Variables:

- Declaration:
  > **Variable _Name   DB/DW   initial_value**

  - DB = Define Byte
    Example:
    VAR1 DB 5EH

  - DW = Define Word
    Example:
    VAR2 DW 8DC6h

  - DB/DW are variable types

- Variable _Name:
  > Can be any letter or digit combination, though it **must start with a letter.**
  > It's possible to declare unnamed variables by not specifying the name using "?"
  > (this variable will have an address but no name)

- Initial_value:
  > can be any numeric value:

  - Decimal number ends with an optional "D"/"d"
  - Binary number ends with "B"/"b"
  - Hex number ends with **"H"/"h" and must start with a decimal digit.** Otherwise the assembler would be unable to decide whether the data represents a number or a string. (Ex: 2AH, 5C4H, 1ABCH, 0ABCDH)
  - Numbers may have signs
  - "?" denotes an uninitialized byte/word

Example 1: Define a byte variable with the value 35H and print the value of the variable.

```
01  .MODEL SMALL
02  .STACK 100H
03  .DATA
04      V1 DB 35H
05  .CODE
06      MOV AX, @DATA
07      MOV DS, AX
08
09      MOV AH, 2
10      MOV DL, V1
11      INT 21H
12
13      MOV AH, 4CH
14      INT 21H
```

```
01  .MODEL SMALL
02  .STACK 100H
03  .DATA
04      V1 DW 54H
05  .CODE
06      MOV AX, @DATA
07      MOV DS, AX
08
09      MOV AH, 2
10      MOV DX, V1
11      INT 21H
12
13      MOV AH, 4CH
14      INT 21H
```

@DATA is the name of the data segment defined by .DATA. The assembler translates the name @DATA into a segment number. Two instructions are needed because a number (the data segment number) may not be moved directly into a segment register.

Creating Constants:

Constants are just like variables, but they exist only until your program is compiled (assembled) because no memory is allocated for constants. After definition of a constant its value cannot be changed. To define constants EQU (equates) directive is used:

constant_name   EQU   constant_value (numeric value / string)

Example:

k EQU 5

MOV BX, k

Creating Arrays:

- 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).
Example:

  VAR1 DB 48h, 65h, 6Ch, 6Ch, 6Fh, 00h
  VAR2 DB 'Hello', 0

- You can access the value of any element in an array using square brackets
Example:

  MOV AL, VAR1[3]

- You can also use any of the memory index registers BX, SI, DI, BP
Example:

  MOV SI, 3
  MOV CL, VAR2[SI]

- If you need to declare a large array you can use the DUP operator.
The syntax for DUP:
  > **NUMBER   DUP   (VALUE(S))**
  number - number of duplicates to make (any constant value).
  value - expression that DUP will duplicate.

  Example:

  c DB 4 DUP(9)   ;is an alternative way of declaring: c DB 9, 9, 9, 9

  d DB 4 DUP(1, 2)   ;is an alternative way of declaring: d DB 1, 2, 1, 2, 1, 2, 1, 2

Example 2: Define a byte variable with initial value 65h and a string "HELLO!". Print those.

```
02  .MODEL SMALL
03  .STACK 100H
04  .DATA
05      V1 DB 65h
06      S DB "HELLO!$"
07  .CODE
08      MOV AX, @DATA
09      MOV DS, AX
10
11      MOV AH, 2
12      ;DISPLAY THE VARIABLE
13      MOV DL, V1
14      INT 21H
15
16      ;PUT A SPACE AFTER VARIABLE
17      MOV DL, 20H
18      INT 21H
19
20      ;PRINT THE STRING
21      ;USING FUNCTION# 9
22      LEA DX, S
23      MOV AH, 9
24      INT 21H
25
26      MOV AH, 4CH
27      INT 21H
28
```

INT 2lh, function 9, expects the offset address of the character string to be in DX. To get it there, we use a new instruction:

> **LEA Destination, Source**

where destination is a general register and source is a memory location. LEA stands for "Load Effective Address." It puts a copy of the **source offset address** into the destination. Example:

> **LEA DX, MSG1**

puts the offset address of the variable MSG into DX.

Instruction	Operands	Descriptions
LEA	REG, MEM	Load Effective Address. Algorithm: REG = address of memory (offset)

Example 3: create an array of size 3 and load the array with user input data.

```
02  .MODEL SMALL
03  .STACK 100H
04  .DATA
05      A DB 3 DUP (?), '$'
06  .CODE
07      MOV AX, @DATA
08      MOV DS, AX
09
10      MOV AH, 1
11
12      ;TAKE INPUT
13      INT 21H
14      MOV A[0], AL
15
16      INT 21H
17      MOV A[1], AL
18
19      INT 21H
20      MOV A[2], AL
21
22      MOV AH, 4CH
23      INT 21H
24
```

```
02  .MODEL SMALL
03  .STACK 100H
04  .DATA
05      A DB 3 DUP (?), '$'
06  .CODE
07      MOV AX, @DATA
08      MOV DS, AX
09
10      MOV AH, 1
11
12      ;SI HOLDS THE OFFSET
13      ;ADDRESS OF A
14      LEA SI, A
15      ;TAKE INPUT
16      INT 21H
17      MOV [SI], AL
18
19      INT 21H
20      MOV [SI+1], AL
21
22      INT 21H
23      MOV [SI+2], AL
24
25      MOV AH, 4CH
26      INT 21H
27
```