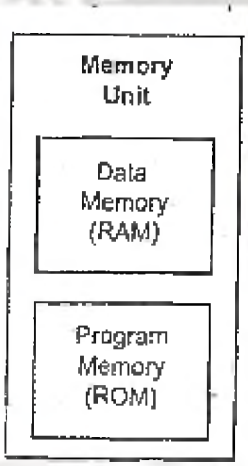
PROGRAM AND DATA MEMORY

Introduction

The 8051 microcontroller memory is separated as program memory (ROM) and data memory (RAM) on the same chip (IC), whereas a microprocessor has to be externally interface with the memory modules.



8051 microcontroller has both internal ROM and internal RAM. If the internal memory is inadequate, you can add external memory using the suitable circuits. 8051 has 4KB on-chip program memory (ROM) and 64 KB external program memory. It also has 128 bytes of on-chip data memory (RAM) and 64 KB external data memory.

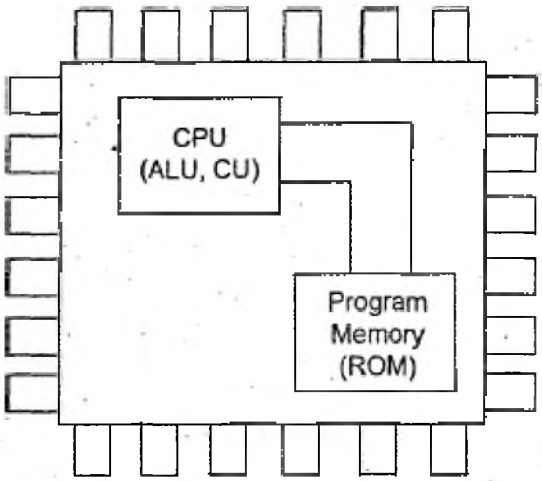
Program Memory (ROM) of 8051 Microcontroller.

Definition:

In 8051 microcontroller, the code or instructions to be executed are stored in the program memory, which is also called as the ROM of the microcontroller. The original 8-bit 8051 microcontroller by Intel has 4KB of internal ROM.

Some variants of 8051 like the 8031 and 8032 series doesn't have any internal ROM and must be interfaced with an external program memory with instructions loaded in it.

Almost all modem 8051 microcontrollers, like 8052 series, have 8KB of internal, program memory (ROM) in the form the flash memory and provides an option of reprogramming the memory.



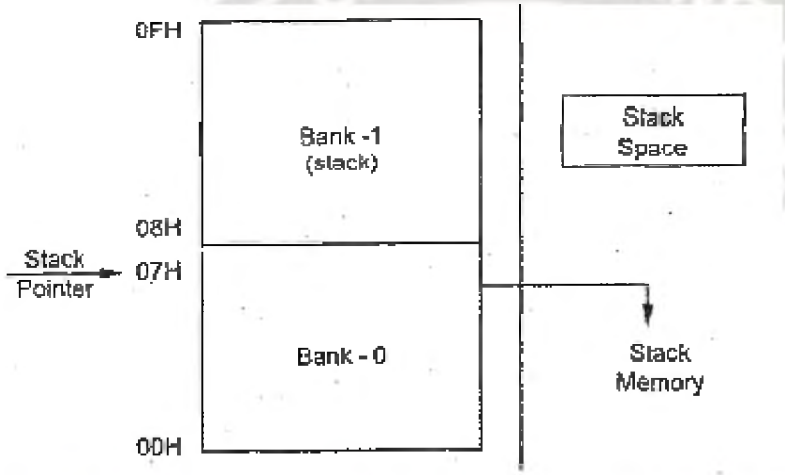
When an External Access (EA = 1) pin is HIGH, then the CPU first fetches the instructions from the 4KB of internal (on-chip) ROM in the address range of 0000H to 0FFFH and if the memory addresses exceed this limits then the instructions are fetched from the external ROM in the address range i 1000H to FFFFH.

