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**Introduction to 'C++' Language**

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**Introduction to C Plus Plus**

**Module 4 - Data Types and Variables in C Plus Plus**

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**Data Types in C++**

Data types in C++ define the type of data that a variable can store. For example, whether a variable holds an integer, a floating-point number, a character, or any other type of value. Understanding data types is essential to writing programs that work correctly and efficiently.

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<u><b>TYPE</b></u>	<u><b>BYTES</b></u>	<u><b>RANGE</b></u>
char	1	-128 to – 127
unsigned	1	0 to 265
sgned char	1	-128 to 127
int	2	-32768 to 32768
unsigned int	2	0 to 65535
singed int	2	-32768 to 32768
short int	2	-32768 to 32768

**Built-in-type**

**1. Integral type:**

The data types in this type are int and char. The modifiers signed, unsigned, long & short may be applied to character & integer basic data type. The size of int is 2 bytes and char is 1 byte.

**2. Void:** To specify the return type of a function when it is not returning any value.

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### 3. Floating type:

The data types in this are float & double. The size of the float is 4 byte and double is 8 byte. The modifier long can be applied to double & the size of long double is 10 byte.

### User-defined type:

The user-defined data type structure and union are same as that of C.

1. **Classes:** Class is a user defined data type which can be used just like any other basic data type once declared. The class variables are known as objects.

### 2. Enumerated Data Types:

Like structures, enumerated data type is another user defined data type. Enumerated means that all the values are listed.

- They are used when we know a finite list of values that a data type can take on or it is an alternative way for creating symbolic constants.
- The 'enum' keyword automatically lists a list of words and assign them values 0,1,2...

Syntax:

```
enum shape {
    circle, square, triangle;
}
```

Now shape becomes a new type name & we can declare new variables of this type.

Ex: shape oval;

In C++, enumerated data type has its own separate type. Therefore C++ does not permit an int value to be automatically converted to an enum value.

Ex. shape shapes1 = triangle, // is allowed

shape shape1 = 2; // Error in c++

shape shape1 = (shape)2; //ok

By default, enumerators are assigned integer values starting with 0, but we can override the default value by assigning some other value.

Ex enum colour {red, blue, pink = 3}; //it will assign red to 0, blue to 1, & pink to 3 or enum colour {red = 5, blue, green}; //it will assign red to 5, blue to 6 & green to 7.

### Derived Data types:



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1) **Arrays:** An array in C++ is similar to that in C, the only difference is the way character arrays are initialized. In C++, the size should be one larger than the number of character in the string where in C, it is exact same as the length of string constant.

Ex - `char string1[3] = "ab"; // in C++`  
`char string1[2] = "ab"; // in C`

2) **Functions:** Functions in C++ are different than in C, there is lots of modification in functions in C++ due to object orientated concepts in C++.

3) **Pointers:** Pointers are declared & initialized as in C.  
Ex `int * ip; // int pointer`  
`ip = &x; //address of x through indirection`

Variables in C++

**Declaration of variables:**

C requires all the variables to be defined at the beginning of a scope. But C++ allows the declaration of variable anywhere in the scope.

That means a variable can be declared right at the place of its first use. It makes the program easier to understand.

In order to use a variable in C++, we must first declare it specifying which data type we want it to be. The syntax to declare a new variable is to write the specifier of the desired data type (like int, bool, float...) followed by a valid variable identifier.

Ex.: `int a; float mynumber;`

These are two valid declarations of variables. The first one declares a variable of type int with the identifier a. The second one declares a variable of type float with the identifier mynumber.

Once declared, the variables a and mynumber can be used within the rest of their scope in the program. If you are going to declare more than one variable of the same type, you can declare all of them in a single statement by separating their identifiers with commas.

Ex.: `int a, b, c;` This declares three variables (a, b and c), all of them of type int, and has exactly the same meaning as: `int a; int b; int c;`

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The integer data types can be char, short, long. Integer data type can be either signed or unsigned depending on the range of numbers needed to be represented. Signed types can represent both positive and negative values, whereas unsigned types can only represent positive values (and zero).

This can be specified by using either the specifier signed or the specifier unsigned before the type name.

Ex.: unsigned short int Number; signed int Balance;

By default, if we do not specify either signed or unsigned most compiler settings will assume the type to be **signed**, therefore instead of the second declaration above we could have written:

**int Balance;**  
with exactly the same meaning (with or without the keyword signed)

Scope of Variables:

All the variables that we intend to use in a program must have been declared with its type specifier in an earlier point in the code.

A variable can be either of global or local scope.

A global variable is a variable declared in the main body of the source code, outside all functions, while a local variable is one declared within the body of a function or a block.

Global variables can be referred from anywhere in the code, even inside functions, whenever it is after its declaration.

The scope of local variables is limited to the block enclosed in braces ( { } ) where they are declared.

For example, if they are declared at the beginning of the body of a function (like in function main) their scope is between its declaration point and the end of that function. In the example above, this means that if another function existed in addition to main, the local variables declared in main could not be accessed from the other function and vice versa.

Assignment

Ques 1: Write a program to calculate the area of a rectangle. Take the length and width as input from the user.

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Ques 2: Write a program to input and display a student's name, roll number, and marks in three subjects.

Ques 3: Write a program to input five floating-point numbers from the user and calculate their average.

Ques 4: Write a program to input a character and display its ASCII value.

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