The University of Chicago
Department of Computer Science

CMSC 15200 – Introduction to Computer Science 2
Summer Quarter 2006
Homework #4 (08/04/2006)
Due: 08/09/2005 @ 1:30pm

Name:

Student ID:

Instructor: Borja Sotomayor

Do not write in this area

1	2	3	4	5	**TOTAL**

Maximum possible points: 70

Exercise 1 <<15 points>>

Modify exercise 2 from homework #2 so that the user will be able to place bets in each game:

- The user starts with $100.
- In the guessing game, the user will place a bet and the prize will be proportional to the bet:
  - Guess on the first try: 40 x bet
  - Guess on the second try: 20 x bet
  - Guess on the third try: 5 x bet
  - Guess on the fourth try: 2 x bet
  - Guess on the fifth: 1 x bet (the user gets his/her money back)
- Playing the lottery always costs $1, and has the following prizes:
  - Guessing all six number: $1,000,000
  - Guessing any five numbers: $100,000
  - Guessing any four numbers: $100
  - Guessing any three numbers: $10
  - Guessing any two numbers: $1 (the user gets his/her money back)

The modified program must allow the user to play any of the two games repeatedly until the user runs out of money (e.g. the user can play the guessing game once, then the lottery twice, then the guessing game again, etc.)

Exercise 2 <<15 points>>

Modify exercise 4 from homework #2 (the hangman game) so that the program chooses a word at random from a text file with one word per line. You do not know the size of the file in advance, so choosing a word at random will not be as simple as choosing a number between 1 and N. If you get stumped on how to do this, simply read the first word in the file.

Note: The 15 points in this exercise are divided this way:

- Five points for reading a word from the file (random or not)
- Five points for reading a *random* word from the file.
- Five points if you don't hardcode the filename in your code. In other words, instead of limiting your program to always using a word file with the same name, the user should be able to run the program like this:

```
$ ./hangman <wordfile>
```

Note (2): A sample file called hangmanwords is provided in the homework files (available at the course website)

Note (3): You should be able to make these modifications even if your hangman game doesn't work correctly (reading the word from the file happens before you actually start the game itself). i.e. you will not be penalized for errors related to the game itself.

Exercise 3 <<15 points>>

The following program is a naïve implementation of the UNIX standard command `cat` (you can find the source code in the lab website).

```
#include <iostream>
#include <fstream>
using namespace std;

int main(int argc, char **argv)
{
    int i, numread;
    char buf[100];

    if(argc==0)
    {
        cerr << "ERROR: Not enough parameters" << endl;
        cerr << "Syntax: " << argv[0] << "[file1] [file2] ... [fileN]" << endl;
        exit(1);
    }

    for(i=1;i<argc;i++)
    {
        ifstream ifs;
        ifs.open(argv[i], ios::in);
        if (ifs.fail())
        {
            cerr << argv[0] << ": " << argv[i] << " No such file or directory" << endl;
        }
        else while(!ifs.eof())
        {
            ifs >> buf;
            cout << buf;
        }
    }
    exit(0);
}
```

However, this implementation contains several errors. These errors manifest themselves like this:

- On any input file, the output has been stripped of all whitespace (which is not the desired outcome of `cat`)
- The program will segfault on certain files (a sample `segfault.txt` file is available in the lab website).

Furthermore, there is at least one other error related to file I/O which does not cause any visible effect but is, nonetheless, Bad Karma.

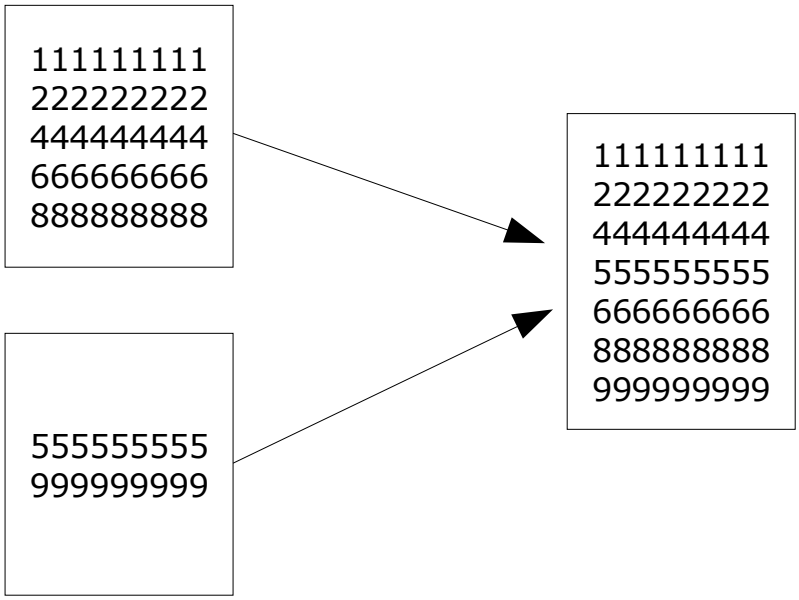
You are asked to do the following:

- Point out (in the code itself, with comments) what lines of the program are wrong, and why.
- Correct the errors. You will get most of the credit for fixing the segfault error and by handling the whitespace error when using the program with a *single* file. Concatenating several files correctly requires some non-obvious modifications, so don't worry if you can't manage to do that.

