Interrupts programming

It is a sub-routine calls that given by the microcontroller when some other program with high priority is request for acquiring the system buses than interrupt occur in current running program.

Interrupts provide a method to postpone or delay the current process, performs a sub-routine task and then restart the standard program again.

Types of interrupt in 8051 Microcontroller

Let's see the five sources of interrupts in 8051 Microcontroller:

- Timer 0 overflow interrupt - TF0
- External hardware interrupt - INT0
- Timer 1 overflow interrupt - TF1
- External hardware interrupt - INT1
- Serial communication interrupt - RI/TI

The timer and serial interrupts are internally produced by the microcontroller, whereas the external interrupts are produced by additional interfacing devices or switches that are externally connected with the microcontroller. These external interrupts can be level triggered or edge triggered.

When interrupt occur then the microcontroller executes the interrupt service routine. Therefore the memory location corresponds to interrupt enables it. Consider the interrupt corresponding to the memory location is shown in the interrupt vector table below.

Interrupt Number	Interrupt Description	Address
0	EXTERNAL INT 0	0003h
1	TIMER/COUNTER 0	000Bh
2	EXTERNAL INT 1	0013h
3	TIMER/COUNTER 1	001Bh
4	SERIAL PORT	0023h

Interrupt Enable (IE) Register

IE register is used for enabling and disabling the interrupt. This is a bit addressable register in which EA value must be set to one for enabling interrupts. The individual bits in this register

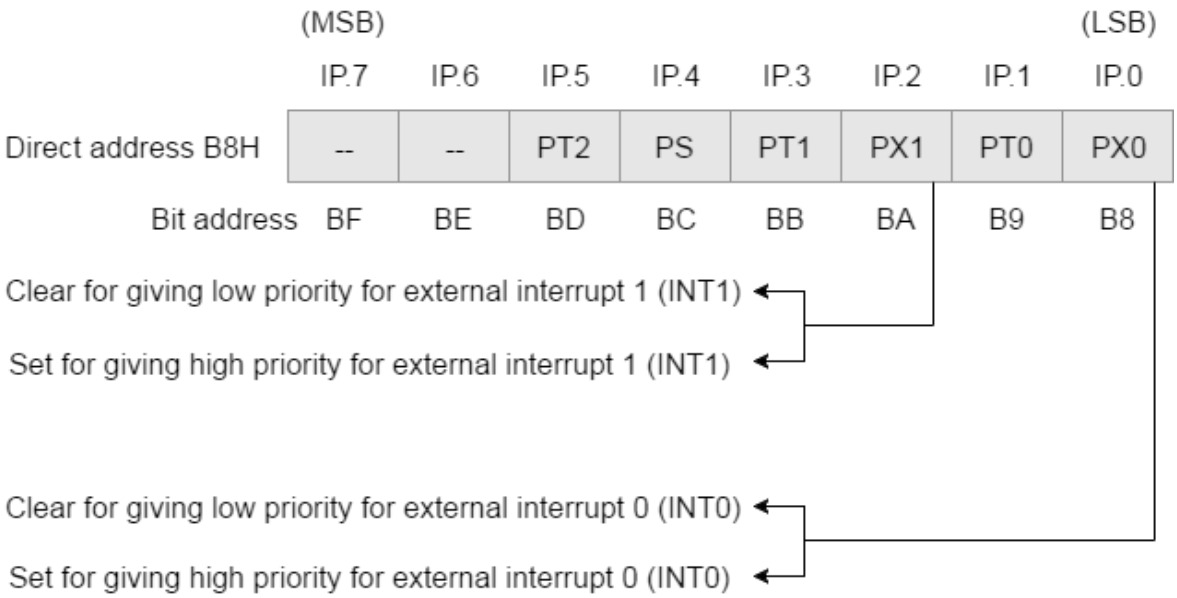
enables the particular interrupt like timer, serial and external inputs. Consider in the below IE register, bit corresponds to 1 activate the interrupt and 0 disable the interrupt.

EA	--	--	ES	ET1	EX1	ET0	EX0

EA	IE.7	Disables all interrupts, If EA=0, no interrupt will be acknowledged. If EA=1, interrupt source is individually enable or disabled by setting or clearing its enable bit.
--	IE.6	Not implemented, reserved for future use*.
--	IE.5	Not implemented, reserved for future use*.
ES	IE.4	Enable or disable the Serial port interrupt.
ET1	IE.3	Enable or disable the Timer 1 overflow interrupt.
EX1	IE.2	Enable or disable External interrupt 1.
ET0	IE.1	Enable or disable the Timer 0 overflow interrupt.
EX0	IE.0	Enable or disable External interrupt 0.

Interrupt Priority Register (IP)

Using IP register it is possible to change the priority levels of an interrupts by clearing or setting the individual bit in the Interrupt priority (IP) register as shown in figure. It allows the low priority interrupt can interrupt the high-priority interrupt, but it prohibits the interruption by using another low-priority interrupt. If the priorities of interrupt are not programmed, then microcontroller executes the instruction in a predefined manner and its order are INT0, TF0, INT1, TF1, and SI.



External Hardware Interrupt Programming

Microcontroller 8051 is consisting of two external hardware interrupts: INT0 and INT1 as discussed above. These interrupts are enabled at pin 3.2 and pin 3.3. It can be level triggered or edge triggered. In level triggering, low signal at pin 3.2 enables the interrupt, while at pin 3.2 high to low transition enables the edge triggered interrupt.

Let us see the programmable feature of 8051 microcontroller are:

- Enables the equivalent bit of external interrupt in Interrupt Enable (IE) register.
- If it is level triggering, then write subroutine appropriate to this interrupt, or else enable the bit in TCON register corresponding to the edge triggered interrupt.

Consider the edge triggered external hardware interrupt programming is:-

```
1. void main()
2. {
3. IT0 = 1;    // Configure interrupt 0 for falling edge on INT0
4. EXO = 1;    // Enabling the EX0 interrupt
5. EA =1;      // Enabling the global interrupt flag
6. }
7. void ISR_ex0(void) interrupt 0
8. {
9. <body of interrupt>
10. }
```