EXPERIMENT-10

AIM: To study the architecture instruction set of 8085 microprocessor.

REFERENCES USED:

- Geeksforgeeks
- Javatpoint.com

THEORY:

BASIC ARCHITECTURE:

The 8085 microprocessor is an 8-bit microprocessor that was developed by Intel in the mid-1970s. It was widely used in the early days of personal computing and was a popular choice for hobbyists and enthusiasts due to its simplicity and ease of use. The architecture of the 8085 microprocessor consists of several key components, including the accumulator, registers, program counter, stack pointer, instruction register, flags register, data bus, address bus, and control bus.

REGISTERS

- **ACCUMULATOR(A)**: The accumulator is an 8-bit register that is used to store arithmetic and logical results. It is the most commonly used register in the 8085 microprocessor and is used to perform arithmetic and logical operations.
- **GENERAL-PURPOSE REGISTERS:** The 8085 microprocessor has six general-purpose registers, including **B, C, D, E, H, and L**, which can be combined to form 16-bit register pairs (BC, DE, HL register pairs). These register pairs are commonly used to store memory addresses and other data.
- **PROGRAM COUNTER(PC)**: The program counter is a 16-bit register that contains the memory address of the next instruction to be executed. The program counter is incremented after each instruction is executed, which allows the microprocessor to execute instructions in sequence.

- **STACK POINTER(SP)**: The stack pointer is a 16-bit register that is used to manage the stack. The stack is a section of memory that is used to store data temporarily. The stack pointer is used to keep track of the top of the stack.
- **INSTRUCTION REGISTER**: The instruction register is an 8-bit register that contains the current instruction being executed. The instruction register is used by the microprocessor to decode and execute instructions.
- **FLAGS REGISTER:** The flags register is an 8-bit register that contains status flags that indicate the result of an arithmetic or logical operation. These flags include the carry flag, zero flag, sign flag, and parity flag.

BUS

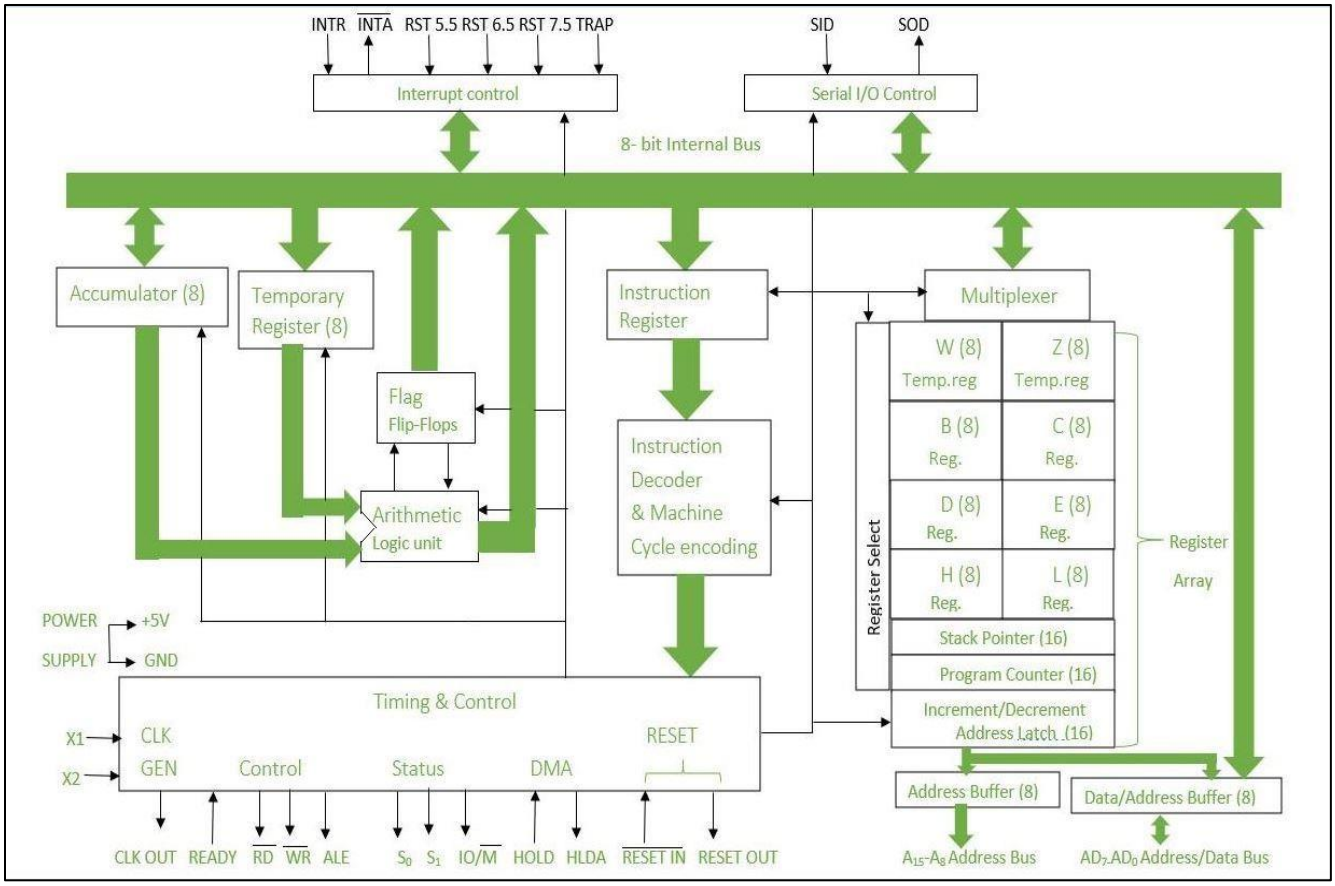
- **DATA BUS:** The data bus is an 8-bit bus that is used to transfer data between the microprocessor and memory or other devices. The data bus is bidirectional, which means that it can be used to read data from memory or write data to memory.
- **ADDRESS BUS:** The address bus is a 16-bit bus that is used to address memory and other devices. The address bus is used to select the memory location or device that the microprocessor wants to access.
- **CONTROL BUS:** The control bus is a set of signals that controls the operations of the microprocessor, including the read and write operations.

