

NOORUL ISLAM COLLEGE OF ENGINEERING, KUMARACOIL
DEPARTMENT OF COMPUTER APPLICATIONS

Third Semester

MC 1702 – MICRO PROCESSOR AND ITS APPLICATIONS

Short Answers

1. Define Microprocessor?

Microprocessor is a multipurpose, programmable, clock-driven, register based electronic device that reads binary instructions from a storage device called memory, accepts binary data as input and processes data according to those instructions, and provides as output.

2. What is Hardware and Software?

The physical components of the system i.e. computer are called Hardware. Group of programs is called software.

3. Why the microprocessor is viewed as a programmable Device?

Microprocessor is programmable because it can be instructed to perform given tasks within its capability. Microprocessor is designed to understand and execute many binary instructions.

4. What is Central processing Unit (CPU) ? And Write the use of it.

CPU is a heart of the computer. Central processing Unit controls the operation of the computer. In a microcomputer the CPU is a microprocessor. The CPU fetches binary coded instructions from memory, decodes the instructions into a series of simple actions and carries out these actions in a sequence of steps.

5. What is a chip?

A chip is also called an integrated circuit. Generally it is a small, thin piece of silicon onto which the transistors making up the microprocessor have been etched. A chip might be as large as an inch on a side and can contain tens of millions of transistors. Simpler processors might consist of a few thousand transistors etched onto a chip just a few millimeters square.

6. What is System Bus?

The System bus is a communication path between the microprocessor and peripherals. It is nothing but a group of wires to carry bits.

7. What is Address Bus?

The address bus consists of 16, 20, 24 or 32 parallel signal lines. On these lines the CPU sends out the address of the memory location that is to be written to or read from. The number of address lines determines the number of memory locations that the CPU can address. If the CPU has N address lines, then it can directly address 2^N memory locations. Simply, we can say that Address Bus is used to carry the address.

8. What is Data Bus?

The data bus consists of 8, 16, or 32 parallel signal lines. The data bus lines are bidirectional. This means that the CPU can read data in from memory or from a port on these lines, or it can send data out to memory or to a port on these lines. Simply we can say that data bus is used to carry the data.

9. What is Assembly Language?

A medium of communication with a computer in which programs are written in mnemonics. Binary instructions are given abbreviated names called mnemonics, which form the assembly language for a given processor.

10. What is Machine Language?

The binary medium of communication with a computer through a designed set of instructions specific to each computer.

11. What is Bit-Slice processor?

For some Applications , general purpose CPUs such as the 8080 and 6800 are not fast enough or do not have suitable instruction sets. For these applications ,several manufacturers produce devices which can be used to build the custom CPU. This family includes 4 bit ALUs, multiplexers, sequencers and other parts needed for custom building a CPU. The term slice comes from the fact that these parts can be connected in parallel to work with 8 bit words, 16-bit words, or 32 bit words.

12. What is microcontroller?

Microcontroller is a Device that includes microprocessor, memory and I/O signal lines on a single chip, fabricated using VLSI technology.

13. List the main applications of 8 bit microprocessors?

8 bit microprocessors is used in a variety of applications such as appliances, automobiles, industrial process and control applications.

14. Write the uses of microprocessors in Medical Instrumentation field?

Patient Monitoring in Intensive Care Unit, Pathological Analysis and the measurement of parameters like blood pressure and temperature.

15. Define Real Time Systems :

Real Time Systems are those in which timeliness is as important as the correctness of the outputs, although this does not mean that they have to be “fast systems”.

16. List the limitations of 8 bit microprocessor:

- Lower Execution Speed
- It can address less memory size
- Few instructions are available

17. What do you mean ‘ Data Width’?

Data Width is the width of the ALU. An 8 bit ALU can add / subtract/ multiply etc.. two 8 bit numbers . In many cases, the external data bus is the same width as the ALU, but not always. The 8088 had a 16 bit ALU and 8 bit bus , while the modern Pentiums fetch data 64 bits at a time for their 32 bit ALUs.

18. Draw and specify the complete bit configuration of 8085 flag Register?

D7	D6	D5	D4	D3	D2	D1	D0
S	Z		AC		P		CY

S- Sign Flag . If D7 =1 , then sign flag is set, otherwise rest.

Z-Zero flag. If ALU operation results in zero, then this flag is set, Otherwise it is reset.

AC-Auxilliary flag. In an arithmetic operation ,when a carry is generated by digit D3 and passed on to digit D4, the AC flag is set. Otherwise it is reset.

P-Parity Flag. If the result of an arithmetic or logic operation has an even number of 1’s then this flag is set. Otherwise it is reset.

CY-Carry Flag. If an arithmetic operation results in a carry, the carry flag is set. Otherwise it is reset.

