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Assignment-4

Title : Write x86/64 ALP to perform multiplication of Two 8 bit hexadecimal numbers. Use successive addition and add and shift method.

Objective : To understand following multiplication techniques in ALP

i) Successive Addition.
ii) Add and Shift method.

Outcome : Students will be able to do multiplication in ALP.

Theory :

1) Successive Addition method :

Consider that a byte is present in the al register and second byte in bl register.

i) We have to multiply the byte in AL with the byte in bl.
ii) We will multiply the numbers using successive addition method.
iii) In this method, one number is accepted and other number is taken as a counter. The first number is added with itself till the counter decrements to zero.
iv) Result is stored in dx register. Display the result, using display routine.

Example

AL - 05 H BL = 04H.

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2) Add and Shift method:

Consider that one byte is present in the al register and other byte is present in the bl register. We have to multiply the byte in al with the byte in bl.

- We will multiply the numbers using add and shift method. In this method you add number with itself and rotate the other number each time and shift it by one bit to left along with carry.
  If carry is present add the two numbers.
- Initialize the count to 4 as we are scanning for 4 digits. Decrement counter each time the bits are added. The result is stored in AX
- Display the result

* MUL instruction.

This instruction is used to multiply unsigned numbers when operand is a byte.

AX = AL * operand

when operand is a word.

(DX AX) = AX * operand.

In modern computers (64 bit):

when operand is a word:

eax = ax * operand.

when operand is a double word

rax = eax * operand.

When operand is a quad word.

(RDX RAX) = RAX * operand.

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Algorithm :

1) Successive Addition.

i) Start
ii) Accept two 2 digit number (multiplier and multiplicand)
iii) Set multiplicand value as a counter value.
iv) Add multiplier with itself, 'counter-1' no. of times
v) Print the answer.

2) Add and Shift method :

i) Start
ii) Accept two 2 digit numbers.
iii) Store multiplier to bl and multiplicand to cl initialize Ax with 00.
iv) Shift bl to left by 1 bit (shifted bit will be stored to carry flag)
v) If carry flag is set, add cl to al and shift al to left by 1 bit.
vi) If carry flag is reset, shift al to left by 1 bit
vii) Repeat step (iv) to (vi) for 8 times.

SHL instruction :

This instruction is used to shift contents of operand 1 by the value given by operand2 to the left.

Syntax :

SHL operand 1, operand 2

- The bit that goes off is set to CF (carry flag)
- zero bit is inserted to the right most position.

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Test cases :

Description	Expected	Actual	Result
Multiply 12 by 10 using successive addition	Ans = 0120 H	Same as expected	Pass
Multiply 11 by 10 using add and shift method	Ans = 0110 H	Same as expected	Pass

Conclusion :

We are able to multiply two 2-digit no.'s using successive addition and add & shift method. We also learnt about carry flag and shift instructions.

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