Microprocessor

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Tag	

Questions

13th Batch Questions

1. a) Show the comparison between Microprocessor and Microcomputer.

Aspect	Microprocessor	Microcomputer
Definition	An integrated circuit that contains the CPU and performs data processing and instruction execution.	A complete computer system that includes a microprocessor, memory, input/output devices, and storage.
Function	Processes data and executes instructions; primarily acts as the CPU of a system.	Performs full computing tasks, including data processing, storage, input/output operations, and running applications.
Components	Includes an ALU, control unit, and registers.	Includes a microprocessor, memory (RAM, ROM), storage devices, input/output devices, and peripherals.
Size	Small and typically integrated as a single chip.	Varies in size: can be a desktop PC, laptop, tablet, or even a smartphone.
Usage	Used in electronic devices to provide processing capabilities, such as embedded systems and appliances.	Used by individuals and organizations for general-purpose tasks like gaming, web browsing, and software execution.
Examples	Intel Pentium, AMD Ryzen, ARM Cortex.	PCs, laptops, tablets, smartphones.

b) Write the names of 8-bit, 16-bit and 32-bit µPs.

8-bit Microprocessors: Intel 8080, Intel 8085, Zilog Z80, Motorola 6800, MOS Technology 6502, Intel 8051, TMS9900, Signetics 2650

16-bit Microprocessors: Intel 8086, Intel 8088, Intel 80186, Intel 80286, Motorola 68000, Zilog Z8000,

32-bit Microprocessors: Intel 80386, Intel 80486, Intel 80586, Motorola 68020, ARMv7, SPARC, MIPS R3000, AMD Am386, PowerPC 601

c) Describe briefly the main functional components of µP.

- **CPU (Central Processing Unit)**:
  - Executes instructions and performs arithmetic, logical, and control operations.
  - Key parts:
    - **Instruction Register (IR)**: Holds the instruction being executed.
    - **Decoder**: Decodes the instruction into machine-level language.

        - **Arithmetic Logic Unit (ALU)**: Performs arithmetic (e.g., add, subtract) and logical operations (e.g., AND, OR).
        - **Control Unit (CU)**: Supervises instruction execution and coordinates actions between system components.
        - **Registers**: High-speed storage locations for intermediate results (e.g., Program Counter, Memory Address Register).
    - **Bus**:
        - Facilitates communication between components:
            - **Data Bus**: Transfers data; bidirectional.
            - **Address Bus**: Transfers memory or I/O addresses; unidirectional.
            - **Control Bus**: Transfers control signals like clock or interrupt; bidirectional.
    - **Memory**:
        - **RAM (Random Access Memory)**: Volatile memory used for temporary data storage during program execution.
        - **ROM (Read Only Memory)**: Non-volatile memory preloaded with essential data like boot instructions.

2. a) Distinguish between 80386 and 80486 µPs.

MP	Pin	Address	Data	ALU/ Register	Comments
8085	40	16	8	8	
8088	40	16	8	16	1 MB address
8086	40	20	16	16	
80186	68	20	16	16	2x faster than 8086
80286	68	24	16	16	16MB address, 2^30 VM
80386	132	32	32	32	4GB address. 64TB VM
80486	168	32	32	32	Cache Memory, 4GB MMU
80586	273	32	64	32	read mode and virtual mode

   b) Draw interfacing circuits between µP and memory for READ and WRITE operations and explain.

   c) Distinguish between logical address and physical address. How can you calculate PA from LA? Calculate the Physical Addresses of the following segments and offsets:

   i). [CS]=50A0H and [IP]=2B8AH;

ii). [DS]=BCDEH and [SI]=1200H.

Parameters	LOGICAL ADDRESS	PHYSICAL ADDRESS
Basic	generated by CPU	location in a memory unit
Address Space	Logical Address Space is set of all logical addresses generated by CPU in reference to a program.	Physical Address is set of all physical addresses mapped to the corresponding logical addresses.
Visibility	User can view the logical address of a program.	User can never view physical address of program.
Generation	generated by the CPU	Computed by MMU
Access	The user can use the logical address to access the physical address.	The user can indirectly access physical address but not directly.

(i) $PA = [CS] \times 10H + [PI] = 5358AH$

(ii) $PA = [DS] \times 10H + 1200 = BDFE0H$

3. a) Compare between sequential and pipelined processing.

