Variables

In programming, a variable is a container (storage area) to hold data. To indicate the storage area, each variable should be given a unique name that is also called (identifier). Variable names are just the symbolic representation of a memory location. Variables can be change value during the execution of program.

Rules of variable name declarations

The name you assign to a ***variable*** is also called ***identifier***. Some rules of variable declaration are following.

1) Variable name must be start alphabet letters or underscore "_" tart a like salary, name, _Number etc.
2) Identifier/Variable may contain uppercase and lowercase Letters, Numbers, or underscore.
3) The if first character "_"underscore after must be a letter.
4) Identifier/Variable cannot contain special character and spaces.
5) Identifier/Variable are case sensitive.
6) Identifier/Variable cannot contain reserve words or keywords of C/C++ language

Syntax: `datatype variable_name ;`

Convention Of variable:

```
DataType variableName = Content or data ;
char Father_Name[20] = "Muhammad  Ali";
int ConvanceAllownace = 6500;
int  _Salary = 25000;
char gr='A';
```

Constants/Literals

A constant is a value or an identifier whose value cannot be altered in a program. For example: 1, 2.5, "C programming is easy" etc. As mentioned, an identifier also can be defined as a constant. Constant define must be write starting of C/ C++ program

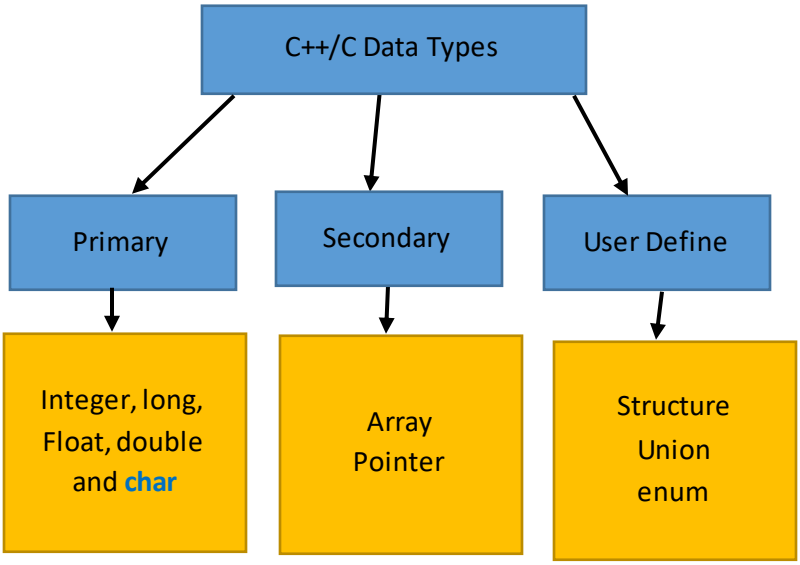
Syntax: `const datatype variable_name = Value ;`

```
#include <stdio.h>
#include <conio.h>
void main()
{
      const float PI=3.142;
      printf("value of PI is  %f \n",PI);
}
```

Format Specifiers: It is usual variable type display, specific for each data type like **integer** for **%d** , **character** for **%c** , **long integer** for **%ld** and **float** for **%f** and so on.

C++ Data Types:

C++ has a concept of 'data types' which are used to define a variable before its use. The definition of a variable will assign storage for the variable and define the type of data that will be held in the location. There are many data types in C++ / C.



Data types store specified memory size and data values range. There are following tables.

Data Type	Memory (In Bytes)	Format Specifiers	Range
int	2	%d	-32,768 to 32,767
short **int**	2	%d	-32,768 to 32,767
unsigned **int**	2	%u	0 to 65535
long **int**	4	%ld	-2,147,483,648 to 2,147,483,647
unsigned long **int**	4	%lu	0 to 4,294,967,295
char	1	%c	-128 to 127
Unsigned **char**	1	%c	0 to 255
float	4	%f	+/- 3.4e +/- 38 (~7 digits)
double	8	%lf	+/- 1.7e +/- 308 (~15 digits)
long double	12	%Lf	–

Numeric

This data type is based on digits it has further divided into three classes.

1) Integer
2) Float
3) Double

1. **Integer:** This data type contains numeric data up to 2 bytes .Format specifier used for integer data type is %d or %i and it is denoted by "**int**".

2. **Float:** This data type contains floating point data. It reserves 4 bytes in memory, Format specifier used for **float** data type is %f and it is denoted by "**float**".

