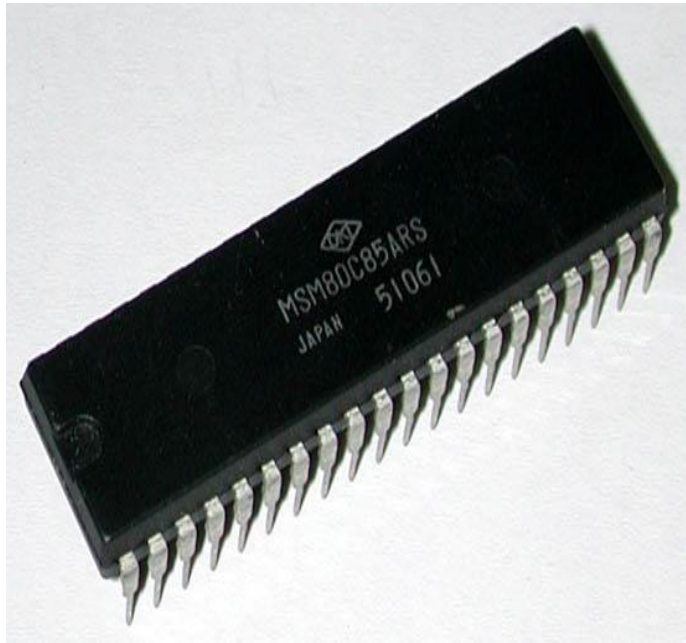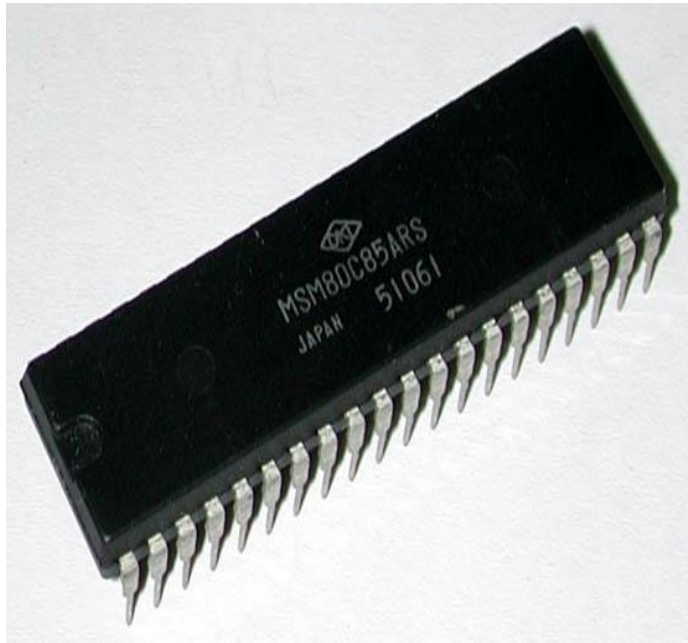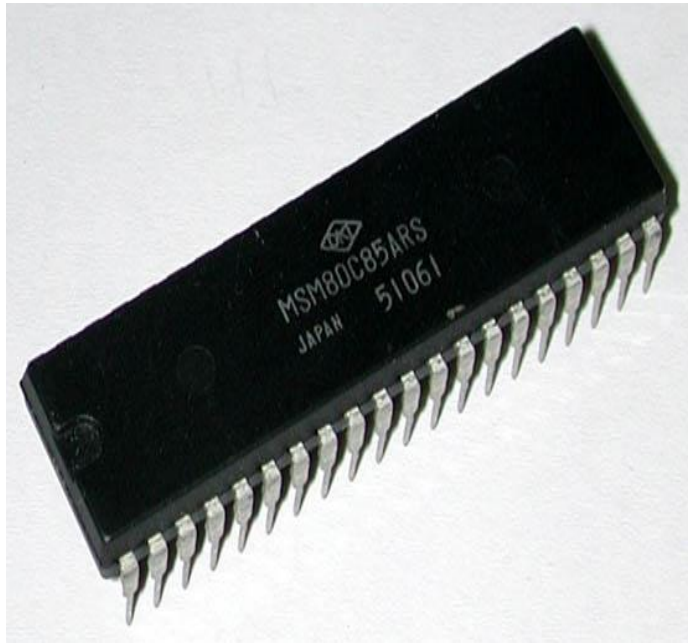# PIN DIAGRAM OF 8085

Introduction to 8085

- It was introduced in 1977.
- It is 8-bit microprocessor.
- Its actual name is 8085 A.
- It is single NMOS device.
- It contains 6200 transistors approx.
- Its dimensions are
  164 mm x 222 mm.
- It is having 40 pins Dual-Inline-Package (DIP).

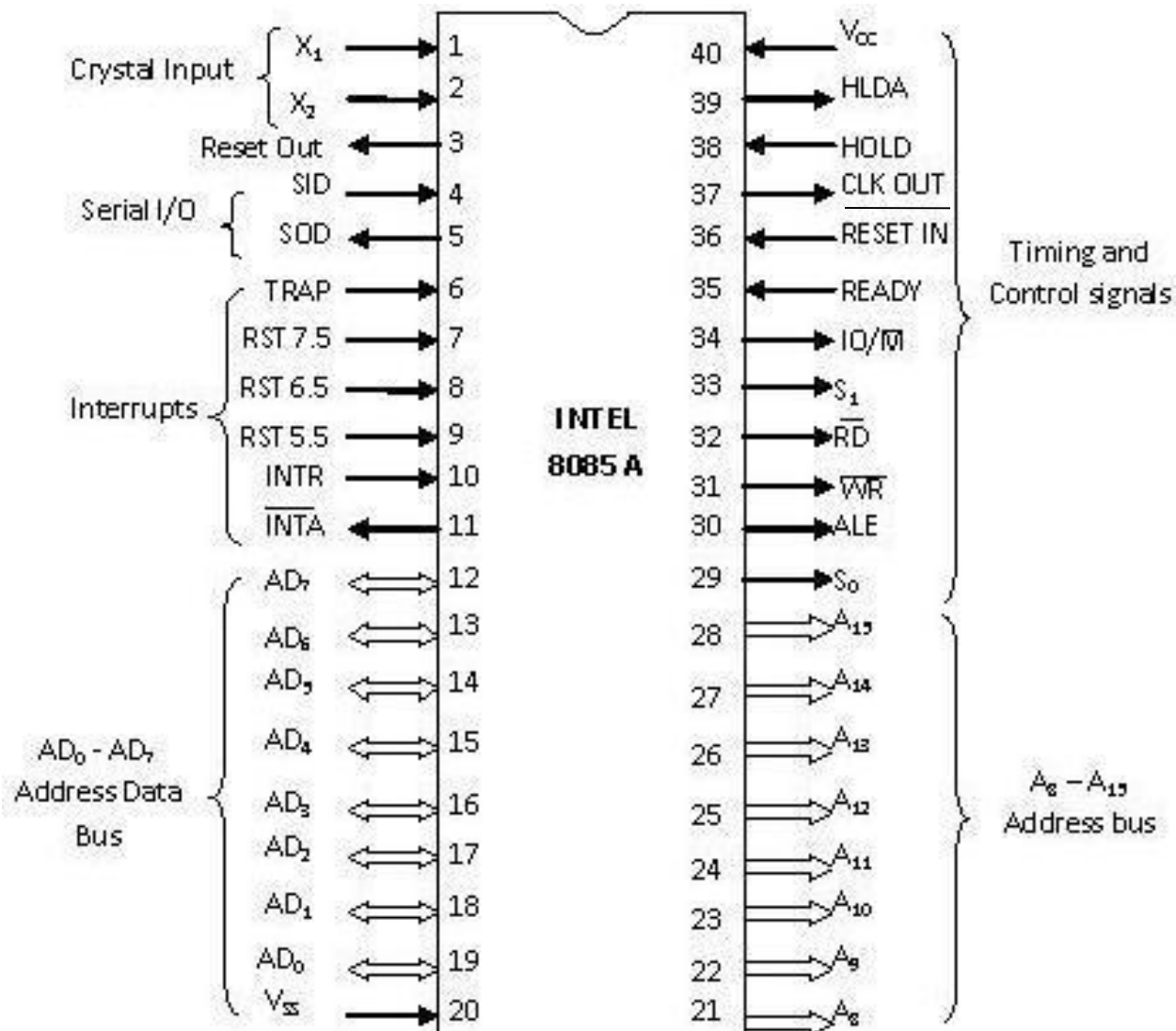# **Introduction to 8085**

- It has three advanced versions:
  - 8085 AH
  - 8085 AH2
  - 8085 AH1

- These advanced versions are designed using HMOS technology.

