Shift Registers and Memories

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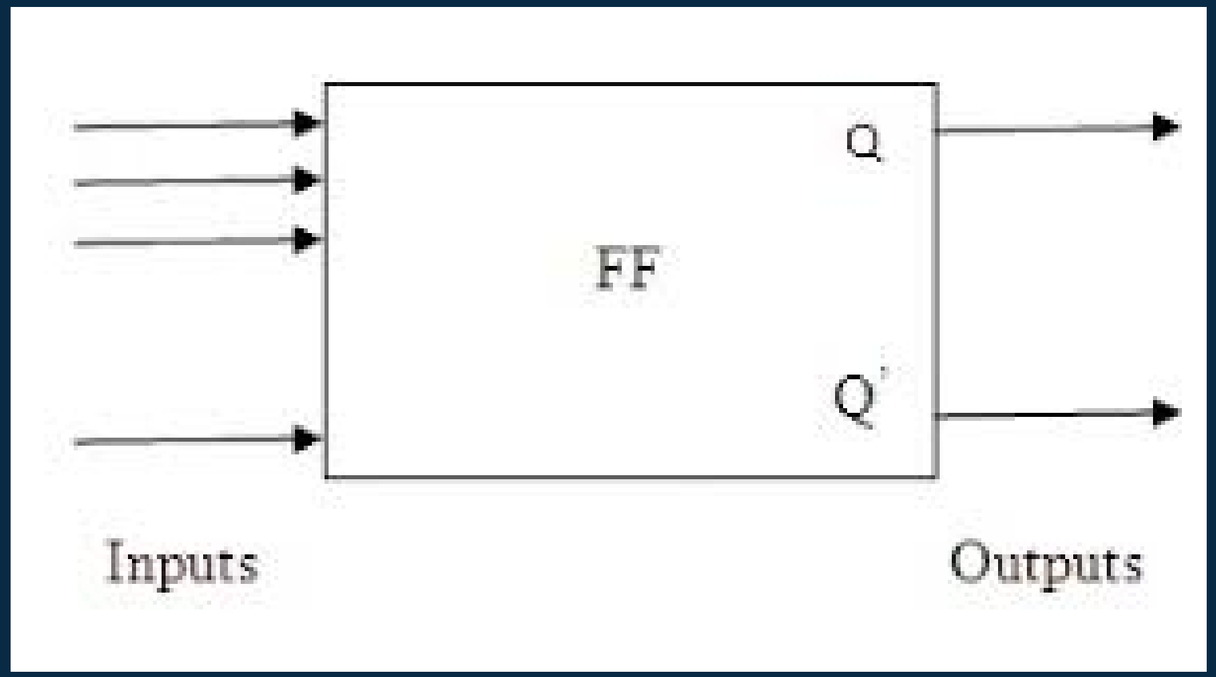


Flip-Flops

Basic memory elements capable of storing one bit in a digital system.

Types:

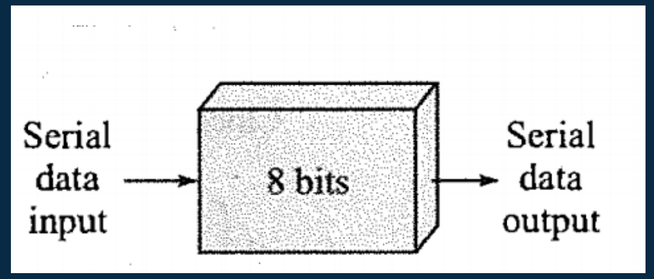
1. D flip-flop
2. R-s flip-flop
3. J-K flip-flop
4. T flip-flop

Shift Registers

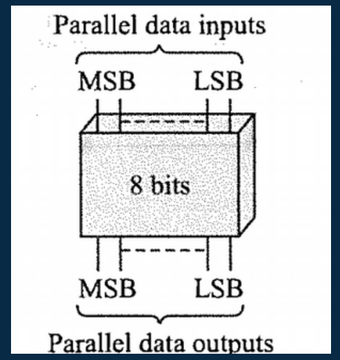
- Digital device for data storage and and transfer - data is entered then shifted out
- Links between main digital system and I/O channels
- Constructed by flip-flops. Number of flip-flops defines the size of the register

