

Arithmetic Instructions

- **These instructions perform the operations like:**
- **Addition**
- **Subtraction**
- **Increment**
- **Decrement**

(1) Arithmetic Instructions

- **ADD R**
- **ADD M**
- **The contents of register or memory are added to the contents of accumulator.**
- **The result is stored in accumulator.**
- **If the operand is memory location, its address is specified by H-L pair.**
- **Example: ADD C or ADD M**

A	20		
B		C	30
D		E	
H		L	

ADD C
A=A+R

A	50		
B		C	30
D		E	
H		L	

BEFORE EXECUTION

AFTER EXECUTION

A	20		
B		C	
D		E	
H	20	L	50

10

ADD M
A=A+M

A	30		
B		C	
D		E	
H	20	L	50

10

(2) Arithmetic Instructions

- **ADC R**
- **ADC M**
- **The contents of register or memory and Carry Flag (CY) are added to the contents of accumulator.**
- **The result is stored in accumulator.**
- **If the operand is memory location, its address is specified by H-L pair. All flags are modified to reflect the result of the addition.**
- **Example: ADC C or ADC M**

CY	1
----	---

A	50
---	----

B		C	20
---	--	---	----

D		E	
---	--	---	--

H		L	
---	--	---	--

ADC C
 $A = A + R + CY$

CY	0
----	---

A	71
---	----

B		C	20
---	--	---	----

D		E	
---	--	---	--

H		L	
---	--	---	--

BEFORE EXECUTION

AFTER EXECUTION

CY	1
----	---

A	20
---	----

2050H 30

H	20	L	50
---	----	---	----

ADC M
 $A = A + M + CY$

CY	0
----	---

A	51
---	----

2050H 30

H	20	L	50
---	----	---	----

(3) Arithmetic Instructions

- **ADI 8-bit data**
- **The 8-bit data is added to the contents of accumulator.**
- **The result is stored in accumulator.**
- **Example: ADI 10 H**

BEFORE EXECUTION

A	50
----------	-----------

ADI 10H
A=A+DATA(8)

AFTER EXECUTION

A	60
----------	-----------

(4) Arithmetic Instructions

- **ACI 8-bit data**
- **The 8-bit data and the Carry Flag (CY) are added to the contents of accumulator.**
- **The result is stored in accumulator.**
- **Example: ACI 20 H**

BEFORE EXECUTION

CY	1
----	---

A	30
---	----

ACI 20H
A=A+DATA
(8)+CY

AFTER EXECUTION

CY	0
----	---

A	51
---	----

(5) Arithmetic Instructions

- **DAD Register pair**
- The 16-bit contents of the specified register pair are added to the contents of H-L pair.
- The result is stored in H-L pair.
- If the result is larger than 16 bits, then CY-flag is set.
- No other flags are effective
- No. of bytes : 1-byte
- Example: DAD D, DAD B

BEFORE EXECUTION

CY	0
----	---

SP			
B		C	
D	10	E	20
H	20	L	50

DAD D

HL=HL+R

AFTER EXECUTION

CY	0
----	---

SP			
B		C	
D	10	E	20
H	30	L	70

(6) Arithmetic Instructions

- **SUB R**
- **SUB M**
- **The contents of the register or memory location are subtracted from the contents of the accumulator.**
- **The result is stored in accumulator.**
- **If the operand is memory location, its address is specified by H-L pair.**
- **Example: SUB B or SUB M**

BEFORE EXECUTION

A	50		
B	30	C	
D		E	
H		L	

SUB B
A=A-R

AFTER EXECUTION

A	20		
B	30	C	
D		E	
H		L	

BEFORE EXECUTION

A	50			1020H	
					10
H	10	L	20		

SUB M
A=A-M

AFTER EXECUTION

A	40			1020H	
					10
H	10	L	20		

(7) Arithmetic Instructions

- **SBB R**
- **SBB M**
- The contents of the register or memory location and Borrow Flag (i.e.CY) are subtracted from the contents of the accumulator.
- The result is stored in accumulator.
If the operand is memory location, its address is specified by H-L pair.
- **Example: SBB C or SBB M**

