HIGH PERFORMANCE PROGRAMMING
UPPSALA UNIVERSITY
SPRING 2017
ASSIGNMENT 2: PROGRAMMING IN C

This assignment is to be done individually. It is recommended to do Lab 2 and Lab 3 before this assignment.

It is important that you submit the assignment in time. **See the deadline in the Student Portal.**

The assignment consists of two parts, described in the sections below. Start by creating a directory for this assignment, and put the resulting files for each part in subdirectories `part1` and `part2`. When you are ready to submit your assignment, package your files into a compressed tar-ball with `.tar.gz` extension (see Lab 1) and upload that in the Student Portal.

Important:

- You must write the code by yourself.
- Your code must compile without errors and warnings and run on the computers in the lab room.
- Your code must be commented and be well-formatted. Use self-descriptive variable names.

Your code for each part should contain a makefile so that it can be built by simply doing "make" and cleaned up by doing "make clean".

Part 1

Pascal's triangle can be written as a lower triangular matrix. The entry in the nth row and kth column of Pascal's triangle is a binomial coefficient given by the formula

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} = \frac{n(n-1)(n-2)\cdots(n-(k-1))}{k(k-1)(k-2)\cdots 1} = \prod_{i=1}^{k} \frac{n+1-i}{i}.$$

Note that indexing starts with 0, then $n \geq 0$, $k \geq 0$ and $n \geq k$. For example, the unique nonzero entry in the row 0 is $\binom{0}{0} = 1$.

Write a C program which prints Pascal's triangle. Your program should accept the number of rows in a triangle as the parameter from the command line.

For example, if the name of your executable file is `triang`, then running

```
./triang 5
```

Date: January 25, 2017.

you should get the following output

```
1
1   1
1   2   1
1   3   3   1
1   4   6   4   1
```

Part 2

Create a database storing maximum and minimum temperature for days in January. Let your program accept commands until the user stops the execution. The allowed commands are:

`A index min max` - save the maximum and the minimum temperature for a day with a given index; if such index already exists in the database, replace the data.

`D index` - remove day with a given index from the database.

`P` - print all data as a table with columns: day min max

`Q` - stops the execution

If the user enters an invalid command, print an error message and continue the execution. Assume that index is an integer between 1 and 31, max and min are real numbers.

Example:

```
Enter command: A 1 -15.2 -5.1
Enter command: A 3 -11 -2
Enter command: A 5 -1 1
Enter command: P
day  min            max
1   -15.200000     -5.100000
3   -11.000000     -2.000000
5   -1.000000      1.000000

Enter command: A 6 -4 -2
Enter command: D 3
Enter command: A 11 -8 -5
Enter command: A 6 -1 0
Enter command: A 12 -5 -2.3
Enter command: P
day   min           max
1    -15.200000     -5.100000
5    -1.000000      1.000000
6    -1.000000      0.000000
11   -8.000000      -5.000000
12   -5.000000      -2.300000
```

Create a database as a linked list. Let each node of your linked list contain a structure containing data for a given day. Keep your list sorted by index when

inserting or deleting data from it. For more information on linked lists see for example here: http://www.learn-c.org/en/Linked_lists.

Submission

When you are done, package all your results into a single compressed tar-ball with `.tar.gz` extension (see Lab 1) and upload that in the Student Portal.

Questions?

If there are any questions about this assignment, e-mail to `anastasia.kruchinina@it.uu.se`.