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# Launchpad

Lecture - 11

Mixed Topics

Anushray Gupta

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## Some more stuff related to Functions

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## Inline Functions

I. If a function is inline, the compiler places a copy of the code of that function at each point where the function is called at compile time.

II. To inline a function, place the keyword inline before the function name and define the function before any calls are made to the function

III. The compiler can ignore the inline qualifier in case defined function is more than a line.

## Default Parameter

I. A default parameter is a function parameter that has **a default value** provided to it.

II. If the user does not supply a value for this parameter, the default value will be used. If the user does supply a value for the default parameter, the user-supplied value is used

## Scope and Duration of Variables

I. When discussing variables, it's useful to separate out the concepts of **scope** and **duration**.

II. A variable's scope determines where a variable is accessible

III. A variable's duration determines where it is created and destroyed

## Local Variables

I. Variables defined inside a block are called local variables.
II. Local variables have automatic duration, which means they are created when the block they are part of is entered, and destroyed when the block they are part of is exited.
III. Local variables have block scope (also called local scope), which means they are visible only within the block that they are defined in.

## Global Variables

I. Variables declared outside of a block are called global variables
II. Global variables have static duration, which means they are created when the program starts and are destroyed when it ends
III. Global variables have global scope (also called “global namespace scope” or “file scope”), which means they are visible until the end of the file in which they are declared
IV. By convention, global variables are declared at the top of a file, below the includes, but above any code.

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## Local Static Variables

I. Using the static keyword on local variables changes them from automatic duration to static duration.

II. A static duration variable (also called a “static variable”) is one that retains its value even after the scope in which it has been created has been exited!

III. Static duration variables are only created (and initialized) once, and then they are persisted throughout the life of the program.

## Function Overloading

I. You can have multiple definitions for the same function name in the same scope
II. The definition of the function must differ from each other by the types and/or the number of arguments in the argument list.
III. You can not overload function declarations that differ only by return type.

## More about Pointers!

## Pointer to a Pointer ( type ** var )

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## Dynamic Memory Allocation!

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## Allocating Memory

There are two ways that memory gets allocated for data storage:

I. Compile Time (or static) Allocation
   I. Memory for named variables is allocated by the compiler
   II. Exact size and type of storage must be known at compile time
   III. For standard array declarations, this is why the size has to be constant
II. Dynamic Memory Allocation
   I. Memory allocated "on the fly" during run time
   II. dynamically allocated space usually placed in a program segment known as the heap or the free store
   III. Exact amount of space or number of items does not have to be known by the compiler in advance.
   IV. For dynamic memory allocation, pointers are crucial

## Dynamic Memory Allocation

I. We can dynamically allocate space while the program is running  but we cannot create new variable names "on the fly"

II. For this reason, dynamic allocation requires two steps

   1. Creating the dynamic space
   2. Storing its address in a pointer

III. To dynamically allocate memory in C++, we use new operator

## De-allocation

I. De-allocation is the “clean up” of space being used by variables or other data storage
II. Compile time variable are automatically deallocated based on their know scope
III. It is the programmer’s job to de-allocate dynamically created memory
IV. To de-allocate dynamic memory we use delete operator

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## new Operator

I. To allocate space dynamically, use the unary operator new, followed by the type being allocated.
   I. new int;        // dynamically allocates an int
   II. new double;     // dynamically allocates a double
II. If creating an array dynamically, use the same form, but put brackets with a size after the type:
   I. new int[40];      /allocates an array of 40 ints
   II. new double[size]; // allocates an array of size double
                         // doubles
III. These statements above are not very useful by themselves, because allocation space have no names.

## new operator contd..

```
int * p;        // declare a pointer p
 p = new int;    // dynamically allocate an int and
load address into p

 double * d;     // declare a pointer d
 d = new double; // dynamically allocate a double
and load address into d

 // we can also do these in single line statements
 int x = 40;
 int * list = new int[x];
 float * numbers = new float[x+10];
```

## delete operator

I. To de-allocate memory that was created with new, we use the unary operator delete. The one operand should be a pointer that stores the address of the space to be deallocated:

```
int * ptr = new int;       // dynamically created int
// ...
delete ptr;                // deletes the space that ptr points to
```

**Note that the pointer ptr still exists in this example. That's a named variable subject to scope and extent determined at compile time. It can be reused:**

I. To deallocate a dynamic array, use this form:

```
int * list = new int[40];   // dynamic array

delete [] list;             // deallocates the array
list = 0;                                  // reset list to null pointer
```

**After deallocating space, it's always a good idea to reset the pointer to null unless you are pointing it at another valid target right away.**

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Lets see some input/output problems.

