

C++ STL Stack, Queue, and Deque

- C++ STL stack and queue containers
- Problems
 - Checking if symbols are balanced
 - Checking if input strings are palindrome
 - A programming contest problem (steps)
- C++ STL deque container
- Word puzzle problem
- All examples are in Examples/r5

C++ STL Stack

- `stack()`: zero parameter default constructor
- `stack(const Container & con)`: one parameter constructor
- `empty()`: check if the stack is empty
- `push(cont T& val)`: push value `val` into the stack
- `pop()`: delete the top element from the stack
- `size()`: return the number of elements in stack
- `top()`: return a reference to the top elements in stack

- **More information**
 - <http://www.cppreference.com/wiki/stl/stack/start>

C++ STL Queue

- `queue()`: zero parameter default constructor
- `queue(const Container & con)`: one parameter constructor
- `empty()`: check if the queue is empty
- `push(cont T& val)`: add element `val` to the end of the queue
- `pop()`: delete the front element from the queue
- `size()`: return the number of elements in queue
- `front()`: return a reference to the front element in queue
- `back()`: return reference to the last element in queue
-
- **More information**
 - <http://www.cppreference.com/wiki/stl/queue/start>

P1: Checking If Symbols are Balanced

- Problem description (balancingsymbols.pdf)
- Outline of the solution (using stack)

```
while (has next symbol)
    if next symbol is [ or (
        stk.push(symbol);
    else if next symbol is ] or )
        if stk.top() == symbol
            stk.pop()
        else
            not balanced
end while
if (!stk.empty())
    not balanced
```

- Source code (which contains a run-time error)
 - examples/r5/balancingsymbols_wrong.cpp
 - Example input file: balancingsymbols.input
 - Demo how to debug this program using gdb with coredump file

P2: Checking if Input Strings are Palindrome

- **Problem statement (palindrome.pdf)**
- **Basic idea**
 - Using a queue and stack to save input string in both queue and stack
 - Pop out characters from queue and stack and compare them one by one
 - Note that queue provides the forward reading, while stack provides the backward reading
 - Palindrome if characters from queue and stack are all equal
- **Source code**
 - `examples/r5/palindrome.cpp`
 - Example input file: `palindrome.input`

Palindrome: Recursive Version

- How to recursively determine if a string is palindrome?
- See examples/r5/palindrome_recursive.cpp

Steps

- **This is a programming contest problem**
 - A bit more complicated than our normal problems
 - But you can see the usages of STL containers and recursive algorithms
- **Problem statement**
 - steps.pdf
- **Solutions**
 - steps_stack.cpp (using stack to maintain the steps)
 - steps_recursive.cpp (a recursive solution, note how we pass parameter total)
- **Test case**
 - steps_input.txt
 - steps_output.txt
- **To compile**
 - Make steps_stack.x (or make steps_recursive.x)

STL Deque Container

- Header file `<deque>`
- Important member functions
 - `begin()` and `end()`: return iterators
 - `front()` and `back()`: reference to first and last elements
 - `clear()`: delete all elements
 - `push_front()`: insert at front
 - `push_back()`: insert at end
 - `pop_front()`: delete first element
 - `pop_back()`: delete last element
 - `size()`: number of elements
 - `empty()`: if vector is empty
 - `resize()`: change vector size
- More information at
 - <http://www.cplusplus.com/reference/deque/deque/>

Word Puzzle

- **Problem description**
 - word_puzzle.pdf
- **Explaining the source code**
 - word_puzzle_deque.h, word_puzzle_deque.cpp
 - Pay attention to the use of I/O streams, stringstream, strings, and deque
 - To compile: make