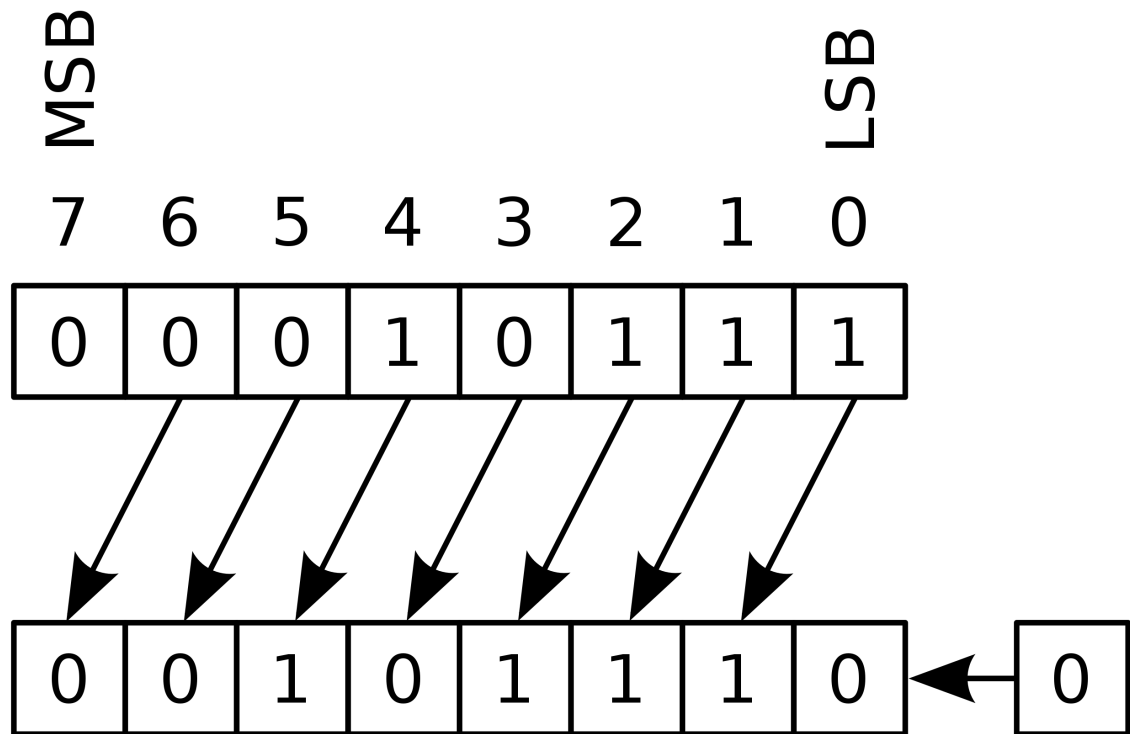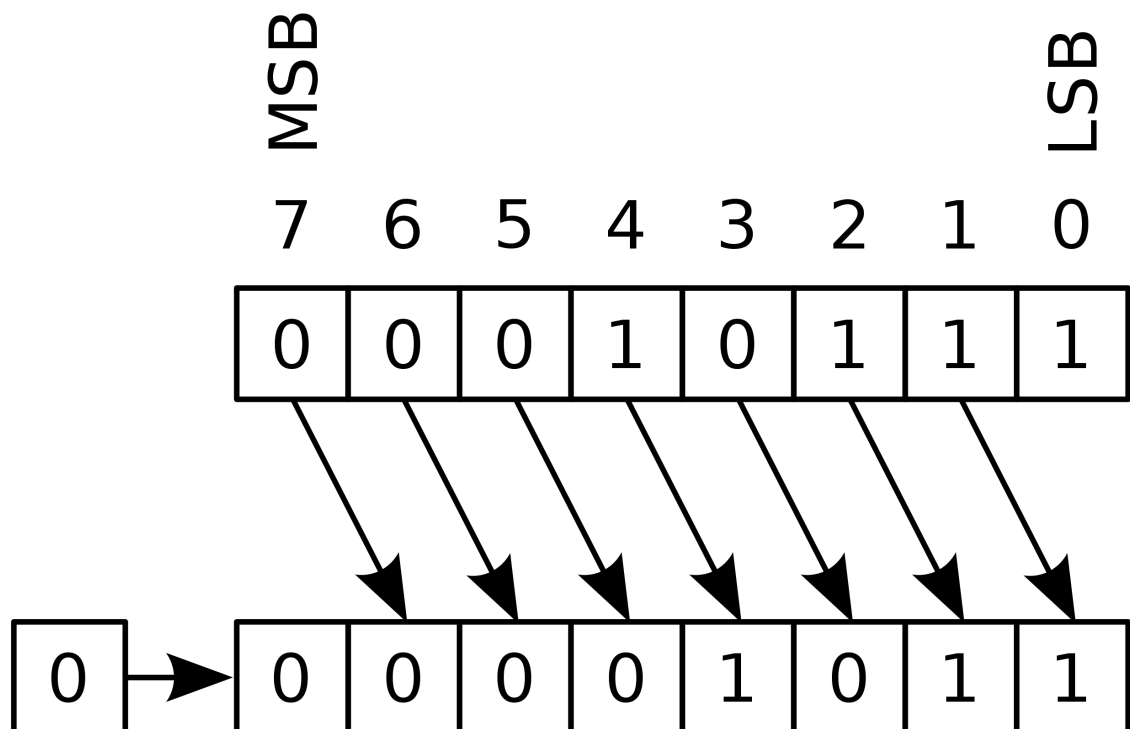# 3. Bit manipulation