Introduction to 8085

- The advanced versions consume 20% less power supply.

- The clock frequencies of 8085 are:
  - 8085 A   3 MHz
  - 8085 AH3 MHz
  - 8085 AH2   5 MHz
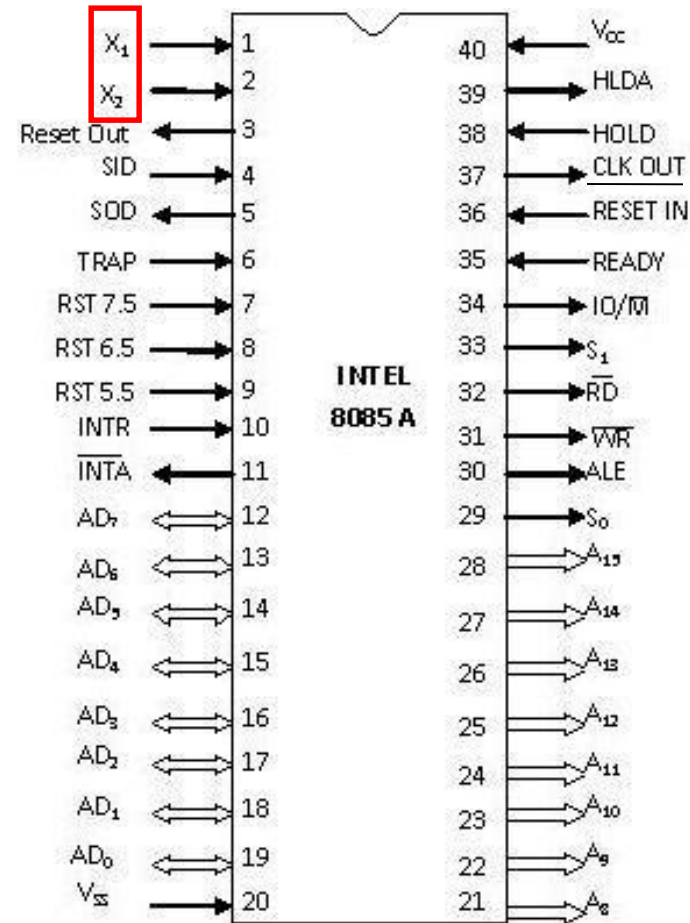 - 8085 AH1   6 MHz

Pin Diagram of 8085

X_1 & X_2

Pin 1 and Pin 2 (Input)

- These are also called Crystal Input Pins.

- 8085 can generate clock signals internally.

To generate clock signals internally, 8085 requires external inputs from X_1 and X_2.
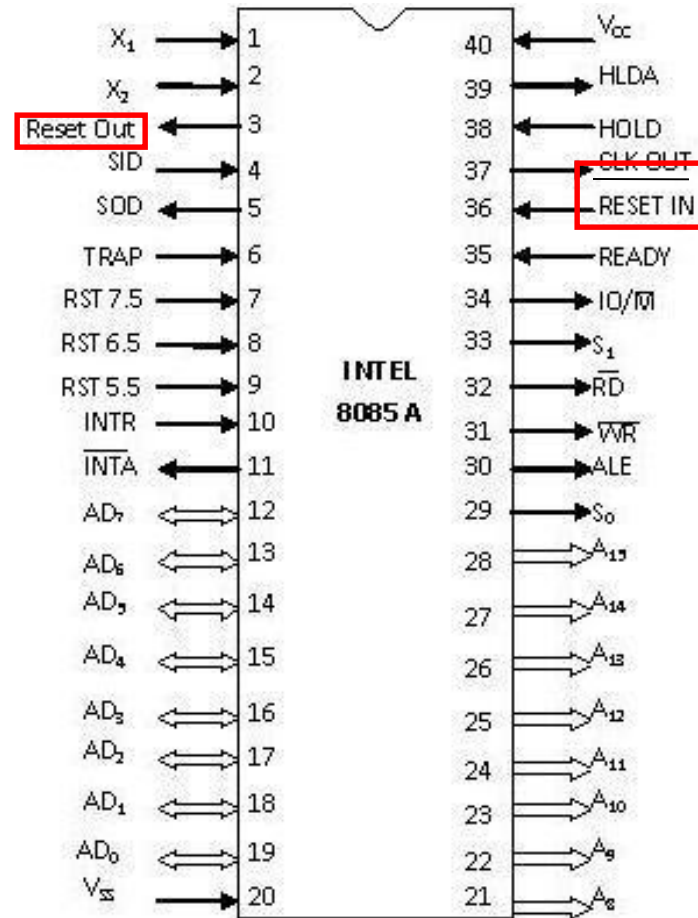
RESET IN and RESET OUT
Pin 36 (Input) and Pin 3 (Output)

- **RESET IN**:

  ◦ It is used to reset the microprocessor.

  ◦ It is active low signal.

  ◦ When the signal on this pin is low for at least **3** clocking cycles, it forces the microprocessor to reset itself.
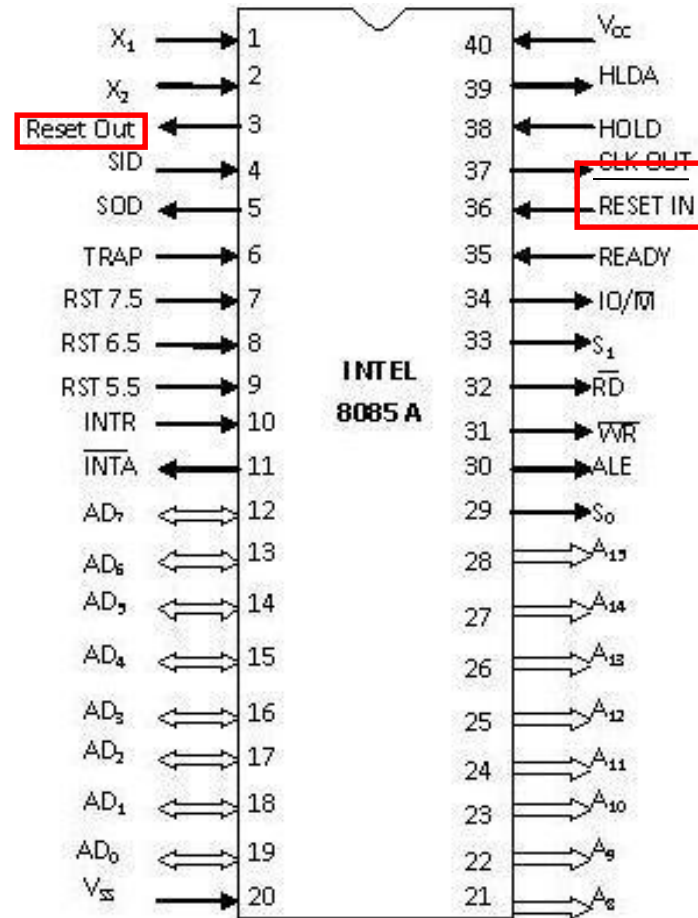
RESET IN and RESET OUT
Pin 36 (Input) and Pin 3 (Output)

- Resetting the microprocessor means:

Clearing the PC and IR.