Aspect	**Sequential Processing**	**Pipelined Processing**
Execution Flow	Tasks are executed one after another, in a linear order.	Tasks are divided into stages, with stages executing concurrently.
Speed	Slower.	Faster due to overlap.
Resource Utilization	Underutilizes resources.	More efficient use of resources.
Dependency	Simple.	Complex, requires hazard handling.
Latency	Higher for individual tasks.	Lower system latency.
Complexity	Simple to design.	More complex, requires coordination.
Scalability	Limited.	Better scalability.
Examples	Single-threaded programs.	Modern CPUs, assembly lines.

[**Latency** refers to the delay or time it takes for a system to respond to a request or complete a task.]

b) Draw the basic microprocessor architecture.

c) Write the application for special purpose microprocessor.

A special purpose microprocessor is designed to perform a specific task or set of tasks.

1. Parallel Computing: Transputer
2. Graphics, Complex Arithmetic, Single Processing: Corprocessor
3. Audio and Video Processing : Digital Signal Processor
4. Graphic rendering: Graphic Processing Unit(GPU)

5. Network Device: Network Processor
6. Control and manage I/O : I/O Processor (IOP)

d) Briefly discuss about the registers for 8085 microprocessors.

Total 10 registers including six GPRs.

- **Accumulator:** The accumulator is the 8 bit primary register used in arithmetic and logical operations. Most instructions involve the accumulator either as a source or destination for data.
- **GPR**: These are 6 **8-bit registers** (B, C, D, E, H, L) used to hold temporary data and copy data during operations. These registers can also be paired to form **16-bit registers**:
  - **BC** (B and C combined): 16-bit register.
  - **DE** (D and E combined): 16-bit register.
  - **HL** (H and L combined): 16-bit register.
- **Program Counter:** The program counter (16 bits) stores the memory address of the next instruction to be executed. It automatically increments after each instruction, pointing to the next instruction in the program.
- **Stack Pointer:** The stack pointer (16 bits) points to the top of the stack, a memory area used for storing temporary data, return addresses, and saving registers during function calls and interrupts.
- **Flag Register:** It is a 8-bit register having 5 flip flops which holds either 0 or 1 depending upon the result stored in the accumulator. It represents specific conditions of microprocessor.

  Flag conditions : Will be set when

  i. Sign flag (S) : result of the operation is negative
  ii. Zero flag (Z) : result .. 0
  iii. Parity Flag(P) : number of one's in result is even
  iv. Carry Flag (CY) : carry out from the MSB when addition or borrow into the MSB when subtraction
  v. Overflow flag: result of signed operation is too large
  vi. Auxiliary Carry Flag (AC): used internally to perform binary to BCD conversation

4. a) A single transistor acts like an on-off switch but a number of transistors may build a microprocessor. Which change actually happen inside it - discuss your opinion.

   b) What are the advantages of transistor over vacuum tube?

   c) Discuss about the evolution of microprocessor through IC technology.

   1. First Generation: invented by Intel in 1971, named Intel 4004, 4-bit microprocessor
   2. Second Generation: developed by Intel in 1973, named 8008, 8-bit microprocessor
   3. Third Generation: Introduced in 1978 by Intel, 16 bit, Intel 80286
   4. Fourth Generation: 1985, 32 bit, 80386 or i383

5. Fifth Generation: 1995, 64 bit, high speed and performance, Intel dual, quad, octa-core microprocessors

d) Write the features of Intel 4004.

- World's first commercially available microprocessor, invented by Intel in 1971
- 4 bit microprocessor, it processes data in 4 bit chunks
- Clock Speed: 740KHz
- 16 pins
- Instruction set : addition, subtraction and logical, branching and looping
- Address bus and data bus: 12 bit, 4KB memory, 4-bit data bus
- Registers: 16 GPR (each 4 bit), 1 PC, 1 SP, 1 Accumulator
- Support 64 I/O Devices
- Instruction cycle: 12 cycles/instruction

5. a) Calculate the values of registers before execution and after execution:

i). `MOV AX,BX;` where [AX]=3A50H, [BX]=420BH

ii). `ADD CX,DX;` where [CX]=B950H, [DX]=320BH

iii). `NEG AX;` [AX]=9A5CH

b) If [AX]=1027H, [BX]=5A27H and [CX]=54A5H. Find the values of:

i). `XOR AX,CX;`

ii). `NOT AX`

iii). `OR AX,BX.`

c) Find out the legal and illegal instructions with comments from the following instructions:

i). `MOV AX,2A9BH;`

Legal

ii). `MOV CL,DX;`

Illegal, Comments : Source and destination should be same size.