MEMORY:

- 8085 can address 64 KB of memory.
- Memory is divided into segments like Data Segment, Stack Segment, and Code Segment.

CONTROL AND TIMING SIGNALS:

- Machine cycles: Fetch, Decode, Execute.
- Clock frequency is typically around 3 MHz.



Functional units

ADDRESING MODES

Each instruction requires some data on which it has to operate. There are different techniques to specify data for instructions. These techniques are called **addressing modes**. Intel 8085 uses the following addressing modes:

DIRECT ADDRESSING MODE:

- The effective address of the operand is given directly in the instruction.
- Example: LDA 2000H (Load Accumulator) - loads the contents of memory location 2000H into the accumulator.

REGISTER ADDRESSING MODE:

- The operand is present in one of the general-purpose registers.
- Example: MOV B, C (Move Register) - contents of register C are moved to register B.

REGISTER INDIRECT ADDRESSING

- In Register Indirect mode of addressing, the address of the operand is specified by a register pair.
- Example MOV A, M - Move the content of the memory location, whose address is in H-L pair (i.e. 2500 H) to the accumulator.

IMMEDIATE ADDRESSING

- In this addressing mode, the operand is specified within the instruction itself.
- Example: MVI A, 05H (Move Immediate) - here, 05H is the immediate data.

INSTRUCTION SET:

DATA TRANSFER GROUP:

- MOV: Move data between registers and between register and memory.
- MVI: Move immediate data to a register.

8085 - Instruction set list

8085 Instructions - Datatransfer

Opcode	Operand	Explanation of Instruction	Description
MOV	Rd, Rs M, Rs Rd, M	Copy from source(Rs) to destination(Rd)	This instruction copies the contents of the source register into the destination register; the contents of the source register are not altered. If one of the operands is a memory location, its location is specified by the contents of the HL registers. **Example: MOV B, C or MOV B, M**
MVI	Rd, data M, data	Move immediate 8-bit	The 8-bit data is stored in the destination register or memory. If the operand is a memory location, its location is specified by the contents of the HL registers. **Example: MVI B, 57H or MVI M, 57H**
LDA	16-bit address	Load accumulator	The contents of a memory location, specified by a 16-bit address in the operand, are copied to the accumulator. The contents of the source are not altered. **Example: LDA 2034H**
LDAX	B/D Reg. pair	Load accumulator indirect	The contents of the designated register pair point to a memory location. This instruction copies the contents of that memory location into the accumulator. The contents of either the register pair or the memory location are not altered. **Example: LDAX B**

ARITHMETIC GROUP:

- ADD, SUB, INR, DCR: Addition, subtraction, increment, decrement.
- ADI, SUI, DAI, DFI: Add immediate, subtract immediate, add with carry immediate, decrement with carry immediate.