- Disabling all interrupts (except TRAP).
- Disabling the SOD pin.
- All the buses (data, address, control) are *tri-stated*.
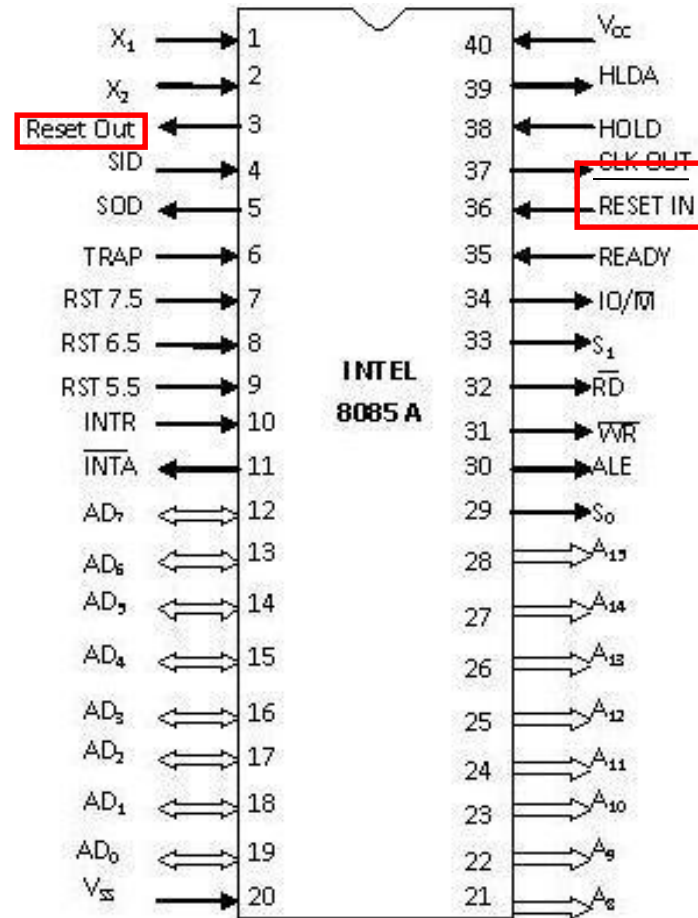- Gives HIGH output to RESET OUT pin.

RESET IN and RESET OUT
Pin 36 (Input) and Pin 3 (Output)

- **RESET OUT:**

  ◦ It is used to reset the peripheral devices and other ICs on the circuit.

  ◦ It is an output signal.

  ◦ It is an active high signal.

  ◦ The output on this pin goes high whenever RESET IN is given low signal.

  ◦ The output remains high as long as RESET IN is kept low.

SID and SOD

- **SID (Serial Input Data):**

  - It takes 1 bit input from serial port of 8085.

  - Stores the bit at the 8th position (MSB) of the Accumulator.

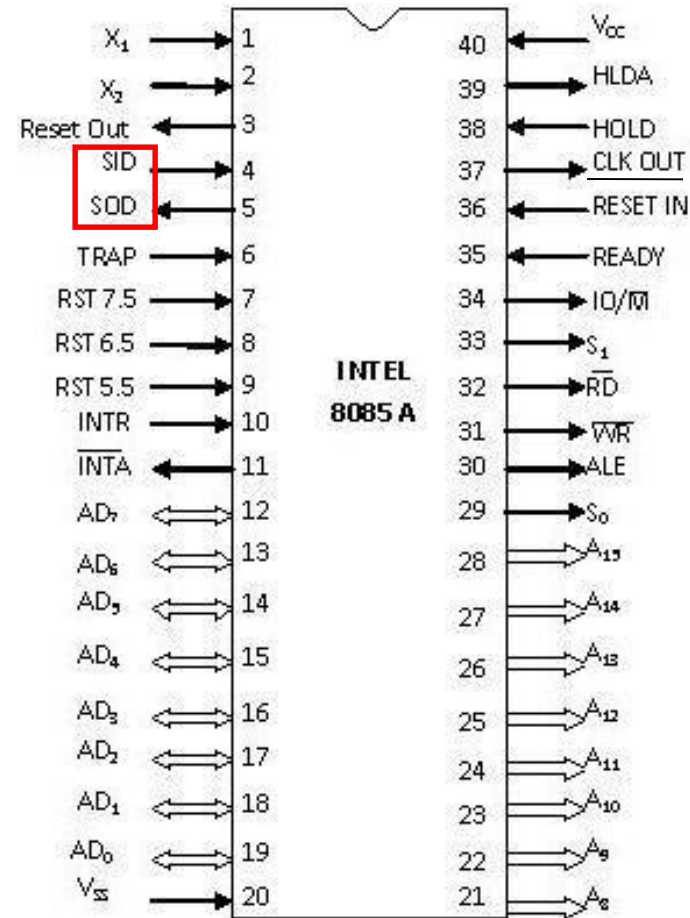 - RIM (Read Interrupt Mask) instruction is used to transfer the bit.
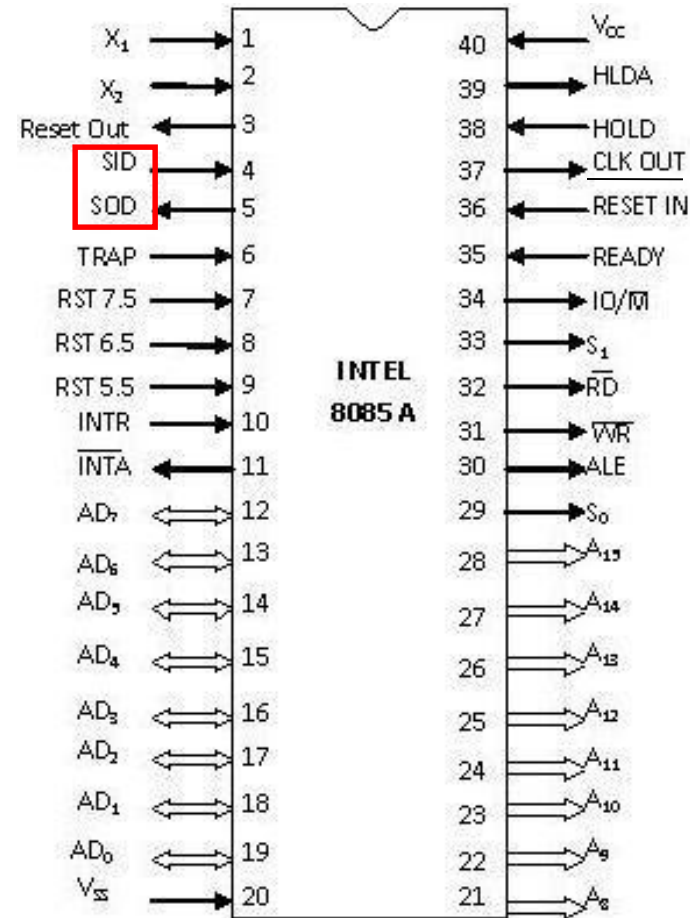
SID and SOD
Pin 4 (Input) and Pin 5 (Output)

- **SOD (Serial Output Data):**

  - It takes 1 bit from Accumulator to serial port of 8085.

  - Takes the bit from the 8th position (MSB) of the Accumulator.

  - SIM (Set Interrupt Mask) instruction is used to transfer the bit.

Interrupt Pins

- **Interrupt:**

    - It means *interrupting* the normal execution of the microprocessor.

    - When microprocessor receives interrupt signal, it discontinues whatever it was executing.

    - It starts executing new program indicated by the interrupt signal.

    - Interrupt signals are generated by external peripheral devices.

    - After execution of the new program, microprocessor goes back to the previous program.

Sequence of Steps Whenever There is an Interrupt

- Microprocessor completes execution of current instruction of the program.

- PC contents are stored in stack.

- PC is loaded with address of the new program.

- After executing the new program, the microprocessor returns back to the previous program.

- It goes to the previous program by reading the top value of stack.

Five Hardware Interrupts in 8085

- TRAP

- RST 7.5

- RST 6.5

- RST 5.5

- INTR

Classification of Interrupts

- Maskable and Non-Maskable

- Vectored and Non-Vectored

- Edge Triggered and Level Triggered

- Priority Based Interrupts

Maskable Interrupts

- Maskable interrupts are those interrupts which can be *enabled* or *disabled*.

- Enabling and Disabling is done by software instructions.

Maskable Interrupts

- List of Maskable Interrupts:

  - RST 7.5

  - RST 6.5

  - RST 5.5

  - INTR

Non-Maskable Interrupts

- The interrupts which are always in *enabled* mode are called non-maskable interrupts.

- These interrupts can never be disabled by any software instruction.

- TRAP is a non-maskable interrupt.

Vectored Interrupts

- The interrupts which have fixed memory location for transfer of control from normal execution.

- Each vectored interrupt points to the particular location in memory.

Vectored Interrupts

- List of vectored interrupts:

  - RST 7.5

  - RST 6.5

  - RST 5.5

  - TRAP

Vectored Interrupts

- The addresses to which program control goes:

Name	Vectored Address
RST 7.5	003C H (7.5 x 0008 H)
RST 6.5	0034 H (6.5 x 0008 H)
RST 5.5	002C H (5.5 x 0008 H)
TRAP	0024 H (4.5 x 0008 H)

- Absolute address is calculated by multiplying the RST value with 0008 H.