MOV CL, DL;

iii). `MOV DS,SS;`

Illegal. Comments : Direct segment to segment movement is not possible

iv). `MOV B1,B2.`

Illegal. Comment : Direct Memory to memory data transfer is not possible.

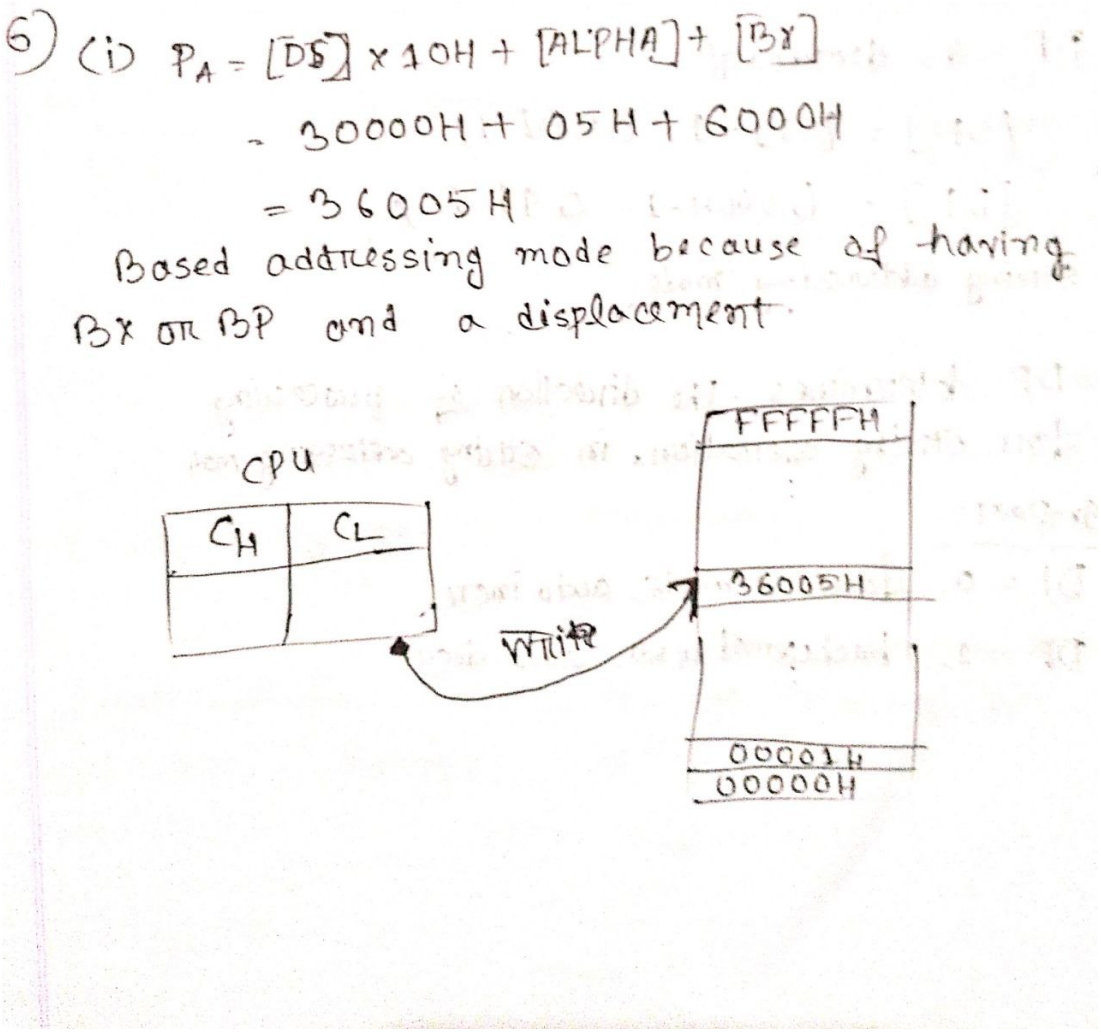
6. a) Determine the effects of following 8086 instructions:

