Details of Pointers

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Opening Discussion

- Let's look at some solutions to the interclass problem.

Pointer to Pointers

- Adding a * makes a new type that is a pointer to the specified type.
- We can make a pointer to any type.
- Combine these and you see we can create pointers to pointers.
  - int** is a pointer to a pointer to an int.
- A pointer to a pointer is typically called a handle. We use handles when we want to pass a pointer by reference so that the called function can change the pointer value.
- There are other uses as well. As with arrays, you probably won't have this go to many levels.

Pointer Type Agreement

- In order for an assignment to work types have to agree.
- For pointers this means the pointers should point to the same type of thing.
- Unlike other types, pointer types are all the same size. Type casts can get around the requirement of type equivalence.
- The void* can be used when you write code that needs a pointer but doesn't really care what type it points to.

Returning Pointers

- Let's run through a little experiment with a function that returns a pointer and think through what we are doing.
- The basic rule is that you can't return pointers to local variables. You can only return pointers to things that live outside of the current function.

Lvalues and Rvalues

- Some of you have gotten the message “improper Lvalue”. This means you have something on the left side of an assignment that you can't assign to.
- Only certain expressions are allowed as Lvalues and they all basically refer to locations in memory.
- Dereferenced pointers are always valid Lvalues because they have to be locations in memory. Of course, if the pointer is invalid the code will likely crash, but it will compile.

Pointer Arithmetic

- You can do some numeric operations with pointers.
- Addition and subtraction are well defined on pointers as these simply move you forward and backward through memory.
- The size of the “step” you take when you add or subtract from a pointer is equal to the size of what it points to.

Minute Essay

- Given the following declaration tell me the types of the expressions.
  - int a,*b;
  - &a
  - *b
  - *(b+2)
  - &(*b)
  - *(&a)
- Interclass Problem - Write a program that uses a pointer type casting to look at the internal structure of a double. Using a function to print things in binary might help. Can you use this to figure out the IEEE standard?