

Lab 3: Variables and Data Types

Week 3: 10th Aug, 2015

Practice (20 minutes)

- In this assignment, you have been given some programs to study and play with
- On your Assignment interface, click on the “helper code” link. This will download a “lab3.tar” file. It will get saved in the “Downloads” folder.
- Create a folder named by your roll number in your home directory
- Move the lab3.tar file to the roll number directory (Ask your JTA if you do not know how to do this)
- Extract the files from lab3.tar (Ask your JTA).
- Now you will see the program files that have been given to you. Five programs have been given to you: average.cpp, caseChange.cpp, factorial.cpp, max.cpp, temperature.cpp. (There are also some other files, ignore them for now).
- Open the code files in Text Editor and study the code. Try to figure out what the programs are doing and how they are doing it.
- Now open Terminal and as usual type:

```
cd 150010001
```

```
(replace the roll number with your roll number)
```

- Compile and run each of the above programs (using the s++ compile command as usual) and understand further how they programs work.

Programming Problems

In today’s lab, you are expected to complete the first FOUR tasks. The rest should be done by those who finish early.

1. **(15 mins)** Nirbhai just became the new mess secy of his hostel and he ordered **n** sweets for this sunday dinner. He wants to distribute the sweets equally amongst the hostel inmates. There are **m** students in his hostel. Help him in deciding how many sweets (**a**) should each student get. And also how many sweets (**b**) will be left after the distribution. Your program should ask the user for **n** & **m**, and output **a** and **b**. Save file as *sweets.cpp*

Sample input 1:

10

3

Sample output 1:

3

1

Sample input 2:

3432

47

Sample output 2:

73

1

Sample input 3:

7984

34

Sample output 3:

234

28

2. **(15 mins)** Write a program that takes as input the coordinates of two points (x_1 , y_1), (x_2 , y_2) in the plane and prints out the distance between them. Save file as *euclid_distance.cpp*.

Sample input

5.3242

43.1312

17.845

25.8

Output for above input

21.3809

Today, you should also learn how to “take input from a file” instead of typing it in. Taking input from a file is helpful when there is a lot of input to give. It will also allow the TAs to quickly check your program output on these inputs.

You have been given 3 files - pointsinp1, pointsinp2 and pointsinp3. Each of these files have x_1 , y_1 , x_2 and y_2 on one line each. Follow these steps in the “terminal window”.

To view one of these files type the following at the command prompt:

more pointsinp1

To give the input contained in "points1" to your program, type:

./a.out < pointsinp1

This will make your program read input from the file pointsinp1, instead of from the terminal.

You have also been given files pointsout1, pointsout2 and pointsout3. pointsout1 is the correct output for pointsinp1, pointsout2 is the correct output for pointsinp2, and pointsout3 is the correct output for pointsinp3,

To view the correct output for pointsout1, type:

more pointsout1

Now you can compare the output of your program, with the correct output.

3. **(25 mins)** One of other favorite sequence of Nirbhai is Geometric sequence. It is a sequence of numbers where each term after the first is found by multiplying the previous one by a fixed, non-zero number called common ratio, general form of Geometric Sequence is : a, ar, ar^2, \dots, ar^n . Write a program for Nirbhai that prints out the geometric sequence taking a, r, n as input. Save file as geom_seq.cpp

Sample input 1

2 3 10

Sample output1

2, 6, 18, 54, 162, 486, 1458, 4374, 13122, 39366, 118098,

Sample input 2

0.8 2 6

Sample output2

0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2,

Sample input 3

30 0.5 8

Sample output3

30, 15, 7.5, 3.75, 1.875, 0.9375, 0.46875, 0.234375, 0.117188,

4. **(30 minutes)** Modify the average.cpp program so that it also prints out the standard deviation. Save the program in a file *avdStd.cpp* .

For standard deviation use the formula:

Variance = Second moment - average*average), that is

$$\text{StdDev} = \sqrt{E[N^2] - (E[N])^2}$$

Second Moment, $E[N^2]$, is defined as follows. For a set of numbers $\{N_1, N_2, N_3, \dots, N_k\}$ second moment is:

$$E[N^2] = (N_1^2 + N_2^2 + N_3^2 + \dots + N_k^2) / k$$

Sample Input: (number of numbers, followed by the numbers)

5
5.3242
43.1312
17.845
25.8
65.4

Output for above input (average, followed by Standard deviation)

31.5001
20.9218

THREE sample input and output files are given for this program, the last file has 100 numbers, so you will not be able to type in the input. This is a good example of a program where you should take input from a file. Type the command:

```
./a.out < avgStdinp3
```

SUBMISSION INSTRUCTIONS ARE GIVEN ON THE ASSIGNMENT PAGE. FOLLOW THOSE AND SUBMIT. CALL A JTA FOR HELP IF REQUIRED.

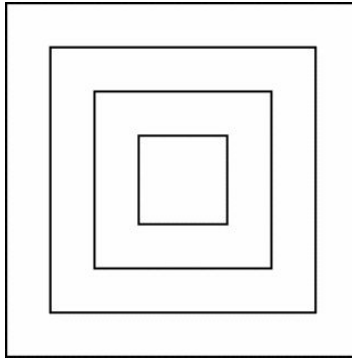
Solve following questions, if you have extra time

5. **(25 mins)** Hitendra finds concentric patterns very interesting and is trying to draw concentric squares. Write a program for him, which draws n concentric squares, increasing sidelength by q units at each step and initial square with sidelength m units. Take n, q, m as input. Save file as *conc_squares.cpp*

Sample Input :

4
3
3

Sample Output :



6. Hitendra likes to draw. This time he wants to draw a smooth spiral. The spiral should wind around itself in a parallel manner, i.e. there should be a certain point called “center” such that if you draw a line going out from it, the spiral should intersect it at equal distances as it winds around. The figure should look something similar to the one given below. Help Hitendra, by writing a program to draw this pattern. Save the file as *spiral.cpp*



7. The ASCII codes for the digits 0 to 9 are 48 to 57. Suppose in response to the third statement below, the user types in two digits. The ASCII codes for the digits will then be placed in p, q. You are to fill in the blanks in the code such that dig1 gets the value of digit in p (not the value of its ASCII code), and similarly dig2 should get the value of the digit in q. Finally the integer n should contain the value of the number in which p is in the tens place and q in the units place.

```
char p, q;
```

```
int dig1, dig2, n;  
cin >> p >> q; // equivalent to cin >> p; cin >> q;  
dig1 = ...  
dig2 = ...  
n = ...
```

For example, if the user typed '1', '2', then **p**, **q** will contain the values 49, 50. At the end we would like **dig1**, **dig2**, **n** to be respectively 1, 2, 12. Save file as *ascii.cpp*