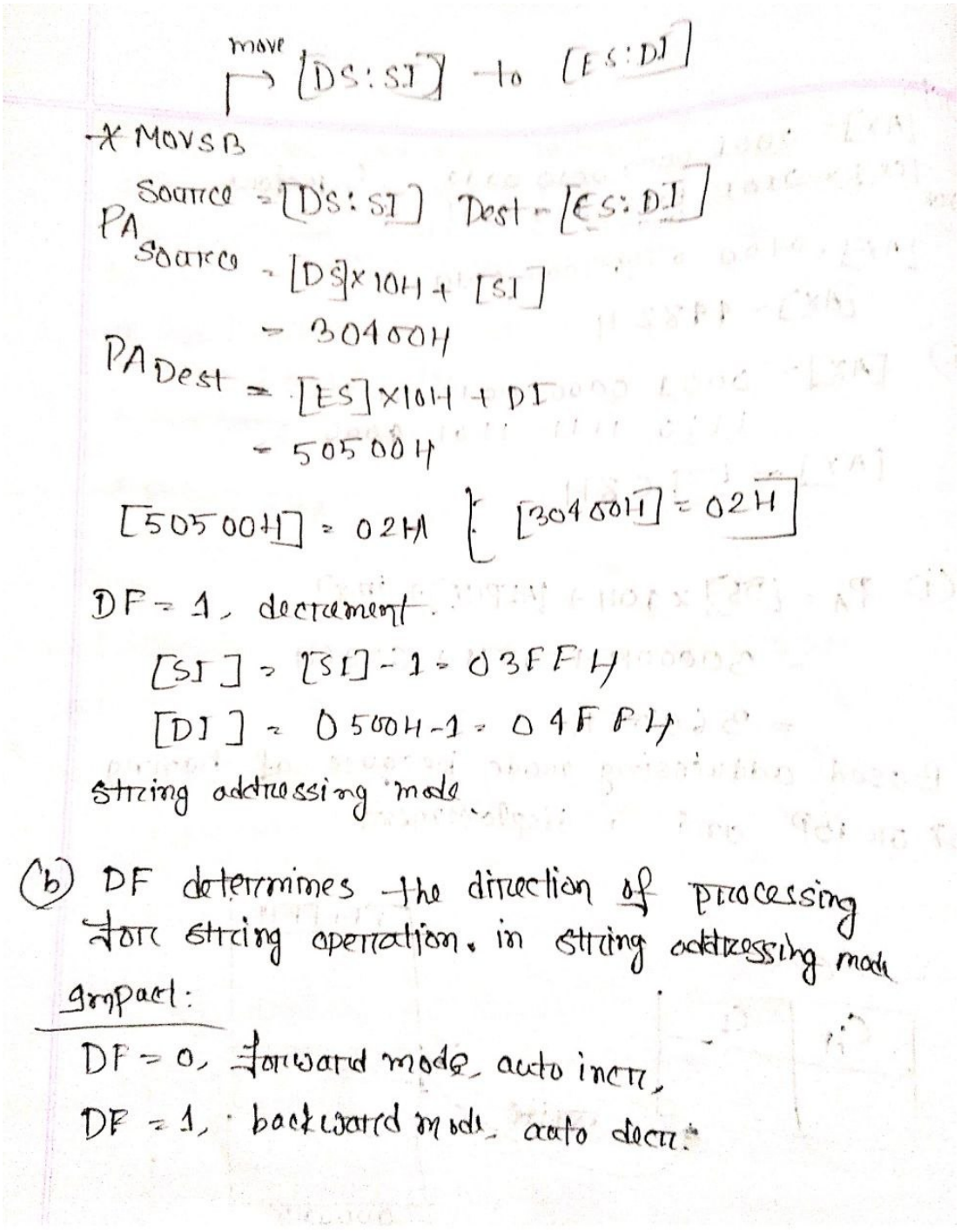
i). `MOV ALPHA[BX],CL;`

ii). `MOVSB.`

Assume the following data prior to execution of each one of the above instructions:

[SI]=0400H, [DI]=0500H, [DF]=1, [BX]=6000H, [DS]=3000H, [ES]=5000H, [30400H]=02H, [5000H]=05H, [ALPHA]=05H. Justify the above instructions with the name of addressing modes and memory interfacing figures.





b) Write the impacts of control flag DF values in string addressing mode.

