

# Microprocessor & Microcontroller Systems (1333202) - Winter 2023 Solution (Gujarati)

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## પ્રશ્ન 1(a) [3 ગુણ]

Define Microprocessor.

### જવાબ

Microprocessor ek single-chip CPU chhe jema digital computer na central processing unit na karyo karva mate jaruri arithmetic, logic ane control circuitry samayeli hoy chhe.

કોષ્ટક 1. Microprocessor Key Features

Feature	Description
Single Chip	Ek j integrated circuit par sampurna CPU
Processing Unit	Instructions execute kare chhe ane ganatri kare chhe
Control Logic	System operations ane data flow nu sanchalan kare chhe

- Central Processing Unit:** Mukhya ghatak je instructions execute kare chhe
- Integrated Circuit:** Badha karyo ek silicon chip par samayela hoy chhe
- Programmable Device:** Stored instructions na amare alag alag programs run kari shake chhe

### મેમરી ટ્રીક

``Single Chip CPU = Smart Computer Processor Unit''

## પ્રશ્ન 1(b) [4 ગુણ]

Explain Flag register of microprocessor.

### જવાબ

Flag register ALU dwara karvama aaveli arithmetic ane logical operations na parinam vishe ni status mahiti store kare chhe.

કોષ્ટક 2. 8085 Flag Register Bits

Flag	Position	Purpose
S (Sign)	Bit 7	Result nu sign darshave chhe (1=negative, 0=positive)
Z (Zero)	Bit 6	Jyare result zero hoy tyare set thay chhe
AC (Auxiliary Carry)	Bit 4	Bit 3 mathi bit 4 ma carry aave tyare
P (Parity)	Bit 2	Even parity flag
CY (Carry)	Bit 0	MSB mathi carry generate thay tyare

- **Status Indicator:** Chhella operation na result ni sthiti darshave chhe
- **Conditional Instructions:** Branching ane decision making mate upayogi
- **5 Active Flags:** Sign, Zero, Auxiliary Carry, Parity, ane Carry flags

### મેમરી ટ્રીક

``Flags Show Zero, Sign, Parity, Auxiliary, Carry''

## પ્રશ્ન 1(c) [7 ગુણ]

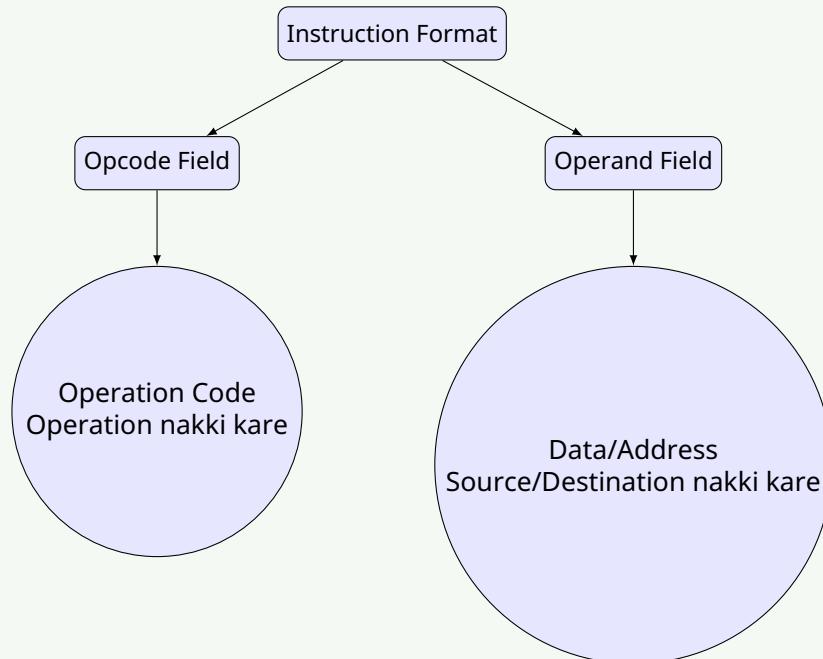
Explain format of instruction of microprocessor with example.

### જવાબ

Microprocessor instructions ma opcode ane operand fields hoy chhe je operation ane data locations nirdishit kare chhe.

કોષ્ટક 3. 8085 Instruction Format Types

Format	Size	Structure	Example
1-Byte	8 bits	Opcode only	MOV A,B
2-Byte	16 bits	Opcode + 8-bit data	MVI A,05H
3-Byte	24 bits	Opcode + 16-bit address	LDA 2000H



આકૃતિ 1. Instruction Format Structure

- Opcode Field:** Kai operation karvanu chhe te vyakhyayit kare chhe (ADD, MOV, JMP)
- Operand Field:** Data, register, athva memory address ni mahiti dharave chhe
- Variable Length:** Instructions 1, 2, athva 3 bytes lambi hoi shake chhe
- Addressing Modes:** Operand location nirdishit karvani vividh rit

### મેમરી ટ્રીક

“Opcode Operations + Operand Objects = Complete Commands”

## પ્રશ્ન 1(c OR) [7 ગુણ]

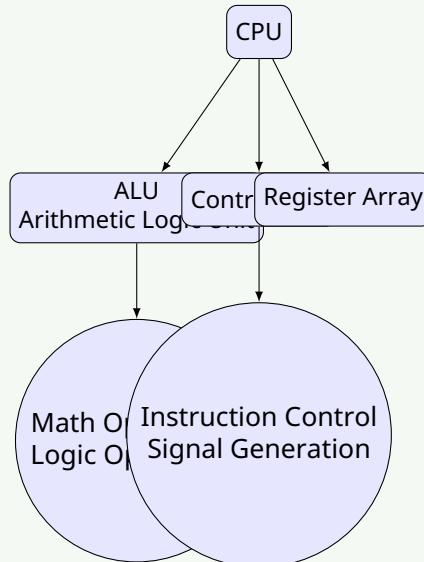
Explain function of ALU, Control Unit and CPU of Microprocessor.