8085 Instructions - Arithmetic

Opcode	Operand	Explanation of Instruction	Description
ADD	**R** **M**	Add register or memory, to accumulator	The contents of the operand (register or memory) are added to the contents of the accumulator and the result is stored in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the addition. **Example: ADD B or ADD M**
ADC	**R**	Add register to accumulator with	The contents of the operand (register or memory) and M the Carry flag are added to the contents of the
	M	carry	accumulator and the result is stored in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the addition. **Example: ADC B or ADC M**
ADI	**8-bit data**	Add immediate to accumulator	The 8-bit data (operand) is added to the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the addition. **Example: ADI 45H**
ACI	**8-bit data**	Add immediate to accumulator with carry	The 8-bit data (operand) and the Carry flag are added to the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the addition. **Example: ACI 45H**
LXI	**Reg. pair, 16-bit data**	Load register pair immediate	The instruction loads 16-bit data in the register pair designated in the operand. **Example: LXI H, 2034H or LXI H, XYZ**
DAD	**Reg. pair**	Add register pair to H and L registers	The 16-bit contents of the specified register pair are added to the contents of the HL register and the sum is stored in the HL register. The contents of the source register pair are not altered. If the result is larger than 16 bits, the CY flag is set. No other flags are affected. **Example: DAD H**
SUB	**R** **M**	Subtract register or memory from accumulator	The contents of the operand (register or memory) are subtracted from the contents of the accumulator, and the result is stored in the accumulator. If the operand is a memory location, its location is specified by the contents of the HL registers. All flags are modified to reflect the result of the subtraction. **Example: SUB B or SUB M**

LOGICAL GROUP:

- ANA, XRA, ORA, CPI: Logical AND, XOR, OR, Compare immediate.
- CMA, CMC, STC: Complement accumulator, complement carry, set carry.

LOGICAL INSTRUCTIONS

Opcode	Operand	Explanation of Instruction	Description

CMP	R
	M
		Compare register or memory with accumulator	The contents of the operand (register or memory) are M compared with the contents of the accumulator. Both contents are preserved . The result of the comparison is shown by setting the flags of the PSW as follows:
			if (A) < (reg/mem): carry flag is set
			if (A) = (reg/mem): zero flag is set
			if (A) > (reg/mem): carry and zero flags are reset
			Example: CMP B or CMP M

CPI	8-bit data	Compare immediate with accumulator	The second byte (8-bit data) is compared with the contents of the accumulator. The values being compared remain unchanged. The result of the comparison is shown by setting the flags of the PSW as follows:
			if (A) < data: carry flag is set
			if (A) = data: zero flag is set
			if (A) > data: carry and zero flags are reset
			Example: CPI 89H

ANA	R M	Logical AND register or memory with accumulator	The contents of the accumulator are logically ANDed with M the contents of the operand (register or memory), and the result is placed in the accumulator. If the operand is a memory location, its address is specified by the contents of HL registers. S, Z, P are modified to reflect the result of the operation. CY is reset. AC is set. **Example: ANA B or ANA M**
ANI	8-bit data	Logical AND immediate with accumulator	The contents of the accumulator are logically ANDed with the 8-bit data (operand) and the result is placed in the accumulator. S, Z, P are modified to reflect the result of the operation. CY is reset. AC is set. **Example: ANI 86H**
XRA	R M	Exclusive OR register or memory with accumulator	The contents of the accumulator are Exclusive ORed with M the contents of the operand (register or memory), and the result is placed in the accumulator. If the operand is a memory location, its address is specified by the contents of HL registers. S, Z, P are modified to reflect the result of the

I/O GROUP:

- IN, OUT: Input and output instructions.

SPECIAL GROUP:

- HLT: Halt the microprocessor.
- NOP: No operation.

USES OF 8085 MICROPROCESSOR :

The 8085 microprocessor is a versatile 8-bit microprocessor that has been used in a wide variety of applications, including:

1. Embedded Systems: The 8085 microprocessor is commonly used in embedded systems, such as industrial control systems, automotive electronics, and medical equipment.
2. Computer Peripherals: The 8085 microprocessor has been used in a variety of computer peripherals, such as printers, scanners, and disk drives.
3. Communication Systems: The 8085 microprocessor has been used in communication systems, such as modems and network interface cards.
4. Instrumentation and Control Systems: The 8085 microprocessor is commonly used in instrumentation and control systems, such as temperature and pressure controllers.
5. Home Appliances: The 8085 microprocessor is used in various home appliances, such as washing machines, refrigerators, and microwave ovens.
6. Educational Purposes: The 8085 microprocessor is also used for educational purposes, as it is an inexpensive and easily accessible microprocessor that is widely used in universities and technical schools.

RESULT

The architecture instruction set of 8085 microprocessor has been studied.

Criteria	Total Marks	Marks Obtained	Comments
Concept (A)	2		
Implementation (B)	2		
Performance (C)	2		
Total	6		