The Direction Flag (DF) in the 8086 microprocessor determines the direction of processing for string operations in string addressing mode.

DF Value	Effect on String Operations	Operation Mode
DF = 0	- **Auto-Increment Mode**: The `SI` and `DI` registers are **incremented** after each string operation. - Processing moves **forward**, from lower memory addresses to higher memory addresses.	**Forward Mode**

DF Value	Effect on String Operations	Operation Mode
DF = 1	- **Auto-Decrement Mode**: The `SI` and `DI` registers are **decremented** after each string operation. - Processing moves **backward**, from higher memory addresses to lower memory addresses.	**Backward Mode**

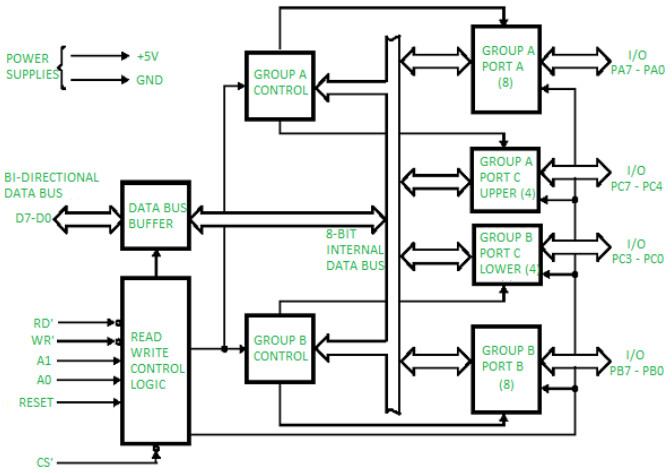
7. a) Distinguish between Microprocessor and Micro Controller. Write the features of Micro Controller.

Aspect	Microprocessor	Microcontroller
Definition	CPU only, external components required.	CPU, memory, and peripherals integrated.
Application	General-purpose systems (PCs, laptops).	Embedded systems (IoT, appliances).
Cost	Higher due to external components.	Lower, single-chip design.
Power	Higher power consumption.	Lower power consumption.
Processing	High, for complex multitasking.	Moderate, task-specific optimization.
Examples	Intel 8086, AMD Ryzen.	8051, ARM Cortex-M.

Features of a Microcontroller

1. **Integrated Components**: Combines CPU, RAM, ROM, I/O ports, and peripherals on a single chip.
2. **Low Power Consumption**: Optimized for low power usage, making it suitable for battery-operated devices.
3. **Small Size**: Compact design ideal for embedded systems with space constraints.
4. **Cost-Effective**: Lower cost due to integration of multiple components on one chip.
5. **Real-time Operation**: Suitable for real-time applications like automation and control systems.
6. **Multiple I/O Ports**: Includes input/output ports for interfacing with sensors, actuators, and other devices.
7. **Timers and Counters**: Built-in timers for generating delays, counting events, or controlling time-sensitive tasks.

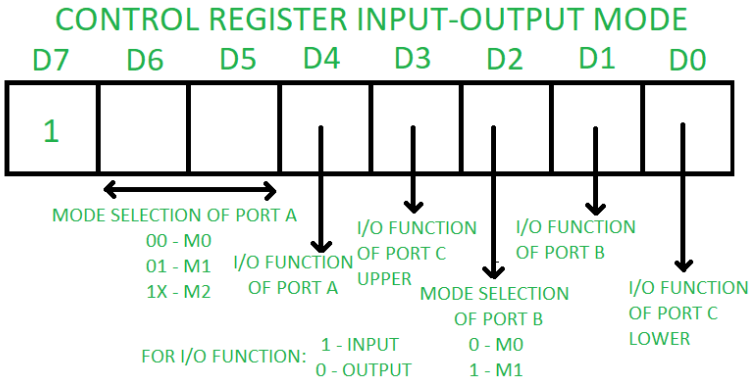
b) Draw the block diagram of 8255 I/O Controller.



CS'	A1	A0	Selection
0	0	0	PORT A
0	0	1	PORT B
0	1	0	PORT C
0	1	1	Control Register Word

c) Draw Interface Circuits to read from I/P DIPs and display at O/P LEDs for Mode 0 operation of 8255 I/O Controller and also write the Interface Program.