Types of Shift Registers

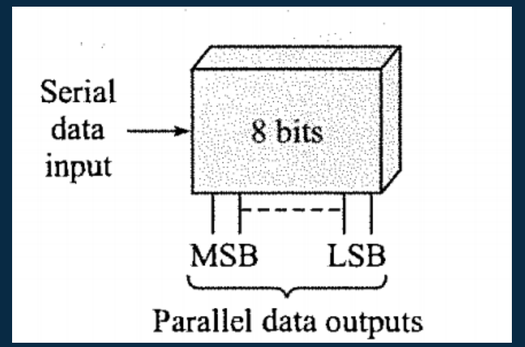
SERIAL IN SERIAL OUT



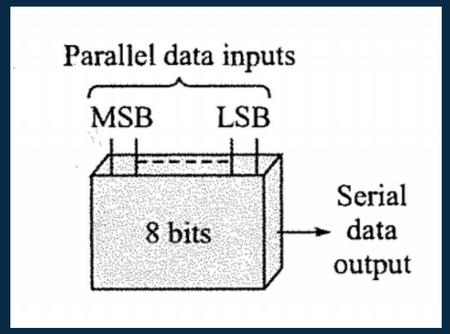
PARALLEL IN PARALLEL OUT



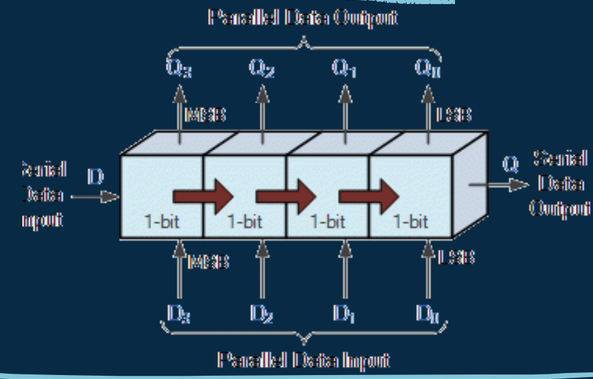
SERIAL IN PARALLEL OUT



PARALLEL IN SERIAL OUT



UNIVERSAL



Semi-conductor Memories

- Larger systems use SC chips which are made of an array of memory cells.
- Made of flip-flops which are Bipolar, MOS, CMOS.
- Two types:

1. RAM
2. ROM

- Can be used to store programmed instructions and data.

RAM

- Volatile
- Temporary storage of programs
- Types:

1. SRAM
2. DRAM

ROM

- Not volatile
- Used to store data that is not to change e.g startup programs
- Types:

1. Mask Programmed RO
2. PROM
3. EPROM
4. EEPROM

Memory in Arduino

FLASH MEMORY

Stores arduino sketch; program image and any initialized data.

ATMega 128-32k

ATMega 2560-256k

SRAM

Where sketch creates and manipulates variables.

Is made of 3 parts: static data, heap, stack.

ATMega 128-2k

ATMega 2560-8k

EEPROM

Where you can store long-term data.

ATMega 128-1k

ATMega 2560-4k

Optimizing Memory

SHIFT DATA OR CALCULATIONS TO COMPUTER

If sketch talks to program on computer.

STORE DATA THAT YOU WON'T MODIFY IN FLASH

Use PROGMEM

F() STRINGS

Arduino will store them in PROGMEM

USE SMALLER DATA SETS

If you are using arrays, large data sets.

REMOVE UNUSED VARIABLES

Variables occupy space

RESERVE() STRINGS

Avoid realloc().

Optimizing Memory (continued)

VARIABLE ALLOCATION

Go local.

Avoid dynamic allocation

REMOVE DEAD CODE

Unused libaries, functions and variables.

REMOVE BOOTLOADER

Last option!

You'll require ISP programmer.

CONSOLIDATE REPEATED CODE

Make it a function!!

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