### જવાબ

CPU tran mukhya karyatmak ekamo dharave chhe je instructions execute karva mate sathe maleene karya kare chhe.

કોષ્ટક 4. CPU Components and Functions

Component	Primary Function	Key Operations
ALU	Arithmetic & Logic Operations	ADD, SUB, AND, OR, XOR
Control Unit	Instruction Control	Fetch, Decode, Execute
CPU	Overall Processing	Badha karyo nu sankalan



આકૃતિ 2. CPU Components

- ALU Functions:** Badhi ganatri ane tarkik operations kare chhe
- Control Unit Tasks:** Instruction execution cycle nu sanchalan kare chhe ane control signals generate kare chhe
- CPU Coordination:** Sampurna processing mate ALU ane Control Unit ne jode chhe

### મેમરી ટ્રીક

“ALU Adds, Control Commands, CPU Coordinates”

## પ્રશ્ન 2(a) [3 ગુણ]

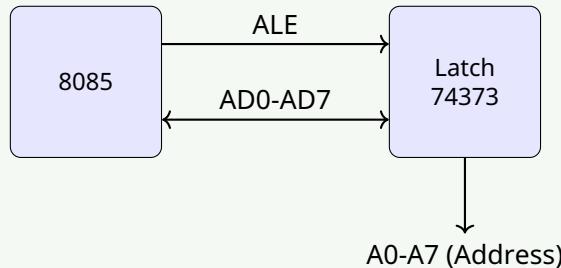
Explain function of ALE signal with diagram.

### જવાબ

ALE (Address Latch Enable) signal no upayog lower-order address ane data lines ne demultiplex karva mate thay chhe.

કોષ્ટક 5. ALE Signal Functions

Function	Description
Address Latching	Lower 8-bit address capture kare chhe
Demultiplexing	Address ne data thi alag kare chhe
Timing Control	Timing reference puru pade chhe



આકૃતિ 3. ALE and Demultiplexing

- Active High Signal: T1 state darmiyan ALE high thay chhe
- External Latching: Address hold karva mate 74373 latch sathe vapray chhe
- System Timing: External devices mate reference puru pade chhe

### મેમરી ટ્રીક

“ALE Always Latches External Addresses”

## પ્રશ્ન 2(b) [4 ગુણ]

Compare microprocessor and microcontroller

### જવાબ

કોષ્ટક 6. Microprocessor vs Microcontroller Comparison

Parameter	Microprocessor	Microcontroller
Design	General purpose	Application specific
Memory	External RAM/ROM	Internal RAM/ROM
I/O Ports	External interface	Built-in I/O ports
Timers	External	Built-in timers
Cost	Vadhu system cost	Ocho system cost
Power	Vadhu power consumption	Ocho power consumption

- Integration Level: Microcontroller ma vadhu ghatako integrated hoy chhe
- Application Focus: Microprocessor computing mate, microcontroller control mate
- System Complexity: Microprocessor ne vadhu external components ni jarur pade chhe

- **Design Flexibility:** Microprocessor vadhu expandability aape chhe

મેમરી ટ્રીક

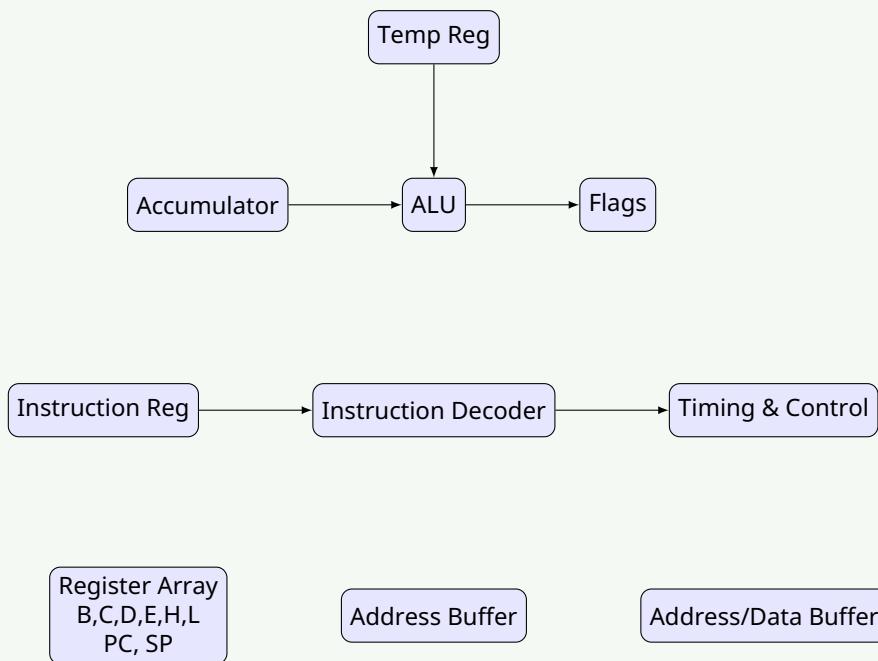
“Microprocessor = More Power, Microcontroller = More Control”

## પ્રશ્ન 2(c) [7 ગુણ]

Draw & explain block diagram of microprocessor.

જવાબ

8085 microprocessor vivdh functional blocks dharave chhe je ek sathe karya kare chhe.