STACKS

Definition:

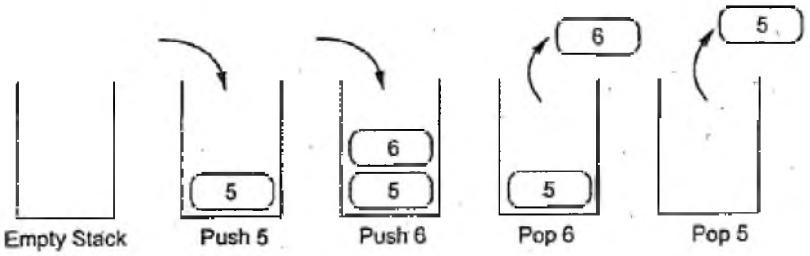
- The stack is a section of internal RAM used by the CPU to store the information temporarily. This information could be a data or an address. The CPU needs this storage area since there is only limited number of registers.
- 'a. Stack Pointer (SP):

- If the stack is a section of RAM, then there must be registers inside the CPU to point to it. The register used to access the stack is called the Stack Pointer (SP) register.
- The stack pointer is a small register used to point the stack. When we push something into the stack memory, then the stack pointer gets increased.



PUSH and POP Operation:

- A The storing operation of a CPU register in the stack is known as PUSH, and> getting the contents from the stack back into a CPU register is called POP.
- PUSH Operation: Pushing onto the Stack.
- In the 8051 the SP points to the last used location of the stack. When PUSH is. executed, the contents of the register are saved on the stack and SP incremented by 1. To push the registers onto the stack, we must use their RAM addresses.



POP Operation: Popping from the Stack

Popping the contents of the stack back into a given register is the opposite to the process of pushing. With every pop operation, the top byte of the stack is copied to the register specified by the instruction and the stack pointer gets decremented by once.

Other Instructions

- A The other instructions of the 8051 that affect the stack and the stack pointer are ACALL, LCALL, RET, and RETI.
- The CPU also uses the stack to save the address of an instruction just below the CALL instruction because the CPU knows where to resume when it returns from the called subroutine.
- The Stack pointer can be initialized to any internal RAM address by the programmer, by writing the required address in the SP SFR address 81H.

8051 INTERRUPTS

Introduction

An interrupt is an external or internal event that interrupts the microcontroller to inform that a device needs its service. A single microcontroller can serve several devices by two ways:

(i) Interrupts:

- Whenever any device needs its service, then the device notifies the microcontroller by sending it an interrupt signal.

- After receiving an interrupt signal, the microcontroller interrupts whatever it is doing and serves the device.
- The program which is associated with the interrupt is called the Interrupt Service Routine (ISR) or Interrupt Handler.

Definition:

- Interrupt is a sub-routine calls which is given to the microcontroller. When some other program with high priority is requesting for acquire the system buses than an interrupt occur in current running program.
- Interrupts provide a method to postpone or delay the current process, thereby performs a sub-routine task and then restart the standard program again.

(ii) Polling

- The microcontroller continuously monitors the status of a given device. When the conditions met, it performs the service. After that, it moves on in order to monitor the next device until everyone is serviced.
- Polling can monitor the status of several devices and serve each of them as certain conditions are ments.
- Drawback:
- The polling method is not efficient, since it wastes much of the microcontroller's time by polling the devices which do not need service.

Advantages

- The advantages of interrupts in the microcontrollers are,
- It can serve many devices but not all at the same time.
- Each device can get the attention of the microcontroller based on the assigned priority.

- For the polling method, it is not possible to assign priority since it checks all devices in a round-robin fashion.
- The microcontroller can also ignore (mask) a device request for service, which is not possible for the polling method.

Interrupt Service Routine (ISR)

For every interrupt, there must be an Interrupt Service Routine (ISR), or interrupt handler. When an interrupt is raised, then the microcontroller runs an interrupt service routine.