

Input Shifters

Last updated 11/7/24

Input Shifters

- Logical Shift

- Right shift

- Fill in 0s on the left
 - Remove bits on the right

- Left shift

- Fill in 0s on the right
 - Remove bits on the left

- 10011010 shifted to the right by 3

```
10011010
010011010
0010011010
00010011010
```

- 10011010 shifted to the left by 3

```
10011010
100110100
1001101000
10011010000
```

Input Shifters

- Arithmetic Shift

- Unsigned

- Same as logical

- Signed

- Left shift – same as logical

- Right shift

- Fill in with the MSB on the left – preserves the sign
- Remove bits on the right

Left shifts \leftrightarrow multiply by 2
Right shifts \leftrightarrow divide by 2
subject to range limitations

- 10011010 shifted to the right by 3 00011010

10011010

110011010

1110011010

11110011010

00011010

000011010

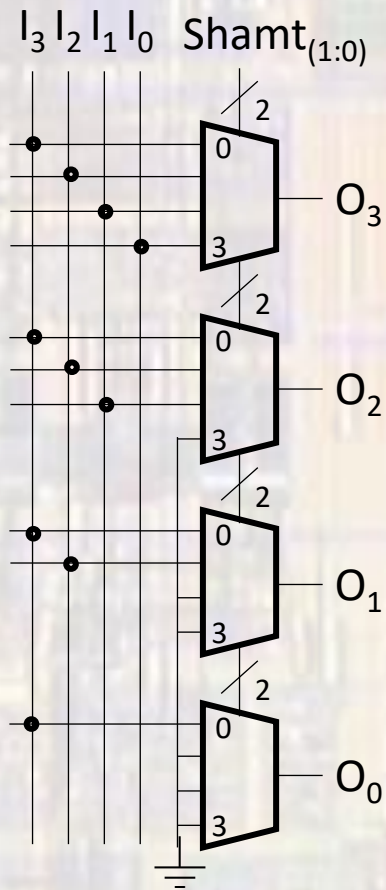
0000011010

00000011010

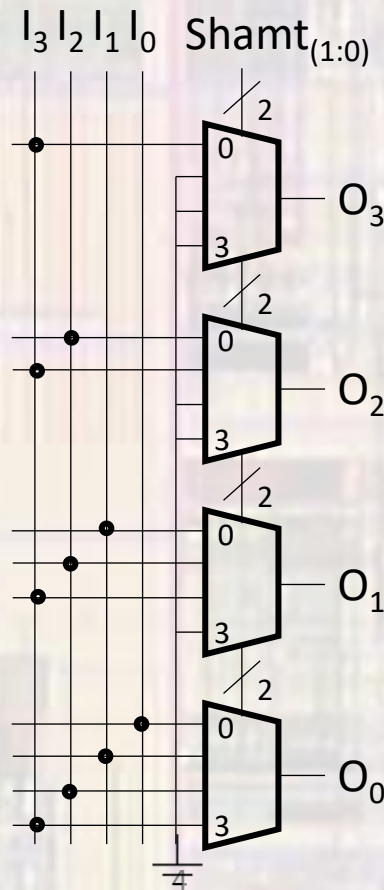
Input Shifters

- Shifters - Implementation – 4 bit

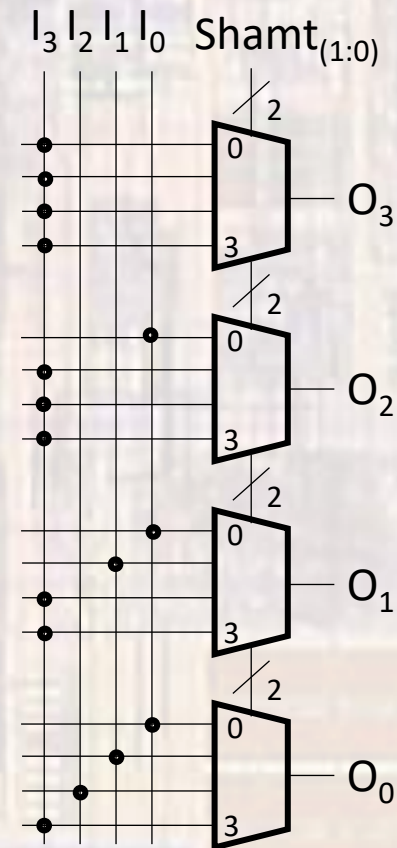
Logical Shift Left
Arithmetic Shift Left



Logical Shift Right
Arithmetic Shift Right
(unsigned)



Arithmetic Shift Right
(signed)



Input Shifters

- Rotator

- Rotates bits

- Instead of dropping and adding bits – they wrap around to the other end

- 10011010 rotated by 2 to the right

```
10011010
01001101
10100110
```

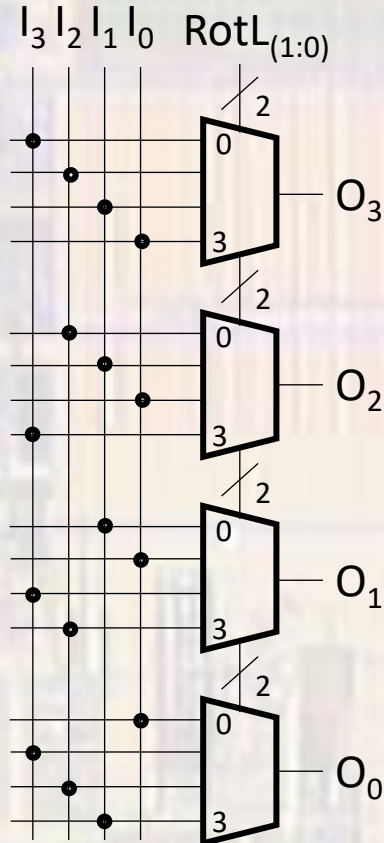
- 10011010 rotated by 2 to the left

```
10011010
00110101
01101010
```

Input Shifters

- Rotator - Implementation – 4 bit

Rotate Left



Rotate Right