આકૃતિ 4. 8085 Architecture Block Diagram

### કોષ્ટક 7. Block Functions

Block	Function
ALU	Arithmetic and logical operations
Register Array	Temporary data storage (B,C,D,E,H,L)
Control Unit	Instruction execution control
Address Buffer	Address bus lines drive karva

- **Data Path:** Internal bus marfate registers vacche mahiti ni aap-le thay chhe
- **Control Signals:** Timing and control unit dwara generate thay chhe
- **Bus Interface:** External memory and I/O devices sathe jodann kare chhe
- **Register Operations:** Operands and results mate temporary storage

મેમરી ટ્રીક

“Blocks Build Better Processing Systems”

## પ્રશ્ન 2(a OR) [3 ગુણ]

Explain 16 bits registers of microprocessor.

### જવાબ

8085 pase tran 16-bit registers chhe je 8-bit register pairs ne jodi ne bane chhe.

**કોષ્ટક 8.** 16-bit Registers

Register	Formation	Purpose
PC	Single 16-bit	Program Counter - agli instruction nu address
SP	Single 16-bit	Stack Pointer - stack ni top nu address
HL	H + L registers	Memory pointer - data address

- **Program Counter:** Automatic rite agli instruction par increment thay chhe
- **Stack Pointer:** Stack par push thayela chhella data address point kare chhe
- **HL Pair:** Memory addressing mate sauthi vadhu vapray chhe

### મેમરી ટ્રીક

“PC Points Program, SP Stacks Properly, HL Holds Location”

## પ્રશ્ન 2(b OR) [4 ગુણ]

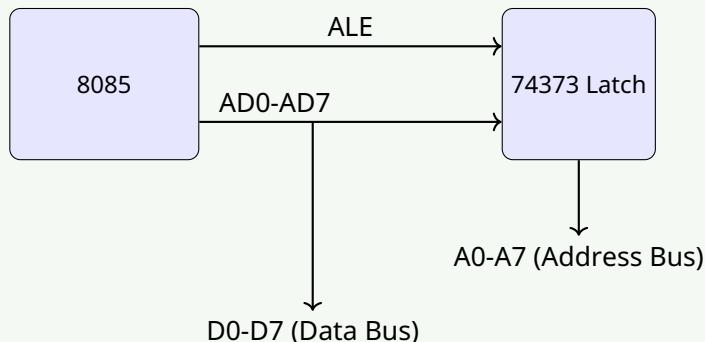
Explain de-multiplexing lower order address and data lines with diagram of microprocessor.

### જવાબ

8085 pin count ghatadva mate lower 8-bit address ne data lines sathe multiplex kare chhe.

**કોષ્ટક 9.** Multiplexed Lines

Lines	T1 State	T2-T4 States
AD0-AD7	Lower Address A0-A7	Data D0-D7
ALE Signal	High	Low



**આકૃતિ 5.** De-multiplexing Circuit

- **Time Division:** Ek j lines pehla address ane pachi data wahan kare chhe
- **External Latch:** Jyare ALE high hoy tyare 74373 address capture kare chhe
- **Signal Separation:** Alag address ane data buses banave chhe

## મેમરી ટ્રીક

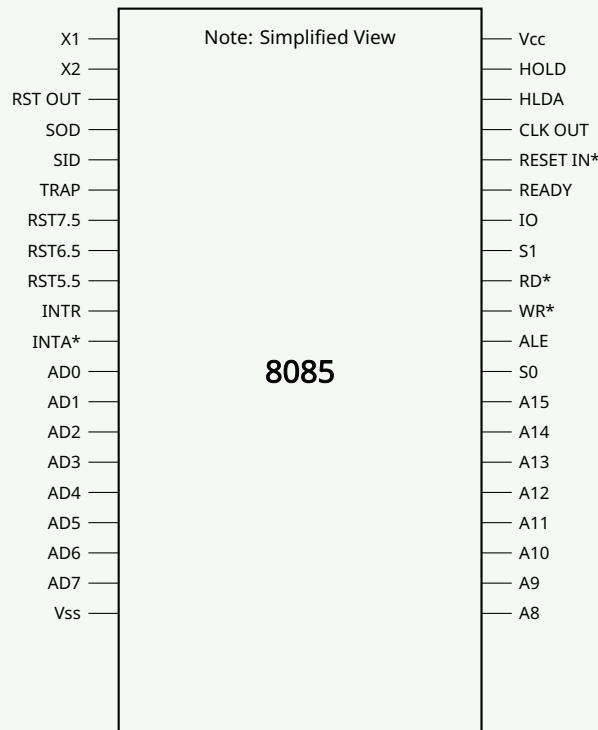
"ALE Always Latches External Address Elegantly"

## પ્રશ્ન 2(c OR) [7 ગુણ]

Draw and explain pin diagram of 8085.

## જવાબ

8085 ek 40-pin microprocessor chhe je multiplexed address/data bus dharave chhe.