- Binary shifts
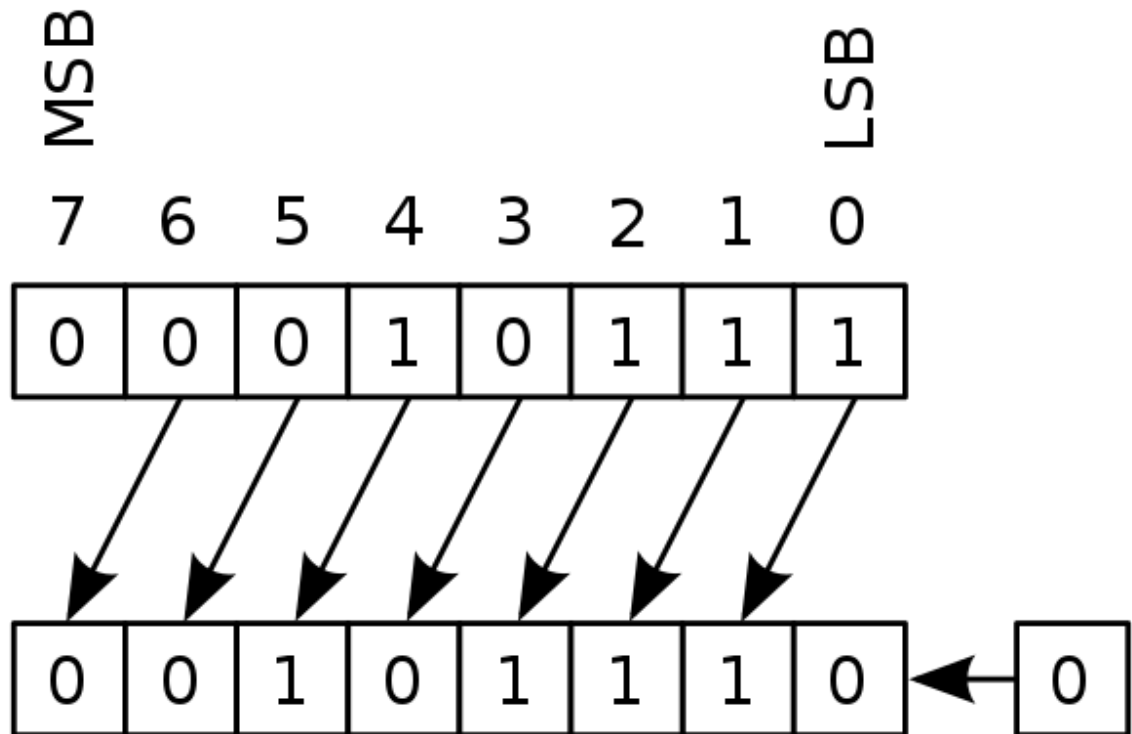 - Logical shift

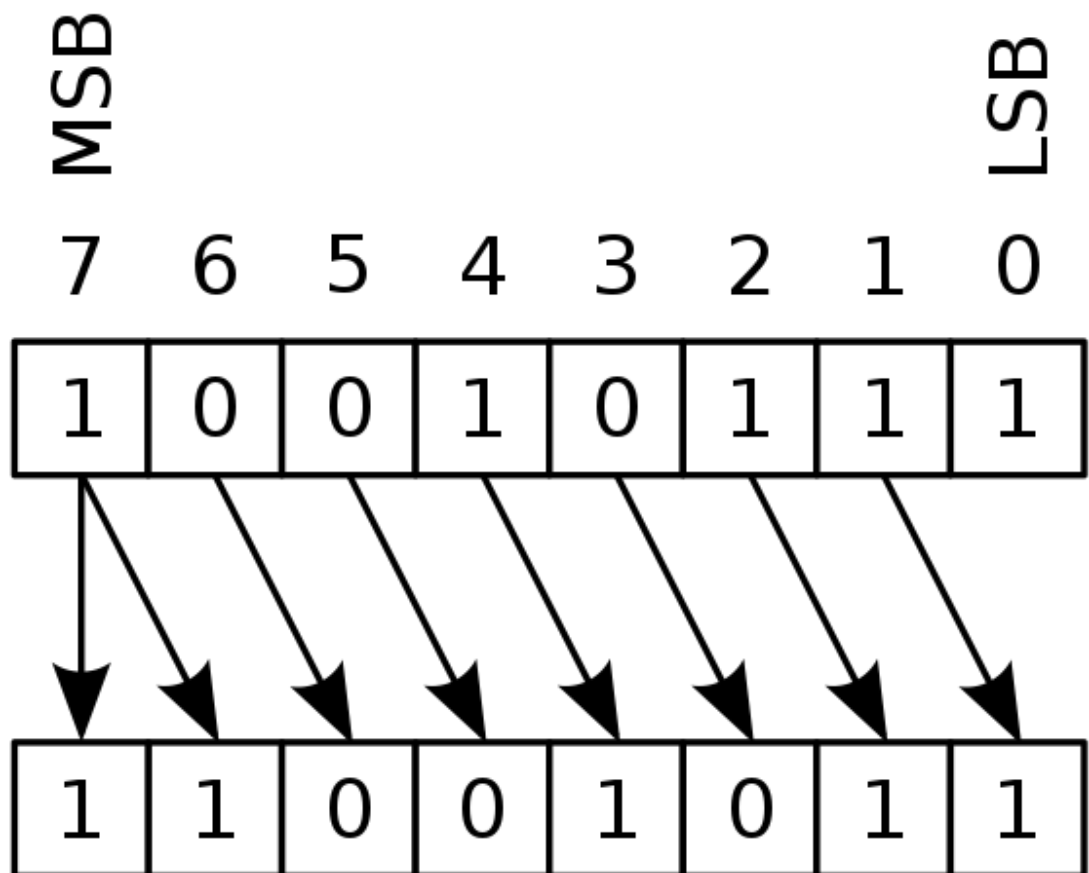Left shift:

Right shift:

- Arithmetic shift

  Left shift:
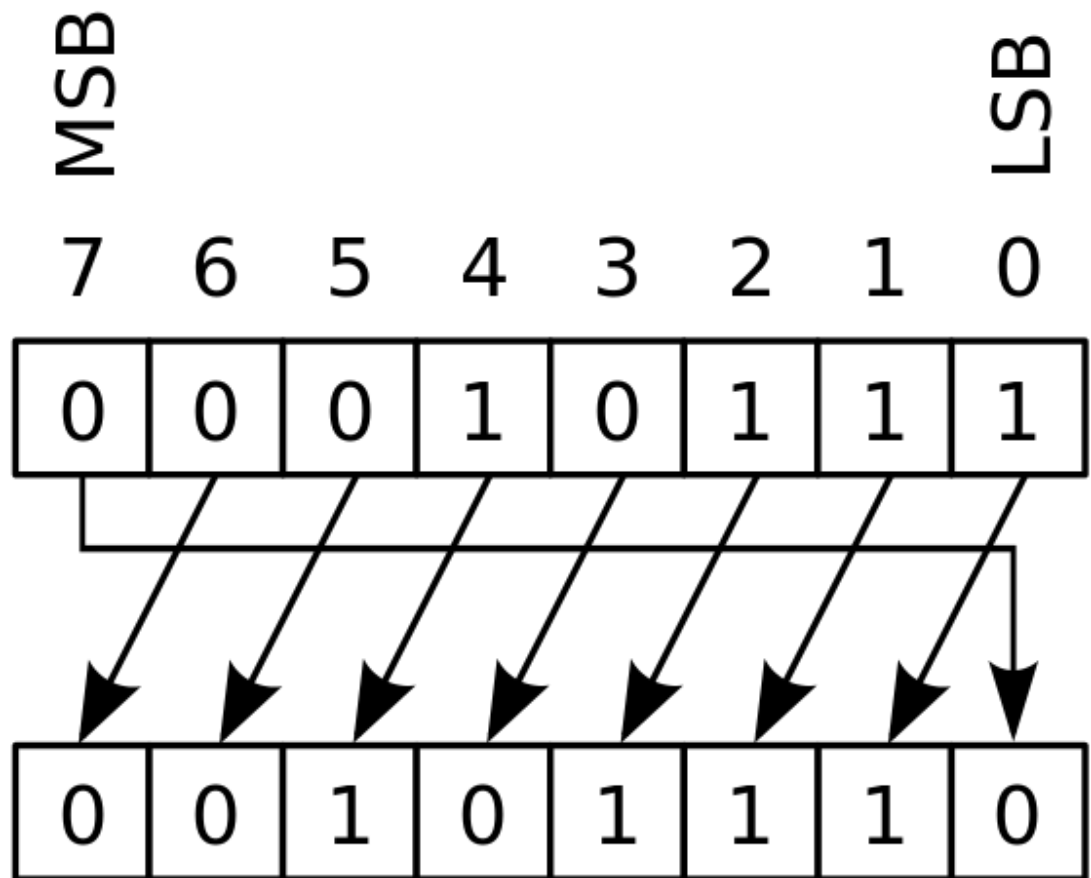

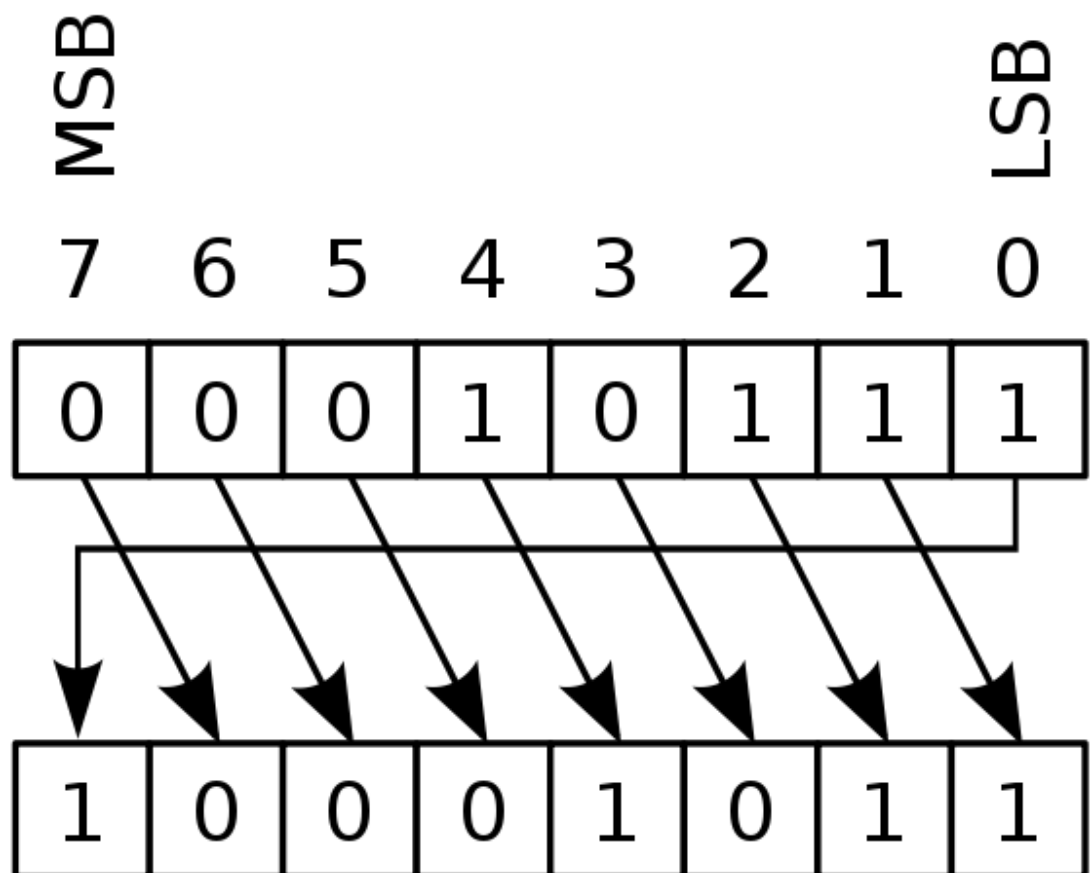 Right shift: (The empty position in the most significant bit is filled with a copy of the original MSB)

- Cyclic shift

  Left shift:

MSB

7 6 5 4 3 2 1 0

| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

LSB

| 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |

Right shift:

MSB

7 6 5 4 3 2 1 0

| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

LSB

| 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |

- How bit manipulation is used to monitor/control a device

- Each bit in a register or memory location can be used as a flag and would need to be tested, set or cleared separately (bit masking)
- AND is used to check if the bit has been set
- OR is used to set the bit
- XOR is used to clear a bit that has been set