19. List the four operations commonly performed by MPU(Micro processing Unit)?

- Memory Read : Reads data (or instructions) from memory.
- Memory Write: Writes Data (or instructions) into memory.
- I/O Read: Accepts data from input devices.

- I/O Write: Sends data to output devices.

20. Write about RST pins in 8085?

In 8085 ,three RST pins are available, such as RST 7.5 ,RST 6.5 , RST 5.5. RST represents Restart Interrupts. These are vectored interrupts that transfer the program control to specific memory locations. They have higher priorities than the INTR interrupt. Among these three, the priority order is 7.5,6.5,5.5.

21. List the control and status signals available in 8085.

ALE , \overline{RD} , \overline{WR} , IO/M, S1, S2

\overline{ALE} -Address Latch Enable

\overline{RD} – Read Control Signal

\overline{WR} – Write Control Signal

IO/M - To specify I/O or memory operation

S1 , S2 – Status signals

22. What are the limitations of 8085 MPU?

- The lower order address bus of the 8085 microprocessor is multiplexed (time shared) with the data bus. The buses need to be demultiplexed.
- Appropriate control signals need to be generated to interface memory and I/O with the 8085.

23. Compare the 8 bit microprocessors 8080A and 8085.

8080A is the predecessor of 8085. 8085 has the instruction set of 8080A plus some additional ones. Program written for 8080A will be executed by 8085. 8085 and 8080A are not pin compatible. Both require a +5V power supply.

24. Define Register Relative Addressing Mode.

Register Relative Addressing Mode : The Effective Address is Calculated by the sum of 8- or 16 bit displacement and the contents of a base Register or an index Register.

E.A. = content of(BX or BP or SI or DI) + (8 bit displacement (sign extended) or 16 bit displacement

Physical Address = E.A + (DS)*16₁₀

25. Define Immediate Addressing.

An 8 bit or 16 bit immediate data follows the instruction. For e.g MOV AX,5020H instruction transfers a word 5020H to the AX register .

26. Define Direct Addressing mode :

A 16 bit offset address of the data memory location is specified with reference to the DS segment starting address.

For.E.g MOV [1020H],5020H instruction transfers a word 5020H to the data memory location at 11020H if DS=1000H.

27. Define Relative based indexed addressing mode:

Relative Based Indexed Addressing Mode : Effective Address is calculated by the sum of 8- or 16 bit displacement and a based indexed address.

$$E.A. = (BX \text{ or } BP) + (SI \text{ or } DI) + (8 \text{ bit displacement (sign extended) or } 16 \text{ bit displacement})$$

$$\text{Physical Address} = E.A + (DS) * 16_{10}$$

28. List the branch related addressing mode:

- Intra segment Direct
- Intra segment Indirect
- Inter segment Direct
- Inter Segment Indirect

29. List the functions of Bus Interface Unit in 8086.

- Sends out addresses
- Fetches instructions from memory
- Reads data from ports and memory
- Writes data to port and memory

30. Write any two advantages of segment registers in 8086

- a. It allows the memory capacity to be 1MB even though the address associated with individual instructions are 16 bits wide.
- b. It allows the instruction, data, or stack portion of a program to be more than 64KB long by using more than one code, data, or stack segment

31. What is the use of Instruction pointer in 8086 ?

Instruction pointer holds the 16 bit address of the next code byte within the code segment. The value contained in the IP is called effective address or offset. It contains the distance from the base address to the next instruction byte to be fetched.

32. Write about the auxiliary carry flag used in 8086 ?

It is set if there is a carry out of bit 3 during an addition or a borrow by bit 3 during a subtraction. This flag is used exclusively for BCD arithmetic.

- 33.** When the Overflow flag is set ?
For addition of 16 bits, this flag is set when there is a carry into the MSB and no carry out of the MSB.
- 34.** Define Register addressing mode:
Datum is in the register that is specified by the instruction
E.g : MOV CX,AX (16 bit operand)
 MOV CL,AL (8 bit operand)
- 35.** Define Register Indirect Addressing mode:
Effective address of the datum is in the base register BX or an index register that is specified by the instruction.
- 36.** Define Register relative addressing mode:
The effective address is the sum of an 8- or 16 bit displacement and the contents of a base register or an index register.
- 37.** Define Based Indexed addressing mode:
The effective address is the sum of a base register and an index register , both of which are specified by the instruction. It is also called as Base related Indexed addressing.
- 38.** Define Intra segment direct addressing mode:
The effective branch address is the sum of an 8- or 16 bit displacement and the current contents of IP.
- 39.** Define Intra segment Indirect addressing mode:
The effective branch address is the contents of a register or memory location that is accessed using any of the data related addressing modes except the immediate mode. The contents of IP are replaced by the effective branch address.
- 40.** Define Inter segment addressing mode:
It replaces the contents of IP with part of the instruction and the contents of CS with another part of the instruction.
- 41.** Define Inter segment Indirect addressing mode:
It replaces the contents of IP and CS with the contents of two consecutive words in memory that are referenced by using any of the data related addressing modes except immediate and register modes.
- 42.** What is the use of PUSHF instruction used in 8086 ?
It pushes the flag register contents to the top of the stack. No flags are affected.
- 43.** Define XLAT instruction used in 8086.

