Programming Assignment #3

Practice with pointers and dynamic memory allocation

CS 2308.003 Fall 2019
Instructor: Jill Seaman

Due: Wednesday, 10/9/2019: upload electronic copy by 9:30am!

Problem:

Write a C++ program that will implement and test the five functions described below that use pointers and dynamic memory allocation.

The Functions:

You will write the five functions described below. Then you will call them from the main function, to demonstrate their correctness.

1. **isSorted**: takes an array of integers and its size as arguments. It should return true if the elements of the array are already in ascending order, and false if they are not. **Do not use square brackets anywhere in the function, not even the parameter list (use pointers instead).**

2. **pizza**: The following function uses reference parameters. Rewrite the function so it uses pointers instead of reference parameters. When you test this function from the main program, demonstrate that it sets the values of the variables passed into it.

   ```cpp
   double pizza (int people, int &pizzas, int &slices) {
       int totalSlices = people*3;
       pizzas = totalSlices/8;
       slices = totalSlices%8;
       return pizzas*11.95 + slices*1.75;
   }
   ```

3. **doubleReverse**: takes an int array and the array's size as arguments. It should create a new array that is twice the size of the argument array. The function should copy the contents of the argument array to the first half of the new array, and again to the second half of the new array, **but in reverse order**. The function should return a pointer to the new array.
4. **shiftX**: takes an int array, the array’s size, and an integer value (x) as arguments. The function should create a new array that is x elements larger than the argument array. The first x elements of the new array should be set to -1. The remaining elements should contain the elements from the original array in the original order. The function should return a pointer to the new array.

5. **subArray**: takes an int array, a start index and a length as arguments. It creates a new array that is a copy of the elements from the original array starting at the start index, and has length equal to the length argument. For example, subArray(aa,3,4) would return a new array containing only the elements aa[3], aa[4], aa[5], and aa[6].

You must define subArray as follows:

Add the code for the duplicateArray function from the lecture slides for Unit 3 (slide 24) to your program. Add the code for the subArray function given below to your program. Fill in the blanks with expressions so that the function subArray behaves as described above.

```c
int *subArray (int *array, int start, int length) {
    int *result = duplicateArray(__________, ___________);
    return result;
}
```

**DO NOT** alter duplicateArray, **DO NOT** alter subArray as defined above.

**Output:**

Test these five functions using the main function as a driver. The driver should pass **constant** test data as arguments to the functions. Select appropriate test data for each function and then call that function using the test data. For each function, you should output four lines: a label indicating which function is being tested, the test data, the expected results, and the actual results. For the test data and Expected result, you should hard code the output values (use string literals containing the numeric values), for the Actual results, use the actual values returned/obtained by the function.

**testing isSorted:**

<table>
<thead>
<tr>
<th>Test data array 1: 1 2 3 4 5 6 7 8</th>
<th>Expected result: true</th>
</tr>
</thead>
<tbody>
<tr>
<td>test data array 2: 8 7 6 5 4 3 2 1</td>
<td>Expected result: false</td>
</tr>
<tr>
<td>test data array 3: 1 2 3 5 4 6 7 8</td>
<td>Expected result: false</td>
</tr>
</tbody>
</table>

```c
testing isSorted:
test data array 1: 1 2 3 4 5 6 7 8
```
testing pizza for 25 people:
Expected result: 112.80  p: 9  s: 3
Actual results : 112.80  p: 9  s: 3

testing doubleReverse:
test data: 1 2 3 4 5 6 7 8 9
Expected result: 1 2 3 4 5 6 7 8 9 9 8 7 6 5 4 3 2 1
Actual result: 1 2 3 4 5 6 7 8 9 9 8 7 6 5 4 3 2 1

testing shiftX:
test data: 1 2 3 4 5 6 7 8 9
and 4
Expected result: -1 -1 -1 -1 1 2 3 4 5 6 7 8 9
Actual result: -1 -1 -1 -1 1 2 3 4 5 6 7 8 9

testing subArray:
test data: 1 2 3 4 5 6 7 8 9
start: 3 length: 4
Expected result: 4 5 6 7
Actual result: 4 5 6 7

RULES:

• DO NOT change the names of the functions!
• DO NOT do any output from the functions (only from main)!
• DO NOT do any input from the user!! Use constants for test values!!

NOTES:

• This program must be done in a Linux or Unix environment, using a command line compiler like g++. Do not use codeblocks, eclipse, or Xcode to compile.
• Your program must compile and run, otherwise you will receive a score of 0.
• It is your responsibility to fully test your functions. They must work for ANY valid input. The main function must have at least one test case for each function.
• For pizza, compute the result of the function call BEFORE you output it:

        double z = pizza(........);
cout << z << ......;

• You do not need to use named constants for your test data (or array sizes) in this assignment, but you DO need to follow the rest of the style guidelines including function definition comments.
• Your program should release any dynamically allocated memory when it is finished using it.

• I recommend using a function that displays the values of an int array on one line, separated by spaces, for displaying test arrays and results.

**Logistics:**

Name your file `assign3_xxxxx.cpp` where `xxxxx` is your TX State NetID (your txstate.edu email id).

Submit an **electronic copy** using the Assignments tool on the TRACS website for this class ([tracs.txstate.edu](http://tracs.txstate.edu)).

See the assignment policy on the course website ([cs.txstate.edu/~js236/cs2308](http://cs.txstate.edu/~js236/cs2308)) for more details, including late deadlines and penalties.