Sub Code: 18BIT46S
Skill Based Subject – II: MICRO PROCESSOR & ASSEMBLY LANGUAGE PROGRAMMING

UNIT III: Assembly language programming - Addition of two 8-bit numbers - 8-bit subtraction -Decimal addition of two 8-bit numbers - Addition of two 16-bit numbers - 8-bit decimal subtraction - finding square from look-up table - Finding largest number in a data array - Arrange a data array in ascending and descending order - Sum of series of 8-bit numbers - 8-bit multiplication - 8-bit division.

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Assembly language programming

1) Addition of two 8 bit numbers: Sum 8-Bits

PROGRAM

Memory Address	Mnemonics	Operands	Comments
2000	LXI	H, 2501 H	Get address of 1st number in H-L pair
2003	MOV	A, M	1st number in accumulator
2004	INX	H	Increment content of H-L pair
2005	ADD	M	Add 1st and 2nd number
2006	STA	2503 H	Store sum in 2503 H.
2009	HLT		Stop

DATA
2501 – 49 H
2502 – 56 H
The sum is stored in the memory location 2503 H.

Result
2503 – 9F H.

2) 8-Bit subtraction

PROGRAM

Memory Address	Mnemonics	Operands	Comments
2000	LXI	H, 2501 H	Get address of 1st number in H-L pair
2003	MOV	A, M	1st number in accumulator
2004	INX	H	Content of H-L pair increases from 2501 to 2502 H
2005	SUB	M	1st number - 2nd number
2006	INX	H	Content of H-L pair becomes 2503 H
2007	MOV	M, A	Store sum in 2503 H.
2008	HLT		Halt

DATA
2501 – 49 H
2502 – 32 H
The sum is stored in the memory location 2503 H.

Result
2503 – 17 H

3) Decimal Addition of Two 8-Bit Numbers, Sum: 16 Bits
PROGRAM

Memory Address	Label	Mnemonics	Operands	Comments
2000		LX1	H, 2501 H	Address of 1st number in H-L Pair
2003		MVI	C, 00	MSBs of sum in register C. Initial value=00
2005		MOV	A, M	1st Number in Accumulator
2006		INX	H	Address of 2nd number 2502 in H-L pair
2007		ADD	M	Ist number + 2nd Number.
2008		DAA		Decimal adjust.
2009		JNC	AHEAD	Is carry? No, go to the label AHEAD.
200C		INR	C	Yes, increment C.
200D	AHEAD	STA	2503 H	LSDs of sum in 2503 H.
2010		MOV	A, C	MSDs of sum in accumulator.
2011		STA	2504	MSDs of sum in 2504 H.
2014		HLT		

Example 1
DATA
2501 - 84 D
2502 - 75 D

Result
2503 – 59 D, LSDs of the sum.
2504 – 01 D, MSDs of the sum

4) Addition of Two 16 – Bit Numbers, Sum: 16 Bits or more

PROGRAM

Memory Address	Label	Mnemonics	Operands	Comments
2000		LHLD	2501 H	Ist 16 – number in H-L Pair.
2003		XCHG		Get Ist number in D – E pair.
2004		LHLD	2503 H	2nd 16 – bit number in H –L pair.
2007		MVI	C, 00	MSBs of sum in Register C. Initial value = 00.
2009		DAD	D	Ist number + 2nd number.
200A		JNC	AHEAD	Is carry? No, go to the label AHEAD.
200D		INR	C	Yes, increment C.
200E	AHEAD	SHLD	2505 H	Store LSBs of sum in 2505 and 2506 H.
2011		MOV	A, C	MSDs of sum in accumulator.
2012		STA	A, C	Store MSBs of sum in 2507 H
2015		HLT	2507 H	Halt

Example 1
DATA

2501 - 98 H, LSBs of Ist number.
2502 - 5B H, MSBs of Ist number.
2503 – 4C H, LSBs of 2nd number.
2504 - 8E H, MSBs of 2nd number.

5) 8-Bit Decimal Subtraction

PROGRAM

Memory Address	Mnemonics	Operands	Comments
2000	LXI	H, 2502 H	Get address of 2nd number in H-L Pair.
2003	MVI	A, 99	Place 99 in accumulator.
2005	SUB	M	9's complement of 2nd number.
2006	INR	A	10's complement of 2nd number.
2007	DCX	H	Get address Ist number.
2008	ADD	M	Add Ist number and10's complement of 2nd number.
2009	DAA		Decimal adjust.
200A	STA	2503 H	Store result in 2503 H
200D	HLT		Halt

Example 1
DATA
2501 - 96
2502 – 38
Result
2503 – 58

6. Find Square from Lookup Table

PROGRAM

Address	Mnemonics	Operand	Comments
2000	LDA	2500 H	Get data in accumulator.
2003	MOV	L, A	Get data in register L.
2004	MVI	H, 26 H	Get 26 in register H.
2006	MOV	A, M	Square of data in accumulator.
2007	STA	2501	Store square in 2501 H.
200A	HLT		Stop