It translates a byte in AL using a table in memory. The offset address is calculated by adding the 8 bit contents of the AL register and the contents of BX register. BX register contains the starting offset address of the Lookup table.

After execution, corresponding data memory contents of the lookup table are loaded into the AL register.

- 44.** What is the use of 'W' bit in opcode ?.

W bit in op-code : If an instruction in 8086 can operate on either a byte or a word, the op-code includes a W-bit which indicates whether a byte (W =0) or a word (W =1) is being accessed.

- 45.** What is DAS instruction ?

DAS : Decimal Adjust After Subtraction

This instruction converts the binary result of a SUB or SBB instruction in AL to Packed BCD format. It operates only on AL Register.

- 46.** What is Packed BCD Format?

Packed BCD Format: Packed BCD Numbers are stored in two digits to a byte, in 4 bit groups referred to as nibbles. ALU is capable of performing only binary addition and subtraction, but by adjusting the sum or difference the correct result in packed BCD format.

- 47.** What is the value of 'AX' after executing following instructions?

```
MOV AH,00
MOV AL,'7'
ADD AL,'3'
AAA
```

Ans : AX= 0100_H

- 48.** What is difference between DIV and IDIV instruction in 8086 ?

DIV : It operates only on unsigned number.

IDIV : It operates only on signed numbers.

- 49.** Write about the following instruction : MOV CS:[BX], DL

MOV CS:[BX],DL . It copies a byte from DL Register. Effective Address for the memory location is contained in the BX Register. Normally an effective address in BX will be added to the data segment base in DS to produce the physical memory address. In this instruction CS: indicates that we want the BIU to add the effective address to the code segment base in CS to produce the physical address.

content of(BX+(CS) * 16₁₀) = (DL)

- 50.** What is Programmed I/O ?

Programmed I/O : It consists of continually examining the status of an Interface and performing an I/O operation with the Interface when its status

indicates that it has data to be input or its data- out buffer register is ready to receive data from the CPU.

51. What is the use of Directives in 8086 ?

Directives in 8086 give directions to the assembler during the assembly process but are not translated into machine instruction.

52. What is AAS instruction in 8086 ?

AAS: Adjust Result of ASCII Subtraction

This instruction adjusts the binary result of SUB or SBB instruction.

53. What is Unpacked BCD Format?

Unpacked BCD Format: In Unpacked BCD, there is only one digit per byte and because of this, unpacked multiplication and division can be done. Binary operations act on single bytes and the results are adjusted. For Division, the adjustment is done before the binary division.

54. What is the value of AL after executing the following instructions.

MOV AL,35H

ADD AL,49H

DAA

Ans : AL= 84

55. Define Segment Override Prefix.

Segment Override Prefix : To permit exceptions to the Segment Register usage, a special one byte instruction called a segment override prefix is available . It is of the form :

X X X	X X	X X X
Mod	REG	R/M

56. Write the difference between CBW and CWD instruction in 8086.

CBW : Convert a byte to a word, sign extend AL Register into a AH Register.

CWD : Convert a word to a double word ,sign extend the AX Register into the DX Register.

57. Write about the following instruction : LES CX, [3483H]

Copy the contents of memory at the displacement of 3483H in DS to CL, contents of 3484H in DS to CH, and copy the contents of memory at displacement of 3485H and 3486H in DS to ES Register.

58. What is the use of D bit in opcode?

D bit: It is used in double operand instruction. It is used to indicate whether the register specified by REG is the source operand (D=0) or the destination operand (D=1).

59. What is the use of V bit in opcode ?

It is used by shift and rotate instructions to determine the number of shifts. V bit is set to 0 if the shift count is to be 1. V bit is set to 1 if the CL register contains the shift count.

60. Write the use of Z bit in opcode?

It is used by REP instruction. Z bit helps to control the loop. It will be repeated the number of items indicated by the CX register or until Z bit dose not match the Zero flag whichever occurs first.

61. How the execution time of an instruction is calculated?

Execution time of an instruction can be determined by multiplying the number of clock pulses needed to execute the instruction by the clock period.

62. Define EQU directive in 8086 assembly language?

It is used to assign a name to constants used in the programs. Consider the statement 'corr EQU 07H' , this would tell the assembler to insert the value 07H everytime that it finds the name corr in the program statement.

63. Write the use of Assume directive in 8086 assembly language using one example?

Assume CS: code_here, DS:data_here

It tells the assembler that the logical segment code_here contains the instruction statements for the program and should be treated as a code segment. It also tells the assembler that it should treat the logical segment data_here as the data segment for this program.