Non-Vectored Interrupts

- The interrupts which don't have fixed memory location for transfer of control from normal execution.

- The address of the memory location is sent along with the interrupt.

- INTR is a non-vectored interrupt.

Priority Based Interrupts

- Whenever there exists a simultaneous request at two or more pins then the pin with higher priority is selected by the microprocessor.

- Priority is considered only when there are simultaneous requests.

Priority Based Interrupts

- Priority of interrupts:

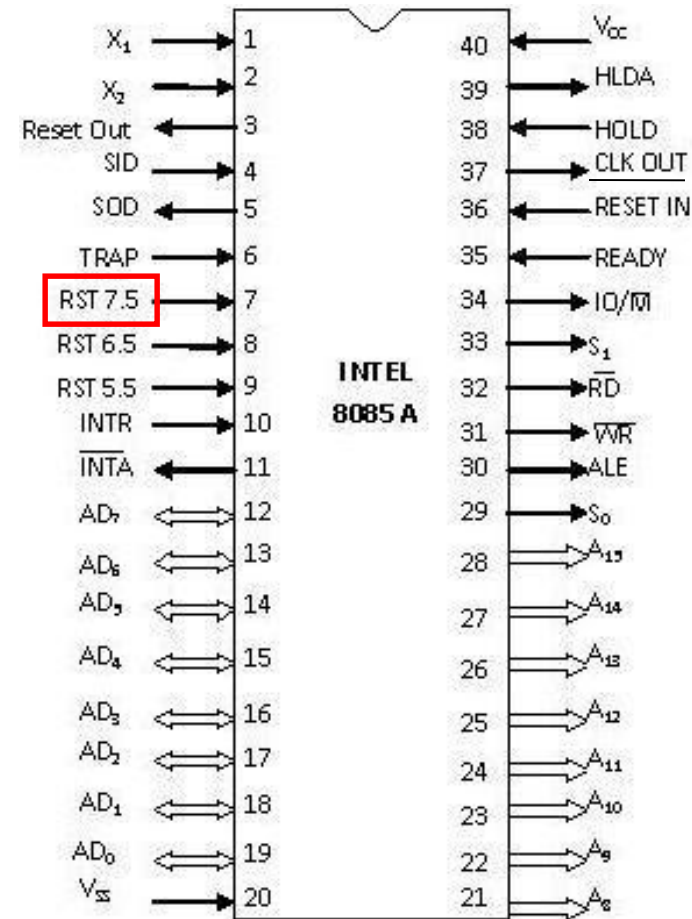| Interrupt	Priority
TRAP	1
RST 7.5	2
RST 6.5	3
RST 5.5	4
INTR	5

TRAP
Pin 6 (Input)

- It is an non-maskable interrupt.

- It has the highest priority.

- It cannot be disabled.

- It is both edge and level triggered.

- It means TRAP signal must go from low to high.

- And must remain high for a certain period of time.

- TRAP is usually used for power failure and emergency shutoff.
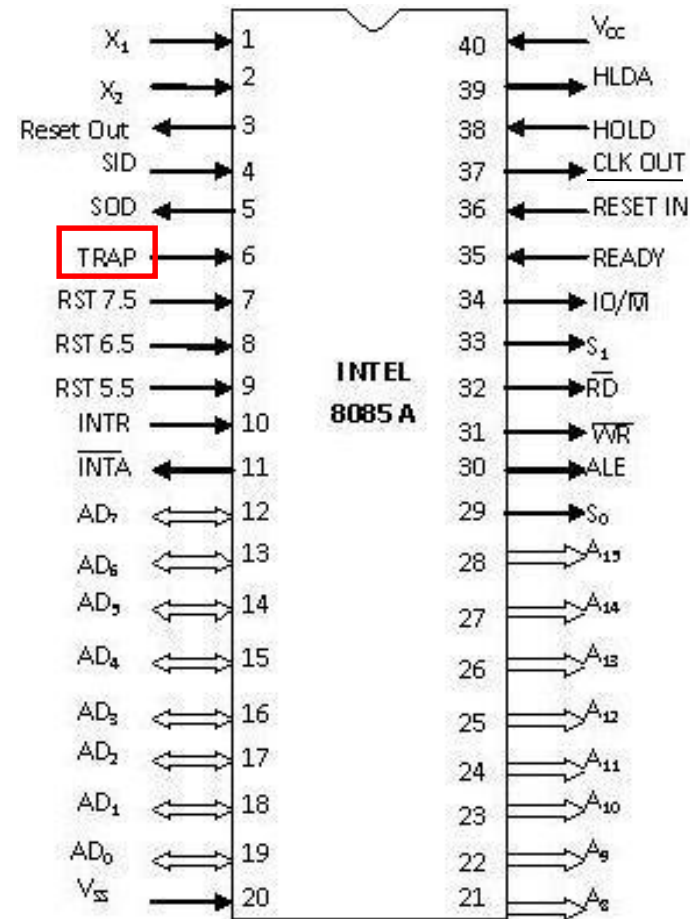
RST 7.5
Pin 7 (Input)

- It is a maskable interrupt.

- It has the second highest priority.

- It is positive edge triggered only.

- The internal flip-flop is triggered by the rising edge.

- The flip-flop remains high until it is cleared by RESET IN.

RST 6.5
Pin 8 (Input)

- It is a maskable interrupt.

- It has the third highest priority.

- It is level triggered only.

- The pin has to be held high for a specific period of time.

- RST 6.5 can be enabled by EI instruction.

- It can be disabled by DI instruction.
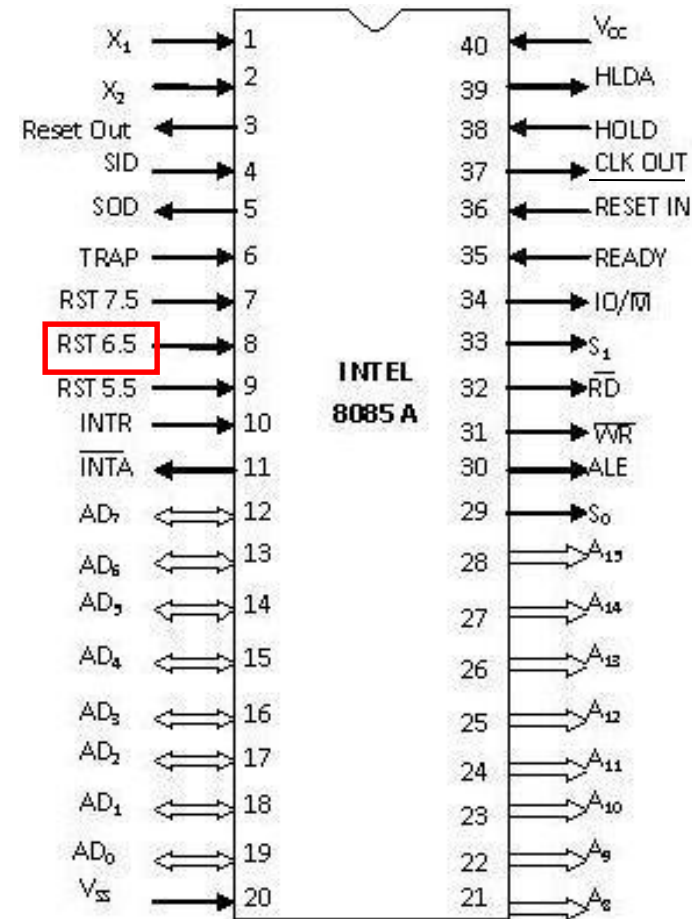
RST 5.5
Pin 9 (Input)

- It is a maskable interrupt.

- It has the fourth highest priority.

- It is also level triggered.

- The pin has to be held high for a specific period of time.

