CSC 122 001 Computer Science I
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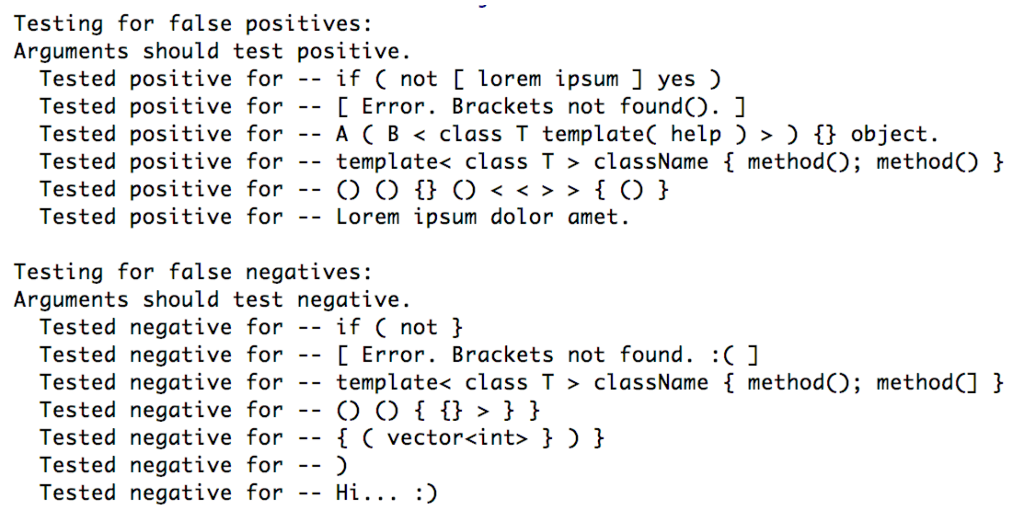
Chapter 18 Programming Challenge 11 Balanced Delimiters
Write a program that tests for the pairing of delimiters (e.g. parenthesis, square brackets, curly brackets).

Screenshot of Runtime:



```
Testing for false positives:
Arguments should test positive.
  Tested positive for -- if ( not [ lorem ipsum ] yes )
  Tested positive for -- [ Error. Brackets not found(). ]
  Tested positive for -- A ( B < class T template( help ) > ) {} object.
  Tested positive for -- template< class T > className { method(); method() }
  Tested positive for -- () () {} () < < > > { () }
  Tested positive for -- Lorem ipsum dolor amet.

Testing for false negatives:
Arguments should test negative.
  Tested negative for -- if ( not }
  Tested negative for -- [ Error. Brackets not found. :( ]
  Tested negative for -- template< class T > className { method(); method(] }
  Tested negative for -- () () { {} > } }
  Tested negative for -- { ( vector<int> } ) }
  Tested negative for -- )
  Tested negative for -- Hi... :)
```

Files included: (1) DelimiterTester.h, (2) DelimiterTester.cpp, (3) main.cpp

DelimiterTester.h

```
#ifndef CH18_PR10_BALANCED_PARENTHESIS_DELIMITERTESTER_H
#define CH18_PR10_BALANCED_PARENTHESIS_DELIMITERTESTER_H

#include <string>
#include <vector>
#include <stack>

class DelimiterTester {

private:
    static unsigned const nBracketTypes;
    static char startingBrackets[];
    static char endingBrackets[];

    int findStartBracket(char);
    int findEndBracket(char);

public:
    DelimiterTester() {}
    bool testString(std::string);
};


#endif //CH18_PR10_BALANCED_PARENTHESIS_DELIMITERTESTER_H
```

DelimiterTester.cpp

```
#include "DelimiterTester.h"

// Controls
unsigned const DelimiterTester::nBracketTypes = 4;
char DelimiterTester::startingBrackets[DelimiterTester::nBracketTypes] = {
        '(', '{', '[', '<'
};
char DelimiterTester::endingBrackets[DelimiterTester::nBracketTypes] = {
        ')', '}', ']', '>'
};

// Private

// This method returns the index of the starting bracket.
// Returns -1 if not found.
int DelimiterTester::findStartBracket(char c) {
    int index = -1;
    for (int i = 0; i < nBracketTypes; i++) {
        if (c == startingBrackets[i]) {
            index = i;
            break;
        }
    }
    return index;
}

// This method returns the index of the ending bracket.
// Returns -1 if not found.
int DelimiterTester::findEndBracket(char c) {
    int index = -1;
    for (int i = 0; i < nBracketTypes; i++) {
        if (c == endingBrackets[i]) {
            index = i;
            break;
        }
    }
    return index;
}

// Public Methods

bool DelimiterTester::testString(std::string text) {
    std::stack<int> bracketIndexStack;
    char lastBracket, testEndBracket;
    bool isGood = false;

    for (char s : text) {
        // Find character in Starting Brackets
        int idx = findStartBracket(s);
        if (idx != -1) { // If first character is a starting bracket.
            bracketIndexStack.push(idx);
            lastBracket = startingBrackets[idx];
            testEndBracket = endingBrackets[idx];
        } else if (!bracketIndexStack.empty() && s == testEndBracket) {
            // If character is not a starting bracket and
            // the stack is not empty...
            bracketIndexStack.pop();
            if (!bracketIndexStack.empty()) {
                lastBracket = startingBrackets[bracketIndexStack.top()];
                testEndBracket = endingBrackets[bracketIndexStack.top()];
            }
        } else if (findEndBracket(s) != -1) {
            // If the stack is empty ...
            // ... and you've found an ending bracket.
            bracketIndexStack.push(-1);
            break;
        }
    }

    if (bracketIndexStack.empty()) {
        return true;
    } else {
        return false;
    }
}
```

main.cpp

```
#include <iostream>
#include "DelimiterTester.h"

int main() {
    DelimiterTester dl;

    // FALSE POSITIVE TESTS.
    std::string positiveTests[] = {
        "if ( not [ lorem ipsum ] yes )",
        "[ Error. Brackets not found(). ]",
        "A ( B < class T template( help ) > ) {} object.",
        "template< class T > className { method(); method() }",
        "() () {} () < < > > { () }",
        "Lorem ipsum dolor amet."
    };

    std::cout << "Testing for false positives: \n";
    std::cout << "Arguments should test positive. \n";
    for (std::string s : positiveTests) {
        if (dl.testString(s)) {
            std::cout << "  Tested positive for -- ";
        } else {
            std::cout << "  Tested negative for -- ";
        }
        std::cout << s << "\n";
    }
    std::cout << "\n";

    // FALSE NEGATIVE TESTS.
    // The following functions should return negative.
    std::string negativeTests[] = {
        "if ( not }",
        "[ Error. Brackets not found. :( ]",
        "template< class T > className { method(); method(] }",
        "() () { {} > } }",
        "{ ( vector<int> } ) }",
        ")",
        "Hi... :)"
    };

    std::cout << "Testing for false negatives: \n";
    std::cout << "Arguments should test negative. \n";
    for (std::string s : negativeTests) {
        if (!dl.testString(s)) {
            std::cout << "  Tested negative for -- ";
        } else {
            std::cout << "  Tested positive for -- ";
        }
        std::cout << s << "\n";
    }
    std::cout << "\n";

    return 0;
}
```