



INTERRUPTS & INTERRUPT SERVICE ROUTINE(ISR)



Session Objectives

- Study the concept and importance of procedure, stack, and Interrupts



Session Outcomes

- At the end of the session, students will be able to
 - Understand the concept of Interrupts.



Outline

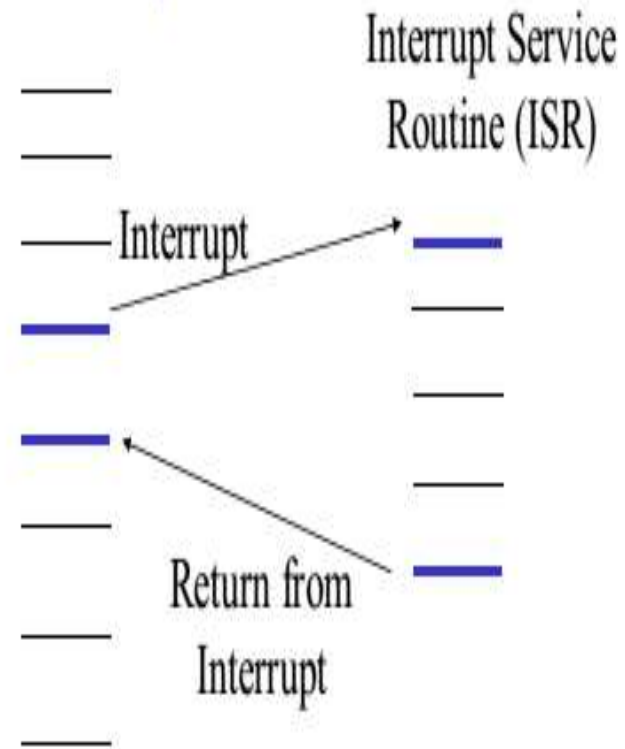
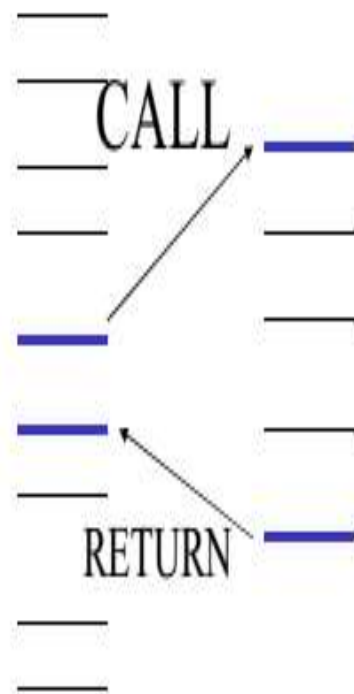
- To discuss the
 - the concept of Interrupts.

