A= 12, B=10

A_3	A_2	A_1	A_0	B_3	B_2	B_1	B_0
1	1	0	0	1	0	1	0

Operation: (S_1 S_0 C_{in})

(0 0 0) F = A (A = 12) Output: 1 1 0 0

(0 0 1) F = A+1 (12 +1 =13)

Output (1 1 0 1)

A_3	A_2	A_1	A_0
1	1	0	0
		+	1
1	1	0	1

(0 1 0) F = A + B (12+10=22)

Output (1 0 1 1 0)

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

(0 1 1) F = A+B+1 (12+10+1=23)

Output (1 0 1 1 1)

	1	1	0	0
	1	0	1	0
			+	1
1	0	1	1	1

(1 0 0) F = A + $\bar{B}$

$\overline{B3}$	$\overline{B2}$	$\overline{B1}$	$\overline{B0}$
0	1	0	1

Output (1 0 0 0 1)

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

(1 0 1) F=A+$\bar{B}$+1= A-B (12-10=2)

Output (1 0 0 1 0)

	1	1	0	0
	0	1	0	1
			+	1
1	0	0	1	0

(1 1 0) F = A-1(Carry Effect)

12-1 = 11

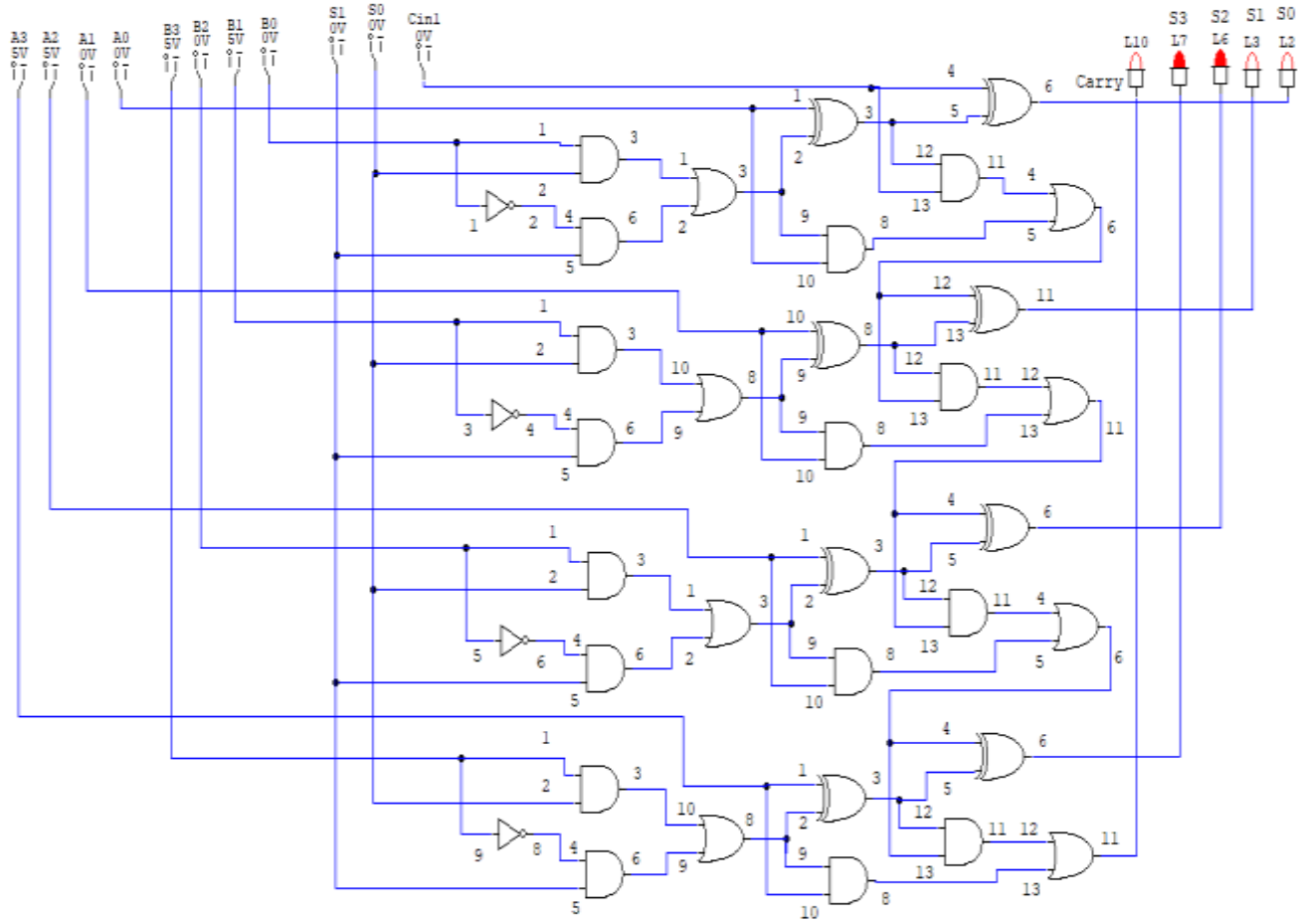
Output(1 1 0 1 1)

A_3	A_2	A_1	A_0
1	1	0	0
		-	1
1	1	0	1

(1 1 1) F = A(Carry Effect) A = 12

Output (1 1 1 0 0)

CIRCUIT DIAGRAM:



DISCUSSION: From this experiment, we learn about the AU and T/C circuit. And how to create an AU circuit using Full Adder and T/C Adder. We also learn how to use the AU for performing eight different logical functions. One is the T/C circuits and other is the Full Adder portion. So, we have to be careful about both of them and should connect the all wire with gates properly. Otherwise, we will get false output and error will be hard to find.