અધ્યક્ષતિ 6. 8085 Pin Diagram

કોષ્ટક 10. Pin Groups

Group	Pins	Function
Address/Data	AD0-AD7, A8-A15	Memory addressing ane data transfer
Control	ALE, RD*, WR*, IO/M*	Bus control signals
Interrupts	INTR, RST7-RST5, TRAP	Interrupt handling
Power	Vcc, Vss	Power supply connections

- **Multiplexed Bus:** AD0-AD7 banne address ane data wahan kare chhe
- **Active Low Signals:** \* sathe na signals active low chhe
- **Crystal Connections:** X1, X2 clock generation mate

## મેમરી ટ્રીક

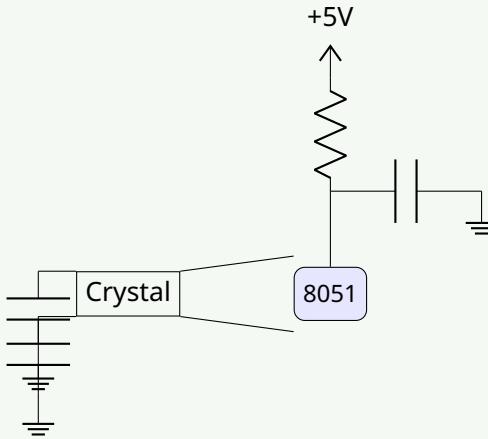
"Forty Pins Provide Perfect Processing Power"

### પ્રશ્ન 3(a) [3 ગુણ]

Draw clock and reset circuit of microcontroller

#### જવાબ

8051 ને યોગ્ય કર્યાવાહી માટે એક્સટ્રિન્યૂલ ક્લોક અને રેસેટ સર્કિટ્સ ની જરૂર પદે ચ્હે.



આકૃતિ 7. Clock and Reset Circuits

કોષ્ટક 11. Circuit Components

Component	Value	Purpose
Crystal	11.0592 MHz	Clock generation
Capacitors	30pF each	Crystal stabilization
Reset Resistor	10KΩ	Pull-up for reset
Reset Capacitor	10μF	Power-on reset delay

- **Clock Frequency:** સેરિયલ ક્રમાંક માટે સમાન રીતે 11.0592 MHz
- **Reset Duration:** ઓચા મા ઓચા 2 માશિન સિક્લે માટે હાઇ હોવુ જોયે
- **Power-on Reset:** પૉર્ટ આપ્યાવાદ એટોમાં રેસેટ થાય ચ્હે

#### મેમરી ટ્રીક

“Crystals Create Clock, Resistors Reset Reliably”

### પ્રશ્ન 3(b) [4 ગુણ]

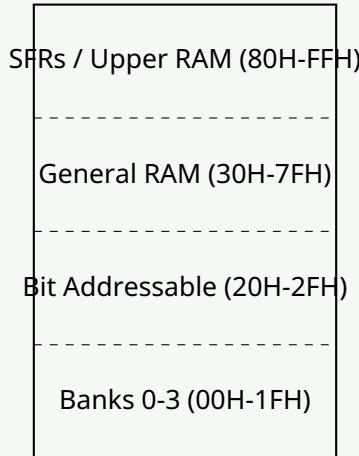
Explain internal RAM of 8051.

#### જવાબ

8051 મા 256 bytes ની ઇન્ટરનાl રેમ અલગ અલગ વિભાગો માટે વાયેન્ચાયેલી હોય ચ્હે.

કોષ્ટક 12. Internal RAM Organization

Address Range	Size	Purpose
00H-1FH	32 bytes	Register Banks (4 banks × 8 registers)
20H-2FH	16 bytes	Bit-addressable area
30H-7FH	80 bytes	General purpose RAM
80H-FFH	128 bytes	Special Function Registers (SFRs)



આકૃતિ 8. Internal RAM Map

- Register Banks:** 4 banks jema darek ma 8 registers (R0-R7)
- Bit Addressing:** 20H-2FH ma individual bits address kari shakay chhe
- Stack Area:** Samany rite general purpose RAM ma rakhvama aave chhe
- Direct Access:** Badha locations direct addressing dwara access kari shakay

### મેમરી ટ્રીક

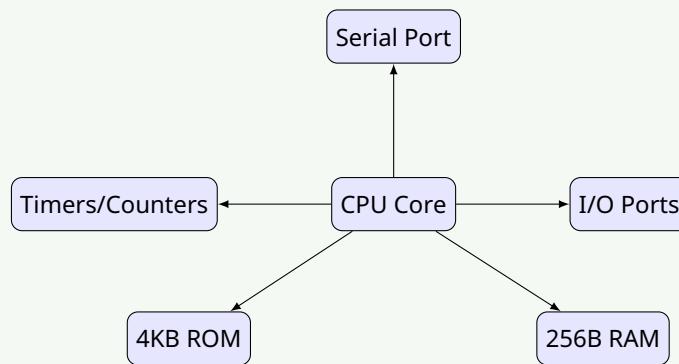
``RAM Registers, Bits, General, Special Functions''

## પ્રશ્ન 3(c) [7 ગુણ]

Explain block diagram of 8051.

### જવાબ

8051 microcontroller ma CPU, memory, ane I/O ek j chip par sankalit chhe.



આકૃતિ 9. 8051 Block Diagram

કોષ્ટક 13. Major Blocks

Block	Function
CPU	Instruction execution and control
Memory	4KB ROM + 256B RAM
Timers	Two 16-bit timer/counters
I/O Ports	Char 8-bit bidirectional ports
Serial Port	Full-duplex UART
Interrupts	5-source interrupt system

- **Harvard Architecture:** Program and data memory spaces are separate
- **Built-in Peripherals:** Timers, serial port, interrupts integrated
- **Expandable:** External memory and I/O are supported
- **Control Applications:** Embedded control tasks are optimized

### મેમરી ટ્રીક

“Complete Control Chip Contains CPU, Memory, I/O”

## પ્રશ્ન 3(a OR) [3 ગુણ]

Explain function of DPTR and PC.

### જવાબ

8051 has DPTR and PC for memory addressing using 16-bit registers.