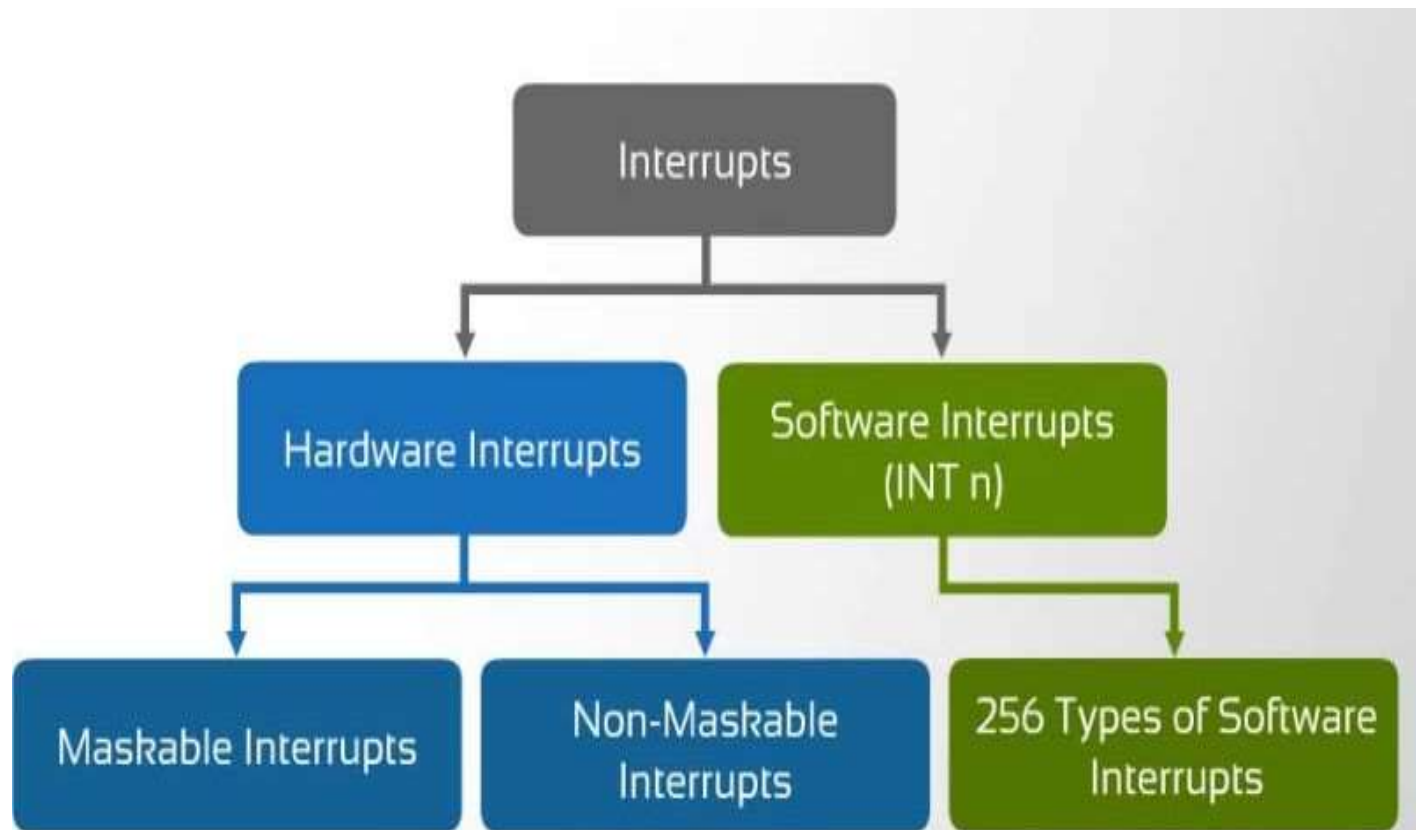


INTERRUPT & ISR ?

- ‘**Interrupts**’ is to break the sequence of operation.
- While the CPU is executing a program, on ‘interrupt’ breaks the normal sequence of execution of instructions, diverts its execution to some other program called **Interrupt Service Routine (ISR)**







Hardware Interrupts

Used to handle external hardware peripherals, such as keyboards, mouse, hard disks, floppy disks, DVD drives, and printers