64. Define EXTRN directive in in 8086 assembly language?

The EXTRN directive is used to inform the assembler that the names or labels following the directive are in some other assembly module.

65. What is the use of TEST instruction in 8086?

Test instruction is the same as the AND instruction except that it does not put the result anywhere. Like the CMP instruction , it is used only to set the flags.

66. Define LAHF and SAHF instructions in 8086.

LAHF : Load the 8085 equivalent flags into the AH register.
SAHF: Store the AH register into the low order byte of the flag register.

67. While handling the interrupt instructions in 8086. What are the internal operations may be carried out by the stack?

- (i) $SP = SP - 2$, stack \leftarrow Push flag reg. Contents, $IF = 0$, $TF = 0$
- (ii) $SP = SP - 2$, Stack \leftarrow CS Reg. Contents, Address of Interrupt pointer = Interrupt type * 4, CS Register Contents \leftarrow Second word of Interrupt pointer
- (iii) $SP = SP - 2$, Stack \leftarrow IP, IP \leftarrow First word of Interrupt pointer

68. Write an ALP program in 8086 to add two 16 bit numbers.

```
MOV AX,1236H
MOV BX,8765H
ADD AX,BX
HLT
```

69. Write about EVEN directive in 8086 ALP.

It forces the address of the next byte to be even. 8086 words can be accessed in less time if they begin at even address.

70. Write about the following instruction :

Call WORD PTR [BX]

Offset of the first instruction of procedure is in two memory addresses in DS. It replaces the contents of IP with contents of word memory locations in DS pointed to by BX.

71. Write an ALP program in 8086 to subtract numbers.

```
MOV AX,1236H
MOV BX,8765H
SUB AX,BX
HLT
```

72. When the 8086 processor is in minimum mode?

The processor 8086 is in minimum mode when its $\overline{MN/MX}$ pin is strapped to +5 V

73. When the 8086 processor is in maximum mode?

The processor 8086 is in maximum mode when its $\overline{MN/MX}$ pin is grounded.

74. Define latch.

A bistable circuit that is set and reset by appropriate input signals.
An electronic circuit that records the status of a signal until it is reset.

75. Define clock pulse.

A synchronization signal provided by a clock. A periodic signal used for synchronization and for measuring intervals of time.

76. What is the use of s1 , s2 ,s3 signals when 8086 is in maximum mode?

It indicates the type of transfer to take place during the current bus cycle.

77. Define Machine cycle.

A group of states required for a basic bus operation is called a machine cycle.

78. Write any three differences between 8086 and 8088?

- a. 8086 – 20 address lines , 16 data lines
8088 – 20 address lines, 8 data lines
- b. (Maximum Mode) 8086 – M/\overline{IO}
8088 – IO/\overline{M}
- c. 8086 uses a maximum supply current of 360 mA
8088 uses a maximum supply of 340mA

79. Define Instruction cycle?

The total time takes the 8086 to fetch an instruction is called an instruction cycle. Instruction cycle consists of one or more machine cycles. Each machine cycle is made up of states.

80. What is polling?

In programmed I/O , testing of ready bits or signals is known as polling.

81. Define Interrupt I/O?

Interrupt is an event that causes the CPU to initiate a fixed sequence known as an interrupt sequence.

82. What do you mean by wait states in system bus timing?

Wait states are inserted between T3 and T4, when a memory or I/O interface is not able to quickly enough during a transfer.

83. What is block transfer?

To execute a sequence of instructions that causes a special system component associated with the interface to transfer a sequence of bytes or words to or from a predestinated block of memory locations. It is called a block transfer.

84. Define Baud Rate:

The data rate can be expressed as bits/sec or characters/sec . The term bits/sec is called baud rate.

85. What is Co-processor?

Most microprocessor has limited mathematical processing capability such as addition, subtraction, multiplication and division. They do not evaluate trigonometric, logarithmic and exponential functions. Therefore, specialized processors have been developed to solve this problem. These are called co-processor.

86. What are the main functions for interfacing a keyboard?

- Sense a key actuation
- Debounce the key
- Decode the key

87. Define the purpose of CRT controller

The CRT controller supports all the functions required for interfacing a CRT terminal to a microprocessor.

88. Define Raster Scan

The horizontal scans from upper left corner to bottom right corner is called raster scan.

89. What are the ways of interfacing the printer to a microcomputer?

- Direct microcomputer control
- Indirect microcomputer control using a special chip called the printer controller.

90. What are the different types of data can be written in input register of 8295?

- A command to be executed
- A character data to be stored in the character buffer for printing

91. What are the aspects includes in 80386?

- Memory organization and segmentation
- Registers
- Instruction format
- Addressing modes
- Features of interrupts and exceptions

92. Define Coprocessor

Coprocessor is a single chip built for performing scientific computations at high speed. This chip is a companion to the original or host processor.

