

Laboratory Exercise 2 (Algorithm Development)

Topics: Code analysis
Algorithm development

Goals: Upon successful completion of this lab you should be able to:

1. Read a C++ program containing loops and decision statements
2. Read a C++ program containing functions and function calls
3. Develop a flow chart for a program containing loops and decision statements
4. Use a debugger to follow the flow of a C++ program

Related text sections:

Chapter 2
Chapter 3

Laboratory Exercise 2 Instructions

Part 1.

1. Using your favorite text editor, create a file called *yourlastname.mail*. Enter the following information into the file (replaced the italicized words with the appropriate information). Make sure there is a carriage return at the end of the line.

```
elm -s "$1" you@favorite.isp < $2 # Firstname Lastname
```

for example:

```
elm -s "$1" cbrownc@sonoma.edu < $2 # Charlie Brown
```

2. Close the file and copy it to the CS 215 dropbox:

```
cp yourlastname.mail ~tiawatts/cs215drop/.
```

Part 2.

On the next page, there is a short program and flowcharts for each of the functions in the program.

1. Predict the output of the program when the following keyboard input is provided:

```
3 6
12 8
3 4
5 0
-2 10
1 0
```

2. Enter and execute the program to determine if your predictions are correct.
3. If your predictions were not correct, use the debugger to trace the execution of the program; in particular, set breakpoints to watch the values passed into and out of the “find” function.
4. Using a text editor, open a file for the answers to the following questions:
 - a. What does the function find actually find?
 - b. What does it do to the input values?
 - c. Describe a problem where the function find would be an important component of a program designed to solve the problem.
5. Place your answers in the dropbox ~tiawatts/cs215drop as *yourlastnameL2.txt*.

Part 3.

1. Using SFC-v2-3.exe (available at <http://www.cs.sonoma.edu/~tiawatts/SFC>), create a flowchart for the program you submitted for lab1, part 2.
2. Modify your flowchart so that it will print the number of vowels, consonants, digits and special characters in each word as well as the total number of vowels, consonants, digits and special characters in the complete file.

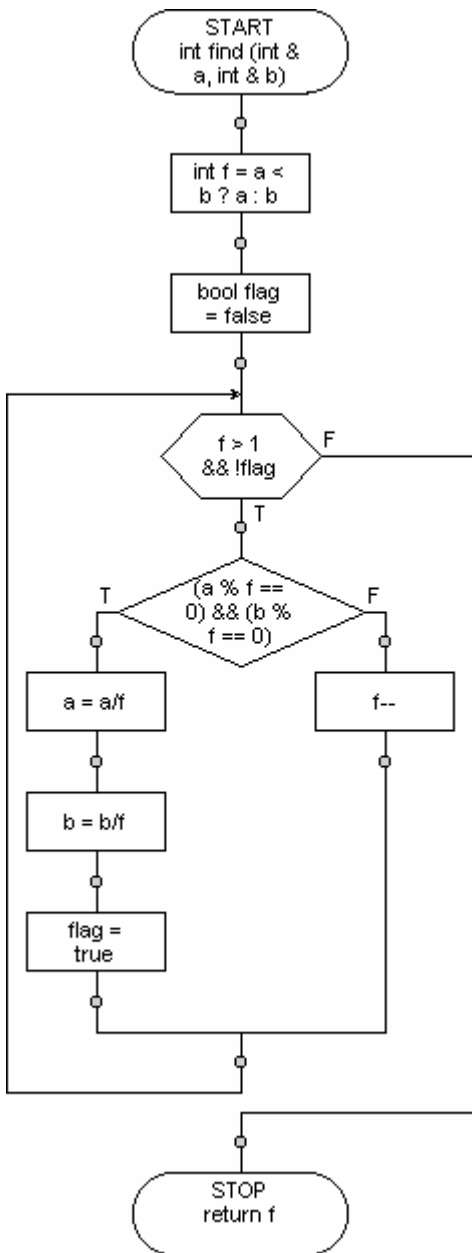
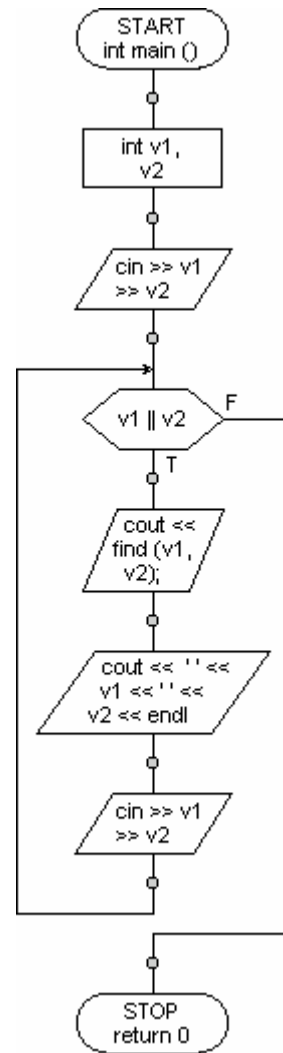
```

#include <iostream>
using namespace std;

int find (int & a, int & b);

int main ()
{
    int v1, v2;
    cin >> v1 >> v2;
    while (v1 || v2)
    {
        cout << find (v1, v2);
        cout << ' ' << v1 << ' ' << v2 << endl;
        cin >> v1 >> v2;
    }
    return 0;
}

```



```

int find (int & a, int & b)
{
    int f = a < b ? a : b;
    bool flag = false;
    while (f > 1 && !flag)
        if ((a % f == 0) && (b % f == 0))
        {
            a = a/f;
            b = b/f;
            flag = true;
        }
        else
            f--;
    return f;
}

```

Part 4.

1. Modify the program you submitted for lab 1 to reflect the changes you made in part 2. Sample input data and results are illustrated below.
2. Format the output of your program as illustrated below. All numeric values should be right justified in 8 spaces.
3. Place your completed program in the dropbox ~tiawatts/cs215drop as *yourlastnameL2.cpp*.
4. Place your completed flowchart in the dropbox ~tiawatts/cs215drop as *yourlastnameL2.sfc*.
5. Verify that all 3 of your files (.txt, .cpp, and .sfc) are in the dropbox.

Sample Input

```
This file contains
15 words. It has
lots of letters
and very few
special
characters!
```

Sample Output

Word	Vowels	Const.	Digits	Special
1	1	3	0	0
2	2	2	0	0
3	3	5	0	0
4	0	0	2	0
5	1	4	0	1
6	1	1	0	0
7	1	2	0	0
8	1	3	0	0
9	1	1	0	0
10	2	5	0	0
11	1	2	0	0
12	1	3	0	0
13	1	2	0	0
14	3	4	0	0
15	3	7	0	1
Totals	22	44	2	2