Keyboard



Mouse



Hard disk



Floppy disk

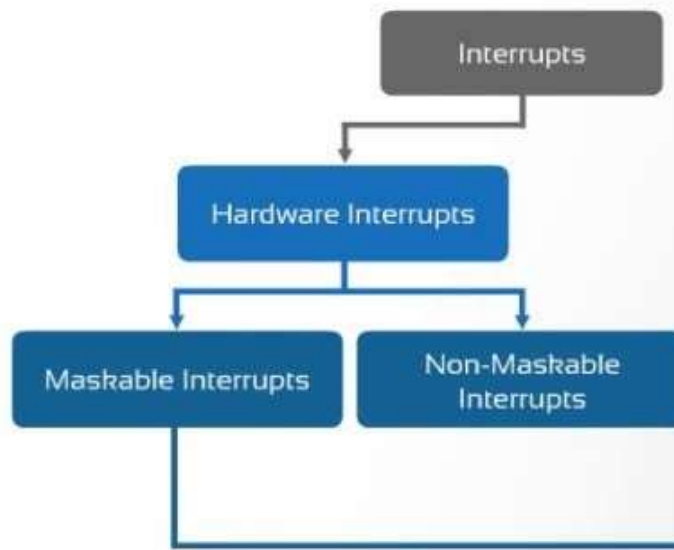


DVD drive

- **Maskable Interrupt:** An Interrupt that can be disabled or ignored by the instructions of CPU are called as Maskable Interrupt.
- **Non- Maskable Interrupt:** An interrupt that cannot be disabled or ignored by the instructions of CPU are called as Non- Maskable Interrupt.
- **Software interrupts** are machine instructions that amount to a call to the designated interrupt subroutine, usually identified by interrupt number.

