

Source File: ~/2336/21/lab21.cpp
Input: under control of main function
Output: under control of main function
Value: 1

Write a recursive function template whose prototype is given by

```
1  template<typename T>
2  const T *linearSearch(const T *array, int n, T itemToFind);
```

The function performs a linear search of the range `[array, array + n)` for `itemToFind`. The function returns the smallest address `i` in the range `[array, array + n)` 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 `lab21main` 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 *linearSearch(const T *array, int n, T itemToFind);
9
10 #include "lab21.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 = linearSearch(array, n, 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/lab21main.C (Part 1 of 2)

```
40 int main()
41 {
42     const int aCount = 5, bCount = 7, cCount = 7, dCount = 12;
43     int a[aCount] = {5, 5, 5, 5, 5};
44     double b[bCount] = {7.7, 6.6, 5.5, 4.4, 3.3, 2.2, 1.1};
45     char c[cCount] = {'r', 'a', 'c', 'e', 'c', 'a', 'r'};
46     string d[dCount] = {"Cadillac", "Oldsmobile", "Chevrolet",
47                        "Toyota", "Lexus", "Dodge", "GMC", "BMW",
48                        "BMW", "GMC", "Dodge", "Lexus"};
49
50     printAndSearch(a, aCount, 5, "a");
51     printAndSearch(a, aCount, 2, "a");
52     printAndSearch(b, bCount, 1.1, "b");
53     printAndSearch(b, bCount, 11.11, "b");
54     printAndSearch(c, cCount, 'e', "c");
55     printAndSearch(c, cCount, 'E', "c");
56     printAndSearch(d, dCount, static_cast<string>("Lexus"), "d");
57     printAndSearch(d, dCount, static_cast<string>("Mercedes"), "d");
58
59     return 0;
60 }
```

Figure 1. /usr/local/2336/src/lab21main.C (Part 2 of 2)

```
1 newuser@csunix ~> cd 2336
2 newuser@csunix ~/2336> ./getlab.ksh 21
3 * Checking to see if a folder exists for Lab 21. . .No
4 * Creating a folder for Lab 21
5 * Checking to see if Lab 21 has sample input and output files. . .Yes
6 * Copying input and output files for Lab 21
7   from folder /usr/local/2336/data/21 to folder ./21
8 * Checking to see if /usr/local/2336/src/lab21main.C exists. . .Yes
9 * Copying file /usr/local/2336/src/lab21main.C to folder ./21
10 * Checking to see if /usr/local/2336/include/lab21.h exists. . .No
11 * Copying file /usr/local/2336/src/Makefile to folder ./21
12 * Adding a target of lab21main to targets1srcfile
13 * Touching file ./21/lab21.cpp
14 * Edit file ./21/lab21.cpp in Notepad++
15 newuser@csunix ~/2336> cd 21
16 newuser@csunix ~/2336/21> ls
17 01.out      Makefile    lab21.cpp   lab21main.C
18 newuser@csunix ~/2336/21> make lab21main
19 g++ -g -Wall -std=c++11 -c lab21main.C -I/usr/local/2336/include -I.
20 g++ -o lab21main lab21main.o -L/usr/local/2336/lib -lm -lbits
```

Figure 2. Commands to Compile, Link, & Run Lab 21 (Part 1 of 2)

```
21 newuser@csunix ~/2336/21> ./lab21main
22 Array a contains:
23 5 5 5 5 5
24 5 is in array a and is located at index 0
25
26 Array a contains:
27 5 5 5 5 5
28 2 is not in array a
29
30 Array b contains:
31 7.7 6.6 5.5 4.4 3.3 2.2 1.1
32 1.1 is in array b and is located at index 6
33
34 Array b contains:
35 7.7 6.6 5.5 4.4 3.3 2.2 1.1
36 11.11 is not in array b
37
38 Array c contains:
39 r a c e c a r
40 e is in array c and is located at index 3
41
42 Array c contains:
43 r a c e c a r
44 E is not in array c
45
46 Array d contains:
47 Cadillac Oldsmobile Chevrolet Toyota Lexus Dodge GMC BMW BMW GMC Dodge Lexus
48 Lexus is in array d and is located at index 4
49
50 Array d contains:
51 Cadillac Oldsmobile Chevrolet Toyota Lexus Dodge GMC BMW BMW GMC Dodge Lexus
52 Mercedes is not in array d
53
54 newuser@csunix ~/2336/21> ./lab21main > my.out
55 newuser@csunix ~/2336/21> diff 01.out my.out
56 newuser@csunix ~/2336/21>
```

Figure 2. Commands to Compile, Link, & Run Lab 21 (Part 2 of 2)