

**Source File:** ~/4301/02/lab02.(C|CPP|cpp|c++|cc|cxx|cp)

**Input:** Under control of `main` function

**Output:** Under control of `main` function

**Value:** 1

For  $\Sigma = \{1, 2, 3\}$ , construct a boolean C++ function that accepts a string of unknown length as its argument and determines if the string is a member of the set consisting of

$$\{x \mid x \in \{1, 2, 3\}^+ \text{ and } x \text{ is divisible by nine}\}$$

A number is divisible by nine (9) if the sum of its digits is divisible by nine (9). Valid strings include 333, 1332, 2133, 3213, 333333, 1233333, 2323233, 33333333111, and 121212121212, but not  $\epsilon$ , 0, 1, 2, 3, 10, 3330, 1331, 23223, 31233, 111333, or 232323232323.

A sample `main` function for testing your function is shown in Figure 1, and a sample execution sequence is shown in Figure 2. To use the `Makefile` as distributed in class, add a target of `lab02` to `targets2srcfiles`.

```

1 #include <iostream>
2 #include <cstdlib>
3 #include <string>
4
5 using namespace std;
6
7 bool isValid(string);
8
9 int main()
10 {
11     string s;
12
13     while (getline(cin, s))
14         cout << s << " is " << (isValid(s) ? "valid" : "invalid") << endl;
15
16     return EXIT_SUCCESS;
17 }
```

Figure 1. /usr/local/4301/src/lab02main.C

```

1 newuser@csunix ~> mkdir 4301
2 newuser@csunix ~> cd 4301
3 newuser@csunix ~/4301> cp /usr/local/4301/src/getlab.ksh .
4 newuser@csunix ~/4301> ./getlab.ksh 02
5 * Checking to see if a folder exists for Lab 02. . .No
6 * Creating a folder for Lab 02
7 * Checking to see if Lab 02 has sample input and output files. . .Yes
8 * Copying input and output files for Lab 02
9     from folder /usr/local/4301/data/02 to folder ./02
10 * Checking to see if /usr/local/4301/src/lab02main.C exists. . .Yes
11 * Copying file /usr/local/4301/src/lab02main.C to folder ./02
12 * Checking to see if /usr/local/4301/include/lab02.h exists. . .No
13 * Copying file /usr/local/4301/src/Makefile to folder ./02
```

Figure 2. Commands to Compile, Link, & Run Lab 02 (Part 1 of 3)

```
14 * Adding a target of lab02 to targets2srcfiles
15 * Touching file ./02/lab02.cpp
16 * Edit file ./02/lab02.cpp in Notepad++
17 newuser@csunix ~/4301> cd 02
18 newuser@csunix ~/4301/02> ls
19 00.dat      00.out      Makefile      lab02.cpp      lab02main.C
20 newuser@csunix ~/4301/02> make lab02
21 g++ -g -Wall -std=c++11 -c lab02main.C -I/usr/local/4301/include -I.
22 g++ -g -Wall -std=c++11 -c lab02.cpp -I/usr/local/4301/include -I.
23 g++ -o lab02 lab02main.o lab02.o -L/usr/local/4301/lib -lm
24 newuser@csunix ~/4301/02> cat 00.dat
25
26 0
27 1
28 2
29 3
30 10
31 11
32 12
33 13
34 21
35 22
36 23
37 31
38 32
39 33
40 123
41 132
42 213
43 231
44 312
45 321
46 111
47 222
48 232
49 333
50 3330
51 1331
52 1332
53 2133
54 3213
55 23223
56 31233
57 111333
58 333333
59 1233333
60 2323233
61 3333333111
62 121212121212
```

**Figure 2.** Commands to Compile, Link, & Run Lab 02 (Part 2 of 3)

```
63 232323232323  
64 111222333111222333111222333111222333111222333111222333111222333  
65 newuser@csunix ~/4301/02> cat 00.dat | ./lab02  
66 is invalid  
67 0 is invalid  
68 1 is invalid  
69 2 is invalid  
70 3 is invalid  
71 10 is invalid  
72 11 is invalid  
73 12 is invalid  
74 13 is invalid  
75 21 is invalid  
76 22 is invalid  
77 23 is invalid  
78 31 is invalid  
79 32 is invalid  
80 33 is invalid  
81 123 is invalid  
82 132 is invalid  
83 213 is invalid  
84 231 is invalid  
85 312 is invalid  
86 321 is invalid  
87 111 is invalid  
88 222 is invalid  
89 232 is invalid  
90 333 is valid  
91 3330 is invalid  
92 1331 is invalid  
93 1332 is valid  
94 2133 is valid  
95 3213 is valid  
96 23223 is invalid  
97 31233 is invalid  
98 111333 is invalid  
99 333333 is valid  
100 1233333 is valid  
101 2323233 is valid  
102 3333333111 is valid  
103 1212121212 is valid  
104 2323232323 is invalid  
105 111222333111222333111222333111222333111222333111222333 is valid  
106 newuser@csunix ~/4301/02> cat 00.dat | ./lab02 > my.out  
107 newuser@csunix ~/4301/02> diff 00.out my.out  
108 newuser@csunix ~/4301/02>
```

**Figure 2.** Commands to Compile, Link, & Run Lab 02 (Part 2 of 2)