93. List the major sections of the 8279 keyboard/display interface

- i) Keyboard section
- ii) Scan Section
- iii) Display section
- iv) CPU interface section

94. What is the need of Coprocessor?

The general-purpose processors such as 8086 or 8085 are not optimized to do arithmetic manipulations, CRT display manipulation and word processing. Hence we go for a coprocessor, which is capable of doing dedicated functions (Special Operations) to increase the overall execution speed of larger systems

95. How is Coprocessor connected to the main processor?

Coprocessor is connected in parallel with the main processor, and they operate on the same buses with the same instruction byte stream

96. What are non-programmable and programmable I/O ports?

Non-programmable I/O Port: It behaves as an input port if it has been designed and connected in input mode. Similarly a port connected in output mode acts as an output port. Example: INTEL 8212

Programmable I/O Port: It can be programmed to act either as an input port or output port. In both the cases the electrical connections remain same. Example: 8212

Programmable I/O Port: It can be programmed to act either as an input port or output port. In both the cases the electrical connections remain same. Example: INTEL 8255

97. Define memory-mapped I/O.

In this method, an I/O device is treated as a memory location. The microprocessor uses 16-bit address to identify an I/O device. Thus the memory map is shared between memory and I/O devices

98. What are the steps required to get data from keyboard?

- i) Detect a key press
- ii) Debounce the key press
- iii) Encode it

99. What is key bouncing?

Mechanical switches are used as keys in most of the keyboards. When a key is pressed the contacts bounce back and forth and settle down only after a small time delay (about 20 ms). Even though a key is actuated once, it will appear to have been actuated several times. This problem is called key bouncing

100. What is meant by keyboard debouncing?

Key bouncing may cause multiple entries made for the same key. To overcome this problem after a key press is sensed the device is made to wait for few milliseconds. Then the key is checked again to ensure it is still pressed. If it is still pressed it is taken as a valid key press. This process is called keyboard debouncing

Descriptive Answers (in detail)

1. **i) Explain the general features of microprocessors (Cost, Size etc..) ?**
ii) Compare the microprocessors in terms of Transistors used, clock speed, Data Width and MIPS.

(i) Features:

Cost :

The cost per function goes on decreasing with the increasing complexity of a chip. Volume of production is high. So, it is responsible for the availability of microprocessor chips at fairley low prices.

Size:

It is very small size. Because VLSI electronic circuitry has become so dense that a tiny silicon chip can contain hundreds of thousands of transistors constituting the microprocessors.

Power consumption:

Low power consumption. It is manufactured by metal-oxide semi conductor (MOS) technology.

Versatility:

Versatility of microprocessor results from its 'stored Program' mode of operation. A microprocessor based system can be configured for numerous applications by altering the software. It is very flexible.

Reliability:

Reliability is high due to lower chip count in the system as compared to its hardwired counter part.

- (ii) Compare the microprocessors in terms of Transistors used, clock speed, Data Width and MIPS.**

Chip :

A chip is also called an integrated circuit. Generally it is a small, thin piece of silicon onto which the transistors making up the microprocessor have been etched. A chip might be as large as an inch on a side and can contain tens of millions of transistors. Simpler processors might consist of a few thousand transistors etched onto a chip just a few millimeters square.

Date :

The date is the year that the processor was first introduced. Many processors are re introduced at higher clock speeds for many years after the original release Date.

Transistors :

Transistors is the number of transistors on the chip. We can see that the number of transistors on a single chip has risen steadily over the years.

Microns:

Microns is the width, in microns, of the smallest wire on the chip. For comparison, a human hair is 100 microns thick. As the feature size on the chip goes down, the number of transistors rises.

Clock Speed :

Clock speed is the maximum rate that the chip can be clocked at.

Data Width :

Data Width is the width of the ALU. An 8-bit ALU can add/subtract/multiply/etc. two 8bit numbers, while a 32-bit ALU can manipulate 32-bit numbers. An 8-bit ALU would have to execute four instructions to add two 32-bit numbers, while a 32-bit ALU can do it in one instruction. In many cases, the external data bus is the same width as the ALU, but not always. The 8088 had a 16-bit ALU and an 8-bit bus, while the modern Pentiums fetch data 64 bits at a time for their 32-bit ALUs.

MIPS :

MIPS stands for "millions of instructions per second" and is a rough measure of the performance of a CPU. Modern CPUs can do so many different things that MIPS ratings lose a lot of their meaning, but we can get a general sense of the relative power of the CPUs from this column.(from the table)

In general, there is a relationship between clock speed and MIPS. The maximum clock speed is a function of the manufacturing process and delays within the chip. There is also a relationship between the number of transistors and MIPS. For example, the 8088 clocked at 5 MHz but only executed at 0.33 MIPS (about one instruction per 15 clock cycles). Modern processors can often execute at a rate of two instructions per clock cycle. That improvement is directly related to the number of transistors on the chip.