Extra:



8. a) Write the functions of HOLD, HLDA, DREQ and DACK handshaking signals.

   b) Draw the block diagram and explain how a DMA Controller operates in Micro Computer system.

   c) How to initialize the 8254 for binary 16-bit counter 1 in Mode 2? Write instructions to generate a 2 KHz Square Wave Signal from binary 16-bit counter 2.

9. Write any two short notes:

i). 8259
The
8259 is a **Programmable Interrupt Controller (PIC)** used to manage multiple interrupt requests in microprocessor systems.

ii). Addressing Modes

iii). 8051 microcontroller

The **8051 microcontroller** is an 8-bit microcontroller widely used in embedded systems due to its simplicity and versatility.

1. **Architecture**: 8-bit processor with Harvard architecture
2. **Memory**:
   - 4 KB ROM (program memory).
   - 128 bytes of RAM (data memory).
3. **I/O Ports**: Four 8-bit parallel ports (P0 to P3).
4. **Timers**: Two 16-bit timers/counters.
5. **Interrupts**: 5 interrupt sources with priority levels.
6. **Communication**: Serial communication via UART.

Applications: Used in IoT, automation, robotics, and consumer electronics.

14th Batch

1.a)

1. Distinguish between microprocessor and microcontroller. Write down the names of four computer peripheral interfacing devices.

Aspect	Microprocessor	Microcontroller
Definition	CPU only, external components required.	CPU, memory, and peripherals integrated.
Application	General-purpose systems (PCs, laptops).	Embedded systems (IoT, appliances).
Cost	Higher due to external components.	Lower, single-chip design.
Power	Higher power consumption.	Lower power consumption.
Processing	High, for complex multitasking.	Moderate, task-specific optimization.
Examples	Intel 8086, AMD Ryzen.	8051, ARM Cortex-M.

- **8255** - Programmable Peripheral Interface (PPI)
- **8257** - Direct Memory Access (DMA) Controller
- **8251** - USART (Universal Synchronous/Asynchronous Receiver Transmitter)
- **8259** - Programmable Interrupt Controller (PIC)

2. Show the comparison between LA and PA with examples. How can PA be calculated? The contents of several segment registers and offsets are shown below:
   - $[CS] = 57ABH, [DS] = 2C5CH,$

$[SS] = 5D5AH, [DI] = 168H, [SP] = 152AH$
and
$[IP] = 25ABH$

Calculate the corresponding PAs for the segment registers CS, DS, and SS.

3. Find out the legal and illegal instructions with comments from the following instructions:
   - i) MOV AX,CL;

     Legal.
   - ii) MOV ECX,EDX;

     Legal.
   - iii) MOV AL,BX;

     Illegal. Comments: Size of destination is smaller than source.
   - iv) MOV A1,A2;

     Illegal. Direct transferring of memory address or variable is illegal.
   - v) MOV SI,DI;

     Legal.
   - vi) MOV SS,ES

     Illegal. Segment to segment is illegal.

2.a)

1. How many address lines are necessary on the chip of 16KB memory?

   16KB = 2^4 ∗ 2 ^ 10 = 2 ^ 14 . 14 address lines
2. The memory address of the last location of 8KB memory chip is given FFFFH. Specify the starting address.
3. Design 2Kx8 memory chip with NAND gate; chip selects using the range of memory addresses from D800H to DFFFFH.

b)

1. Design 32Kx16 RAM. Show the interfacing diagrams of READ and WRITE operations with microprocessor.
2. If \[AX\]=A34FH, \[BX\]=596BH, and \[CX\]=708DH. Find out the values of the following logical operations:
   - i) XOR AX,BX;
   - ii) NOT CX

3.a)

1. Explain the demultiplexing AD0-AD15 of 8086 with ALE, latch and interfacing diagram.

2. Design 8Kx16 RAM. Show the interfacing diagrams of READ and WRITE operations with microprocessor.

b)

1. Design a simple NAND gate Decoder logic circuit and also find out the starting and ending addresses AB000H and ABFFFFH respectively in 8086 µP.

4.a)

1. Illustrate all condition flags of 8086.
2. Explain the instructions with bit size and operations:
   - i) MOV CL,74;
   - ii) IN AL,P4 and
   - iii) OUT DX,AX.
3. Draw and describe the memory or I/O interfacing figures of the READ and WRITE instructions:
   - i) MOV AL,5AH;
   - ii) MOV \[5000H\],BL;
   - iii) IN AL,DX and
   - iv) OUT P8,AL

5.a) How can you calculate the physical addressing from the logical addresses?