DATA
2500 – 07 D

7. Find the Largest Number in a Data Array

PROGRAM

Address	Labels	Mnemonics	Operands	Comment
2000		LXI	H,2500,H	Address for count in H-I pair.
2003		MOV	C, M	Count in register C.
2004		INX	H	Address of 1st number in H-L pair.
2005		MOV	A, M	1st number in accumulator.
2006		DCR	C	Decrement count.
2007	LOOP	INX	H	Address of next number.
2008		CMP	M	Compare next number with previous maximum. Is next number > Previous maximum?
2009		JNC	AHEAD	No larger number is in accumulator. Go to the label AHEAD.
200C		MOV	A, M	Yes, get larger number in accumulator.
200D	AHEAD	DCR	C	Decrement count.
200E		JNZ	LOOP	
2011		STA	2450 H	Store result in 2450 H.
2014		HLT		Stop

DATA
2500- 03
2501 – 98
2502- 75
2503 – 99
Result
2450 - 99

8. To Arrange a Series of Numbers in Descending Order

PROGRAM

Address	Label	Mnemonics	Operand	Comments
2000		LXI	D, 2601	Memory locations to store results.
2003		LXI	H, 2500	Count address in H – L.
2006		MOV		Count in register B to check whether all Numbers have been arranged in descending order.
2007	START	CALL	2200	Call subordinate-1 to find largest number.
200A		STAX	D	Store result.

Address		Mnemonics	Operands	Comments
200B		CALL	2050	Call subrouting-2 to check which number is largest.
200E		INX	D	
200F		DCR	B	Have all numbers been arranged in descending order?
2010		JNZ	START	No, repeat process.
2013		HLT		Stop

9. To Arrange a Data Array in Ascending Order

PROGRAM

Address	Labels	Mnemonics	Operands	Comments
2000		LXI	D, 2601	Memory location to store result.
2003		LXI	H, 2500	Count address in H – L pair.
2006		MOV	B, M	Count in register B to check whether all numbers have been arranged in ascending order.
2007	START	CALL	2200	Call Subroutine – 1 to find smallest number.
200A		STAX	D	Store the result.
200B		CALL	2050	Call Subroutine – 2 to check which number is smallest.
200E		INX	D	Have all numbers been arranged in ascending order?
200F		DCR	B	No, repeat process.
2010		JNZ	START	Stop
2013		HLT		

10. Sum of a Series of 8 – Bit Numbers ; Sum: 8 Bits.

PROGRAM

Address	Labels	Mnemonics	Operands	Comments
2400		LXI	H, 2500 H	Address for the count inn H – L pair.
2403		MOV	C, M	The count in register C.
2404		MVI	A, 00	Initial value of sum = 00.
2406	LOOP	INX	H	Address of next data is H – L pair.
2407		ADD	M	Previous sum + next number.
2408		DCR	C	Decrement count.
2409		JNZ	LOOP	Is count = 0? No, jump to LOOP.
240C		STA	2450 H	Store sum in 2450 H.
240F		HLT		Stop

11. 8–Bit Multiplication: Product 16 – Bit

Address	Labels	Mnemonics	Operands	Comments
2000		LHLD	2501 H	Get multiplicand in H – L pair.

Address	Labels	Mnemonics	Operands	Comments
2003		XCHG		Multiplicand in D – E pair.
2004		LDA	2503 H	Multiplier in accumulator.
2007		LXI	H, 0000	Invalid value of product = 00 in H – L pair.
200A		MVI	C, 08	Count = 8 in register C.
200C	LOOP	DAD	H	Shift partial product left by 1 bit.
200D		RAL		Rotate multiplier left one bit. Is multiplier's bit – 1?
200E		JNC	AHEAD	No, go to AHEAD.
2011		DAD	D	Product = Product + Multiplicand.
2312	AHEAD	DCR	C	Decrement count.
2013		JNC	LOOP	
2016		SHLD	2504	Store result.
2019		HLT		

Example 1
DATA
2501 – 84 H, LSBs of multiplicand.
2502 – 00, MSBs of multiplicand.
2503 – 56 H, Multiplier.
Result
2504 – 58 H, LSBs of product.
2505 – 2C MSBs of product.

12) 8 – Bit division
PROGRAM

Address	Labels	Mnemonics	Operands	Comments
2400		LHLD	2501 H	Get dividend in H – L pair.
2403		LDA	2503 H	Get divisor from 250 H.
2406		MOV	B, A	Divisor in register B.
2407		MVI	C, 08	Count = 08 in register C.
2409	LOOP	DAD	H	Shift dividend and quotient left by one bit.
240A		MOV	A, H	Most significant bits of dividend in accumulator.
240B		SUB	B	Subtract divisor from most significant bits of dividend.
240C		JC	AHEAD	Is most significant part of dividend > divisor? No, go to AHEAD.
240F		MOV	H, A	Most significant bits of dividend in register H.
2410		INR	L	Yes, add 1 to quotient.
2411	AHEAD	DCR	C	Decrement count.
2412		JNZ	LOOP	Is count = 0? No, jump to LOOP.
2415		SHLD	2504 H	Store quotient in 2504 and remainder in 2505 H.
2418		HLT		Stop