

ALU Design

By

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Basic Elements

Combination of 3 basic units –

1. Arithmetic Unit – Addition , subtraction, etc.
2. Logic Unit – AND, OR, NOT, Ex-OR
3. Shifter Unit –

a) Logical Shift

- Left Shift
- Right Shift

b) Arithmetic Shift

- Left Shift
- Right Shift

c) Circular Shift

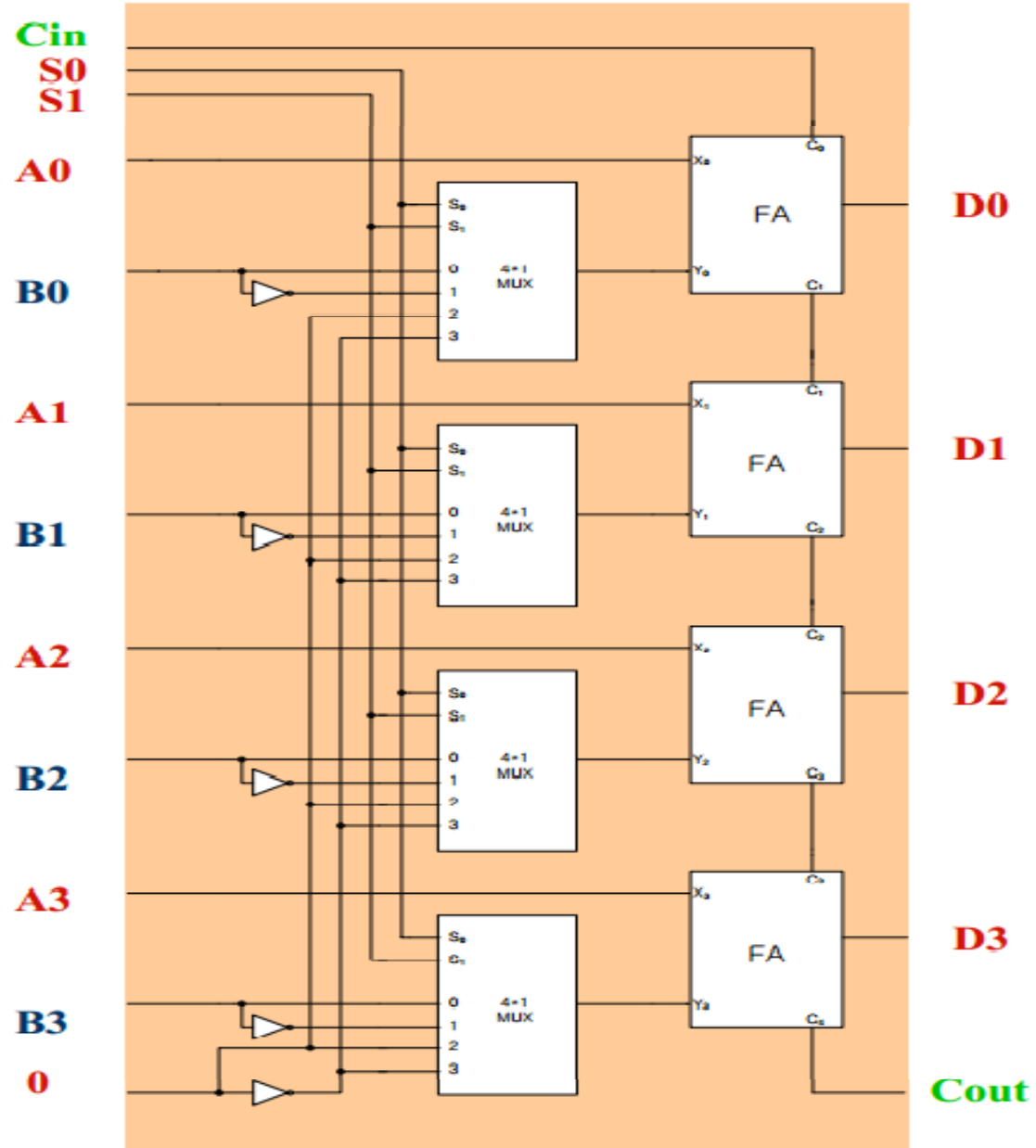
- Left Shift
- Right Shift

Arithmetic Unit

Arithmetic Circuit Function Table

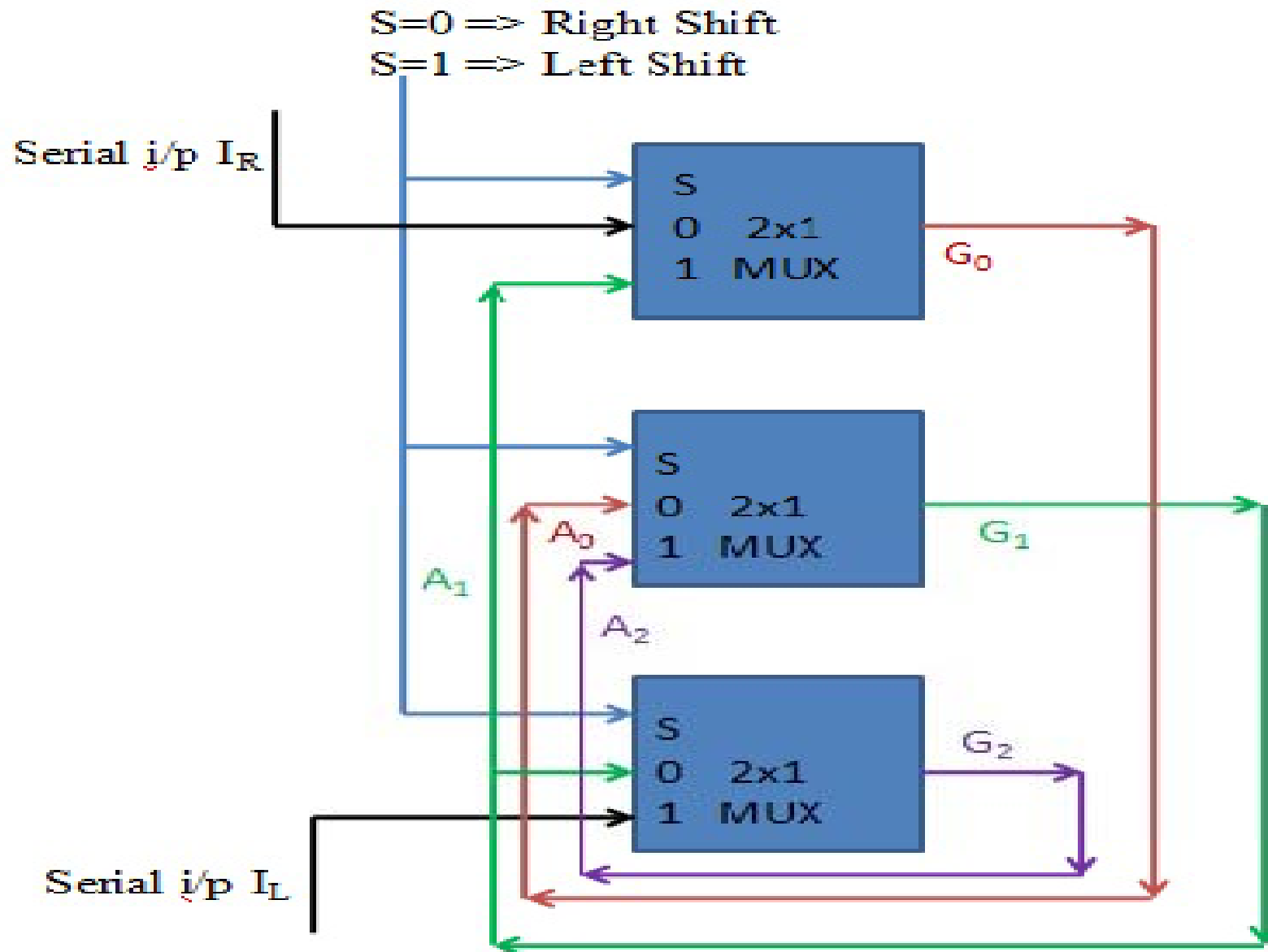
Select			Input Y	Output $D = A + Y + C_{in}$	Microoperation
S_1	S_0	C_{in}			
0	0	0	B	$D = A + B$	Add
0	0	1	B	$D = A + B + 1$	Add with carry
0	1	0	\overline{B}	$D = A + \overline{B}$	Subtract with borrow
0	1	1	\overline{B}	$D = A + \overline{B} + 1$	Subtract
1	0	0	0	$D = A$	Transfer A
1	0	1	0	$D = A + 1$	Increment A
1	1	0	1	$D = A - 1$	Decrement A
1	1	1	1	$D = A$	Transfer A

Cntd...



4-Bit Binary Arithmetic Unit

Shifter Unit (3-bit)





1. $A + \text{complement of } B + 1 = ?$
a) $A + B$ b) $A - B$ c) $A * B$ d) A / B
2. In binary, $A + 1111 = ?$
a) $A + 1$ b) $A - 1$ c) $A * 1$ d) $A / 1$
3. Logical shift includes sign bit.
a) True b) False
4. Arithmetic shift includes sign bit.
a) True b) False
5. Circular shift includes sign bit.
a) True b) False
6. The vacant position for Logical Shift can be filled with 0.
a) True b) False
7. The vacant position for Arithmetic Shift can be filled with 0.
a) True b) False
8. The vacant position for Circular Shift can be filled with 0.
a) True b) False

8. Logical shift may change the sign bit.
a) True b) False
9. Arithmetic shift may change the sign bit.
a) True b) False
10. Circular shift may change the sign bit.
a) True b) False

References:

1. Morris Mano
2. T. K. Ghosh

————— *Thank You* —————