Logical Address : Segment : Offset
Physical Address : Segment*10 + Offset

b)

1. Determine the addressing modes for the following instructions:
   - i) MOV AX,SI;
   - ii) MOV AX, DS:START;
   - iii) MOV \[SI\],AL;
   - iv) MOV SI, BYTEPTR \[BP+2\]\[DI\].

c)

1. Calculate the logical address and the physical address for the following:
   - i) MOV AL,ES:START\[BX\];
   - ii) MOV AX,START\[SI\]\[BX\];

   Where, \[DS\]=5004H, \[ES\]=3000H, \[SS\]=6000H, \[SI\]=0020H, \[BX\]=2000H, \[BP\]=0040H, START=02H.

6.a)

1. Write down the several steps to run a program in assembly language. Explain the difference between byte variable and word variable.
2. How can a DMA control over the bus from the CPU?
3. Define cache memory and discuss the types of cache memories in a microprocessor.

7.a)

1. Mention the names of all embedded components of microcontroller unit Intel MCS-51.
2. Summarize the operations of MCS-51 with block diagram.
3. Illustrate the functions of different Operational Modes of 8255 I/O Controller.

b)

1. Design NAND gate chip select logic circuits with IC255; when I/O addresses of port A, port B, port C and CRW are 78H, 79H, 7AH, and 7BH respectively?
2. Draw the calculation table.

8.a)

1. If the contents of CRW of 8255 is 8AH, write down the different bit status of CRW.

b)

1. Draw Interface Circuits to read from I/P DIPs and display at O/P LEDs for Mode 0 operation of 8255 I/O Controller.

c)

1. Write down the functions of programmable interrupt controller 8259.

9.a)

1. Write an assembly language program to display the characters that are to be input before pressing the enter key.

b)

1. Explain the function of PUSH and POP instructions with examples.

c)

1. Discuss the controller word for B C55 interfacing component.

15th Batch

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1. a) Distinguish between Microprocessor and Microcomputer.

   b) Write the characteristics of 8086, 80386, and 80586 µPs.

   c) Describe briefly the main functional components of µP.

2. a) What is the meaning of the following program status word?

S	Z	AC	P	CY
1	0	1	0	1

b) How can you address a structure in a memory using appropriate addressing mode? Explain with example.

c) Explain the 8086 addressing modes for addressing immediate and register data.

d) What is Interrupt Service Routine (ISR)? How does interrupt differ from polling?

3. a) How many address lines are necessary on the chip of 64KB memory?

b) The memory address of the last location of a 4KB memory chip is given as AFFFH. Specify the starting address.

c) Design a 32K x 8 memory chip with NAND gate chip select using the range of memory addresses from A800H to AFFFH.

d) Design a 32KB x 16 RAM. Show the interfacing diagram of READ and WRITE operations with a microprocessor.

e) [AX]=A95BH and [CX]=43B8H. Find out the values of the following logical operations:

- i) XOR AX, CX

- ii) NOT AX.

4. a) How can you calculate the physical addressing from the logical addresses?

b) Determine the addressing modes for the following instructions:

- i) MOV CH, 8
- ii) MOV AX, DS:START
- iii) MOV [SI], AL
- iv) MOV SI, BYTEPTR [BP+2][DI].

c) Calculate the logical address and the physical address for the following instructions:

- i) MOV AL, ES:START[BX]
- ii) MOV AX, START[SI][BX].
- Where [ES]=5004H, [DS]=3000H, [SS]=6000H, [SI]=0020H, [BX]=2000H, [BP]=0040H, START=02H.

5. a) If register AL = 7FH and the instruction ADD AL, 1 is executed, what will be the status of flag register in 8086 microprocessors?

b) Describe the functions of Ready, Trap, INTR/INTA, HOLD, and HLDA pins of an 8085 MP.

c) Draw the fundamental block diagram of the 8051 Microcontroller and also explain the timer of 8051 to show the use of the flag register using D-latch.

d) Explain with block diagram the difference between Von Neumann and Harvard architectures of Microcontroller.

