

Source File: ~/2336/22/lab22.cpp
Input: under control of main function
Output: under control of main function
Value: 2

Write a recursive function template whose prototype is given by

```
1 template<typename T>
2 const T *binarySearch(const T *first, const T *last, T itemToFind);
```

The function performs a binary search of the range `[first, last]` for `itemToFind`. The function returns an address `i` in the range `[first, last]` such that `*i == itemToFind`. The function returns `nullptr` if no such address exists. A main function for testing your function is shown in Figure 1. The expected output from executing this code is shown in Figure 2. To use the Makefile as distributed in class, add a target of `lab22main` to `targets1srcfile`.

```
1 #include <iostream>
2 #include <string>
3
4 using namespace std;
5
6 // function template prototype
7 template<typename T>
8 const T *binarySearch(const T *first, const T *last, T itemToFind);
9
10 #include "lab22.cpp"
11
12 template<typename T>
13 void printArray(const T *array, int count)
14 {
15     if (count > 0)
16     {
17         cout << *array << " ";
18         printArray(array + 1, count - 1);
19     }
20     else
21         cout << endl;
22 }
23
24 template<typename T>
25 void printAndSearch(const T *array, int n, T itemToFind, string nameOfArray)
26 {
27     const T *ptr;
28
29     cout << "Array " << nameOfArray << " contains:" << endl;
30     printArray(array, n);
31     ptr = binarySearch(array, array + (n - 1), itemToFind);
32     cout << itemToFind;
33     if (ptr)
34         cout << " is in array " << nameOfArray << " and is located at index "
35             << ptr - array << endl << endl;
36     else
37         cout << " is not in array " << nameOfArray << endl << endl;
38 }
39
```

Figure 1. /usr/local/2336/src/lab22main.C (Part 1 of 2)

```

40 int main()
41 {
42     const int aCount = 5, bCount = 7, cCount = 26, dCount = 10;
43     int a[aCount] = {5, 15, 25, 35, 45};
44     double b[bCount] = {1.1, 2.2, 3.3, 4.4, 5.5, 6.6, 7.7};
45     char c[cCount] = {'a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j',
46                     'k', 'l', 'm', 'n', 'o', 'p', 'q', 'r', 's', 't',
47                     'u', 'v', 'w', 'x', 'y', 'z'};
48     string d[dCount] = {"Audi", "BMW", "Bentley", "Buick", "Cadillac",
49                       "Chevrolet", "Dodge", "GMC", "Jaguar", "Lexus"};
50
51     printAndSearch(a, aCount, 25, "a");
52     printAndSearch(a, aCount, 55, "a");
53     printAndSearch(b, bCount, 1.1, "b");
54     printAndSearch(b, bCount, 11.11, "b");
55     printAndSearch(c, cCount, 'z', "c");
56     printAndSearch(c, cCount, 'Z', "c");
57     printAndSearch(d, dCount, static_cast<string>("Cadillac"), "d");
58     printAndSearch(d, dCount, static_cast<string>("Mercedes"), "d");
59
60     return 0;
61 }

```

Figure 1. /usr/local/2336/src/lab22main.C (Part 2 of 2)

```

1  newuser@csunix ~> cd 2336
2  newuser@csunix ~/2336> ./getlab.ksh 22
3      * Checking to see if a folder exists for Lab 22. . .No
4      * Creating a folder for Lab 22
5      * Checking to see if Lab 22 has sample input and output files. . .Yes
6      * Copying input and output files for Lab 22
7          from folder /usr/local/2336/data/22 to folder ./22
8      * Checking to see if /usr/local/2336/src/lab22main.C exists. . .Yes
9      * Copying file /usr/local/2336/src/lab22main.C to folder ./22
10     * Checking to see if /usr/local/2336/include/lab22.h exists. . .No
11     * Copying file /usr/local/2336/src/Makefile to folder ./22
12     * Adding a target of lab22main to targets!srcfile
13     * Touching file ./22/lab22.cpp
14     * Edit file ./22/lab22.cpp in Notepad++
15  newuser@csunix ~/2336> cd 22
16  newuser@csunix ~/2336/22> ls
17  01.out      Makefile     lab22.cpp    lab22main.C
18  newuser@csunix ~/2336/22> make lab22main
19  g++ -g -Wall -std=c++11 -c lab22main.C -I/usr/local/2336/include -I.
20  g++ -o lab22main lab22main.o -L/usr/local/2336/lib -lm -lbits

```

Figure 2. Commands to Compile, Link, & Run Lab 22 (Part 1 of 2)

```
21 newuser@csunix ~/2336/22> ./lab22main
22 Array a contains:
23 5 15 25 35 45
24 25 is in array a and is located at index 2
25
26 Array a contains:
27 5 15 25 35 45
28 55 is not in array a
29
30 Array b contains:
31 1.1 2.2 3.3 4.4 5.5 6.6 7.7
32 1.1 is in array b and is located at index 0
33
34 Array b contains:
35 1.1 2.2 3.3 4.4 5.5 6.6 7.7
36 11.11 is not in array b
37
38 Array c contains:
39 a b c d e f g h i j k l m n o p q r s t u v w x y z
40 z is in array c and is located at index 25
41
42 Array c contains:
43 a b c d e f g h i j k l m n o p q r s t u v w x y z
44 Z is not in array c
45
46 Array d contains:
47 Audi BMW Bentley Buick Cadillac Chevrolet Dodge GMC Jaguar Lexus
48 Cadillac is in array d and is located at index 4
49
50 Array d contains:
51 Audi BMW Bentley Buick Cadillac Chevrolet Dodge GMC Jaguar Lexus
52 Mercedes is not in array d
53
54 newuser@csunix ~/2336/22> ./lab22main > my.out
55 newuser@csunix ~/2336/22> diff 01.out my.out
56 newuser@csunix ~/2336/22>
```

Figure 2. Commands to Compile, Link, & Run Lab 22 (Part 2 of 2)