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Assignment - 4

1. The various members of the 8051 family based on their ROM are:
   a) 8031 - No ROM
   b) 80xx - Mask ROM
   c) 87xx - EPROM
   d) 89xx - Flash EEPROM (Example: AT89C51, AT89LV51, AT89S51)

→ 8031: Intel 8031 and 80C31 are members of MCS-51 family of 8-bit microcontrollers. 8031/80C31 have the same integrated peripherals as 8051 MCUs - 4 I/O ports, two 16-bit timers/counters, on-chip oscillator and a serial port. The MCUs have 128 bytes of internal RAM, and, in addition to that, can utilize upto 64KB of external data memory. The microcontrollers don't have on-chip ROM and must use external program memory.

→ 8051: It has 128 bytes of RAM, 4KB of on-chip ROM, two 16 bit timers/counters, one serial port, six interrupt sources, 8-bit ALU and 4 ports of 8 bits each. It has a Havard Memory Architecture i.e., it has 16 bit Address bus (each of RAM and ROM) and 8-bit data bus.

→ 8052: This microcontroller has 256 bytes of RAM and 3 timers. In addition to the standard features of 8051, the microcontroller has an added 128 bytes of RAM and a timer. It has one serial port and 8 interrupt sources

→ 8751: This microcontroller is the UV-EPROM version of 8051. This chip has only 4K bytes of UV-EPROM. It's required to have access to the PROM burner and the UV-EPROM eraser to erase the contents of the chip before its programmed again.

→ AT89C51: Its an 8-bit microcontroller from the Atmel family. Its the flash ROM version of 8051. Its a 40pin IC package with 4KB flash memory. It has four ports and they altogether provide 32 programmable GPIO pins.

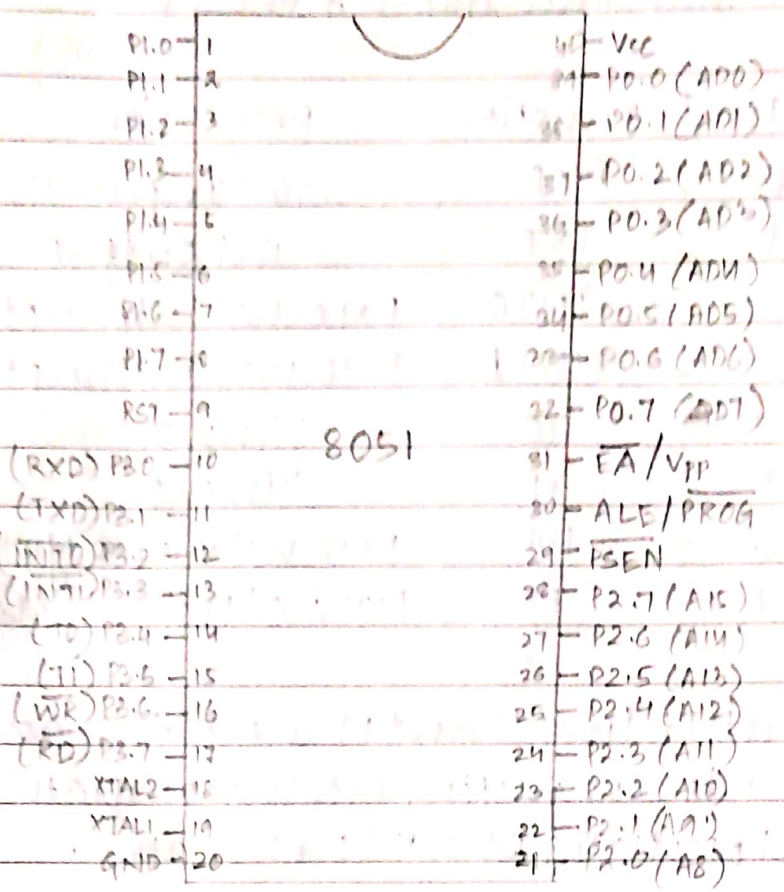
→ AT89S52 : Its an 8-bit CMOS microcontroller from 8051 family of Atmel microcontrollers. It has 8K flash memory and 256 bytes of RAM. It has 32 I/O pins comprising of three 16-bit timers, external interrupts, full-duplex serial port, on chip oscillator and clock circuitry.

