2.3 ARITHMETIC INSTRUCTIONS

Includes the instructions which performs the addition, subtraction, increment or decrement operations. The flag conditions are altered after execution of an instruction in this group.

Ex: i) ADD B   ii) SUB C   iii) INR D   iv) INX H

Opcode	Operand	Description
		Add register or memory to accumulator
ADD	R 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. Example: ADD B or ADD M
		Add register to accumulator with carry
ADC	R 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 registers. All flags are modified to reflect the result of the addition. Example: ADC B or ADC M
		Add immediate to accumulator
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. Example: ADI 45H
		Add immediate to accumulator with carry
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. Example: ACI 45H
		Add register pair to H and L registers
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. Example: DAD H
		Subtract register or memory from accumulator
SUB	R 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.
Example: SUB B or SUB M

Subtract source and borrow from accumulator
SBB   R   The contents of the operand (register or memory) and
       M   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.
Example: SBB B or SBB M

Subtract immediate from accumulator
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.
Example: SUI 45H

Subtract immediate from accumulator with borrow
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 subtracion.
Example: SBI 45H

Increment register or memory by 1
INR   R   The contents of the designated register or memory) are
       M   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.
Example: INR B or INR M

Increment register pair by 1
INX   R   The contents of the designated register pair are incremented by 1 and the result is stored in the same place.
Example: INX H

Decrement register or memory by 1
DCR   R   The contents of the designated register or memory are
       M   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.
Example: DCR B or DCR M

Decrement register pair by 1
DCX   R   The contents of the designated register pair are decremented by 1 and the result is stored in the same place.
Example: DCX H

Decimal adjust accumulator
DAA   none   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.

Example: DAA

LOGICAL INSTRUCTIONS

Opcode   Operand   Description

Compare register or memory with accumulator
CMP   R   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

Compare immediate with accumulator
CPI   8-bit data   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

Logical AND register or memory with accumulator
ANA   R   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

Logical AND immediate with accumulator
ANI   8-bit data   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

Exclusive OR register or memory with accumulator

XRA   R
            M

The contents of the accumulator are Exclusive ORed with 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 and AC are reset.
Example: XRA B or XRA M

Exclusive OR immediate with accumulator

XRI   8-bit data

The contents of the accumulator are Exclusive ORed 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 and AC are reset.
Example: XRI 86H

Logical OR register or memory with accumulaotr

ORA   R
            M

The contents of the accumulator are logically ORed with 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 and AC are reset.
Example: ORA B or ORA M

Logical OR immediate with accumulator

ORI   8-bit data

The contents of the accumulator are logically ORed 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 and AC are reset.
Example: ORI 86H

Rotate accumulator left

RLC   none

Each binary bit of the accumulator is rotated left by one position. Bit D_7 is placed in the position of D_0 as well as in the Carry flag. CY is modified according to bit D_7. S, Z, P, AC are not affected.
Example: RLC

Rotate accumulator right

RRC   none

Each binary bit of the accumulator is rotated right by one position. Bit D_0 is placed in the position of D_7 as well as in the Carry flag. CY is modified according to bit D_0. S, Z, P, AC are not affected.
Example: RRC

Rotate accumulator left through carry

RAL   none

Each binary bit of the accumulator is rotated left by one position through the Carry flag. Bit D_7 is placed in the Carry flag, and the Carry flag is placed in the least significant

position D_0. CY is modified according to bit D_7. S, Z, P, AC are not affected.
Example: RAL

Rotate accumulator right through carry

RAR   none   Each binary bit of the accumulator is rotated right by one position through the Carry flag. Bit D_0 is placed in the Carry flag, and the Carry flag is placed in the most significant position D_7. CY is modified according to bit D_0. S, Z, P, AC are not affected.
Example: RAR

Complement accumulator

CMA   none   The contents of the accumulator are complemented. No flags are affected.
Example: CMA

Complement carry

CMC   none   The Carry flag is complemented. No other flags are affected.
Example: CMC

Set Carry

STC   none   The Carry flag is set to 1. No other flags are affected.
Example: STC