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## References in C++

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## Reference Variable

I. A reference variable is an alias, that is, another name for an already existing variable/memory instance.
II. Once a reference is initialized with a variable, either the variable name or the reference name may be used to refer to the variable.
III. The reference variable once defined to refer to a variable can't be changed to point to other variable.

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## Defining Reference Variable

I. Reference variables are defined by using & symbol in the definition.
II. Since they do not have any storage of their own and are just another name for the existing storage, they need to initialized before using them.
III. For e.g. int x; int & y = x. The exisiting memory X will now also have another name Y.

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## Reference Variable VS Pointer Variable

I. You cannot have NULL references. You must always be able to assume that a reference is connected to a legitimate piece of storage.
II. Once a reference is initialized to an object, it cannot be changed to refer to another object. Pointers can be pointed to another object at any time.
III. A reference must be initialized when it is created. Pointers can be initialized at any time.

## References as Function Parameters!

## References as Return Value from Functions.

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## Constant Variables

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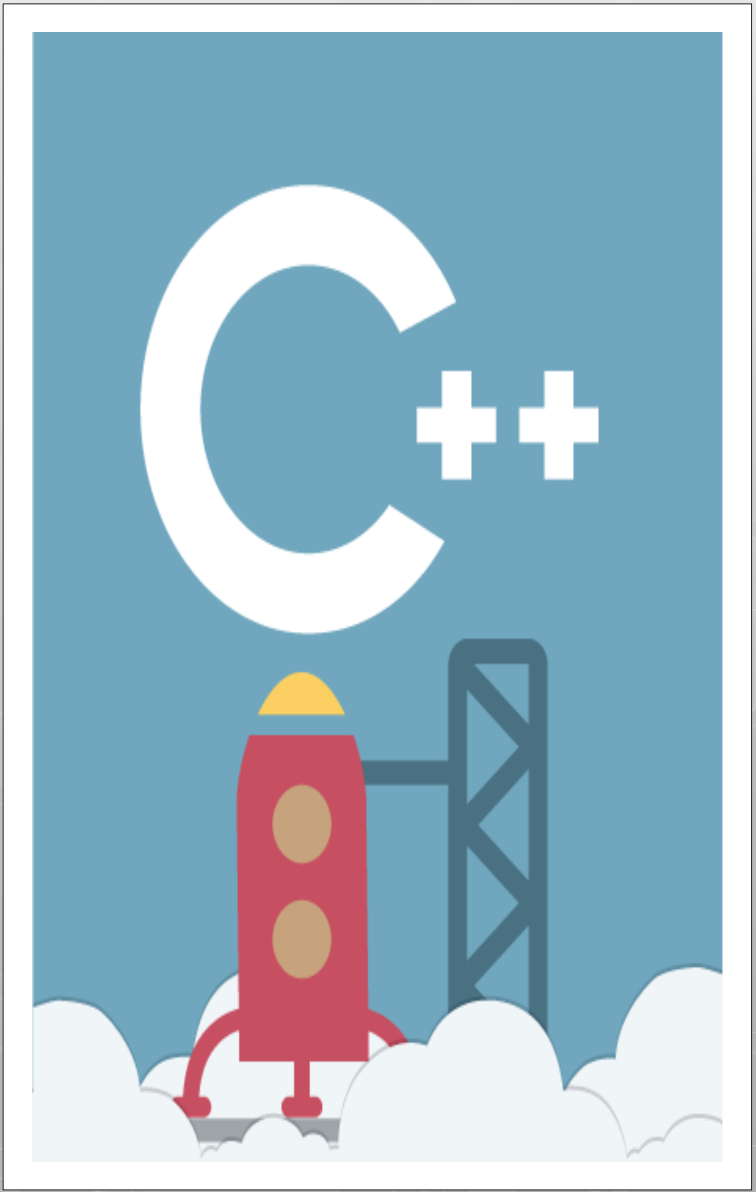
## Constant Pointers

## Constant References

## What is next class about?

I. Structures.



## Thank You!

Anushray Gupta

anushray@codingblocks.com
+91-9555567876