

Addition of two 16-bit numbers

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ADDITION OF TWO 16-BIT NUMBERS

AIM

To write an assembly language program to add two 16-bit numbers (i) without carry, (ii) with carry

ADDITION WITHOUT CARRY

ASSEMBLY LANGUAGE PROGRAM

```

C000 LHL D C100    2A ; Load the HL register pair directly with
C001                00 ; Addend
C002                C1 ;
C003 XCHG         EB ; Exchange the content of HL register pair
                    with DE register pair
C004 LHL D C102    2A ; Load the HL register pair directly with
C005                02 ; Augend
C006                C1 ;
C007 DAD D        19 ; Add the content of HL pair with DE pair
C008 SHL D C104    22 ; Store the content of HL register pair to
C009                04 ; memory location C104H and C105H
C00A                C1 ;
C00B HLT          76 ; Halt the execution
  
```

EXECUTION

```

C100 56 ; Low byte of Addend(Input data)
C101 45 ; High byte of Addend(Input data)
C102 12 ; Low byte of Augend(Input data)
C103 22 ; High byte of Augend(Input data)
C104 68 ; Low byte of Sum(Output data)
C105 67 ; High byte of Sum(Output data)
  
```

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	2A	LHL D C100	00	00	00	00	00	45	56	0000	0000 0000
C003	EB	XCHG	00	00	00	45	56	00	00	0000	0000 0000
C004	2A	LHL D C102	00	00	00	45	56	22	12	0000	0000 0000
C007	19	DAD D	00	00	00	45	56	67	68	0000	0000 0000
C008	22	SHL D C104	00	00	00	45	56	67	68	0000	0000 0000
C00B	76	HLT	00	00	00	45	56	67	68	0000	0000 0000

FLAG WORD

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

ADDITION WITH CARRY

ASSEMBLY LANGUAGE PROGRAM

```

C700 MVI C 00      0E ; Initialise the C register with 00H
C701              00 ;
C702 LHLD C800    2A ; Load the HL register pair directly with
C703              00 ; Addend
C704              C8 ;
C705 XCHG         EB ; Exchange the content of HL register pair
                   with DE register pair
C706 LHLD C802    2A ; Load the HL register pair directly with
C707              02 ; Augend
C708              C8 ;
C709 DAD D        19 ; Add the content of HL pair with DE pair
C70A JNC C70E     D2 ; If carry =0 then jump to C00EH
C70B              0E ;
C70C              C7 ;
C70D INR C        0C ; Increment the C register content (Carry)
C70E SHLD C804    22 ; Store the HL register pair content (Sum) in
C70F              04 ; the memory location C804H and C805H
C710              C8 ;
C711 MOV A C      79 ; Move the content of C register to
                   Accumulator
C712 STA C806     32 ; Store the accumulator content (Carry) to
C713              06 ; memory location C806H
C714              C8 ;
C715 HLT         76 ; Halt the execution

```

EXECUTION - 1

```

C800 23 ; Low byte of Addend(I/P)
C801 AB ; High byte of Addend(I/P)
C802 57 ; Low byte of Augend(I/P)
C803 BC ; High byte of Augend(I/P)
C804 7A ; Low byte of Sum(O/P)
C805 67 ; High byte of Sum(O/P)
C806 01 ; Carry(O/P)

```

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
C700	0E	MVI C 00	00	00	00	00	00	00	00	0000	0000 0000
C702	2A	LHLD C800	00	00	00	00	00	AB	23	0000	0000 0000
C705	EB	XCHG	00	00	00	AB	23	00	00	0000	0000 0000
C706	2A	LHLD C802	00	00	00	AB	23	BC	57	0000	0000 0000
C709	19	DAD D	00	00	00	AB	23	67	7A	0000	0000 0001
C70A	D2	JNC C70E	00	00	00	AB	23	67	7A	0000	0000 0001
C70D	0C	INR C	00	00	01	AB	23	67	7A	0000	0000 0001
C70E	22	SHLD C804	00	00	01	AB	23	67	7A	0000	0000 0001
C711	79	MOV A C	01	00	01	AB	23	67	7A	0000	0000 0001
C712	32	STA C806	01	00	01	AB	23	67	7A	0000	0000 0001
C715	76	HLT	01	00	01	AB	23	67	7A	0000	0000 0001

FLAG WORD

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

EXECUTION - 2

C800 AB ; Low byte of Addend(Input data)
 C801 12 ; High byte of Addend(Input data)
 C802 72 ; Low byte of Augend(Input data)
 C803 23 ; High byte of Augend(Input data)
 C804 1D ; Low byte of Sum(Output data)
 C805 36 ; High byte of Sum(Output data)
 C806 00 ; Carry(Output data)

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
C700	0E	MVI C 00	00	00	00	00	00	00	00	0000	0000 0000
C702	2A	LHLD C800	00	00	00	00	00	12	AB	0000	0000 0000
C705	EB	XCHG	00	00	00	12	AB	00	00	0000	0000 0000
C706	2A	LHLD C802	00	00	00	12	AB	23	72	0000	0000 0000
C709	19	DAD D	00	00	00	12	AB	36	1D	0000	0000 0000
C70A	D2	JNC C70E	00	00	00	12	AB	36	1D	0000	0000 0000
C70E	22	SHLD C804	00	00	00	12	AB	36	1D	0000	0000 0000
C711	79	MOV A C	00	00	00	12	AB	36	1D	0000	0000 0000
C712	32	STA C806	00	00	00	12	AB	36	1D	0000	0000 0000
C715	76	HLT	00	00	00	12	AB	36	1D	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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