EL2208	Problem Solving with C Lab.	Lab #7

Using for loops, plotting data with MATLAB and using program controlled I/O.

Use praktikum.ee.itb.ac.id server as usual.

This week in lab will offer more experience using **for** loops, plotting data with MATLAB and using program controlled I/O. The lab is in two parts with a different method of plotting data for each part. The programs are quite short and will be used to generate data for plotting.

The first program computes **z** in the formula

$$z = 3(1-x)^2 e^{-(y+1)^2 - x^2} - 10\left(\frac{x}{5} - y^5 e^{-x^2-y^2}\right) - \frac{1}{3} e^{-(x+1)^2 - y^2}$$

Use two **for** loops for this problem. The outer one loops over the **x** coordinate from **x=-5** up to, and including, **x=5** at intervals of **0.1**. The inner loop goes over the **y** coordinate from **x=-5** up to, and including, **x=5** at intervals of **0.1**. The output data file is going to be written using the (`fopen/fprintf/fclose`) commands. The program will open a data file called "mesh1.out" and print all the data into that file. For each iteration through the inner loop, print **x**, **y** and **z** in three columns. Do not put any column headings in the output.

Run your program and look at the output data file using **more** command.

Next, start another C file and compute a 2-dimensional **sinc** operation over the same range as used for **x** and **y** in the previous program. The **sinc** function is computed as

$$z = \begin{cases} 1 & , r = 0 \\ \dfrac{\sin(r)}{r} & , r \neq 0 \end{cases}$$

where

$$r = \sqrt{x^2 + y^2}$$

The argument to the **sin** function is already in radians so no conversion is necessary.

The outer loop will be over the **x** coordinate and the inner loop will be over **y**. Print **z** from inside the inner-most loop. Be sure to put a space after the place **z** is printed but do NOT put a newline within this print statement. Instead, print a newline just outside of the inner loop but inside the outer loop. Do NOT put in any text such as **z=** in the output; the output should just be a table of numbers separated by spaces. The output will be written to a file called "mesh2.out" using the (`fopen/fprintf/fclose`) commands.

Run your program and look at the output data file using **more** command.

Next, start MATLAB by typing **matlab** on the Linux command line. To plot the first set of data, type the following commands on the MATLAB prompt line.

```
>> load mesh1.out
>> plot3(mesh1(:,1),mesh1(:,2),mesh1(:,3))
>> grid
>> xlabel('x')
>> ylabel('y')
>> zlabel('z')
```

The **plot3** command takes three arguments, the **x**, **y** and **z** data, respectively. To see more information about this command, you can type **help plot3**.

To rotate the plot to see the data from different views, click the mouse on the icon to the farthest right (it has a arc with an arrow on the end) just below the menu bar. Then click somewhere on the plot and drag the mouse in different directions. The plot will rotate with the mouse. To turn off this feature, click the icon again.

Next, plot the data from the second program. Type the following

```
>> load mesh2.out
>> [x,y] = meshgrid(-5:0.1:5)
>> mesh(x,y,mesh2)
>> colorbar
```

The **meshgrid** command takes three arguments; the first is the start of the **x** and **y** coordinates, the second is how much the data was incremented and the last is the final value for **x** and **y**. These are separated by colons. The **mesh** command takes the **x** and **y** data which was computed by the **meshgrid** command and then the **z** axis is formed by the **mesh2** data. The last command puts a colorbar legend beside the plot.

Show your lab instructor your plots when you are done then submit your code using perl submitter.