Name	Date	Transistors	Microns	Clock Speed	Data Width	MIPS
8080	1974	6000	6	2 MHZ	8 bits	0.64
8088	1979	29,000	3	5 MHZ	16 bits, 8 bit bus	0.33
80286	1982	1,34000	1.5	6 MHZ	16 bits	1
80386	1985	275,000	1.5	16 MHZ	32 bits	5
80486	1989	1,200,000	1	25 MHZ	32 bits	20
Pentium	1993	3,100,000	0.8	60 MHZ	32 bits, 64 bit bus	100
Pentium II	1997	7,500,000	0.35	233 MHZ	32 bits, 64 bit bus	~300
Penium III	1999	9,500,000	0.25	450 MHZ	32 bits , 64 bit bus	~510
Pentium IV	2000	42,000,000	0.18	1.5 MHZ	32 bitx, 64 bit bus	~1,700

2. With a neat diagram, explain the architecture of 8085 microprocessor. Discuss the functions of various signals in 8085?

The 8085 is an 8-bit general-purpose microprocessor capable of addressing 64K of memory.

The diagram shows the logic pin out of the 8085 microprocessor. All the signals can be classified into six groups: (1) address bus, (2) data bus, (3) control and status signals, (4) power supply and frequency signals, (5) externally initiated signals, and (6) serial I/O ports

Address Bus

The 8085 has eight signal lines, AI5-A8, which are unidirectional and used as the high-order address bus.

Multiplexed Address/Data bus

The signal lines AD7-AD0 are bidirectional: they serve a dual purpose. They are used as the low-order address bus as well as the data bus. In executing an instruction, during the earlier part of the cycle, these lines are used as the low-order address bus. During the later part of the cycle, these lines are used as the data bus. (This is also known as multiplexing the bus.) However, the low-order address bus can be separated from these signals by using a latch.

Control and status signals

ALE-Address Latch Enable: This is a positive going pulse generated every time the 8085 begins an operation (machine cycle); it indicates that the bits on AD7-AD0 are address bits. This signal is used primarily to latch the low-order address from the multiplexed bus and generate a separate set of eight address lines,

A7-A0.

$\overline{\text{RD}}$ -Read: This is a Read control signal (active low). This signal indicates that the selected I/O or memory device is to be read and data are available on the data bus.

$\overline{\text{WR}}$ -Write: This is a Write control signal (active low). This signal indicates that the data on the data bus are to be written into a selected memory or I/O location.

$\overline{\text{IO/M}}$: This is a status signal used to differentiate between I/O and memory operations. When it is high, it indicates an I/O operation. when it is low, it indicates a memory operation. This signal is combined with RD (Read) and WR (Write) to generate I/O and memory control signals.

S_1 and S_0 : These status signals, similar to IO/M, can identify various operations.

Power supply and Clock Frequency :

V_{cc} : +5 V power supply.

V_{ss} : Ground Reference.

X1, X2: A crystal (or RC, LC network) is connected at these two pins. The frequency is internally divided by two; therefore, to operate a system at 3 MHz, the crystal should have a frequency of 6 MHz.

CLK (OUT)-Clock Output: This signal can be used as the system clock for other devices.

Externally Initiated Signals including Interrupts :

INTR (input) : Interrupt Request. It is used as a general purpose interrupt.

$\overline{\text{INTA}}$ (Output) : Interrupt Acknowledge It is used to acknowledge the interrupt.

RST 7.5 (Inputs) : Restart Interrupts. These are vectored interrupts that transfer the program control to specific memory locations. They have higher priorities than the INTR interrupt. Among these three, the priority order is 7.5,6.5,5.5.

TRAP (Input) : It is nonmaskable interrupt and has the highest priority.

HOLD(Input) : It indicates that a peripheral such as a DMA (Direct memory Access) controller is requesting the use of the address and data buses.

HLDA (Output) : Hold Acknowledge .It acknowledges the HOLD request.

READY(Input) : It is used to delay the microprocessor Read or write cycles until a slow responding peripheral is ready to send or accept data.

$\overline{\text{RESET IN}}$: When the signal on this pin goes low, the program counter is set to zero, the buses are tristated, and the MPU is reset.

RESET OUT: It indicates that the MPU is being reset.It can be used to reset other devices.

Serial I/O ports:

8085 has two signals for serial transmission : SID(Serial Input Port), SOD(Serial Output Port)

8085 Architecture

It includes the ALU (arithmetic /Logic Unit), Timing and Control Unit, Instruction Register and Decoder, Register Array, Interrupt Control, and Serial I/O Control.