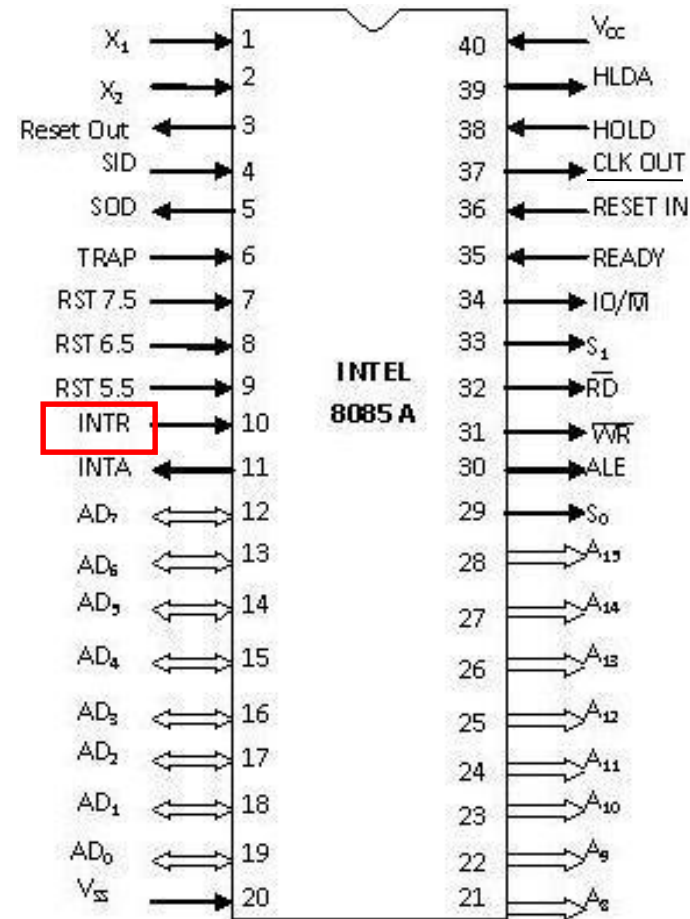- This interrupt is very similar to RST 6.5.
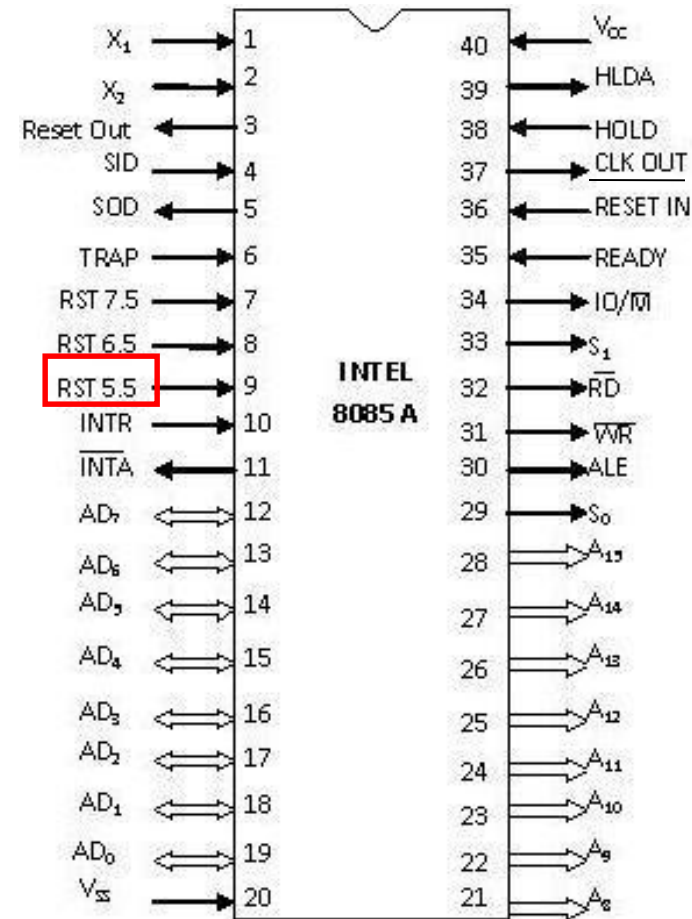
# INTR
Pin 10 (Input)

- It is a maskable interrupt.

- It has the lowest priority.

- It is also level triggered.

- It is a general purpose interrupt.

- By general purpose we mean that it can be used to vector microprocessor to any specific subroutine having any address.

$\overline{\text{INTA}}$
Pin 11 (Output)

- It stands for interrupt acknowledge.

- It is an out going signal.

- It is an active low signal.

- Low output on this pin indicates that microprocessor has acknowledged the INTR request.
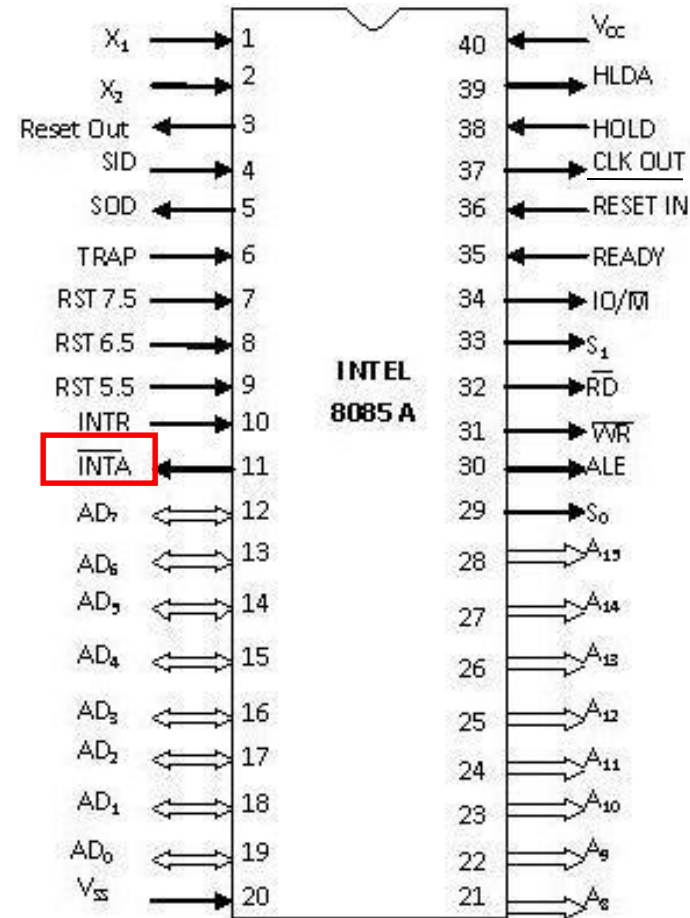
Address and Data Pins

- **Address Bus:**

  - The address bus is used to send address to memory.

  - It selects one of the many locations in memory.

  - Its size is 16-bit.

Address and Data Pins

- **Data Bus:**

  - It is used to transfer data between microprocessor and memory.

  - Data bus is of 8-bit.

AD$_0$ – AD$_7$
Pin 19-12 (Bidirectional)

- These pins serve the dual purpose of transmitting lower order address and data byte.

- During 1st clock cycle, these pins act as lower half of address.

- In remaining clock cycles, these pins act as data bus.

- The separation of lower order address and data is done by address latch.
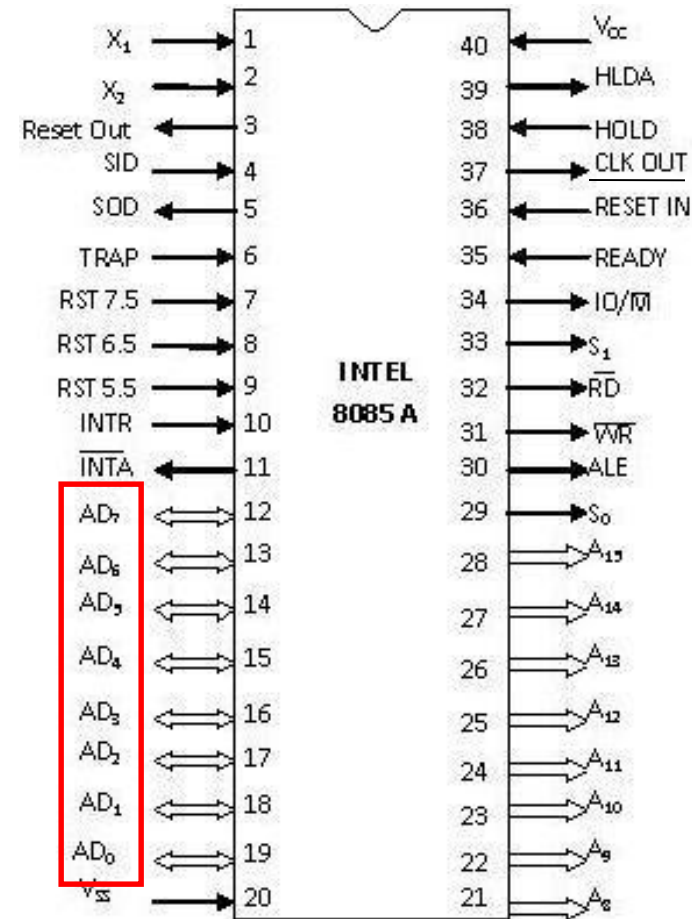
$A_8 - A_{15}$
Pin 21-28 (Unidirectional)

- These pins carry the higher order of address bus.