કોષ્ટક 14. DPTR and PC Functions

Register	Full Form	Function
DPTR	Data Pointer	External data memory point register
PC	Program Counter	Next instruction address point register

- **DPTR Usage:** Access external RAM and lookup tables
- **PC Function:** Instruction fetch, automatically increments
- **16-bit Addressing:** Provides 64KB memory space

### મેમરી ટ્રીક

“DPTR Data Pointer, PC Program Counter”

## પ્રશ્ન 3(b OR) [4 ગુણ]

Explain different timer modes of microcontroller.

### જવાબ

8051 has four timer modes operating in different modes.

કોષ્ટક 15. Timer Modes

Mode	Configuration	Purpose
Mode 0	13-bit timer	8048 sathe compatible
Mode 1	16-bit timer	Maximum count capability
Mode 2	8-bit auto-reload	Constant time intervals
Mode 3	Two 8-bit timers	Timer 0 split operation

- **Mode Selection:** TMOD register bits dwara controlled
- Timer 0/1: Banne timers mode 0, 1, 2 support kare chhe
- **Mode 3 Special:** Fakt Timer 0 j mode 3 ma karya kari shake chhe
- **Applications:** Delays, baud rate generation, event counting

### મેમરી ટ્રીક

“Modes Make Timers Tremendously Versatile”

## પ્રશ્ન 3(c OR) [7 ગુણ]

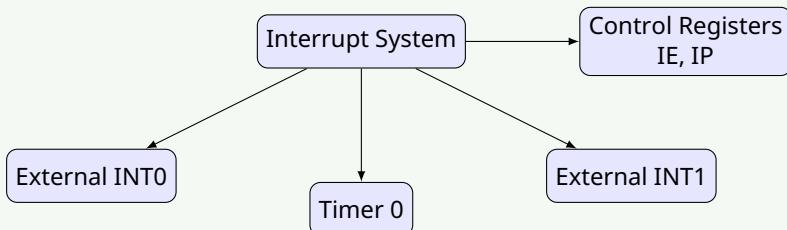
Explain interrupts of microcontroller.

### જવાબ

8051 ma external events handle karva mate 5-source interrupt system chhe.

કોષ્ટક 16. 8051 Interrupt Sources

Interrupt	Vector Address	Priority	Trigger
Reset	0000H	Highest	Power-on/External
External 0	0003H	High	INT0 pin
Timer 0	000BH	Medium	Timer 0 overflow
External 1	0013H	Medium	INT1 pin
Timer 1	001BH	Low	Timer 1 overflow
Serial	0023H	Lowest	Serial communication



આકૃતિ 10. Interrupt System Structure

- **Interrupt Enable:** IE register individual interrupt enables control kare chhe
- **Priority Control:** IP register interrupt priorities set kare chhe
- **Vector Addresses:** Darek interrupt nu fixed vector location hoy chhe
- **Nested Interrupts:** Higher priority lower priority ne interrupt kari shake chhe

### મેમરી ટ્રીક

“Five Interrupt Sources Serve System Efficiently”

## પ્રશ્ન 4(a) [3 ગુણ]

Explain data transfer instruction with example for 8051.

### જવાબ

Data transfer instructions registers, memory, ane I/O ports vacche data transfer kare chhe.

**કોષ્ટક 17. Data Transfer Instructions**

Instruction	Example	Function
MOV	MOV A,#55H	Immediate data ne accumulator ma move kare chhe
MOVX	MOVX A,@DPTR	External RAM mathi accumulator ma move kare chhe
MOVC	MOVC A,@A+PC	Code memory mathi accumulator ma move kare chhe

- **MOV Variants:** Register to register, immediate to register
- **External Access:** External RAM operations mate MOVX
- **Code Access:** Program memory tables read karva mate MOVC

### મેમરી ટ્રીક

“MOV Moves data, MOVX eXternal, MOVC Code”

## પ્રશ્ન 4(b) [4 ગુણ]

List and explain different addressing modes of microcontroller.

### જવાબ

8051 flexible data access mate vividh addressing modes support kare chhe.

**કોષ્ટક 18. 8051 Addressing Modes**

Mode	Example	Description
Immediate	MOV A,#55H	Data instruction ma j aapelo hoy chhe
Register	MOV A,R0	Register contents no upayog kare chhe
Direct	MOV A,30H	Direct memory address
Indirect	MOV A,@R0	Address register ma store karelu hoy chhe
Indexed	MOVC A,@A+DPTR	Base address plus offset

- **Immediate Mode:** Constant data instruction ma samayelo hoy chhe
- **Register Mode:** Register file no upayog kari fastest execution
- **Direct Mode:** Koi pan internal RAM location access kari shake chhe
- **Indexed Mode:** Table lookup ane array access mate

### મેમરી ટ્રીક

“Immediate, Register, Direct, Indirect, Indexed Addressing”

## પ્રશ્ન 4(c) [7 ગુણ]

Write a program to copy block of 8 data starting from location 100h to 200h.

## જવાબ

Listing 1. Block Transfer Program

```

1 ORG 0000H      ; Start address
2 MOV R0,#100H    ; Source address pointer
3 MOV R1,#200H    ; Destination address pointer
4 MOV R2,#08H     ; Counter for 8 bytes
5
6 LOOP:
7 MOV A,@R0       ; Read data from source
8 MOV @R1,A       ; Write data to destination
9 INC R0          ; Increment source pointer
10 INC R1         ; Increment destination pointer
11 DJNZ R2,LOOP   ; Decrement counter and jump if not zero
12
13 END           ; End of program

```

કોડ 19. Register Usage

Register	Purpose
R0	Source address pointer (100H)
R1	Destination address pointer (200H)
R2	Loop counter (8 bytes)
A	Temporary data storage

- **Indirect Addressing:** Memory access mate @R0 ane @R1
- **Loop Control:** DJNZ instruction decrement ane test kare chhe
- **Block Transfer:** 8 consecutive bytes copy kare chhe

## મેમરી ટ્રીક

“Read, Write, Increment, Decrement, Jump Loop”

## પ્રશ્ન 4(a OR) [3 ગુણ]

Write a program to add two bytes of data and store result in R0 register.

