BIL105E - Introduction to Scientific and Engineering Computing
Final Exam - 22.5.2009

- Notes and books are closed.
- Exam duration is 2 hours.
- There are 4 questions.

Question 1) [20 points] The number 138 is called **well-ordered** because the digits in the number (1, 3, 8) increase from left to right (1 < 3 < 8). The number 183 is not well-ordered because 8 is larger than 3.

a) [10 points] Draw a **Flow Chart** that will find and display all possible **3-digited** well-ordered numbers between 100 and 999.

b) [10 points] Write a **C program** for the above.

Example Output

```
123  124  125  126  127  128  129  134  135  136  137  138
139  145  146  147 148  149  156  157  158  159  167  168
169  178  179  189  234  235  236  237 238  239  245  246
247  248  249  256  257  258  259  267  268 ........
```

Question 2) [30 points] The square root $\sqrt{N}$ of a positive integer number ***N*** can be calculated by the following iterative equation:

$$X_{k+1} = \frac{1}{2}\left(X_k + \frac{N}{X_k}\right) \qquad \text{where } X_0 = 1$$

$$\Delta = \left| X_{k+1} - X_k \right|$$

When $\Delta(delta) < 0.01$ the iterations must stop. The final value of X_{k+1} is the answer.

a) [15 points] Draw a **Flow Chart** to calculate and display the square root of ***N***.
The user will enter the N value. If user enters an invalid number, you should display a warning message and user will enter N again. You are **not** allowed to use the sqrt( ) function.

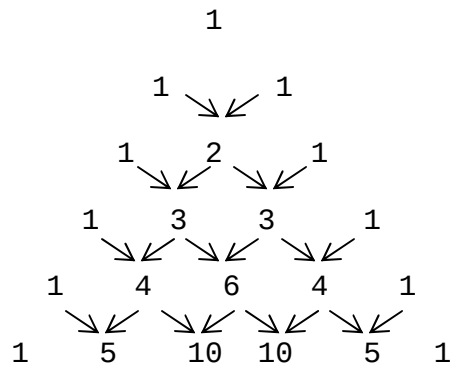
b) [15 points] Write a **C program** for the above.

Example Inputs and Outputs

```
Enter positive N : -3
Invalid input, enter again

Enter positive N : 25
Square Root = 5.00
```

Question 3) [25 points] Pascal's Triangle is defined as follows:

- First element and last element of each row is always 1.
- First row contains only one 1, second row contains two 1's.
- To calculate the elements of other rows, add the number directly left-above with the number directly right-above to find a new value. The following example shows the calculation of a Pascal triangle with 6 rows.



Write a **C program** to calculate and display a Pascal's Triangle.

User will enter the number of rows (N). You may assume that N is maximum of 100.

For simplicity, your output can be similar to the following:

Example Input and Output

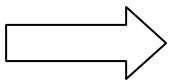
```
Enter  number of rows : 6

1
1   1
1   2   1
1   3   3   1
1   4   6   4   1
1   5  10  10   5   1
```

Question 4) [25 points] Write a **C program** to read the "input.txt" file, eliminate all duplicated records (i.e. identical records) and generate the "output.txt" file. The output file should contain unique records. Note that both files may not neccessarily be sorted.

Your program must be general which is independent from the example data given below. You may assume that the input file can contain maximum of 200 lines.

Example of input.txt file

```
Elizabeth Brown
Carlos Gonzalez
Elizabeth Brown
Antonio Moreno
Antonio Moreno
Bernardo Batista
Antonio Moreno
. . . . .
```



```
Elizabeth Brown
Carlos Gonzalez
Antonio Moreno
Bernardo Batista
. . . . .
```

Example of output.txt file