- The address is sent from microprocessor to memory.

- These 8 pins are switched to high impedance state during HOLD and RESET mode.
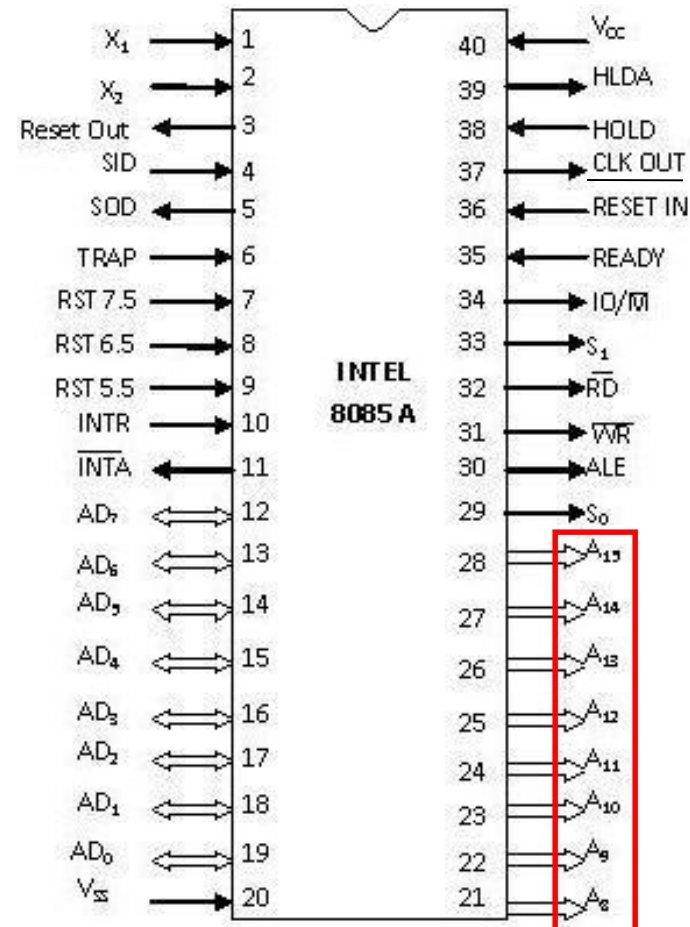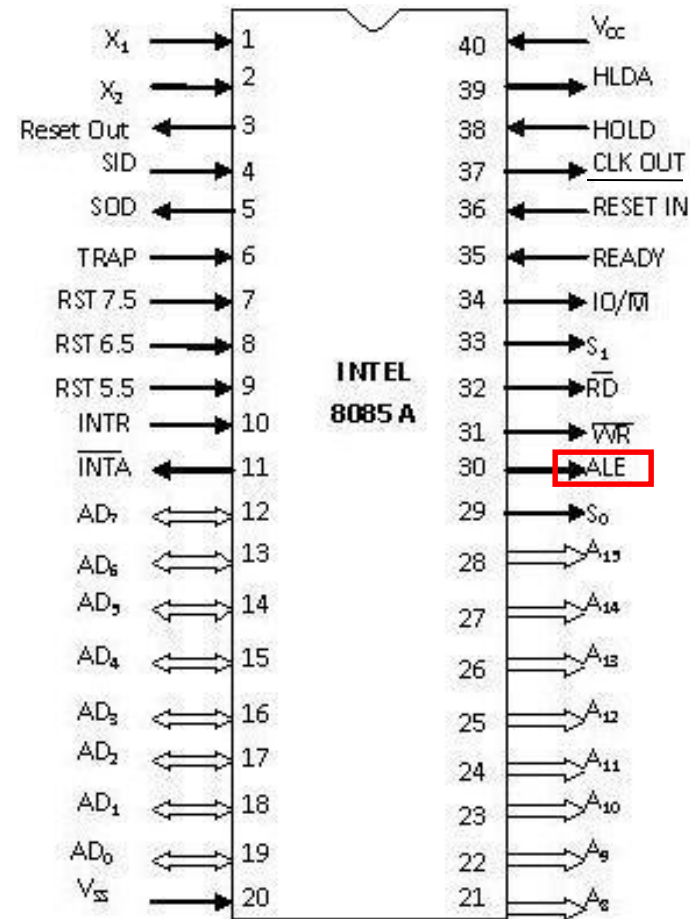
ALE
Pin 30 (Output)

- It is used to enable Address Latch.

- It indicates whether bus functions as address bus or data bus.

- If ALE = 1 then
  - Bus functions as address bus.

- If ALE = 0 then
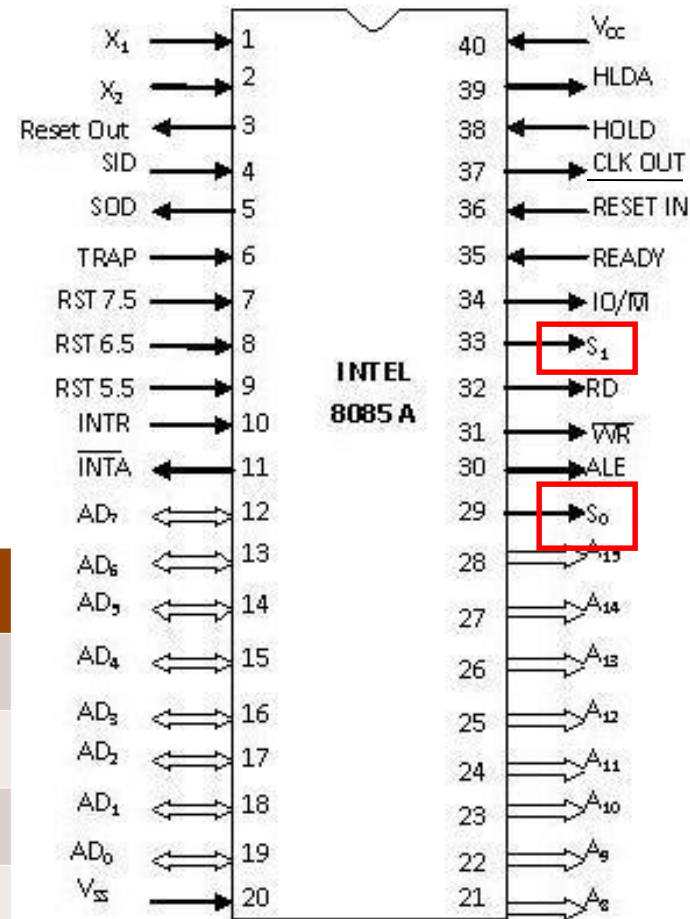 - Bus functions as data bus.

35

S_0 and S_1
Pin 29 (Output) and Pin 33 (Output)

- S_0 and S_1 are called Status Pins.

- They tell the current operation which is in progress in 8085.

S_0	S_1	Operation
0	0	Halt
0	1	Write
1	0	Read
1	1	Opcode Fetch

$IO/\overline{M}$
Pin 34 (Output)

- This pin tells whether I/O or memory operation is being performed.

- If $IO/\overline{M} = 1$ then
  - I/O operation is being performed.

