Course Title: Microprocessors and Assembly Language Lab (CSE-4504)
Department of Computer Science and Engineering (CSE)
Islamic University of Technology (IUT), Gazipur

Lab # 04

Understanding Advanced 8086 I/O Instructions using Array in Assembly Language Program.

Objective:

To understand some advanced 8086 instructions and getting familiar with the use of Array in Assembly Language Program.

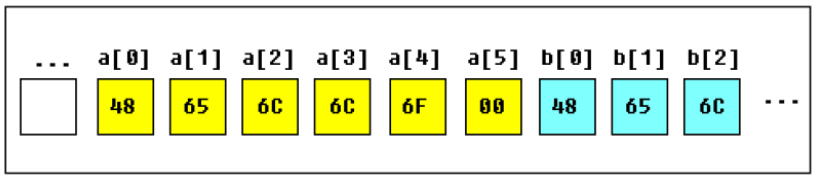
Theory:

- **Array**

Arrays can be seen as chains of variables. A text string is an example of a byte array; each character is presented as an ASCII code value (0..255). Here are some array definition examples:

```
a DB 48h, 65h, 6Ch, 6Ch, 6Fh, 00h
b DB 'Hello', 0
```

b is an exact copy of the an array, when compiler sees a string inside quotes it automatically converts it to set of bytes. This chart shows a part of the memory where these arrays are declared:



You can access the value of any element in array using square brackets, for example:

```
MOV AL, a[3]
```

You can also use any of the memory index registers **BX, SI, DI, BP**, for example:

```
MOV SI, 3
MOV AL, a[SI]
```

If you need to declare a large array with same value you can use **DUP** operator. The syntax for **DUP**: For example:

```
c DB 5 DUP(0)
c DB 0, 0, 0, 0, 0        ; is an alternative way of declaring:
```

one more example:

```
d DB 5 DUP(1, 2)
d DB 1, 2, 1, 2, 1, 2, 1, 2, 1, 2          ; is an alternative way of declaring:
```

Of course, you can use **DW** instead of **DB** if it's required to keep values larger then 255, or smaller then -128. **DW** cannot be used to declare strings!

Assembly Language Program Example for Array:

To derive summation of a series 1 + 2 + 3 using array. Here, value of N is given by user where N=3 and output is shown in the output window:

```
org 100h
.DATA                                   ; Data segment starts
A db 3, 1, 2                            ;1-D array for number
B db 00h
message db 'Enter the value of N:$'     ;1-D array for string
.CODE                                   ; Code segment starts
MAIN PROC
mov ax, @DATA
mov ds, ax
xor ax,ax
mov si, OFFSET A
mov di, OFFSET B
mov dx, OFFSET message ; Load Effective Address of the message in DX register
; lea dx, message ; (similar meaning like Load Effective Address)
mov ah, 09h                             ;display string function
int 21h                                 ;display message
mov ah, 01h
int 21h
mov cl, al
sub cl, 48          ; to convert the ascii value of 3 to decimal 3
xor al, al
Loop_1:
        add al, [Si]
        inc Si
        loop Loop_1
mov bl, al
add bl, 48          ; to convert the ascii value of the output to decimal
mov ah, 02h
mov dl, bl
int 21h
MAIN ENDP
END MAIN
RET
```

Tasks to do:

1. Write an assembly language code to derive the final value of the odd and even number sequence $1^2+3^2+5^2+\ldots..+(2N-1)^2$ or $2^2+4^2+\ldots..+2N^2$ (**use ARRAY and Loop**) upto N. Take the input value of N (in between 1 to 9) as a single ASCII character and then adjust it to actual decimal value in your program. Finally, store and show the output in variables named ODD_SUM and EVEN_SUM.

   Sample Input / Output:

   Input: The value of N in between 2 ~ 9, Let's Consider N = 5
   ODD_SUM: 34
   EVEN_SUM: 20