

Templates and the STL

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Overview

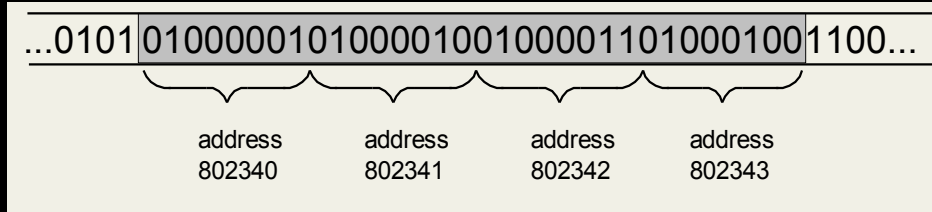
- Variable Types and Storage Review
- Templates
- STL
- Final Information
- Alternative Final

Review

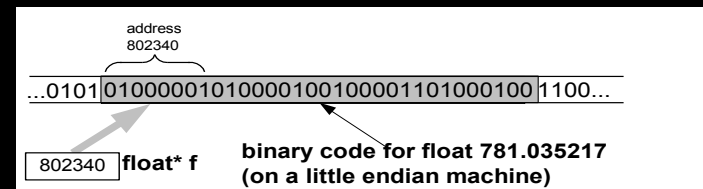
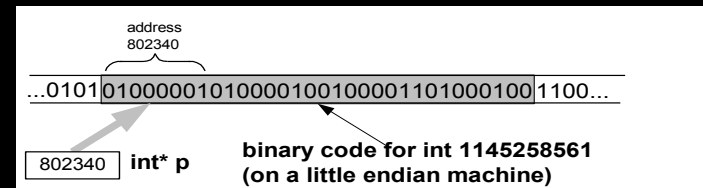
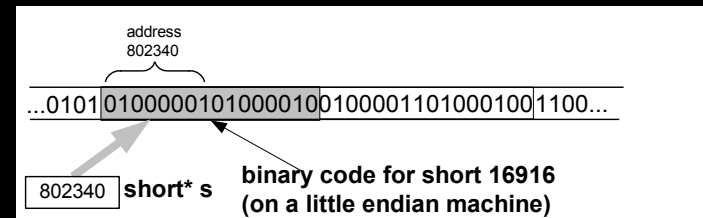
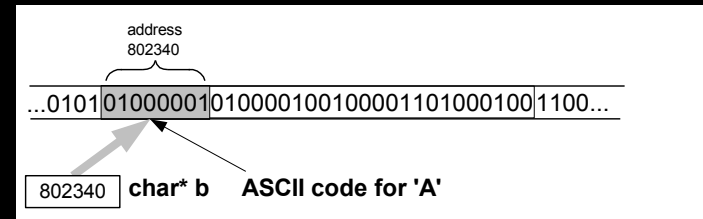
Where is all the data stored?

```
int a1[5];  
char *msg;  
int main {  
    int blah[16];  
    string *tmp = new string("some message");  
return 0;  
}
```

What is



- Could be four chars: 'A', 'B', 'C', 'D'
- Or it could be two shorts: 16961, 17475
 - All numerical values shown here are for a "little endian" machine (more about endian next slide)
- Maybe it's a long or an int: 1145258561
- It could be a floating point number too: 781.035217



Templates

- Templates allow you to code by the DRY method (don't repeat yourself)
- Write a single function or class that can be used with many different types
- Implicitly a copy is made by the compiler for each type needed

Function Templates

```
template <class T>  
T add(const T &arg1, const T &arg2) {  
    return arg1 + arg2;  
}
```

add(1, 2); // integers

add(1.5, 3.0); // floats or doubles

add("hello ", "world); // strings

Class Templates

```
template <class T1, class T2>
class Pair {
    public:
        Pair(T1 a, T2 b): a(a), b(b) {}
        T1 a;
        T2 b;
};
```

```
Pair<int, int> a(1 , 2);
```

```
Pair<string, string> b("hello ", "world);
```

```
Pair<Pair<int, int>, Pair<string, string>> > c(a, b);
```

Note the space



Standard Template Library

- A set of abstract data types that are incredibly convenient to use
- Reference:
 - <http://www.cplusplus.com/reference/stl/>
- The STL will not be on the final

STL Sequence Containers

- vector
 - A dynamic array that grows and shrinks in size as necessary
- deque
 - Double ended queue that supports random access and efficient addition or removal to either end of the deque
- list
 - Doubly linked list implementation

STL container adaptors

- Adapters require some other container to operate
- `stack`
 - Implements the stack ADT (using deque by default)
- `queue`
 - Implements the queue ADT (deque by default)
- `priority_queue`
 - Implements a priority queue ADT (vector used by default)

Associative Containers

- (multi)set
 - stores unique elements, multiset allows for storing multiple copies of the same element
- (multi)map
 - A key/value ADT (hash table), multimap allows for non-unique keys
- bitset
 - Provides convenient means to single bit access (saves space)

C++ See Also

- Boost C++ Libraries
 - <http://www.boost.org>
- /r/cpp on reddit
 - <http://www.reddit.com/r/cpp>
- C++ tag on stackoverflow
 - <http://stackoverflow.com/questions/tagged/c++>

Final Information

- On material following the midterm
 - Friend functions
 - Operator overloading
 - Inheritance (polymorphism)
 - Programs in memory (segments)
 - Variables in memory (padding, overflow, types)
 - Templates
- There should be very few free-response type questions (if any)

Alternative Final

- Full the same score you received on your midterm (adjusted), write a 2-page reflection paper on CS32
- Ideally will only take you ~3 hours (same time as review + final)
- Reflection paper references:
 - <http://goo.gl/Df834>

Reflection Paper

- Should be an assessment (not a summary) of what you've learned in the class
- You want to answer how questions, not what questions. Example:
 - How has what you learned in this class affected the way you approach solving problems
- Provide specific examples to justify your statements
 - Fewer and more complete examples are better than multiple fragmented ideas

Reflection Paper Continued

- You may also reflect on how my teaching had either a positive or negative impact on you
 - Neutral impacts aren't worth writing about
- Don't bullshit (don't write about what you think I want to read, write about how you actually feel)
- Spend nearly as much time editing as writing

Reflection Paper Grading

- Submission due via submission on CSIL by 13:55 on Wednesday (the same end-of-final time)
- If satisfactory effort was made, you will get full credit (same score as midterm), otherwise you will be asked to revise.
- If still not satisfactory after a single revision you will receive some fraction of your midterm score

Thanks!