The comparison chart of 8051 family members is as follows:

8051 family	ROM	RAM	Timer	Int source	IO pin	Other
8031	0K	128	2	6	32	-
8051	4K	128	2	6	32	-
8052	8K	256	3	8	32	-
8953	12K	256	3	9	32	WD
8955	20K	256	3	8	32	WD
898252	8K	256	3	9	32	ISP
891051	1K	64	1	3	16	AC
892051	2K	128	2	6	16	AC

WD: Watch Dog Timer
AC : Analog comparator
ISP : In System Programable

Ans:2.



Pin Diagram of 8051 microcontroller

The pin descriptions are as follows:

- Pins 1-8 (Port 1): Pins 1 to 8 are PORT 1 pins of 8051. Port 1 pins consists of 8-bit bidirectional input/output port with internal pull-up resistors.

- Pin 9 (RST): Pin 9 is the Reset input Pin. It's an active high pin i.e., if the RST pin is high for a minimum of two machine cycles, the microcontroller will be reset i.e., all pins are set to 0000, SP is set to 0007 and the RAM content becomes zero.

- Pins 10-17 (Port 3): Pins 10 to 17 form the PORT 3 pins of the 8051 microcontroller. Port 3 also acts as a bidirectional input/output port with internal pull-ups. Additionally,

the Port 3 has some special functions:

Port 3 Pin	Function	Description
P3.0	RXD	Serial Input
P3.1	TXD	Serial Output
P3.2	$\overline{INT0}$	External Interrupt 0
P3.3	$\overline{INT1}$	External Interrupt 1
P3.4	T0	Timer 0
P3.5	T1	Timer 1
P3.6	$\overline{WR}$	External memory write
P3.7	$\overline{RD}$	External memory read

- Pins 18 & 19: Pins 18 and 19 are XTAL2 and XTA1 i.e., the pins for connecting external oscillator using a quartz crystal oscillator or a TTL oscillator.

- Pin 20 (GND): Pin 20 is the ground Pin of 8051 microcontroller. It represents 0V and is connected to the negative terminal of the power supply.

- Pins 21-28 (Port 2): These are the port 2 pins of 8051. Its also a bidirectional port i.e., all the port 2 pins act as input or output. Additionally, when external memory is interfaced, Port 2 pins acts as the higher order address byte. Port 2 pins have internal pull-ups.

- Pin 29 ($\overline{PSEN}$): Pin 29 is the program store enable pin ($\overline{PSEN}$). It operates on active low signal. Using this pin, external program memory can be read. Its generally connected to the $\overline{OE}$ pin of the ROM.

- Pin 30 (ALE/$\overline{PROG}$) : Pin 30 is the Address Latch Enable Pin. It operates on active high pin. Using this pin, external address can be separated from data (as they are multiplexed by Port 0 of 8051). During Flash Programming, this pin acts as program pulse input ($\overline{PROG}$).

