C++ Pointers

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In this tutorial, we will learn about pointers in C++ and their working with the help of examples.

In C++, pointers are variables that store the memory addresses of other variables.

Address in C++

If we have a variable *var* in our program, *&var* will give us its address in the memory. For example,

Example 1: Printing Variable Addresses in C++

```
#include <iostream>
using namespace std;

int main()
{
    // declare variables
    int var1 = 3;
    int var2 = 24;
    int var3 = 17;

    // print address of var1
    cout << "Address of var1: "<< &var1 << endl;

    // print address of var2
    cout << "Address of var2: " << &var2 << endl;

    // print address of var3
    cout << "Address of var3: " << &var3 << endl;
}
```

Output

```
Address of var1: 0x7fff5fbff8ac
Address of var2: 0x7fff5fbff8a8
Address of var3: 0x7fff5fbff8a4
```

Here, `0x` at the beginning represents the address is in the hexadecimal form.

Notice that the first address differs from the second by 4 bytes and the second address differs from the third by 4 bytes.

This is because the size of an `int` variable is 4 bytes in a 64-bit system.

Note: You may not get the same results when you run the program.

As mentioned above, pointers are used to store addresses rather than values.

Here is how we can declare pointers.

```
int *pointVar;
```

Here, we have declared a pointer *pointVar* of the `int` type.

We can also declare pointers in the following way.

```
int* pointVar; // preferred syntax
```

Let's take another example of declaring pointers.

```
int* pointVar, p;
```

Here, we have declared a pointer *pointVar* and a normal variable *p*.

Note: The `*` operator is used after the data type to declare pointers.

Assigning Addresses to Pointers

Here is how we can assign addresses to pointers:

```
int* pointVar, var;
var = 5;

// assign address of var to pointVar pointer
pointVar = &var;
```

Here, `5` is assigned to the variable *var*. And, the address of *var* is assigned to the *pointVar* pointer with the code `pointVar = &var`.

Get the Value from the Address Using Pointers

To get the value pointed by a pointer, we use the `*` operator. For example:

```
int* pointVar, var;
var = 5;

// assign address of var to pointVar
pointVar = &var;

// access value pointed by pointVar
cout << *pointVar << endl;   // Output: 5
```

In the above code, the address of var is assigned to *pointVar*. We have used the `*pointVar` to get the value stored in that address.

When `*` is used with pointers, it's called the **dereference operator**. It operates on a pointer and gives the value pointed by the address stored in the pointer. That is, `*pointVar = var`.

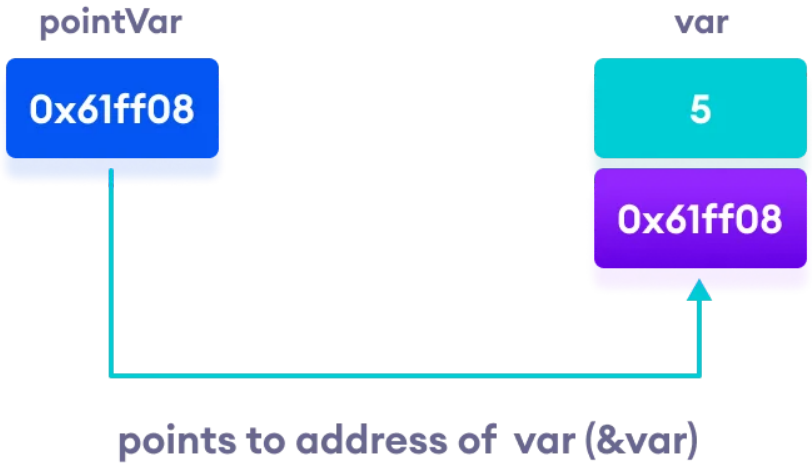
Note: In C++, *pointVar* and **pointVar* is completely different. We cannot do something like `*pointVar = &var;`

Example 2: Working of C++ Pointers

```
#include <iostream>
using namespace std;
int main() {
    int var = 5;

    // declare pointer variable
    int* pointVar;

    // store address of var
    pointVar = &var;

    // print value of var
    cout << "var = " << var << endl;

    // print address of var
    cout << "Address of var (&var) = " << &var << endl
         << endl;

    // print pointer pointVar
    cout << "pointVar = " << pointVar << endl;

    // print the content of the address pointVar points to
    cout << "Content of the address pointed to by pointVar (*pointVar) = " <<
*pointVar << endl;

    return 0;
}
```

Output

```
var = 5
Address of var (&var) = 0x61ff08

pointVar = 0x61ff08
Content of the address pointed to by pointVar (*pointVar) = 5
```



Working of C++ pointers

Changing Value Pointed by Pointers

If *pointVar* points to the address of *var*, we can change the value of *var* by using **pointVar*.

For example,

```
int var = 5;
int* pointVar;

// assign address of var
pointVar = &var;

// change value at address pointVar
*pointVar = 1;

cout << var << endl; // Output: 1
```

Here, *pointVar* and `&var` have the same address, the value of *var* will also be changed when **pointVar* is changed.

Example 3: Changing Value Pointed by Pointers

```
#include <iostream>
using namespace std;
int main() {
    int var = 5;
    int* pointVar;

    // store address of var
    pointVar = &var;

    // print var
    cout << "var = " << var << endl;

    // print *pointVar
    cout << "*pointVar = " << *pointVar << endl
         << endl;

    cout << "Changing value of var to 7:" << endl;

    // change value of var to 7
    var = 7;

    // print var
    cout << "var = " << var << endl;

    // print *pointVar
    cout << "*pointVar = " << *pointVar << endl
         << endl;

    cout << "Changing value of *pointVar to 16:" << endl;

    // change value of var to 16
    *pointVar = 16;

    // print var
    cout << "var = " << var << endl;

    // print *pointVar
    cout << "*pointVar = " << *pointVar << endl;
    return 0;
}
```

Output

```
var = 5
*pointVar = 5

Changing value of var to 7:
var = 7
*pointVar = 7

Changing value of *pointVar to 16:
var = 16
*pointVar = 16
```

Common mistakes when working with pointers

Suppose, we want a pointer *varPoint* to point to the address of *var*. Then,

```
int var, *varPoint;

// Wrong!
// varPoint is an address but var is not
varPoint = var;

// Wrong!
// &var is an address
// *varPoint is the value stored in &var
*varPoint = &var;

// Correct!
// varPoint is an address and so is &var
varPoint = &var;

 // Correct!
// both *varPoint and var are values
*varPoint = var;
```

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