- If $IO/\overline{M} = 0$ then
  - Memory operation is being performed.
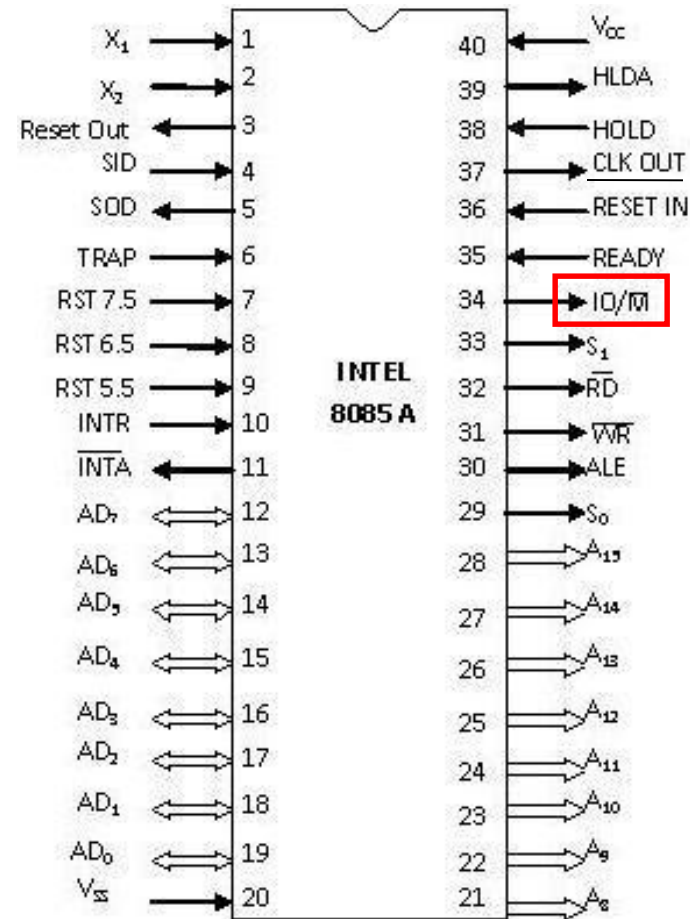
$\overline{IO/M}$

Pin 34 (Output)

- The operation being performed is indicated by S_0 and S_1.

- If $S_0 = 0$ and $S_1 = 1$ then
  - It indicates WRITE operation.

- If $IO/\overline{M} = 0$ then
  - It indicates Memory operation.

- Combining these two we get **Memory Write** Operation.

Table Showing $IO/\overline{M}$, S_0, S_1 and Corresponding Operations

Operations	$IO/\overline{M}$	S_0	S_1
Opcode Fetch	0	1	1
Memory Read	0	1	0
Memory Write	0	0	1
I/O Read	1	1	0
I/O Write	1	0	1
Interrupt Ack.	1	1	1
Halt	High Impedance	0	0

$\overline{\text{RD}}$
Pin 32 (Output)

* RD stands for Read.

* It is an active low signal.

* It is a control signal used for Read operation either from memory or from Input device.

* A low signal indicates that data on the data bus must be placed either from selected memory location or from input device.
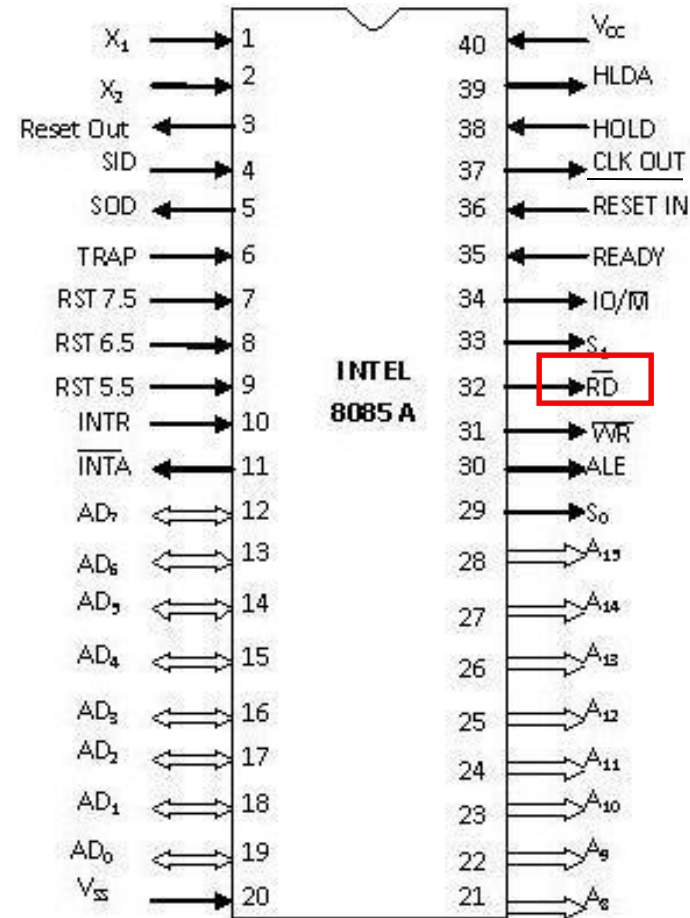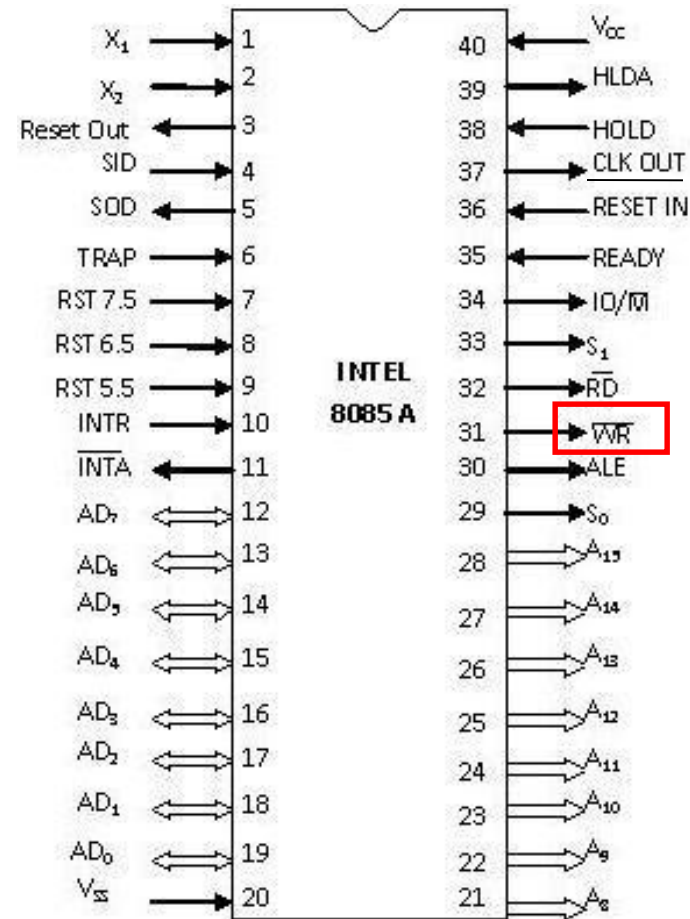
$\overline{\textbf{WR}}$
Pin 31 (Output)

- WR stands for Write.

- It is also active low signal.

- It is a control signal used for Write operation either into memory or into output device.

- A low signal indicates that data on the data bus must be written into selected memory location or into output device.

READY
Pin 35 (Input)