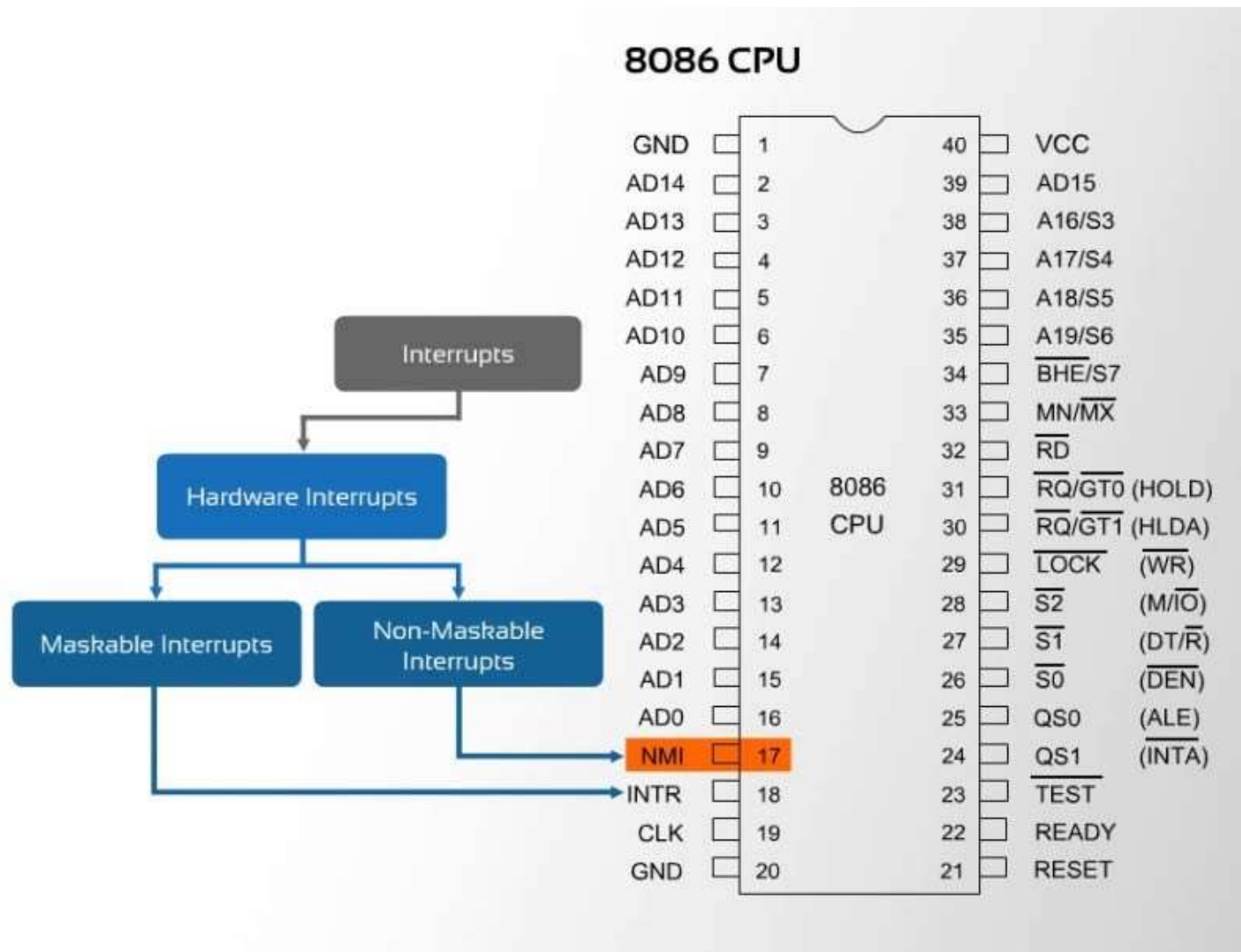
Ex: **INT0 - INT255**



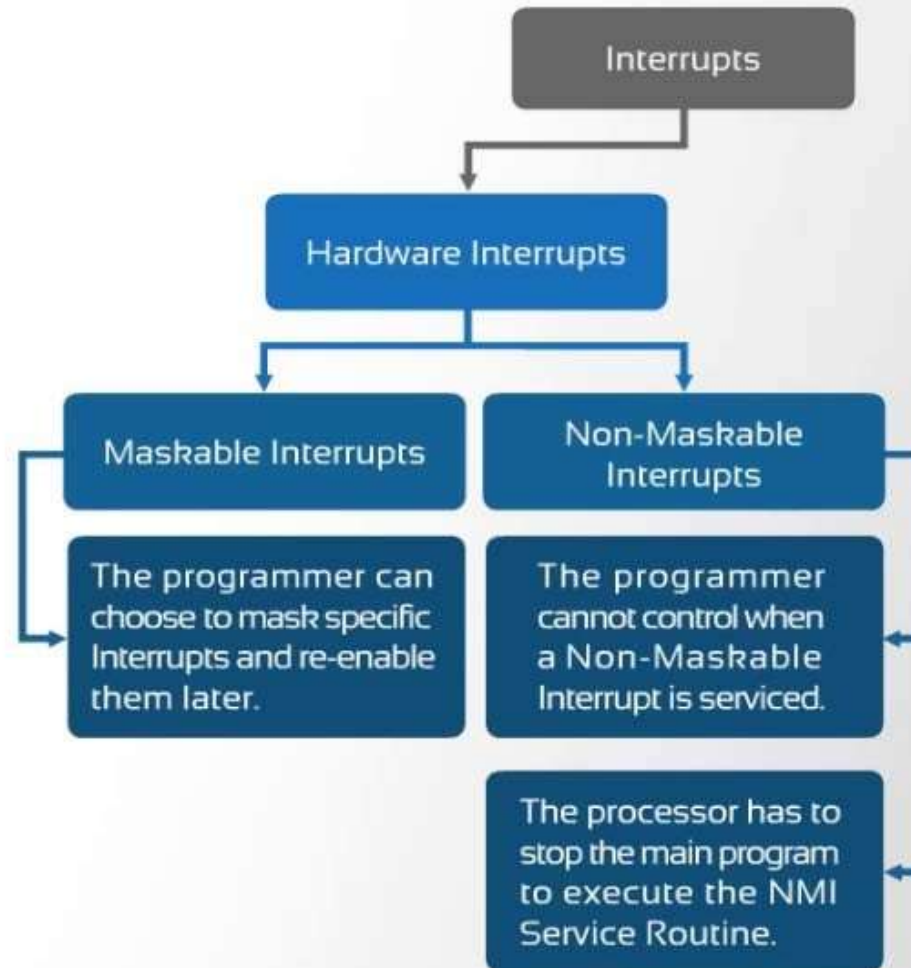


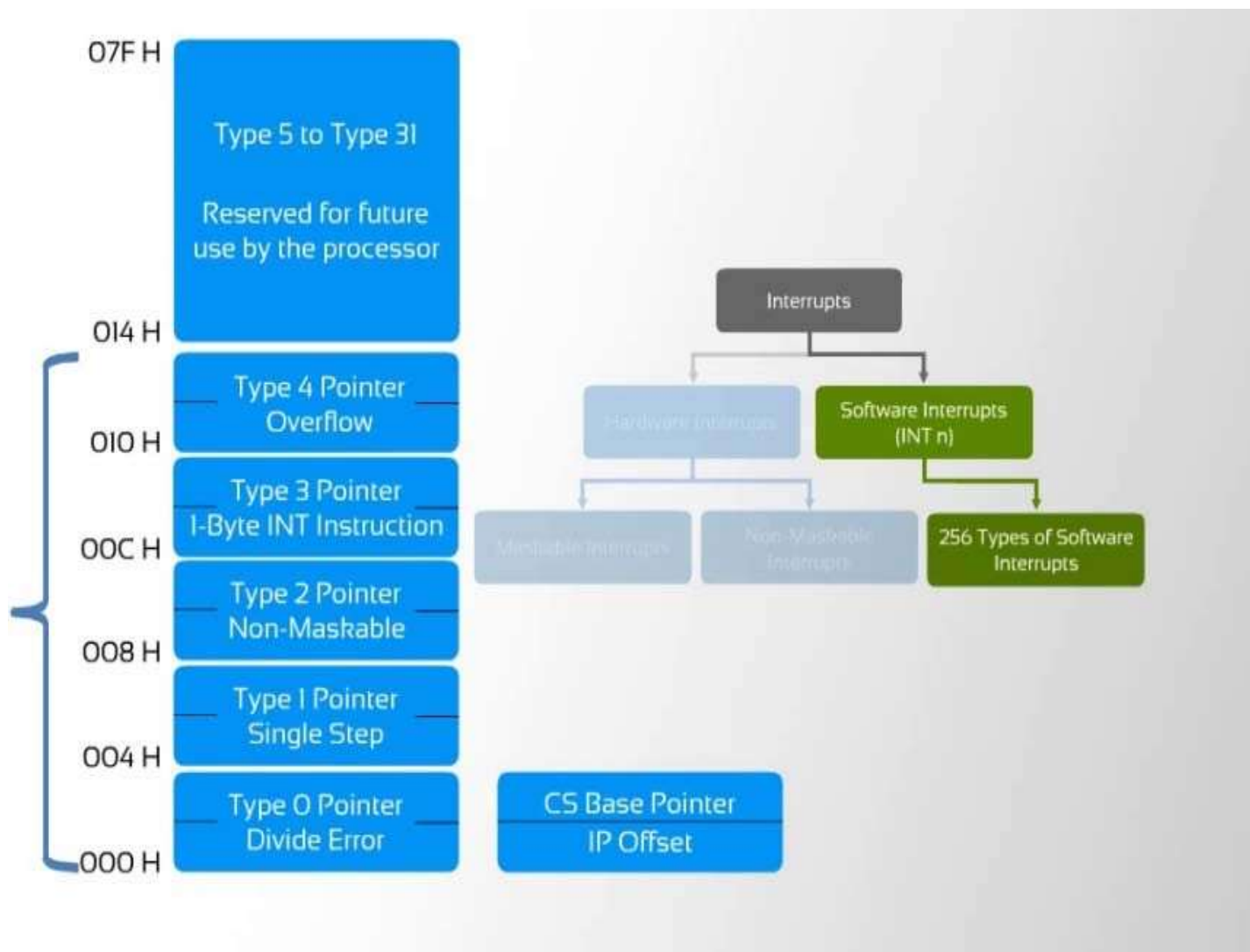
8086 CPU

GND	1	40	VCC
AD14	2	39	AD15
AD13	3	38	A16/S3
AD12	4	37	A17/S4
AD11	5	36	A18/S5
AD10	6	35	A19/S6
AD9	7	34	$\overline{\text{BHE}}/\text{S7}$
AD8	8	33	$\text{MN}/\overline{\text{MX}}$
AD7	9	32	$\overline{\text{RD}}$
AD6	10	31	$\overline{\text{RQ}}/\overline{\text{GT0}}$ (HOLD)
AD5	11	30	$\overline{\text{RQ}}/\overline{\text{GT1}}$ (HLDA)
AD4	12	29	$\overline{\text{LOCK}}$ ($\overline{\text{WR}}$)
AD3	13	28	$\overline{\text{S2}}$ ($\text{M}/\overline{\text{IO}}$)
AD2	14	27	$\overline{\text{S1}}$ ($\text{DT}/\overline{\text{R}}$)
AD1	15	26	$\overline{\text{S0}}$ ($\overline{\text{DEN}}$)
AD0	16	25	QS0 ($\overline{\text{ALE}}$)
NMI	17	24	QS1 ($\overline{\text{INTA}}$)
INTR	18	23	$\overline{\text{TEST}}$
CLK	19	22	READY
GND	20	21	RESET



Maskable Versus Non-Maskable Interrupts

