Pointers II

Class 30

Compile Time

- all of the variables we have seen so far have been declared at compile time
- they are written into the program code
- you can see by looking at the program how many variables will exist in the entire program
- they are in an area of memory called the stack
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- but sometimes you do not know in advance how many variables you will need

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- there is a pool of memory that is available to be drawn from at need
- this pool is called the heap

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- the operating system responds with the address of the 4-byte chunk in the heap
- since new provides an address, it must be assigned to a pointer
- this new variable can be accessed by dereferencing the pointer variable value

Dynamic Allocation

- here is a program fragment that uses a dynamically allocated variable

```
double* value = new double;
*value = 25.0;
*value *= 2.0;
cout << "the value is: " << *value << endl;
```

Diagramming Dynamic Memory

- even though a computer's memory is one huge linear list of locations
- we diagram the stack and heap as separate areas

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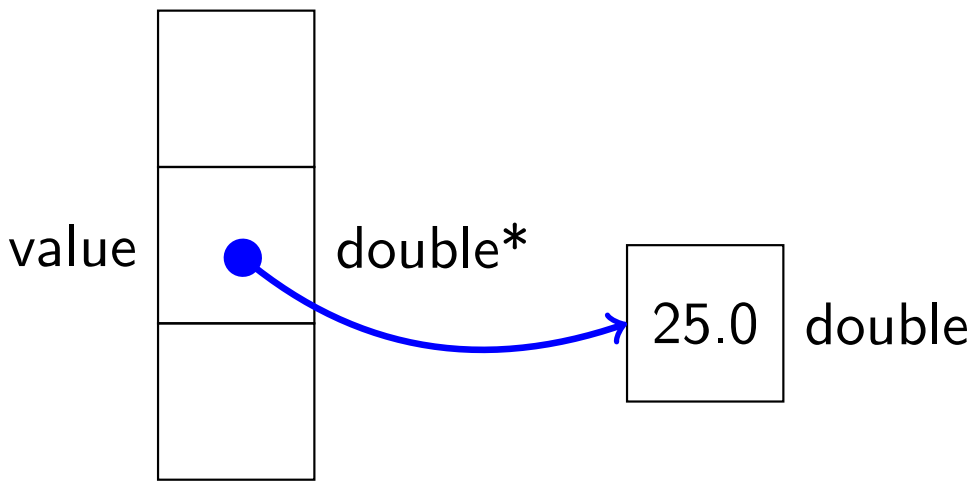

Dynamic Allocation of Arrays

- in reality, allocating a single variable isn't very useful
- the true power of dynamic allocation is in allocating an entire array at runtime

```
cout << "how many values do you need to store? ";
cin >> value_count;

int* values = new int[value_count];
```

- finally we can create an array based on a variable!

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- the programmer is responsible for allocating it, and the programmer is responsible for de-allocating it before your program finishes

- when you use memory from the heap
- you have to give it back before the program finishes

De-Allocating Memory

- just as the new operator allocates a piece of memory
- the delete operator gives it back

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must always be followed eventually by:

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delete value;
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must always be followed eventually by:

```
delete value;
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```
int* values = new int[50];
```

must always be followed eventually by:

```
delete[] values; // note the syntax!!
```

- every program must have exactly as many deletes as news

Skipped Sections

- we will not do sections
  - 9.9
  - 9.10
  - 9.11