ALU

The arithmetic and logic unit performs the computing functions; it includes the accumulator, the temporary register, the arithmetic and logic circuits, and five flags. The temporary register is used to hold data during an arithmetic and logic operation. The result is stored in the accumulator, and the flags are set or reset according to the result of the operation.

The flags are affected by the arithmetic and logic operations in the ALU.

The flags are :

D7	D6	D5	D4	D3	D2	D1	D0
S	Z		AC		P		CY

S- Sign Flag . If D7 =1 , then sign flag is set, otherwise rest.

Z-Zero flag. If ALU operation results in zero, then this flag is set, Otherwise it is reset.

AC-Auxilliary flag. In an arithmetic operation ,when a carry is generated by digit D3 and passed on to digit D4, the AC flag is set. Otherwise it is reset.

P-Parity Flag. If the result of an arithmetic or logic operation has an even number of 1's then this flag is set. Otherwise it is reset.

CY-Carry Flag. If an arithmetic operation results in a carry, the carry flag is set. Otherwise it is reset.

Among the five flags, the AC flag is used internally for BCD arithmetic; the instruction set does not include any conditional jump instructions based on the AC flag. Of the remaining four flags, the Z and CY flags are those most commonly used.

Timing and Control Unit

This unit synchronizes all the microprocessor operations with the clock and generates the control signals necessary for communication between the microprocessor and peripherals.The RD and WR signals are indicating the availability of data on the data bus.

Instruction Register and Decoder.

The instruction register and the decoder are part of the ALU. When an instruction is fetched from memory, it is loaded in the instruction register. The decoder decodes the instruction and establishes the sequence of events to follow. The instruction register is not programmable and cannot be accessed through any instruction.

Register Array:

Two additional registers, called temporary registers W and Z, are included in the register array. These registers are used to hold 8-bit data during the

execution of some instructions. However, because they are used internally, they are not available to the programmer.

3. Explain the Applications of microprocessors.

i. Microcomputers

The simplest and cheapest general purpose microprocessor -based systems are “single board microcomputers” with minimum possible hardware & software configuration.

(a) In universities and educational institutions they are used for imparting training to the students

(b) In industries, they are used for evaluation of the microprocessors or for building systems prototype systems.

ii. Liquid Crystal Display (LCD)

It is commonly used in system where low power consumption is necessary.

Examples: Watches, Calculators, Instrument panels and customer electronic displays.

LCD Display consists of crystal material is arranged in segments or in the form of a dot matrix. The crystal material can pass or block the light that passes through; thus it creates a display.

iii. Matrix Keyboard :

It is a commonly used input device when more than 8 keys are necessary. It reduces the number of interfacing devices are required. It requires 8 lines from the microprocessor to make all the connections instead of 16 lines, if the keys are connected in a linear format.

When a key is pressed, it shorts one row and column. Otherwise, the row and column do not have any connection. The interfacing of a matrix keyboard requires 2 ports. (i) Output port (ii) Input port.

In a matrix keyboard, the major task is to identify a key that is pressed and decode the key in terms of its binary value. This task is accomplished through either software or hardware.

iv. Domestic Appliances:

Microprocessors are also being incorporated with relatively simple domestic devices such as Ovens, Washing machines, Air conditioners, Television sets and Alarms. Microprocessor can be used in Automobiles.

v. Temperature Indicator and Controller

Microprocessors are used in typical process control applications. Microprocessor monitors a process temperature and display it on a 4 digit, seven segment display. The lower and upper limits of the temperature being monitored.

vi. Weight Cost System:

It is to provide a digital display of the weight and the price for an amount of goods. A pressure transducer is used to generate a voltage that corresponds to the weight of the goods being measured. This voltage is converted within the microprocessor into an 8421 BCD representation of the weight.

vii. Traffic Light Control:

Traffic Light Colors : Green, Yellow and Red

Microprocessors are used to give signal to traffic in traffic light controller.

viii. Instrumentation:

The processing power of the 8 bit microprocessor is more than adequate to satisfy the requirements of most of the instrumentation applications.

Frequency meters, function generators, frequency synthesizers, spectrum analyzers, and many other instruments are available, where microprocessors are used as controllers. Microprocessors are also used in Medical Instrumentation. E.g. Patient Monitoring in Intensive Care Unit, Pathological Analysis and the measurement of parameters like blood pressure and temperature.

ix. Communication :

In the telephone Industry, microprocessors are used in digital telephone sets, telephone exchanges and modems.

Microprocessor is used in Radio, Television and satellite communication.

Microprocessors are making possible implementation of LAN and WAN for communication of varied information through computer network.

x. Robots:

It is a Numeric controlled machine. Robots are used in the Motor Car and domestic appliance industries.

