

Subtraction of two 8-bit numbers with borrow

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SUBTRACTION OF TWO 8-BIT NUMBER WITH BORROW

AIM

To write an assembly language program to subtract two 8-bit numbers with borrow

ASSEMBLY LANGUAGE PROGRAM

```

C000 MVI C 00      0E ; Intialize the C register to 00H
C001                00 ;
C002 LXI H C200   21 ; Load the HL register pair immediately
C003                00 ; with memory location address C200H
C004                C2 ;
C005 MOV A M      7E ; Move the memory content(minuend) to
                    accumulator
C006 INX H        23 ; Increment the HL register pair
C007 SUB M        96 ; Subtract the memory content(subtrahend)
                    from accumulator
C008 JNC C00E     D2 ; If carry = 0, then jump to C00EH
C009                0E ;
C00A                C0 ;
C00B INR C        0C ; Increment C register
C00C CMA          2F ; Complement the accumulator
C00D INR A        3C ; Increment the accumulator
C00E INX H        23 ; Increment the HL register pair
C00F MOV M A      77 ; Move the content of accumulator(difference)
                    to Memory
C010 INX H        23 ; Increment the HL register pair
C011 MOV M C      71 ; Move the content of C register(borrow) to
                    memory
C012 HLT          76 ; Halt the execution

```

EXECUTION - 1

```

C200 89 ; Minuend(Input data)
C201 C4 ; Subtrahend(Input data)
C202 3B ; Difference(Output data)
C203 01 ; Borrow(Output data)

```

MANUAL CALCULATION

```

89H => 1000 1001
C4H => 1100 0100

```

```

1's complement OF C4H = 0011 1011
2's complement of C4H = 0011 1100

```

89_H = 1000 1001
 C4_H = 0011 1100

```

    -----
    0 1100 0101
    -----
    
```

Complement Carry = 1
 Result in 2's complement = 0011 1011

i.e. **Difference = 3B_H**
Borrow = 01_H

PROGRAM TRACE

Addr	MC	Mnemonic	A	B	C	D	E	H	L	SP	Flag Word
			00	00	00	00	00	00	00	0000	0000 0000
C000	0E	MVI C 00	00	00	00	00	00	00	00	0000	0000 0000
C002	21	LXI H C200	00	00	00	00	00	C2	00	0000	0000 0000
C005	7E	MOV A M	89	00	00	00	00	C2	00	0000	0000 0000
C006	23	INX H	89	00	00	00	00	C2	01	0000	0000 0000
C007	96	SUB M	C5	00	00	00	00	C2	01	0000	1001 0101
C008	D2	JNC C00E	C5	00	00	00	00	C2	01	0000	1001 0101
C00B	0C	INR C	C5	00	01	00	00	C2	01	0000	0000 0001
C00C	2F	CMA	3A	00	01	00	00	C2	01	0000	0000 0001
C00D	3C	INR A	3B	00	01	00	00	C2	01	0000	0000 0001
C00E	23	INX H	3B	00	01	00	00	C2	02	0000	0000 0001
C00F	77	MOV M A	3B	00	01	00	00	C2	02	0000	0000 0001
C010	23	INX H	3B	00	01	00	00	C2	03	0000	0000 0001
C011	71	MOV M C	3B	00	01	00	00	C2	03	0000	0000 0001
C012	76	HLT	3B	00	01	00	00	C2	03	0000	0000 0001

FLAG WORD

S	Z	x	Ac	x	P	x	Cy
0	0	0	0	0	0	0	1

EXECUTION - 2

C200 C4 ; Minuend(I/P)
 C201 89 ; Subtrahend(I/P)
 C202 3B ; Difference(O/P)
 C203 00 ; Borrow(O/P)

MANUAL CALCULATION

C4_H => 1100 0100
 89_H => 1000 1001

1's complement OF 89_H = 0111 0110
 2's complement of 89_H = 0111 0111

C4_H = 1100 0100

89_H = 0111 0111

```

-----
1 0011 1011
-----

```

Complement Carry = 0

Result in 2's complement = 0011 1011

i.e. **Difference = 3B_H**
Borrow = 00_H

PROGRAM TRACE

Addr	MC	Mnemonic	A	B	C	D	E	H	L	SP	Flag Word
			00	00	00	00	00	00	00	0000	0000 0000
C000	0E	MVI C 00	00	00	00	00	00	00	00	0000	0000 0000
C002	21	LXI H C200	00	00	00	00	C2	00	0000	0000 0000	
C005	7E	MOV A M	C4	00	00	00	00	C2	00	0000	0000 0000
C006	23	INX H	C4	00	00	00	00	C2	01	0000	0000 0000
C007	96	SUB M	3B	00	00	00	00	C2	01	0000	0000 0000
C008	D2	JNC C00E	3B	00	00	00	00	C2	01	0000	0000 0000
C00E	23	INX H	3B	00	00	00	00	C2	02	0000	0000 0000
C00F	77	MOV M A	3B	00	00	00	00	C2	02	0000	0000 0000
C010	23	INX H	3B	00	00	00	00	C2	03	0000	0000 0000
C011	71	MOV M C	3B	00	00	00	00	C2	03	0000	0000 0000
C012	76	HLT	3B	00	00	00	00	C2	03	0000	0000 0000

FLAG WORD

S	Z	x	Ac	x	P	x	Cy
0	0	0	0	0	0	0	0

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