

EEN118  
Frighteningly Awful Test  
24<sup>th</sup> November 2009

Name:

Student number:

Sign here if you did not give or receive aid in any form during this test,  
and did not consult any written or printed material apart from this test:

Don't write in these boxes.

Question	Out of	Grade
5	33	
6	33	
7	33	
8	1	

## 5.

Just like complex numbers, fractions are useful things in engineering and mathematics but are not a part of C++. Here, you are going to do something about that.

A fraction consists of two ints: the one on top (often called the numerator), and the one on the bottom (the denominator). The numerator can be any value, but it is normal to insist that the denominator is strictly greater than zero.

- a.* Define a C++ struct (object) that could be used in a program to represent a fraction, together with a `set` function that can be used to set up the value of a fraction, and a `print` function that will print a fraction nicely. For example, using your definitions, this piece of program:

```
{ fraction a, b, c;
  set(a, 2, 3);
  set(b, 1, 5);
  set(c, 3, 5);
  print(a);
  print(b); ...
```

should produce this output:

(2/3) (1/5)

- b.* I'm sure you remember how to work arithmetic on fractions, and you certainly recall that  $(a/b) + (c/d)$  comes out to be  $(a \times d + b \times c) / (b \times d)$ .

Write two C++ functions that work on fractions. One should add two fractions together, the other should multiply two fractions together. The exact details of their design are up to you, but neither should perform any input or output. Example:

```
either    add(a, b);      or    c = add(a, b);
          print(a);      print(c);
```

should produce this output:

(13/15)

*continued...*

- c. Notice that if  $(2/3)$  and  $(3/5)$  are added together, the answer would come out as  $(19/15)$ . We normally prefer such “top heavy” fractions to be written differently, not as “*nineteen fifteenths*”, but as “*one and four fifteenths*”. Or numerically perhaps as  $(1+4/15)$ .

Write a new print function that would print all top-heavy fractions in this way:

$(19/15)$	should be printed as	$(1+4/15)$
$(9/4)$	should be printed as	$(2+1/4)$
$(23/3)$	should be printed as	$(7+2/3)$
$(24/3)$	should be printed as	$(8)$
$(2/3)$	should still be printed as	$(2/3)$

- d. Finally, write a function that compares two fractions to see which is numerically the greater. It should take two fractions as parameters (a and b), and return an int: -1 if  $a < b$ , 0 if  $a = b$ , and +1 if  $a > b$ .

For example,

comparing $(3/100)$ and $(1/5)$	should return -1,
comparing $(1/3)$ and $(1/3)$	should return 0,
comparing $(5/7)$ and $(2/3)$	should return +1,
comparing $(3/4)$ and $(6/8)$	should return 0.

#### EXTRA CREDIT

- e. Notice that  $(1/2)$  plus  $(1/6)$  gives  $(8/12)$  instead of  $(2/3)$ . The problem is that 8 and 12 have a common divisor, 4, that should be cancelled out.

Write a function that can be used to fix a fraction after any operation, and reduce it to its simplest possible form.

## 6.

For this question, you are to write a program that processes some input typed by the user. The user will type a number of words (he is quite lazy, so you can be assured that he won't type more than 10,000 of them), followed by \*\*\*\* to signify that he has finished typing. Your program should record in an array all of the words that were typed, and then do some work with that array.

Write a C++ program whose `main()` creates a suitably sized array of strings, then calls another function that reads the user input (as described above, up to the \*\*\*\*) into the array. There will be no punctuation, just words and spaces.

After that, `main()` should allow the user to type in some more words. For each additional word typed, you must print out how many times that word appeared in the original input.

For example, if the user types:

```
the cat sat on the mat with the other cat who had  
no mat of her own **** other cat the chicken
```

then the program should print:

```
'other' appeared 1 time  
'cat' appeared 2 times  
'the' appeared 3 times  
'chicken' appeared 0 times
```

## 7.

A data file contains the names, heights, and weights of 1000 children. For the sake of privacy, only their last names are given. The beginning of the file looks like this.

```
Smith 62 95
Jones 59 80
Harbinger 61 120
McSniffy 54 75
```

Write a C++ program that reads this file, and performs the following tasks:

- All of the weights must be written into a new output file (just the weights, one per line, leaving out the names and heights).
- When the file has been completely read, the program should report the minimum, maximum, and average of the heights that appeared in the file. (If the file contained only the four lines shown above, the program would print 54, 62, and 59).

You choose the file names, and exactly how the three pieces of output should appear, but accuracy is important.

8.

What is the best name an elephant could have?