## જવાબ

Listing 2. Simple Addition Program

```

1 ORG 0000H      ; Start address
2 MOV A,#25H      ; Load first byte
3 ADD A,#35H      ; Add second byte
4 MOV R0,A        ; Store result in R0
5 END            ; End program

```

કોડ 20. Operation Steps

Step	Instruction	Result
1	MOV A,#25H	A = 25H
2	ADD A,#35H	A = 5AH
3	MOV R0,A	R0 = 5AH

- **Addition Result:**  $25H + 35H = 5AH$
- **Flag Effects:** Jo result > FFH hoy to Carry flag set thay

મેમરી ટ્રીક

“Move, Add, Move = Simple Addition”

## પ્રશ્ન 4(b OR) [4 ગુણ]

Explain indexed addressing mode with example.

જવાબ

Indexed addressing memory access mate base address plus offset no upayog kare chhe.

કોષ્ટક 21. Indexed Addressing Details

Component	Description	Example
Base Address	DPTR athva PC register	DPTR = 1000H
Index	Accumulator contents	A = 05H
Effective Address	Base + Index	1000H + 05H = 1005H

Listing 3. Indexed Addressing Example

```

1 MOV DPTR,#1000H ; Base address
2 MOV A,#05H      ; Index value
3 MOVC A,@A+DPTR ; Read from address 1005H

```

- **Table Access:** Lookup tables ane arrays mate ideal
- **Program Memory:** MOVC fakt code memory mathi read kare chhe
- **Dynamic Indexing:** Execution darmiyan Index badlai shake chhe

મેમરી ટ્રીક

“Base + Index = Dynamic Access”

## પ્રશ્ન 4(c OR) [7 ગુણ]

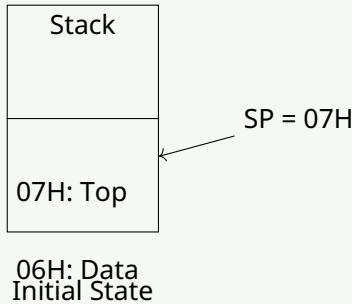
Explain stack operation of microcontroller, PUSH and POP instruction.

જવાબ

Stack ek LIFO memory structure chhe je temporary data storage mate vapray chhe.

કોષ્ટક 22. Stack Operations

Operation	Instruction	Function
PUSH	PUSH 30H	Data ne stack par store kare chhe
POP	POP 30H	Stack mathi data retrieve kare chhe
Stack Pointer	SP register	Stack ni top ne point kare chhe



આકૃતિ 11. Stack Structure

Listing 4. Stack Operation Example

```

1 MOV SP,#30H      ; Initialize stack pointer
2 PUSH ACC        ; Save accumulator
3 PUSH B          ; Save B register
4 POP B           ; Restore B register
5 POP ACC         ; Restore accumulator

```

- LIFO Structure:** Last In, First Out data organization
- SP Auto-increment:** Stack pointer automatically adjust thay chhe
- Subroutine Calls:** Stack return addresses save kare chhe
- Register Preservation:** Register contents save/restore karva mate

## મેમરી ટ્રીક

``PUSH Puts Up, Stack Holds, POP Pulls Out''

## પ્રશ્ન 5(a) [3 ગુણા]

Explain branching instruction with example.

## જવાબ

Branching instructions conditions na aadhare athva unconditionally program flow badle chhe.

કોષ્ટક 23. Branching Instructions

Type	Instruction	Example
Unconditional	LJMP address	LJMP 2000H
Conditional	JZ address	JZ ZERO_LABEL
Call/Return	LCALL address	LCALL SUBROUTINE

Listing 5. Branching Example

```

1 MOV A,#00H      ; Load zero
2 JZ ZERO_FOUND   ; Jump if A is zero
3 LJMP CONTINUE    ; Jump to continue
4 ZERO_FOUND:
5   MOV R0,#01H    ; Set flag
6 CONTINUE:
7   NOP          ; Continue execution

```

- **Program Control:** Execution sequence badle chhe
- **Conditional Jumps:** Flag register status par aadharit
- **Address Range:** Koi pan program memory location par jump kari shake chhe

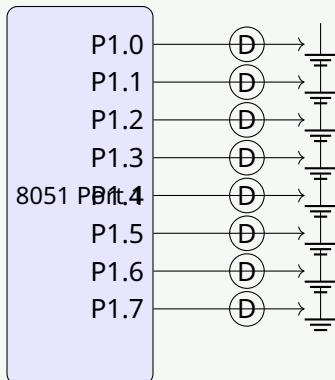
મેમરી ટ્રીક

“Jump Changes Control Flow”

## પ્રશ્ન 5(b) [4 ગુણ]

Interface 8 leds with microcontroller and write a program to turn on and off.