3. **Double:** This data type contains long numeric data. It reserves 8 byte in memory, Format specifier used for double data type is %ld or %lf and it is denoted by "double".

Alphabetic /Non Numeric

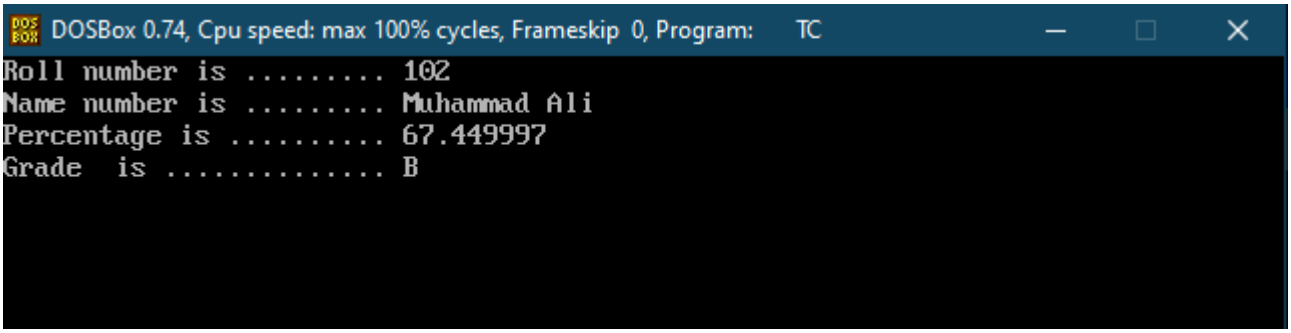
This data type is based on alphabets and alphanumeric data that contains alphabet(s), special character and/or digits. All of these, uses the common data type "**char**".

1. **char:** This data type contains alphabetic data. It reserves 1 byte/character in memory, Format specifier used for double data type is %c and it is denoted by "**char**".
2. **string: C**haracters data type is also used for multiple characters strings, format specifier use for multiple characters is %s.

Example

```
#include <conio.h>
#include <stdio.h>
void main()
{
        int Roll=102;
       float Per=67.45;
      char Grade='B';
      char Name[20]="Muhammad  Ali";

       clrscr();
       printf("Roll number is ..... %d  \n",Roll);
       printf("Name number is ..... %s  \n",Name);
       printf("Percentage is ..... %f  \n",Per);
       printf("Grade  is ..... %c  \n",Grade);
}
```



Strongly/Static typed Programming

Strongly or Static typed programming language is in every variable must be declared with a data Type and data type cannot be change after declaration. Java and C++ are strongly or Static typed Programming languages.

Loosely/Dynamic typed Programming

A loosely typed Programming is a programming language that does not require a variable to be defined. You can declare a variable, but it doesn't require you to classify the type of variable. Loose typing is also known as dynamic typing because the data type for a variable can be change after it has been declared. PHP and Perl is a loosely typed programming language.

Formatting data output with *printf*() function:

The ***printf()*** function outputs message with specified format. ***printf***() takes a string argument called a format string, usually followed by one or more additional arguments containing the string or strings to format. It then outputs the result.

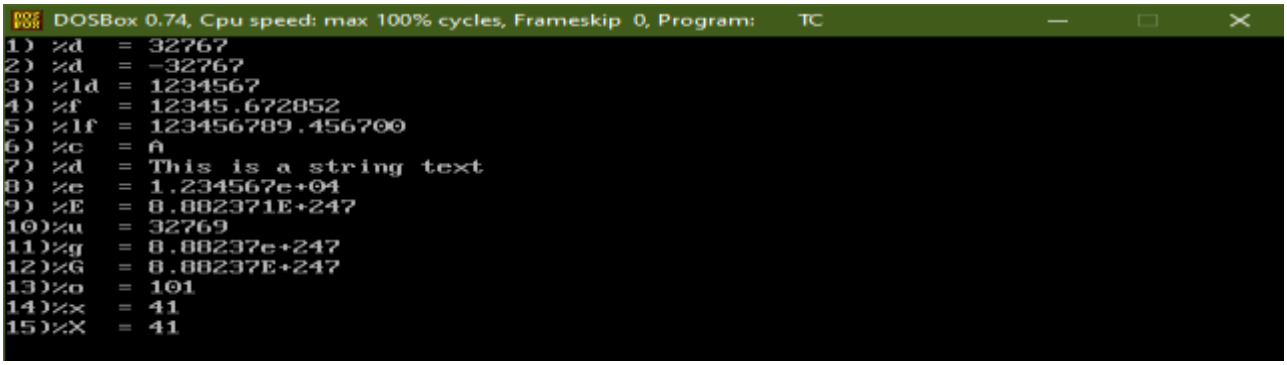
```
void main()
{
    int number=9;
    char str[]="Beijing";
    printf("There are %d million bicycles in %s \n",number, str);
}
```

