

Programming Assignment 6 Searching / Sorting

Due Date : Monday April 21st , 2021
No Later Than @ 2:15 pm For section 253
No Later Than @ 3:45 pm For section 252

Problem:

Write a C++ program that does the following :

Accepts a **positive integer** ($n > 4$) from the keyboard . Create an character array of size n . Using a random number generator, populate the array with only Characters A thru } inclusive. Create 7 individual functions and perform the following

1. In the first function: display elements of the array. Display the first 20 elements If the size is > 20
2. In the second function : Search for a char (80) in the array using **sequential search** and at the end display number of times the char 80 appeared in the array.
3. In the third function : Sort the original array using **selection Sort** and at the end display the number of swaps it makes. Display elements of the array.
4. In the fourth function : Sort the original array using **insertion Sort** and at the end display the number of comparisons it makes.
5. In the fifth function : Sort the original array using **Quick Sort** and at the end display the number of recursion calls it makes. Use the middle value as a pivot value.
6. In the sixth function : Sort the original array using **Quick Sort** and at the end display the number of recursion calls it makes. Use the next to last element as a pivot value. Display elements of the array.
7. In the seventh function : Sort the original array using **Quick Sort** and at the end display the number of recursion calls it makes. Use the first value as a pivot value. Display elements of the array.
8. In the eighth function : Search for a char (80) in the sorted array using **sequential search** and at the end display number of times the char 80 appeared in the array.

9. For each of the preceding steps (2 thru 8), calculate and print the CPU time before each step starts and after each completed step then calculate actual time for the completion of each step. Time should be displayed in seconds and milliseconds Display elements of the array. Display ONLY the first 20 elements If the size is > 20

NOTES:

- Just one .cpp file with at least 8 individual functions (prototypes and definitions) plus main for testing.
- Do not use classes, structures , templates
- Do not use any global variables / global arrays or vector arrays.
- Validations must be done on the size of the array.
- Do not use any sort library that is available with CodeBlocks or any other IDE.

Style Guidelines:

At the beginning of your program (and **before** the #include statement), include the following :

Header comments (file documentation block) should be at the top of each file and should contain: Author / s, Due Date, Assignment Number, Course number and section, Instructor, and a brief description of the purpose of the code in the file. For example :

```
// Author : (Your name here!!)

// Due Date :
// Programming Assignment Number 5
//
// Spring 2021 - CS 3358 - Your Section Number
//
// Instructor: Husain Gholoom.
//
// <Brief description of the purpose of the program>
```

Variable names :

- Must be meaningful.
- The initial letter should be lowercase, following words should be capitalized, no other caps or punctuation (i.e. `weightInPounds`).
- Each variable must be declared on a separate line with a descriptive comment.

Named constants :

- Use for most numeric literals.
- All capitals with underscores (i.e. `TX_STATE_SALES_TAX`)
- Should occur at top of function, or global (only if necessary)

Line length of source code should be no longer than 80 characters (no wrapping of lines).

Indentation :

- Use 2-4 spaces (but be consistent throughout your program).
- Indent blocks, within blocks, etc.
- Use blank lines to separate sections.

Comments for variables :

All variable definitions should be commented as follows:

```
int gender; // integer value for the gender,  
           // 1 = Male , 2 = Female ,
```

Rules : In order to get a full mark :

1. Your program **must compile** and run. We will test your program using the latest version of **Codeblock which is 20:03**. (No Global Compiler Special Flags are set. You are not allowed to use C++11, C++14 ... etc.).
2. Your program must be **documented according to the style above . See the website for the sample programming style program.**
3. Must **use** at **least 8 functions (prototypes and definitions) for all searching / sorting and other functions of this program.** No menu selections are used.
4. You must use the appropriate libraries in writing this program.
5. Must properly format the output . Sample is provided .
6. You must name your program as :

○ **LastName_FirstName_SP21_3358_Section#_PG6.cpp** or

Where LastName is your Last Name and FirstName is your First Name. For example , the file name should look something like :

Gholoom_Husain_SP21_3358_253_PG6.cpp (not .cbp)

7. Must upload the electronic version of your program no later 2:15 pm for section 253 and 3:45 pm for section 252 on the due date. **No late assignments will be accepted. No extensions will be given. DO NOT** send your assignment solution via email.

Use Canvas To upload your program .

The following points will be deducted if :

- Incorrect file format such as uploading .cbp instead of .cpp , missing electronic copy , using .h and .cpp files , Compilation Errors , using global variables, global or fixed size arrays , using global vectors or dynamic arrays, using classes or structures ... etc (- 10 points)
- Other (at least 1.25 point each) :
 - Logical Errors
 - Incorrect program file name.
 - Incorrect output format.
 - Incorrect Style **such as but not limited to** Missing title , footer , comments or program documentations , missing or incorrect section number, missing function prototypes, not replacing my name with your name, not replacing the xxxxxx in the start and end time to be actual time. ... etc

Sample run:

Searching / Sorting Benchmark

Enter the size of the array : 10

Array elements are : A N c B { W Z S b }

Sequential Search

Searching for Char 80

Char 80 Was Not found.

Start Time :

End Time :

Actual CPU Clock time :

Total Number of char 80 :

Array Elements :

Selection Sort :

Start Time : xxxxxxxxx

End Time : xxxxxxxxx

Actual CPU Clock time : xxxxxx

Total Number of Swaps : xxxxxx

Sorted Elements :

Insertion Sort :

Start Time : xxxxxxxxx

End Time : xxxxxxxxx

Actual CPU Clock time : xxxxxx

Total Number of Comparisons : xxxxxx

Sorted Elements :

Quick Sort - The middle element as a pivot :

Start Time : xxxxxxxxx
End Time : xxxxxxxxx
Actual CPU Clock time : xxxxxx
Number of Recursive calls : xxxxxx
Sorted Elements :

Quick Sort - The next to last element as a pivot :

Start Time : xxxxxxxxx
End Time : xxxxxxxxx
Actual CPU Clock time : xxxxxx
Number of Recursive calls : xxxxxx
Sorted Elements :

Quick Sort - First element as a pivot :

Start Time : xxxxxxxxx
End Time : xxxxxxxxx
Actual CPU Clock time : xxxxxx
Number of Recursive calls : xxxxxx
Sorted Elements :

Sequential Search for Char 80 After Sort

Char 80 Was Not found.

Start Time :
End Time :
Actual CPU Clock time :
Total Number of char 80 in the array :
Array Elements :

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Sorting / Searching Benchmark by :
Husain Ghooloom

Sample run:

Searching / Sorting Benchmark

Enter the size of the array : a

*** Error - Invalid input - Size must be > 4 ***

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Sample run:

Searching / Sorting Benchmark

Enter the size of the array : -1

*** Error - Invalid input - Size must be > 4 ***

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