જવાબ



આકૃતિ 12. LED Interfacing Circuit

**Listing 6. LED Blink Program**

```

1 ORG 0000H
2 MAIN:
3     MOV P1,#0FFH      ; Turn ON all LEDs
4     CALL DELAY        ; Wait
5     MOV P1,#00H        ; Turn OFF all LEDs
6     CALL DELAY        ; Wait
7     SJMP MAIN         ; Repeat
8
9     DELAY:
10    MOV R0,#0FFH      ; Outer loop counter
11    LOOP1:
12    MOV R1,#0FFH      ; Inner loop counter
13    LOOP2:
14    DJNZ R1,LOOP2     ; Inner delay loop
15    DJNZ R0,LOOP1     ; Outer delay loop
16    RET               ; Return
17 END

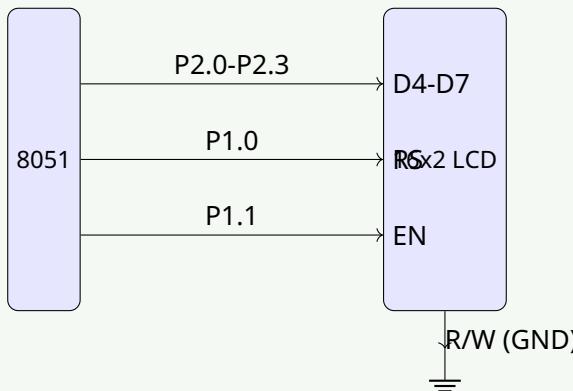
```

- **Current Limiting:** Resistors LEDs ne high current thi bachave chhe
- **Logic High:** Port pin par 1 write karvathi LED chalu thay chhe (jo ground sathe jordan hoy)
- **Delay Loop:** Nested loops visible blink delay banave chhe

## મંજુ 5(c) [૭ ગુણ]

Interface LCD with microcontroller and write a program to display "welcome".

### જવાબ



આકૃતિ 13. LCD Interface Connections

**Listing 7.** LCD Display Program

```

1 ORG 0000H
2 CALL LCD_INIT      ; Initialize LCD
3 CALL DISPLAY_MSG   ; Display message
4 SJMP $             ; Stop here
5
6 LCD_INIT:
7     MOV P2,#38H      ; Function set: 8-bit, 2-line
8     CALL COMMAND
9     MOV P2,#0EH      ; Display ON, Cursor ON
10    CALL COMMAND
11    MOV P2,#01H      ; Clear display
12    CALL COMMAND
13    MOV P2,#06H      ; Entry mode set
14    CALL COMMAND
15    RET
16
17 DISPLAY_MSG:
18     MOV DPTR,#MESSAGE ; Point to message
19 NEXT_CHAR:
20     CLR A
21     MOVC A,@A+DPTR   ; Read character
22     JZ DONE          ; If zero, end of string
23     CALL SEND_CHAR    ; Send character to LCD
24     INC DPTR         ; Next character
25     SJMP NEXT_CHAR
26 DONE:
27     RET
28
29 COMMAND:
30     CLR P1.0        ; RS = 0 for command
31     SETB P1.1        ; EN = 1
32     CLR P1.1        ; EN = 0 (pulse)
33     CALL DELAY
34     RET
35
36 SEND_CHAR:
37     MOV P2,A          ; Put character on data lines
38     SETB P1.0        ; RS = 1 for data
  
```

```

39 SETB P1.1      ; EN = 1
40 CLR P1.1      ; EN = 0 (pulse)
41 CALL DELAY
42 RET
43
44 DELAY:
45 MOV R0,#50      ; Delay routine
46 DELAY_LOOP:
47 MOV R1,#255
48 DELAY_INNER:
49 DJNZ R1,DELAY_INNER
50 DJNZ R0,DELAY_LOOP
51 RET
52
53 MESSAGE:
54 DB "WELCOME",0      ; Message string with null terminator
55 END

```

કાર્યક્રમ 24. LCD Interface Pins

8051 Pin	LCD Pin	Function
P2.0-P2.3	D4-D7	4-bit data lines
P1.0	RS	Register select (0=command, 1=data)
P1.1	EN	Enable pulse
GND	R/W	Read/Write (tied to ground for write)

- 4-bit Mode:** Pins bachava mate fakt upper 4 data lines no upayog kare chhe
- Control Signals:** RS command/data select kare chhe, EN timing pulse puru pade chhe
- Character Display:** Darek character ASCII code tarike mokalvama aave chhe
- Initialization:** Yogya karyavahi mate command sequence jaruri chhe

### મેમરી ટ્રીક

“LCD Displays Characters with Commands and Data”

## પ્રશ્ન 5(a OR) [3 ગુણ]

Explain logical instruction with example.

### જવાબ

Logical instructions data par bitwise operations kare chhe, je individual bits manipulate karva mate upyogi chhe.

કાર્યક્રમ 25. Logical Instructions

Instruction	Example	Function
ANL	ANL A,#0FH	Bitwise AND operation
ORL	ORL A,#F0H	Bitwise OR operation
XRL	XRL A,#FFH	Bitwise XOR operation

Listing 8. Logical Operations

```

1 MOV A,#55H      ; A = 01010101B
2 ANL A,#0FH      ; A = 00000101B (mask upper bits)

```

```

3 ORL A,#F0H      ; A = 11110101B (set upper bits)
4 XRL A,#FFH      ; A = 00001010B (complement all bits)

```

- Bit Manipulation:** Bits set, clear ane test karva mate vapray chhe
- Masking Operations:** ANL unwanted bits clear kare chhe
- Flag Effects:** Result na aadhare parity flag update kare chhe

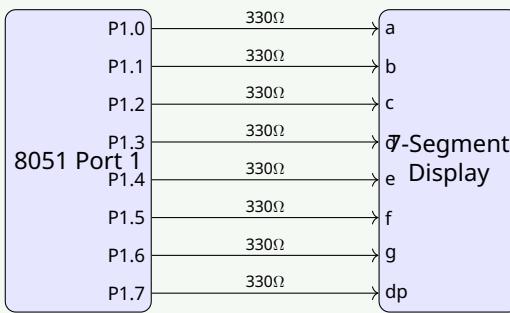
### મેમરી ટ્રીક

“AND Masks, OR Sets, XOR Toggles”

## પ્રશ્ન 5(b OR) [4 ગુણ]

Interface 7 segment with microcontroller.

