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15

Launchpad

Dynamic Allocation,
Additional Topics

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Any doubts?

Pointers Recap

Recap

1. How to define pointers?
2. Address of Operator?
3. Dereference operator?
4. Arithmetic Operators on pointers?
5. Arrays & Pointers
6. Reference Variables
7. Pass by reference
8. Returning pointers or References from functions

Difference – Arrays & Pointers

- the sizeof operator
 - sizeof(array) returns the amount of memory used by all elements in array
 - sizeof(pointer) only returns the amount of memory used by the pointer variable itself
- the & operator
 - &array is an alias for &array[0] and returns the address of the first element in array
 - &pointer returns the address of pointer
- String literal initialization of a character array
 - char array[] = "abc" sets the first four elements in array to 'a', 'b', 'c', and '\0'
 - char *pointer = "abc" sets pointer to the address of the "abc" string (which may be stored in read-only memory and thus unchangeable)
- Pointer variable can be assigned a value whereas array variable cannot be.
int a[10];
int *p;
p=a; /*legal*/
a=p; /*illegal*/
- Arithmetic on pointer variable is allowed.
p++; /*Legal*/
a++; /*illegal*/



Address typecasting

Dynamic Memory Allocation!

Allocating Memory

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

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



Dynamic Memory Allocation

- We can dynamically allocate space while the program is running but we cannot create new variable names “on the fly”
- For this reason, dynamic allocation requires two steps
 1. Creating the dynamic space
 2. Storing its address in a pointer
- To dynamically allocate memory in C++, we use new operator
- De-allocation:
 - De-allocation is the “clean-up” of space being used by variable

De-allocation

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

new operator

- To allocate space dynamically, use the unary operator `new`, followed by the type being allocated.
 - `new int;` `// dynamically allocates an int`
 - `new double;` `// dynamically allocates a double`
- If creating an array dynamically, use the same form, but put brackets with a size after the type:
 - `new int[40];` `// allocates an array of 40 ints`
 - `new double[size];` `// allocates an array of size double`
 `// doubles`
- 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

- 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:

- 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.

Lets see an example!

constant variables

#define

Inline Functions?

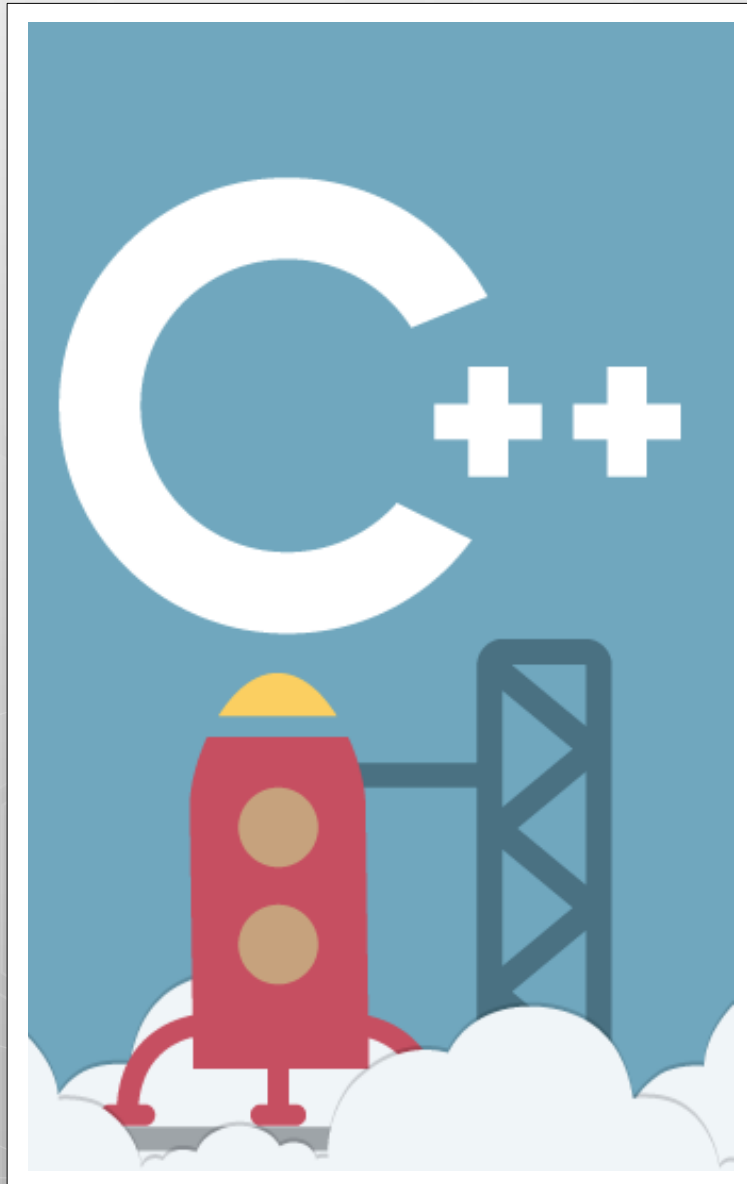
Default Value of Arguments?

Cin.getLine()

Global Variables?

Static Local Variable?

Header Files



Thank You!

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