CY	1
----	---

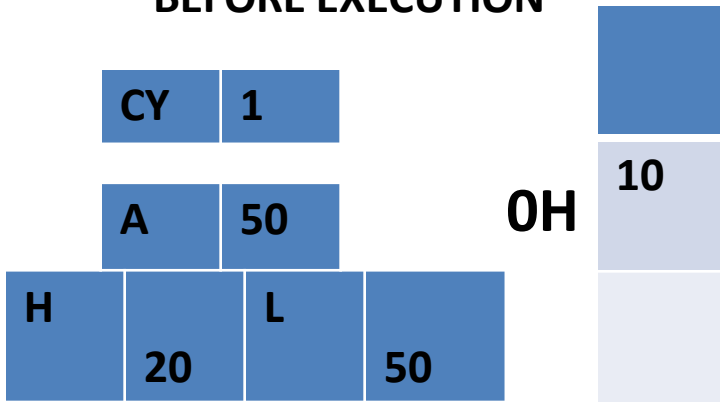
A	40		
B		C	20
D		E	
H		L	

SBB C
A=A-R-CY

CY	0
----	---

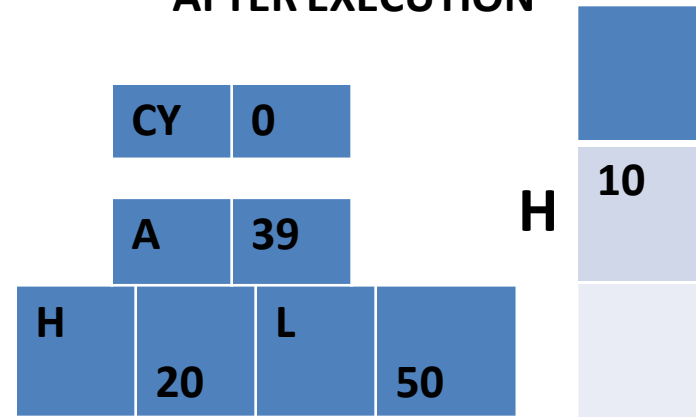
A	19		
B		C	20
D		E	
H		L	

BEFORE EXECUTION



SBB M
A=A-M-CY

AFTER EXECUTION



(8) Arithmetic Instructions

- **SUI 8-bit data**
- **OPERATION: $A=A-DATA(8)$**
- **The 8-bit immediate data is subtracted from the contents of the accumulator.**
- **The result is stored in accumulator.**
- **Example: SUI 45 H**

(9) Arithmetic Instructions

- **SBI 8-bit data**
- **The 8-bit data and the Borrow Flag (i.e. CY) is subtracted from the contents of the accumulator.**
- **The result is stored in accumulator.**
- **Example: SBI 20 H**

BEFORE EXECUTION

CY	1
----	---

A	50
---	----

SBI 20H

$A = A - \text{DATA}(8) - \text{CY}$

AFTER EXECUTION

CY	0
----	---

A	29
---	----

(10) Arithmetic Instructions

- **INR R**
- **INR M**
- **The contents of register or memory location are incremented by 1.**
- **The result is stored in the same place.**
- **If the operand is a memory location, its address is specified by the contents of H-L pair.**
- **Example: INR B or INR M**

BEFORE EXECUTION

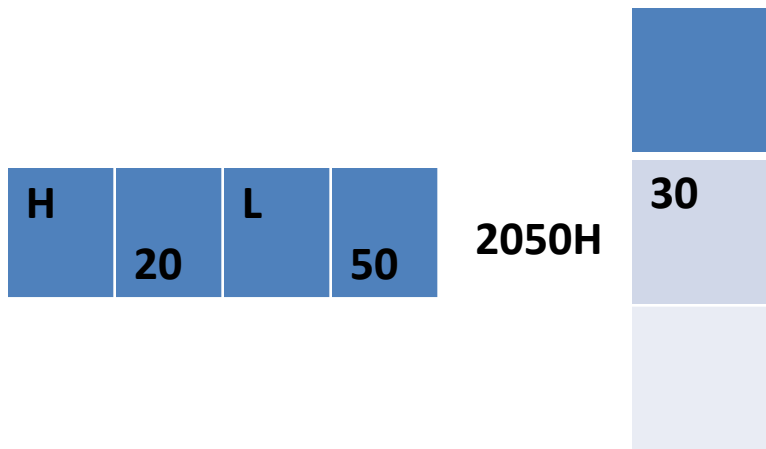
A			
B	10	C	
D		E	
H		L	

INR B
 $R=R+1$

AFTER EXECUTION

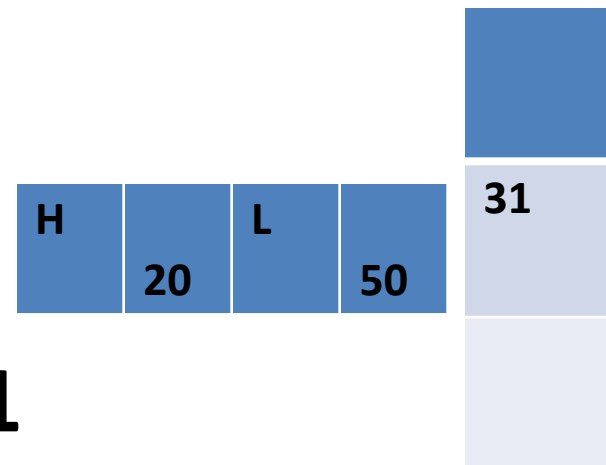
A			
B	11	C	
D		E	
H		L	

BEFORE EXECUTION



INR M
 $M=M+1$

AFTER EXECUTION



(11) Arithmetic Instructions

- **INX Rp**
- **The contents of register pair are incremented by 1.**
- **The result is stored in the same place.**
- **Example: INX H**