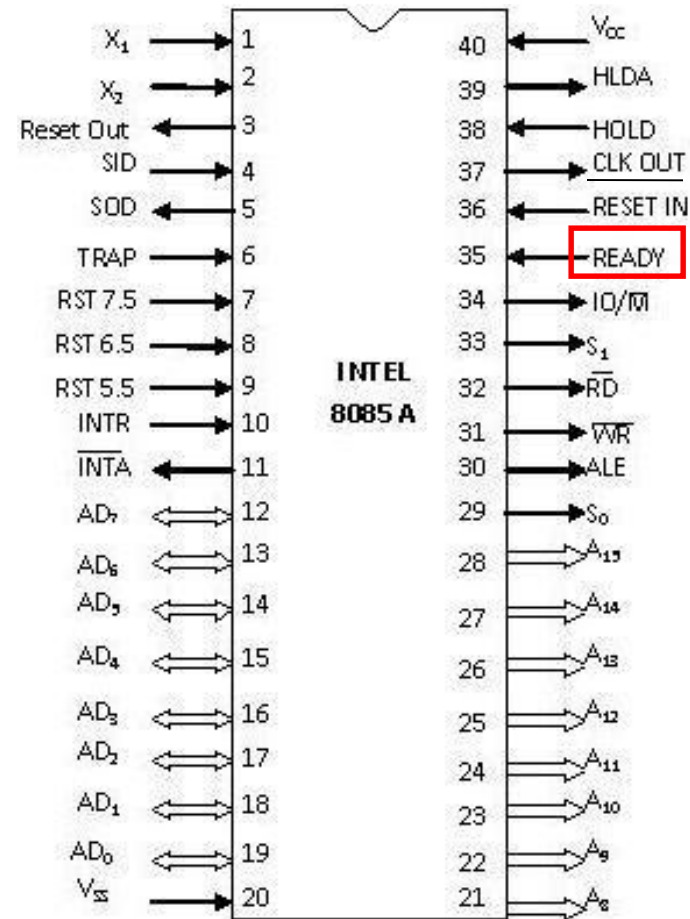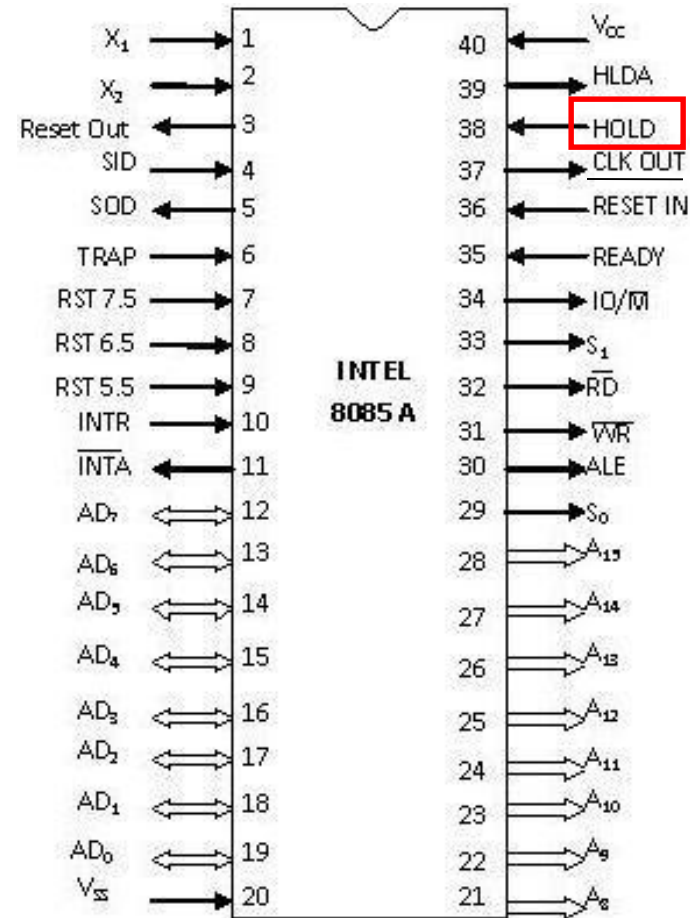- This pin is used to synchronize slower peripheral devices with fast microprocessor.

- A low value causes the microprocessor to enter into *wait state*.

- The microprocessor remains in wait state until the input at this pin goes high.
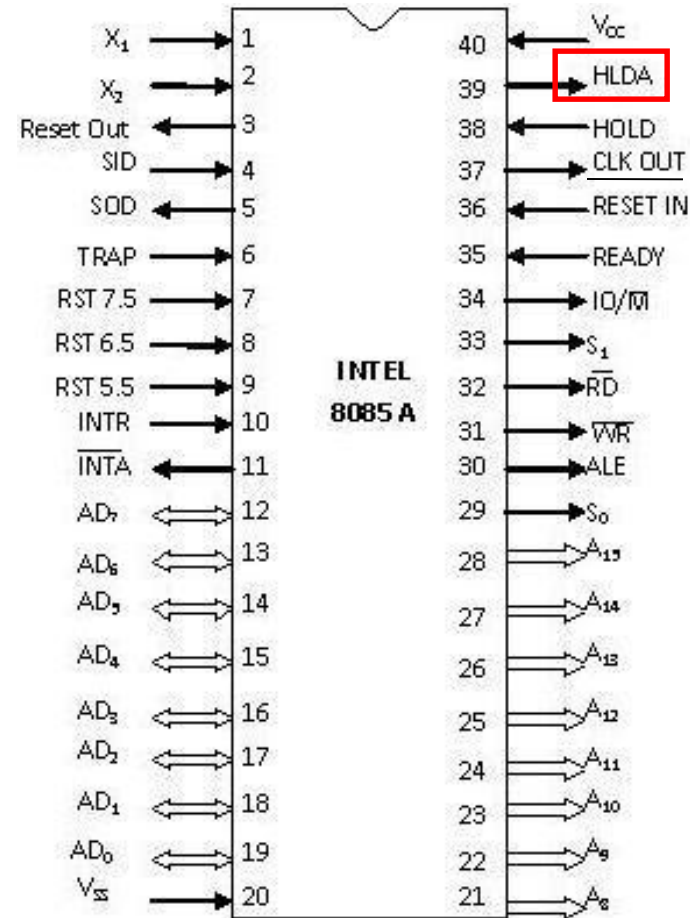
HOLD
Pin 38 (Input)

- HOLD pin is used to request the microprocessor for DMA transfer.

- A high signal on this pin is a request to microprocessor to relinquish the hold on buses.

- This request is sent by DMA controller.

- Intel 8257 and Intel 8237 are two DMA controllers.

|		INTEL 8085 A		
X_1	1		40	V_{CC}
X_2	2		39	HLDA
Reset Out	3		38	HOLD
SID	4		37	CLK OUT
SOD	5		36	RESET IN
TRAP	6		35	READY
RST 7.5	7		34	$IO/\overline{M}$
RST 6.5	8		33	S_1
RST 5.5	9		32	$\overline{RD}$
INTR	10		31	$\overline{WR}$
$\overline{INTA}$	11		30	ALE
AD_7	12		29	S_0
AD_6	13		28	A_{15}
AD_5	14		27	A_{14}
AD_4	15		26	A_{13}
AD_3	16		25	A_{12}
AD_2	17		24	A_{11}
AD_1	18		23	A_{10}
AD_0	19		22	A_9
V_{SS}	20		21	A_8

HLDA
Pin 39 (Output)

- HLDA stands for Hold Acknowledge.

- The microprocessor uses this pin to acknowledge the receipt of HOLD signal.

- When HLDA signal goes high, address bus, data bus, RD, WR, IO/M pins are *tri-stated*.

- This means they are cut-off from external environment.

HLDA
Pin 39 (Output)

- The control of these buses goes to DMA Controller.

- Control remains at DMA Controller until HOLD is held high.

- When HOLD goes low, HLDA also goes low and the microprocessor takes control of the buses.
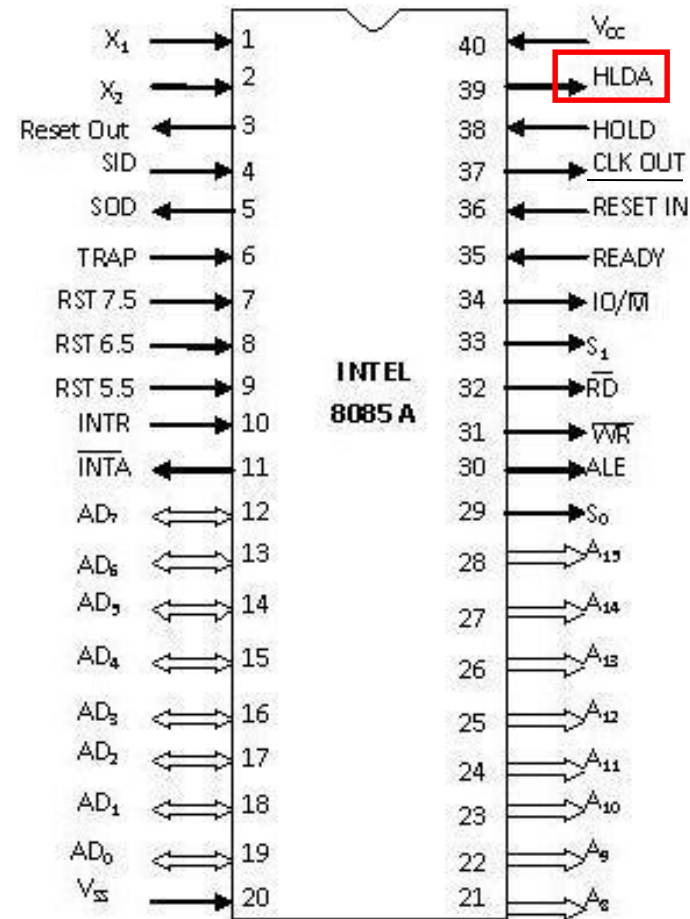
V_{SS} and V_{CC}
Pin 20 (Input) and Pin 40 (Input)

- +5V power supply is connected to V_{CC}.

- Ground signal is connected to V_{SS}.