6. a) Find out the legal and illegal instructions with comments from the following instructions:

- i) MOV AX,2A9BH

- ii) MOV CL,DX

- iii) MOV DS,SS

- iv) MOV A1,A2.

b) Explain the demultiplexing of AD0-AD15 of 8086 with ALE, latch, and interfacing diagram.

c) Write any two short notes:

- i) OUT instruction with its size and operations
- ii) MOV BL,64;
- iii) OUT AX, 2H.

7. (a) Identify the differences between memory space and memory bank of 8086 µP. **(2 marks)**

(b) Draw 8086 memory banks. How can these banks be selected by BHE and A0? Show with a table. **(4 marks)**

(c) How can 8086 read 8-bit data from an even address or 8-bit data from an odd address or 16-bit data from both even and odd addresses? Explain with 8086 instructions. **(4 marks)**

8. (a) Mention the functions of I/O Controller. Draw the block diagram of 8255 I/O Controller. **(3 marks)**

(b) If the content of CRW of 8255 is 8AH, write the different bit status of CRW of 8255. **(2 marks)**

(c) Draw interfacing circuits with programming to read from I/P DIPs and display at O/P LEDs for Mode 0 operation of 8255 I/O Controller. **(5 marks)**

9. (a) State DMA functions and draw the figure of data transfer in DMA mode. **(3 marks)**

(b) Draw the block diagram and explain how a DMA Controller operates in Micro Computer System. **(5 marks)**

(c) Write the functions of HOLD, HLDA, DREQ, and DACK handshaking signals. **(2 marks)**

15 CT

1. (a) Distinguish between Microprocessor and Microcontroller. Write the names of four computer peripheral interfacing devices.

(b) The contents of several segment registers and offsets are shown below:

- [CS] = A4FBH
- [DS] = 2950H
- [SS] = 25ABH
- [DI] = 1259H
- [SP] = 052AH
- [IP] = 29CDHCalculate the corresponding Physical Addresses (PAs) for the segment registers CS, DS, and SS.

2. (a) i) How many address lines are necessary on the chip of 32KB memory?

ii) The memory address of the last location of a 1KB memory chip is given as FBFFH. Specify the starting address.

iii) Design a 4KB x 8 memory chip with NAND gate chip selects using the range of memory addresses from A000H to AFFFH.

(b) If [AX] = ABCDH, [BX] = 585AH, and [CX] = 280AH, find out the values of the following logical operations:

i) XOR AX, CX

ii) NOT AX

3. (a) Explain the demultiplexing of AD0-AD15 in the 8086 microprocessor with ALE, latch, and an interfacing diagram. Design a Kx16 RAM and show the interfacing diagrams of the READ operation with the microprocessor.

(b) Design a simple NAND gate decoder logic circuit where the starting and ending addresses are A0000H and ABFFFH respectively in the 8086 microprocessor.

4. (a) Explain memory addressing modes. Calculate the Physical Address (PA) using the largest Effective Address (EA).

(b) Find out the Physical Addresses (PAs) with comments and interfacing diagrams for the following instructions:

i) MOV BETA[DI], CL

ii) MOV AL, ARRAY[BX][SI].

Where:

- [DS] = 2000H
- [BX] = 2A25H
- [SI] = 0700H
- [DI] = 0200H
- [START] = 02H
- [BETA] = 03H
- [ARRAY] = 04H

5. (a) How can the 8086 microprocessor write:

- 8-bit data from an even address
- 8-bit data from an odd address
- 16-bit data from both even and odd addresses? Explain with appropriate 8086 instructions.

16 CT

1. (a) Distinguish between Microprocessor and Microcontroller.

(b) If the content of the Control Word Register (CRW) of the 8255 is 7BH, write the different bit status of CRW of the 8255.

(c) Design NAND gate chip select logic circuits with the 8255, when I/O addresses of Port A, Port B, Port C, and CRW are 68H, 69H, 6AH, and 6BH respectively. Draw with a calculation table.

2. (a) Mention the functions of Mode 1, Mode 2, Mode 3, and Mode 4 of the 8254 Programmable Timer.

(b) Draw the Read/Write logic of the 8254 and explain the READ and WRITE operations.

(c) How to initialize the 8254 for binary 16-bit counter 1 in Mode 2?

(d) Write instructions to generate a 4 KHz Square Wave signal from binary 16-bit counter 2.