Exercise 4 <<20 points>>

PhoneCorp and PhoneTech, the two biggest phone companies in the US, have just completed a corporate merger. They are now faced with the daunting task of *merging* their client data files into a single file. In particular, each company has a text file with the social security numbers of their clients (one 9-digit number in each line) in increasing order. Your task is to create a program that takes those two files and creates a new file with the numbers from both files, in increasing order. You can assume that the two file have no numbers in common (i.e. the two sets of clients are disjoint)

For example:



Your program must be run like this:

```
mergefiles <clientfile1> <clientfile2> <result>
```

For full credit (10 points otherwise), your file must perform the merge doing a *single pass* through each of the files, without loading them into memory.

Hint: You are asked to perform a *merge* of two sequences of data (in this case, integers). This is a very common task in programming, and there is a very well known algorithm that does this (meeting the requirements for full credit). You are encouraged to look it up on books/websites/etc. as long as you cite your sources.

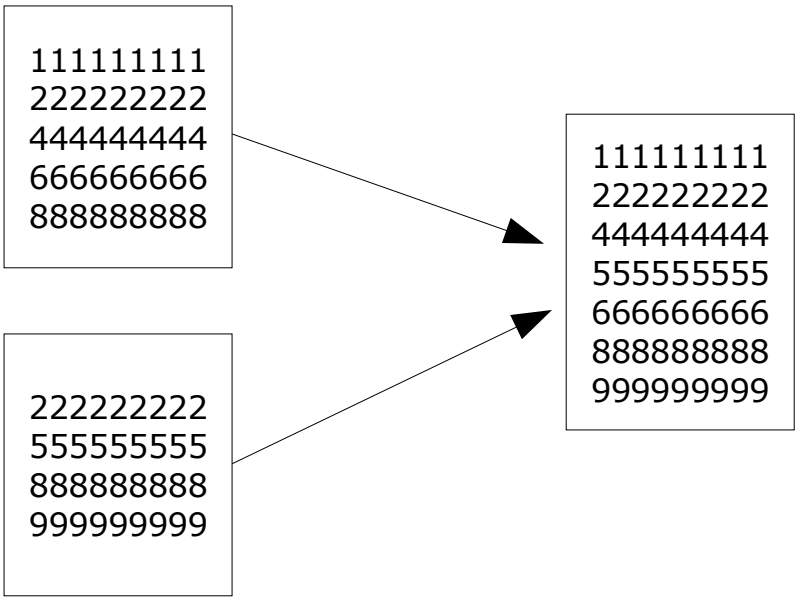
Note: Two example files (`clients1` and `clients2`) are provided in the homework files. The result of correctly merging these two files is the following:

```
113624982
135648623
154564564
168943568
193215689
236584654
276546846
279461322
283216569
295464654
316243213
333218954
342654658
345654858
393546562
395221354
399321545
412135468
422354943
462213589
493215812
539565482
539635482
783213542
896546543
973213215
993219953
```

Hint 2: This is a good example of an exercise you should try to first solve with a more reduced problem set, before approaching the complete problem. For example, to familiarize yourself with the merging algorithm (without dealing with all the I/O messiness), try merging two 5-position arrays (preloaded with any integers you want, as long as they are in increasing order) into a 10-position array. When you do start to add the I/O code, first give your algorithm a try with smaller files than the ones provided (with single-digit integers, for example, which are easier to check than 9-digit numbers).

Exercise 5 <<5 points>>

Make a simple modification to Exercise 4 so that you program will be able to handle files with common numbers (i.e. the two companies share some clients in common, so the two sets of clients are *not* disjoint). For example:



Note: Two example files (`clients1_rep` and `clients2_rep`) are provided in the homework files. The result of correctly merging these two files is the following:

```
113624982
135648623
168943568
236584654
256684623
276546846
279461322
295464654
316243213
333218954
342654658
345654858
356698823
393546562
395221354
399321545
399645652
412135468
419654332
422354943
462213589
539565482
539635482
712315465
896546543
936532132
946546523
982132132
983213223
```