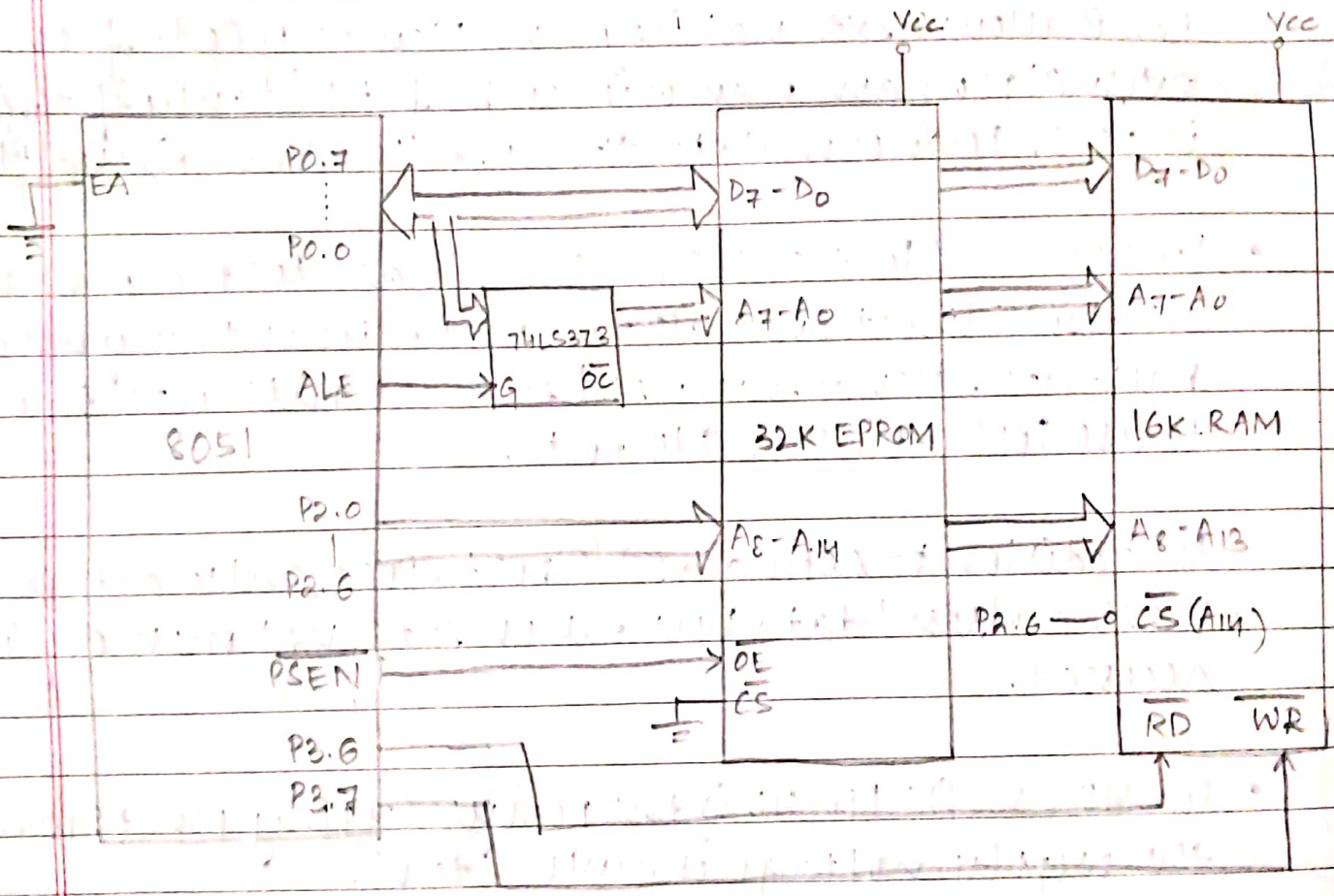
- Pin 31 ($\overline{EA}$/VPP) : Pin 31 is the External Access Enable Pin i.e., it allows external Program Memory. Code from the external program memory can be fetched only if this pin is LOW. For normal operations, this pin is pulled HIGH.

- Pins 32-39 (Port 0) : Pins 32-39 are Port 0 pins. They are also bidirectional I/O pins but without any internal pull-ups. Hence, we need external pull-ups in order to use Port 0 pins as I/O port.

  In addition to acting as I/O port, Port 0 also acts as lower order address/data bus when external memory is accessed.

- Pin 40 (Vcc) : Pin 40 is the power supply pin to which the supply voltage is given (+5V).

3. Given, EPROM = 32K i.e., $2^{10} \times 2^5 = 2^{15}$ = 15 address lines (A_0-A_{14})
RAM = 16K i.e., $2^{10} \times 2^4 = 2^{14}$ = 14 address lines (A_0-A_{13})
Port 0 is used as multiplexed data and address lines.
$\overline{WR}$ and $\overline{RD}$ of RAM are connected to P3.6 and P3.7 of 8051.
$\overline{PSEN}$ is connected to $\overline{OE}$ of the EPROM
$\overline{EA}$ is low to enable external EPROM and RAM



Memory interface circuit diagram for interfacing 32K EPROM and 16K RAM with 8051 microcontroller