Fundamentals of Programming: Pointers in C++

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Agenda

- Address Operator
- Definition of a pointer
- Syntax of a pointer
- Creating pointer variables and accessing those
- Use of Dereference Operator
- Pointer to Pointer
- Pointer Arithmetic (Increment/Decrement)

Address Operator (&)

- Address operator returns the memory address of a variable.

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

int main(){
int a=5;
cout<<&a<<endl;
return 0;
}
```

```
C:\Users\92306\Desktop\Aror

0x70fe1c

--------------------------------
Process exited after 0.06724 seconds with return value 0
Press any key to continue . . .
```

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

int main(){
int a=5;
int b=&a;
cout<<b<<endl;
return 0;
}
```

Can we do this….

Pointer

- A variable which holds the memory address of other variables of same data type.
- Pointers are symbolic representation of memory addresses.

Syntax

Syntax:

```
datatype *var_name;
int *ptr;   // ptr can point to an address which holds int data
```

```
int main(){
int a=5;
int* b=&a;
cout<<b<<endl;
return 0;
}
```

```
C:\Users\92306\Desktop\Aror

0x70fe14

--------------------------------
Process exited after 0.05116 seconds with return value 0
Press any key to continue . . .
```

Pointer variable returns the address where variable a is stored in memory

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

int main(){
string a="Hello";
string* b=&a;
cout<<*b<<endl;
return 0;
}
```

```
C:\Users\92306\Desktop\Aror

Hello

--------------------------------
Process exited after 0.04887 seconds with return value 0
Press any key to continue . . .
```

Another program, to illustrate the usage of dereference operator *

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

int main(){
string a="Hello";
string* b=&a;
cout<<*&a<<endl;
return 0;
}
```

```
C:\Users\92306\Desktop\Aror

Hello

--------------------------------
Process exited after 0.05362 seconds with return value 0
Press any key to continue . . .
```

Another program, to illustrate the usage of dereference operator *

Dereference operator (*)

IT GIVES THE VALUE STORED AT ANY MEMORY ADDRESS.

Variety of uses…

- Call by reference
- Iterating over arrays
- Manipulating dynamic arrays

Why to associate data type with a pointer, Why not directly store address

- Data type tells us how many bytes the data is stored in.
- When we increment a pointer, we increase the pointer by the size of data type it points to.

Pointer to Pointer

```
int main(){
string a="Hello";
string* b=&a;
string**c =&b;

cout<<&a<<endl;
cout<<b<<endl;
cout<<*b<<endl;
cout<<&b<<endl;

cout<<c<<endl;
cout<<*c<<endl;
cout<<**c;
```

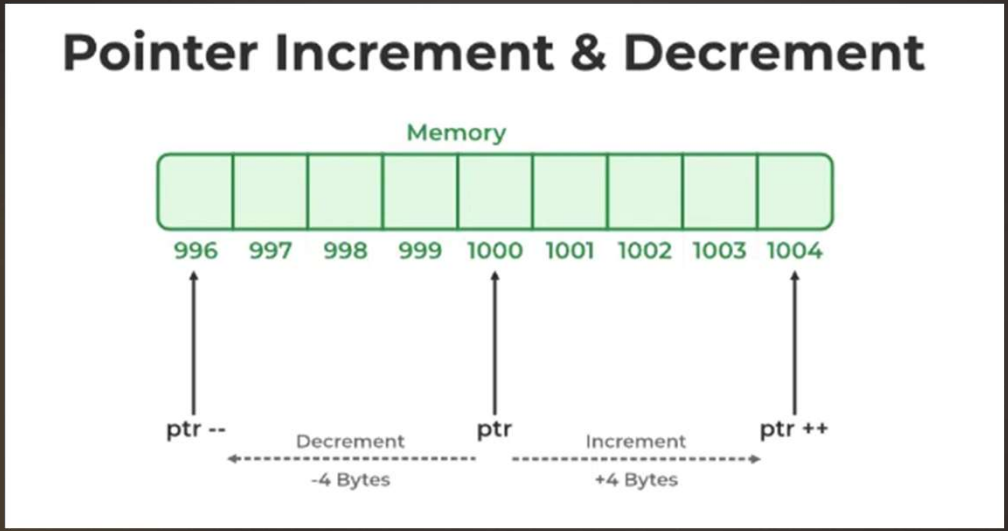
```
C:\Users\92306\Desktop\Aror

0x71fdf0
0x71fdf0
Hello
0x71fde8
0x71fde8
0x71fdf0
Hello
--------------------------
Process exited after 0.
Press any key to contir
```

Pointer Arithmetic (Increment/Decrement)

- Applying increment/decrement operator on pointer variable will change the memory address

Pointer Arithmetic (Addition)



Increment in Pointer


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

int main(){

int a=5;
int* ptr=&a;
cout<<ptr<<endl;
cout<<++ptr<<endl;
return 0;
}
```

C:\Users\92306\Desktop\Aror

```
0x70fe14
0x70fe18

--------------------------------
Process exited after 0.08117 seconds with return value 0
Press any key to continue . . .
```

What about this:


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

int main(){
int a=5;
int* ptr=&a;
cout<<ptr<<endl;
cout<<++ptr<<endl;
cout<<++ptr;
return 0;
}
```

Further on Increment:


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

int main(){
int a=5;
int* ptr=&a;
cout<<ptr<<endl;
cout<<ptr+2;
}
```

C:\Users\92306\Desktop\Aror

```
0x70fe14
0x70fe1c
--------------------------------
Process exited after 0.07309 seconds with return value 0
Press any key to continue . . .
```

Pointer Decrement


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

int main(){
int a=5;
int* ptr=&a;
cout<<ptr<<endl;
cout<<--ptr;
}
```

C:\Users\92306\Desktop\Aror

```
0x70fe14
0x70fe10
--------------------------------
Process exited after 0.06461 seconds with return value 0
Press any key to continue . . .
```

Null Pointer

- A Pointer which points no where
- If we don't have address to be assigned to a pointer, then we can simply use NULL.
- Two ways to assign a pointer as null:
  - int *ptr1=0;
  - int *ptr2=NULL;

Null vs Uninitialized Pointer

- An uninitialized pointer stores an undefined value.
- A null pointer stores a defined value, but one that is defined by the environment to not be a valid address for any member or object.