### જવાબ



આકૃતિ 14. 7-Segment Interface

Listing 9. 0-9 Counter Program

```

1 ORG 0000H
2 MOV DPTR,#DIGIT_TABLE ; Point to lookup table
3 MOV R0,#0             ; Start with digit 0
4
5 MAIN_LOOP:
6     MOV A,R0            ; Get current digit
7     MOVC A,@A+DPTR      ; Get 7-segment code
8     MOV P1,A              ; Display on 7-segment
9     CALL DELAY           ; Wait 1 second
10    INC R0               ; Next digit
11    CJNE R0,#10,MAIN_LOOP ; Check if reached 10
12    MOV R0,#0             ; Reset to 0
13    SJMP MAIN_LOOP       ; Repeat
14
15 DIGIT_TABLE:
16    DB 3FH, 06H, 5BH, 4FH, 66H ; 0,1,2,3,4
17    DB 6DH, 7DH, 07H, 7FH, 6FH ; 5,6,7,8,9
18 END

```

કોડ 26. 7-Segment Codes

Digit	Hex Code	Binary	Segments Lit
0	3FH	00111111	a,b,c,d,e,f
1	06H	00000110	b,c
2	5BH	01011011	a,b,g,e,d

- **Common Cathode:** Jyare port pin high hoy tyare segments light thay chhe
- **Current Limiting:** Resistors segment ne damage thatu attake chhe
- **Lookup Table:** Segment patterns nu efficient storage

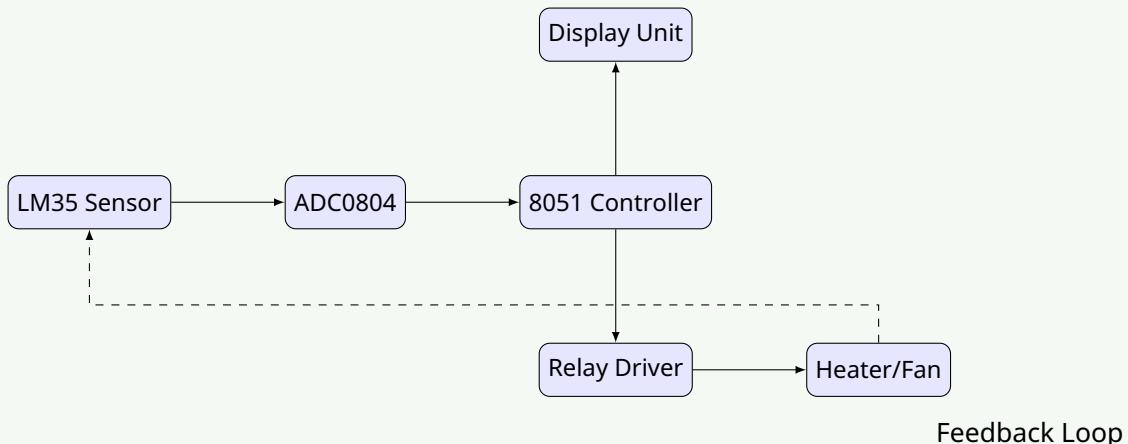
### મેમરી ટ્રીક

“Seven Segments Show Digits Clearly”

## પ્રશ્ન 5(c OR) [7 ગુણ]

Interface LM 35 with microcontroller and explain block diagram of temperature controller.

### જવાબ



આકૃતિ 15. Temperature Controller Block Diagram

Listing 10. Temperature Control Program

```

1 ORG 0000H
2 MAIN:
3     CALL READ_TEMP ; Read temperature from ADC
4     CALL DISPLAY_TEMP ; Show temperature on display
5     CALL TEMP_CONTROL ; Control heating/cooling
6     CALL DELAY ; Wait before next reading
7     SJMP MAIN
8
9 READ_TEMP:
10    CLR P2.0 ; Start ADC conversion
11    SETB P2.0 ; Pulse to start
12    JNB P2.1,$ ; Wait for conversion complete
13    MOV A,P1 ; Read temperature data
14    RET
15
16 TEMP_CONTROL:
17    CJNE A,#30,CHECK_HIGH ; Compare with setpoint (30C)
18    CHECK_HIGH:
  
```

```

19 JC TEMP_LOW      ; If A < 30, temperature is low
20 SETB P3.0        ; Turn ON cooling (fan)
21 CLR P3.1        ; Turn OFF heating
22 RET
23 TEMP_LOW:
24 CLR P3.0        ; Turn OFF cooling
25 SETB P3.1        ; Turn ON heating
26 RET
27 END

```

### કોડ 27. System Components

Component	Function
LM35	Temperature sensor (10mV/°C)
ADC0804	Analog to digital converter
8051	Main controller
Relay	High power loads switch karva
Display	Current temperature batava

- **Temperature Sensing:** LM35 celsius na darek degree mate 10mV aape chhe
- **ADC Conversion:** Analog voltage ne digital value ma convert kare chhe
- **Control Logic:** Setpoint Sathe sarkhamni kare chhe ane relay control kare chhe
- **Feedback System:** Continuous monitoring ane adjustment

### મેમરી ટ્રીક

``Sense, Convert, Compare, Control Temperature Automatically''