Descriptive answers in short

4. Explain in detail about the pins and signals of 8085

- Draw the pin diagram
- Explain each signal in detail

5. Explain the instructions in detail about the data transfer instructions

Explain about MOV, LDA, LHL, LXI, LDAX, STA, STAX, XCHG instructions with example

6. Explain in detail about arithmetic instructions

Explain about ADD, ADI, SUB, SUI, SBB, SBI, DAD, DAA, INR, INX, DCR, DCX with example

7. Explain in detail about 8085 instruction timing and execution
 - Draw basic timing diagram
 - Explain opcode fetch, memory read and memory write cycles with timing Diagram

8. Explain the architecture of 8086 microprocessor
 - Features of 8086
 - Draw the architecture
 - Explanation

9. Explain the minimum mode operation of 8086 in detail.
 - When 8086 is in minimum mode
 - Pin definitions for the minimum mode
 - Diagrams used for minimum mode system
 - Explanations
 - Timing diagram

10. What do you mean by Addressing Mode ? What are the different addressing modes supported by 8086 ? Explain each of them with suitable examples.
 - Definition
 - Data Related Addressing modes with examples
 - Immediate
 - Direct
 - Register
 - Register Indirect
 - Register Relative
 - Based Indexed
 - Relative Based Indexed
 - Branch Related Addressing modes
 - Intra segment Direct
 - Intra segment Indirect
 - Inter segment Direct
 - Inter Segment Indirect

11. Explain the maximum mode operation of 8086 in detail.
 - When 8086 is in maximum mode
 - Pin definitions for the maximum mode
 - Diagrams used for maximum mode system
 - Explanations
 - Timing diagram

12. i) Write about instruction formats in 8086 ?
 ii) Explain the special bit indicators in op-code
 (iii) What do you mean by 'Mod' value in Addressing mode byte ?
 Give explanation with examples.

Ans :

- (i) Instruction formats
 One byte to six byte instructions

- (ii) Explain the special bit indicators in op-code :
 S-bit, W-bit, D-bit, V-bit, Z-bit

- (iii) About mod in addressing mode byte with examples

13. i) Write an ALP Program in 8086 to add the 'N' elements of an array.
 (ii) Write an ALP program in 8086 to find the biggest number of given elements.

Ans :

- (i) Addition of 'N' elements of an array :

```
MOV AX,00H
MOV CX, 05H
MOV SI,2000H
L1:  ADD AX, [SI]
     INC SI
     LOOP L1
     MOV [4000],AX
     HLT
```

- (ii) Finding the biggest number

```
MOV CX,05H
MOV SI, 2000H
MOV AX,00H
NEXT: CMP AX,[SI]
      JNB L1
      MOV AX,[SI]
L1:   INC SI
      LOOP NEXT
      MOV [4000],AX
      HLT
```

14. Explain how 8086 interfaces with Static Memories and Dynamic memories.

- Diagram of 8086 memory array
- ROM and EPROM
- Static RAMs
- Dynamic RAM
- Diagram of how ROM/EPROM interfaces with 8086
- 8086 Programmed I/O

15. Describe the procedure of interfacing static memories with 8086. Interface 2K x 16 EPROMS and 1K x 16RAM chips with 8086. Select suitable maps.
- Two 2716 EPROM, 2142 static RAM, 8255A I/O chips will be used for this purpose.
 - Diagram shows the interface
 - Memory map
16. Draw and discuss about the internal architecture and signals of the Keyboard/Display Controller 8279.
- Architecture of 8257 & explanations
 - Modes of operation of 8279
 - Signals and descriptions
17. Write about 80386 microprocessor.
- Salient Features
 - Signal descriptions of 80386
 - Internal architecture of 80386 & explanations
 - Register organization of 80386
 - Addressing modes
18. Draw and discuss the architecture of Pentium with the important features.
- Salient Features of Pentium
 - Pin configuration of Pentium
 - Architecture of Pentium
 - Super scalar organization of Pentium
19. Explain in detail about the operating modes of 80386
- i. Explain about real mode
 - ii. Explain about protected mode
 - iii. Explain about Virtual mode
20. Explain in detail about the pins and signals of 80386.
Explain all the pins supported by 80386
21. Explain in detail about the memory organization of 80386
- Draw the diagram for Address translation Mechanism
 - Explain the address translation scheme
22. Explain in detail about keyboard and display interface
- Explain the functions performed during interface
 - Explain the basics of Keyboard display interface

23. Explain how the keyboard/display is interfaced with 8085
 - Draw the diagram for keyboard/display interface
 - Explain the working of interface

24. Explain in detail about printer interface and 8295 controller chip
 - Explain the classification of printers
 - Explain the character generation mechanism
 - Explain about serial and parallel interface for 8295

25. Explain in detail about CRT controller and graphics controller chip
 - Explain CRT fundamentals
 - Explain 8275 CRT controller with diagram

26. Explain in detail about the coprocessor
 - Define Co processor, need of co processor
 - Explain the coprocessors 8087,80287,80387