

C++ Pointers

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C++ pointers are easy and fun to learn. Some C++ tasks are performed more easily with pointers, and other C++ tasks, such as dynamic memory allocation, cannot be performed without them.

As you know every variable is a memory location and every memory location has its address defined which can be accessed using ampersand (&) operator which denotes an address in memory. Consider the following which will print the address of the variables defined –

```
#include <iostream>

using namespace std;
int main () {
    int var1;
    char var2[10];

    cout << "Address of var1 variable: ";
    cout << &var1 << endl;

    cout << "Address of var2 variable: ";
    cout << &var2 << endl;

    return 0;
}
```

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When the above code is compiled and executed, it produces the following result –

```
Address of var1 variable: 0xbfefd5c0
Address of var2 variable: 0xbfefd5b6
```

What are Pointers?

A **pointer** is a variable whose value is the address of another variable. Like any variable or constant, you must declare a pointer before you can work with it. The general form of a pointer variable declaration is –

```
type *var-name;
```

Here, **type** is the pointer's base type; it must be a valid C++ type and **var-name** is the name of the pointer variable. The asterisk you used to declare a pointer is the same asterisk that you use for multiplication. However, in this statement the asterisk is being used to designate a variable as a pointer. Following are the valid pointer declaration –

```
int    *ip;    // pointer to an integer
double *dp;    // pointer to a double
float  *fp;    // pointer to a float
char   *ch     // pointer to character
```

The actual data type of the value of all pointers, whether integer, float, character, or otherwise, is the same, a long hexadecimal number that represents a memory address. The only difference between pointers of different data types is the data type of the variable or constant that the pointer points to.

Using Pointers in C++

There are few important operations, which we will do with the pointers very frequently. **(a)** We define a pointer variable. **(b)** Assign the address of a variable to a pointer. **(c)** Finally access the value at the address available in the pointer variable. This is done by using unary operator `*` that returns the value of the variable located at the address specified by its operand. Following example makes use of these operations –

```
#include <iostream>

using namespace std;

int main () {
    int var = 20;    // actual variable declaration.
    int *ip;         // pointer variable

    ip = &var;       // store address of var in pointer variable

    cout << "Value of var variable: ";
    cout << var << endl;

    // print the address stored in ip pointer variable
    cout << "Address stored in ip variable: ";
    cout << ip << endl;

    // access the value at the address available in pointer
    cout << "Value of *ip variable: ";
    cout << *ip << endl;

    return 0;
}
```




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When the above code is compiled and executed, it produces result something as follows –

```
Value of var variable: 20
Address stored in ip variable: 0xbfc601ac
Value of *ip variable: 20
```

Pointers in C++

Pointers have many but easy concepts and they are very important to C++ programming. There are following few important pointer concepts which should be clear to a C++ programmer –

Sr.No	Concept & Description
1	Null Pointers  C++ supports null pointer, which is a constant with a value of zero defined in several standard libraries.
2	Pointer Arithmetic  There are four arithmetic operators that can be used on pointers: ++, --, +, -
3	Pointers vs Arrays  There is a close relationship between pointers and arrays.

4	<p>Array of Pointers </p> <p>You can define arrays to hold a number of pointers.</p>
5	<p>Pointer to Pointer </p> <p>C++ allows you to have pointer on a pointer and so on.</p>
6	<p>Passing Pointers to Functions </p> <p>Passing an argument by reference or by address both enable the passed argument to be changed in the calling function by the called function.</p>
7	<p>Return Pointer from Functions </p> <p>C++ allows a function to return a pointer to local variable, static variable and dynamically allocated memory as well.</p>

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