Lecture – 8

Arithmetic Operations

These instructions perform arithmetic operations such as addition, subtraction, increment and decrement.

- **Addition** — Any 8-bit number, or the contents of a register, or the contents of a memory location can be added to the contents of the accumulator and the result is stored in the accumulator. No two other 8-bit registers can be added directly. The instruction DAD is an exception.
- **Subtraction** — Any 8-bit number, or the contents of a register, or the contents of a memory location can be subtracted from the contents of the accumulator and the result is stored in the accumulator. The subtraction is performed in 2's complement and the results, if negative, are expressed in 2's complement. No two other 8-bit registers can be subtracted directly.
- **Increment / Decrement** — The 8-bit contents of a register or a memory location can be incremented or decremented by one. Similarly, the 16- bit contents of a register pair can be incremented or decremented by 1. These increment and decrement operation differ from the addition and subtraction in an important way; i.e., they can be performed in one of the registers pr in a memory location.

These arithmetic instructions (except INR and DCR)

1. Assume implicitly that the accumulator is one of the operands.
2. Modify all the flags according to the data conditions of the result.
3. place the result in the accumulator
4. Do not affect the contents of the operand register.

The instructions INR and DCR

1. Affect the contents of the specified register.
2. Affect all flags except the CY flag.

The descriptions of the instructions are as follows:

Instruction	Description	Example
ADD R **ADD M**	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.	**ADD B** **ADD M**
ADC R **ADC M**	The contents of the operand (register or memory and the Carry flag 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	**ADC B** **ADC M**

	registers. All flags are modified to reflect the result of the addition.	
ADI 8-bit data	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.	**ADI 45H**
ACI 8-bit data	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.	**ACI 45H**
DAD Reg.pair	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.	**DAD H**
SUB R **SUB M**	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.	**SUB B** **SUB M**
SBB R **SBB M**	The contents of the operand (register or memory) and the Borrow flag are subtracted from the contents of the accumulator and the result is placed 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.	**SBB B** **SBB M**
SUI 8-bit data	The 8-bit data (operand) is subtracted from the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the subtraction.	**SUI 45H**
SBI 8-bit data	The 8-bit data (operand) and the Borrow flag are subtracted from the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the subtraction.	**SBI 45H**
INR R **INR M**	The contents of the designated register or memory are incremented by 1 and the result is stored in the same place. If the operand is a memory location, its location is specified by the contents of the HL registers.	**INR B** **INR M**
INX R	The contents of the designated register pair are incremented by 1 and the result is stored in the same place.	**INX H**
DCR R **DCR M**	The contents of the designated register or memory are decremented by 1 and the result is stored in the same place. If the operand is a memory location, its location is specified by the contents of the HL registers.	**DCR B** **DCR M**

DCX R	The contents of the designated register pair are decremented by 1 and the result is stored in the same place.	DCX H
DAA	The contents of the accumulator are changed from a binary value to two 4-bit binary coded decimal (BCD) digits. This is the only instruction that uses the auxiliary flag to perform the binary to BCD conversion, and the conversion procedure is described below. S, Z, AC, P, CY flags are altered to reflect the results of the operation. If the value of the low-order 4-bits in the accumulator is greater than 9 or if AC flag is set, the instruction adds 6 to the low-order four bits. If the value of the high-order 4-bits in the accumulator is greater than 9 or if the Carry flag is set, the instruction adds 6 to the high-order four bits.	DAA