The arg1, arg2, ++ parameters will be inserted at percent (%) signs in the main string. This function works "step-by-step". At the first % sign, arg1 is inserted, at the second % sign, arg2 is inserted, etc. one more example of all formatted specified.

```
#include <conio.h>
#include <stdio.h>

void main()
{
  short varshort= 32767;
  int   varint  = 32767;
  long int varlong=123456789;
  float varfloat=123456789.6783;
  double vardouble  = -123456789.4567;
  char varchar= 65; // The ASCII Character 65 is A
  char varstr[]="This is a string text ";

   clrscr();
   printf("1) %%d  = %d \n",varshort); // short integer number
   printf("2) %%d  = %d \n",varint); // Signed decimal number
   printf("3) %%ld = %ld \n",varlong); // Signed long integer number
   printf("4) %%f  = %f \n",varfloat); // Signed decimal number
   printf("5) %%lf = %lf \n",vardouble); // Signed double decimal number
   printf("6) %%c  = %c \n",varchar); // single character
   printf("7) %%d  = %s \n",varstr); // Signed decimal number
   printf("8) %%e  = %e \n",varlong); // Scientific notation (lowercase)
   printf("9) %%E  = %E \n",varint); // Scientific notation (uppercase)
   printf("10)%%u  = %u \n",varint); // Unsigned integer number (positive)
   printf("11)%%F  = %F \n",varfloat); // Floating-point number (not local settings aware)
   printf("12)%%g  = %g \n",varint); // Shorter of %e and %f
   printf("13)%%G  = %G \n",varint); // Shorter of %E and %f
   printf("14)%%o  = %o \n",varchar); // Octal number
   printf("15)%%x  = %x \n",varchar); // Hexadecimal number (lowercase)
   printf("16)%%X  = %X \n",varchar); // Hexadecimal number (uppercase)
   getche();
}
```



Exercise

Theory Questions

1) Define five primary data in C++/C Language
2) What is format specifier and describe at least 5 format specifier of C Language.
3) What difference between variables and constant?
4) Explain the purpose of the NULL data type.
5) What do you mean by strongly and loosely typed programming?

Practical Questions

1) Write a simple program to print your G.R # using variable data type "**int**".
2) Write a simple program of the following output using by ***printf*** statements.

   Employee code is 001
   Employee Name is ABC
   Employee Salary is 25000
   Working Hours are 7.5

3) Repeat the above program using Variables. (Hint: Use 4 Variables respectively for each data.)
4) Write down the code of following output, use suitable character or constant(s) if necessary

```
   ***********       ****      ****  ***
*********   ***      ****      ****  ***
*********   ***      ****      ****  ***
            ***      ****      ****  ***
            ***********************
            ***********************
```

5) How do you declare a constant in C/C++ with any suitable example?

Objective & MCQ's

1) Positive and negative number and 0 with no decimal places belong to which data type.
   a) Double
   b) Float
   c) String
   d) Integer

2) Which of the following is a valid variable name?
   a) TotalSalary ;
   b) $Total Salary
   c) Total Salary;
   d) Total-Salary;

3) How many decimal places does an integer store
   a) One decimal
   b) Two decimal
   c) Three decimal
   d) Integer does not store decimal places.

4) Variable name can be starting which symbol.
   a) _ (under score)
   b) @
   c) $
   d) %

5) String constant value
   a) Must be enclosed in double quotes
   b) Must be enclosed in commas
   c) Must be enclosed in round parentheses
   d) Must be square brackets.

6) We use the _____ keyword to create constant.
   a) define
   b) final
   c) redefine
   d) const

7) A strongly typed programming language _____.
   a) Does not required data typed of a variables to be declared.
   b) Requires data types of variables to be declared
   c) Does not have variable
   d) Does not have different data types.

8) A constant variable by convention, constant identifiers are ___.
   a) Lower case
   b) Camel case
   c) Upper case
   d) Normal case

9) Integer value range is ___
   a) -32,768 to +32,767
   b) 0 to 65535
   c) -127 to -128
   d) -2,147,483,648 to 2,147,483,647