Ministry of Education and Science

Technical University of Moldova
CIM Faculty

R E P O R T

Laboratory work #2
Arithmetic and logic instructions.
Conditional and unconditional jumps.
V-11

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I. Arithmetic and logic instructions

1. Calculate 5 DW elements of the string according to the following rule:

$$x_i = x_{i-1} - 7b + a$$

Find the sum of the elements.

Program code:

```
.data
x dw 5 dup(?)
a db 0AAh
b db 3h
sm dw ?

.code
start:
   mov ax, @data
   mov ds, ax


   ;x(i) = x(i-1)-7b+a
   ;mov bx, 4

   xor ax, ax
   mov al, b
   mov bl, 7
   mul bl     ;al = 7b

   xor dx,dx
   mov dl, a
   sub dx, ax ;dx = a-7b

   mov x, 0000h ;this will be the first element

   mov si, 2 ;next array elem index start
   mov cx, 4 ;need to compute 4 more elemnents

   xor ax, ax

findNextElem:
   add ax, dx ; ax=ax+a-7b

   mov x[si],ax ;saves value in array

   inc si ;increment 2 times because element is word
   inc si

   loop findNextElem

   ;compute sum of elem in array
   mov cx, 5
   mov si, 0
   xor ax, ax ; set value to 0

sum:
   add ax, x[si]
   inc si
   inc si
   loop sum

   mov sm, ax ;saves sum
```

```
    mov ah, 4Ch
    int 21h

end start
```

II. Conditional and unconditional jumps.

Calculate the expression.

$$Y = \begin{cases} (X - Z)2 - 41 & \text{if } Z \text{ is even} \\ 2Z + 23 & \text{if } X \text{ is odd} \end{cases}$$

With X, Y, Z being DW.

Program code:

```
.data
x dw 8002h
z dw 7417h
y dd ?

.code
start:
    mov ax, @data
    mov ds, ax

    mov ax, z
    shr ax, 1 ;if cf=1 then odd else even

    jc odd
even:
    mov ax, x
    sub ax, z ;ax=X-Z

    shl ax, 1 ;mul by 2
    mov dx, 0
    adc dx, 0 ;dx:ax = (X-Z)2

    sub ax, 41
    sbb dx, 0 ;dx:ax = (X-Z)2-41

    jmp finish

odd:
    mov ax, z
    shl ax, 1 ;mul by 2
    mov dx, 0
    adc dx, 0 ;dx:ax = 2Z

    add ax, 23
    adc dx, 0 ;dx:ax = 2Z+23

finish:
    mov y, ax
    mov y[2], dx  ;save result in y

    mov ah, 4Ch
    int 21h
end start
```

Conclusion

In this laboratory work we learned how to use loops, conditional and unconditional jumps. We also learned how to compare two numbers and jump if certain flags are set. The jumps and the flags are essential tools in order to use conditions and without them we wouldn't be able to do the first and the second problem.