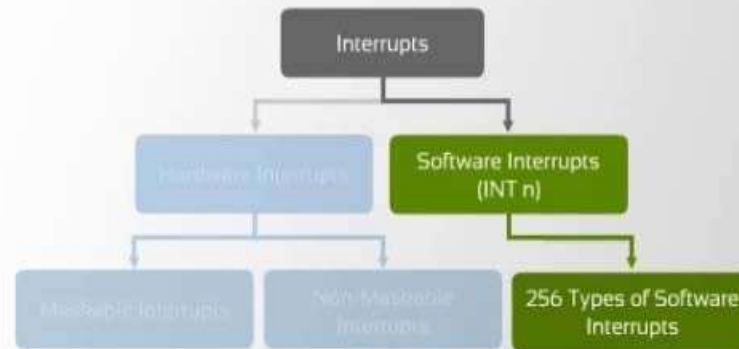




3FF H

Type 32 to Type 255
Free for User

080 H



ssh

INTERRUPT VECTOR TABLE

256 INTERRUPTS OF 8086 ARE DIVIDED INTO 3 GROUPS

1. TYPE 0 TO TYPE 4 INTERRUPTS-

These are used for fixed operations and hence are called dedicated interrupts

2. TYPE 5 TO TYPE 31 INTERRUPTS

Not Used By 8086, reserved For Higher Processors Like 80286 80386 Etc

3. TYPE 32 TO 255 INTERRUPTS

Available For User, called User Defined Interrupts These Can Be H/W Interrupts And Activated Through Intr Line Or S/W Interrupts.

➤ Type – 0 Divide Error Interrupt

Quotient is too large can't be fit in AL/AX or **Divide By Zero**

{ $AX/0=\infty$ }

➤ Type –1 Single Step Interrupt

used for executing the program in **single step** mode by setting **Trap Flag**

```
PUSHF
MOV BP,SP
OR [BP+0],0100H;
SET BIT8
POPF
```

➤ Type – 2 Non Maskable Interrupt

This Interrupt is used for executing **ISR** of **NMI** Pin (Positive Edge Signal). NMI can't be masked by **S/W**

➤ Type – 3 Break Point Interrupt

used for providing **BREAK POINTS** in the program

➤ Type – 4 Overflow Interrupt

used to handle any **Overflow Error** after signed arithmetic



PRIORITY OF INTERRUPTS

Interrupt Type	Priority
INT0, INT3-INT 255,	Highest
NMI(INT2)	↓
INTR	↓
SINGLE STEP	Lowest

Summary

- The basic operations of interrupt is studied.



Test Your Understand

- What is the difference between CALL and Jump instruction?
- The instructions that are used to call a subroutine from the main program and return to the main program after execution of called function are
 - a) CALL, JMP
 - b) JMP, IRET
 - c) CALL, RET
 - d) JMP, RET



References

- Walter A Triebel and Avatar Singh, The 8088 and 8086 Microprocessors – Programming, Interfacing, Software, Hardware and Applications, Pearson, Fourth Edition, 2002.



Thank you