BEFORE EXECUTION

SP			
B		C	
D		E	
H	10	L	20

INX H
RP=RP+1

AFTER EXECUTION

SP			
B		C	
D		E	
H	10	L	21

Mnemonics, Operand	Opcode(in HEX)	Bytes
INX B	03	1
INX D	13	1
INX H	23	1

(12) Arithmetic Instructions

- **DCR R**
- **DCR M**
- **The contents of register or memory location are decremented by 1.**
- **The result is stored in the same place.**
- **If the operand is a memory location, its address is specified by the contents of H-L pair.**
- **Example: DCR E or DCR M**

BEFORE EXECUTION

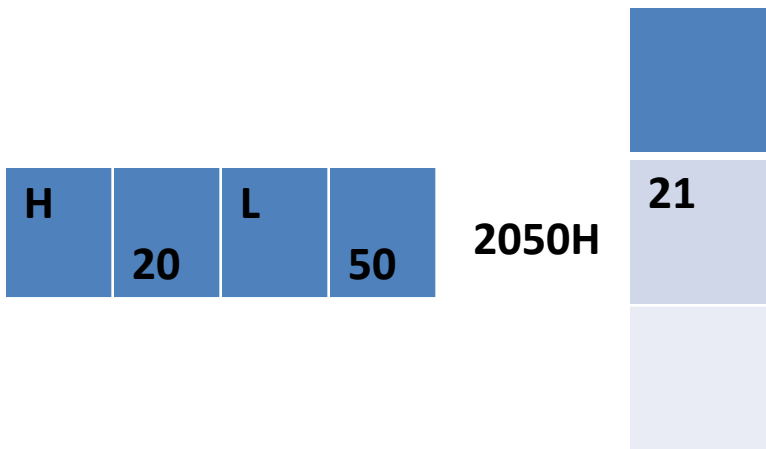
A			
B		C	
D		E	20
H		L	

AFTER EXECUTION

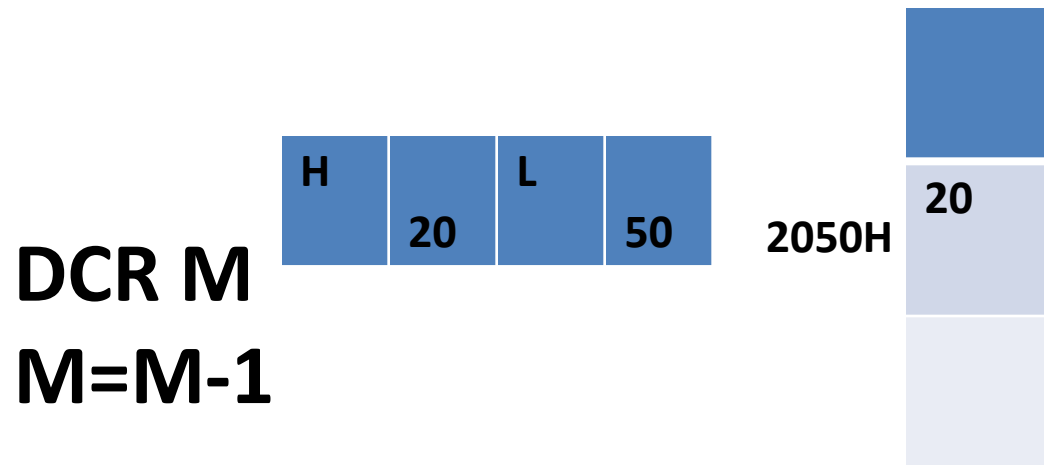
A			
B		C	
D		E	19
H		L	

DCR E
 $R=R-1$

BEFORE EXECUTION



AFTER EXECUTION



DCR M
 $M=M-1$

(13) Arithmetic Instructions

- **DCX Rp**
- **The contents of register pair are decremented by 1.**
- **The result is stored in the same place.**
- **Example: DCX D**

BEFORE EXECUTION

SP			
B		C	
D	10	E	20
H		L	

DCX D
RP=RP-1

AFTER EXECUTION

SP			
B		C	
D	10	E	19
H		L	