



Lab Manual

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Experiment No: 2

Experiment Name: Design of a 2-bit Arithmetic unit.

Introduction:

In this experiment you will construct a 2-bit arithmetic unit which is a part of an ALU. The arithmetic unit will be used to add and subtract two 2 bit inputs, A and B, as well as increment, decrement or transfer any of the inputs.

Arithmetic Operations:

Add- Each bit of input A is added with the corresponding bit of input B and the sum appears at the output of each full adder along with any carry out.

Add with carry- Each bit of input A and B are added with the input carry and the sum appears at the output of each full adder along with any carry out.

Subtract- Each bit of input B is subtracted from the corresponding bit of input A and the difference appears at the output of each full adder along with any borrow out.

Subtract with borrow- Each bit of input B is subtracted from A with borrow. The difference and the borrow out appear at the output.

Increment A- Each bit of A is increased by 1 and the result appears at the output of each full adder.

Decrement A- Each bit of A is decreased by 1 and the result appears at the output of each full adder.

Transfer A- Each bit of A appears at the output of each full adder, unmodified.

Equipments:

- Trainer board
- IC 7404, 7483, 74F153
- Wires for connection.

Function Table:

Complete the function table according to your theoretical knowledge.

S1	S0	Cin	A0	A1	B1	B0	D1	D0	Cout	Microoperation
0	0	0	0	0	0	1	0	1	0	Add
0	0	1	0	0	0	1	1	0	1	Add with Carry
0	1	0	0	0	0	0	0	0	1	Subtract with Borrow

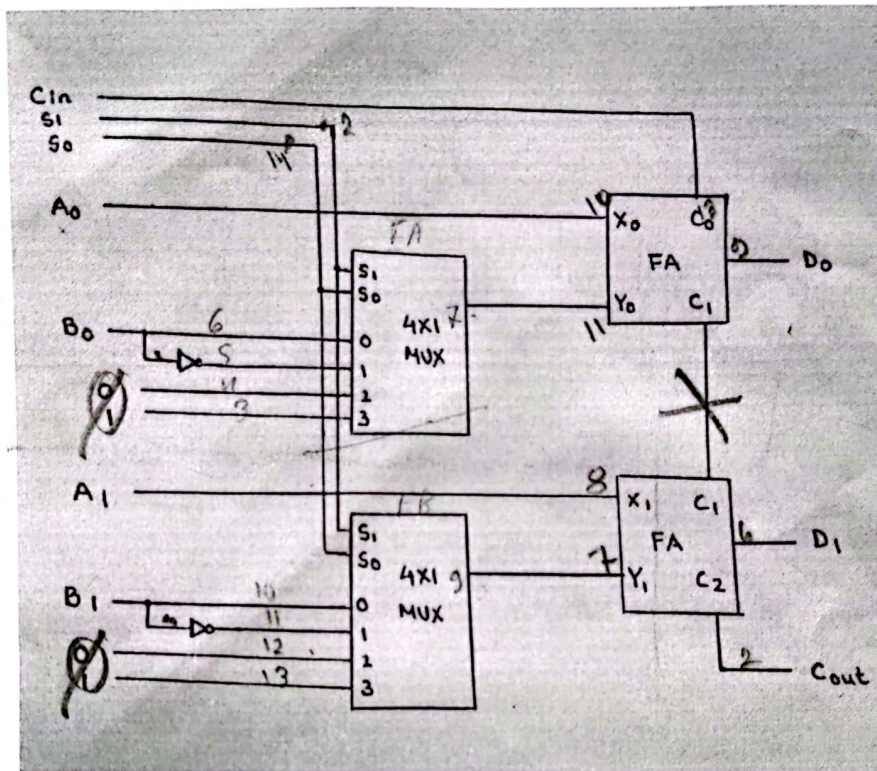
$$\begin{array}{r} A=00 \\ B=01 \\ \hline 001 \end{array}$$

$$\begin{array}{r} A=01 \\ B=10 \\ \hline 011 \end{array}$$

$$\begin{array}{r} A=10 \\ B=00 \\ \hline 010 \end{array}$$

S ₁	S ₀	C _{in}	A ₀	A ₁	B ₀	B ₁	D ₀	D ₁	Count	
0	1	1	1	0	1	1	0	0		Subtract
1	0	0	1	1	0	1	1	1	0	Transfer A
1	0	1	0	0	1	0	1	1	0	Increment A
✓ 1	1	0	1	1	0	0	1	0	1	Decrement A
1	1	1	0	0	0	0	1	0	1	Transfer A

Logic Diagram:

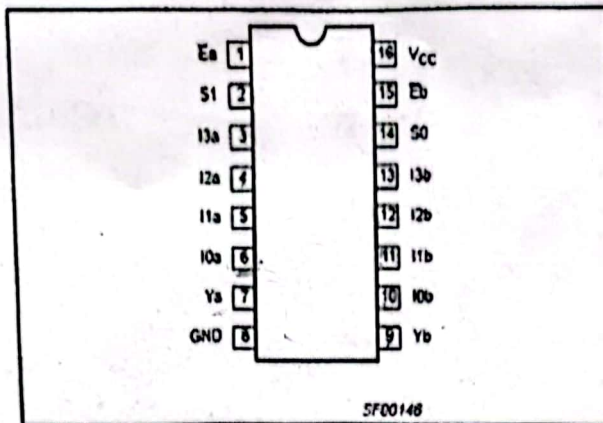


Procedure:

- 1) Place the ICs on the trainer board.
- 2) Connect V_{cc} and ground to the respective pins of IC.
- 3) Connect the inputs with the switches and the outputs with LEDs.
- 4) Apply various combinations of inputs and observe the outputs.
- 5) Verify the experimental outputs with the Function Table.

EEE336/CSE232 LAB
Dual 4x1 Multiplexer 74F153
Data Sheet

PIN CONFIGURATION



INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION
I0a – I3a	Port A data inputs
I0b – I3b	Port B data inputs
S0, S1	Common Select inputs
Ea	Port A Enable input (active Low)
Eb	Port B Enable input (active Low)
Ya, Yb	Port A, B data outputs

Assignment:

- 1) Prepare the lab report.
- 2) Implement the circuit in Logisim. Take a screenshot and include it in your lab report.

Pin configuration of ICs:

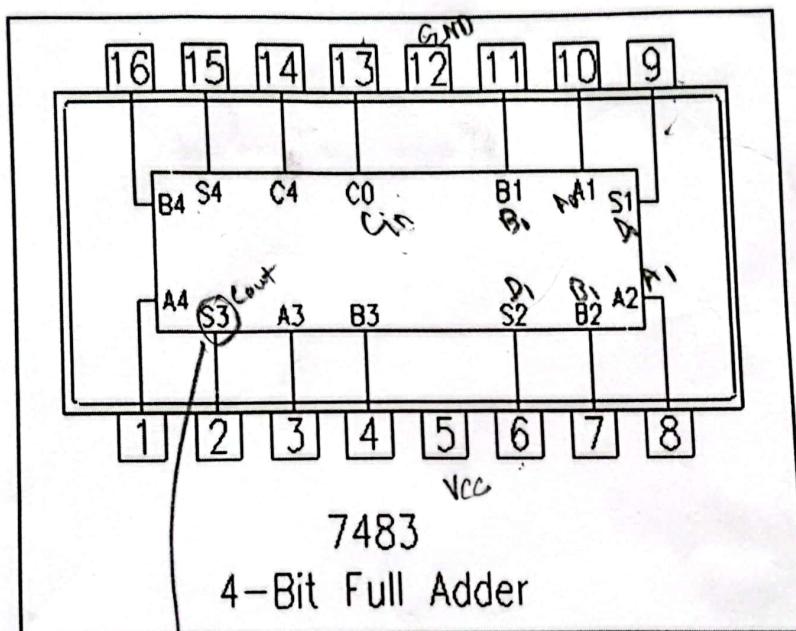
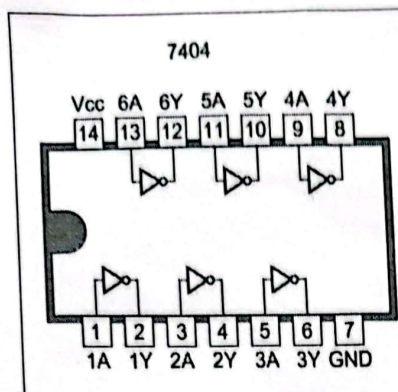


Table:

S_1	S_0	C_{in}	A_0	A_1	B_1	B_0	D_1	D_0	C_{out}	Microoperation
0	0	0	0	0	0	1	0	1	0	Add
0	0	1	1	0	0	1	1	0	1	Add with carry
0	1	0	0	1	0	0	0	1	1	Subs with borrow
0	1	1	1	1	0	1	1	0	1	Subs
1	0	0	1	1	0	1	1	1	0	Trans A
1	0	1	1	0	1	0	1	0	0	Increment A
1	1	0	1	1	0	0	1	0	1	Decrement A
1	1	1	1	0	0	0	0	1	0	Transfer A

~~Arjana~~
~~6/03/24~~