CS 251: Presentation: LaTeX and gnuplot (Inlab)

- Due: 8:10 PM 13/09
- Please write (only if true) the honor code. If you used any source (person or thing) explicitly state it. You can find the honor code on the web page.

Overview

Data visualization and aesthetic presentation are two vital skills to be acquired for the present day academia and industry. This lab will take you through a ride to use these two powerful and long-standing tools.

Part A: Data when not perceived or visualized properly can lead to misinterpretations. Just as we became familiarized with the shell, let us further look into a command-line offering for data visualization. Even though a lot of GUI tools are available, sitting below the layers is a tool called `gnuplot`. As a computer Science student and an aspiring code warrior, one needs a powerful CLI tool to get the job done.

Part B: You would have noticed that all the problem statements released in CS 251 seem different from those created using Microsoft Word or Google Docs (although not different from ACM ICPC!). This is because we use a powerful document preparation system which is different from conventional *WYSIWYG* word processors. Our goal is to become familiar with LaTeX in this inlab. This is something which will stand with you during all your formal report making in CSE, IITB.

A. gnuplot

gnuplot is a simple, yet versatile, open source tool for drawing graphs. In this lab, we are going to draw a simple statistical function using gnuplot in order to understand some of the power of the tool.

0. As a warm-up, generate `data.dat` file using Octave. You should try to use vectorized code instead of `for` loops.

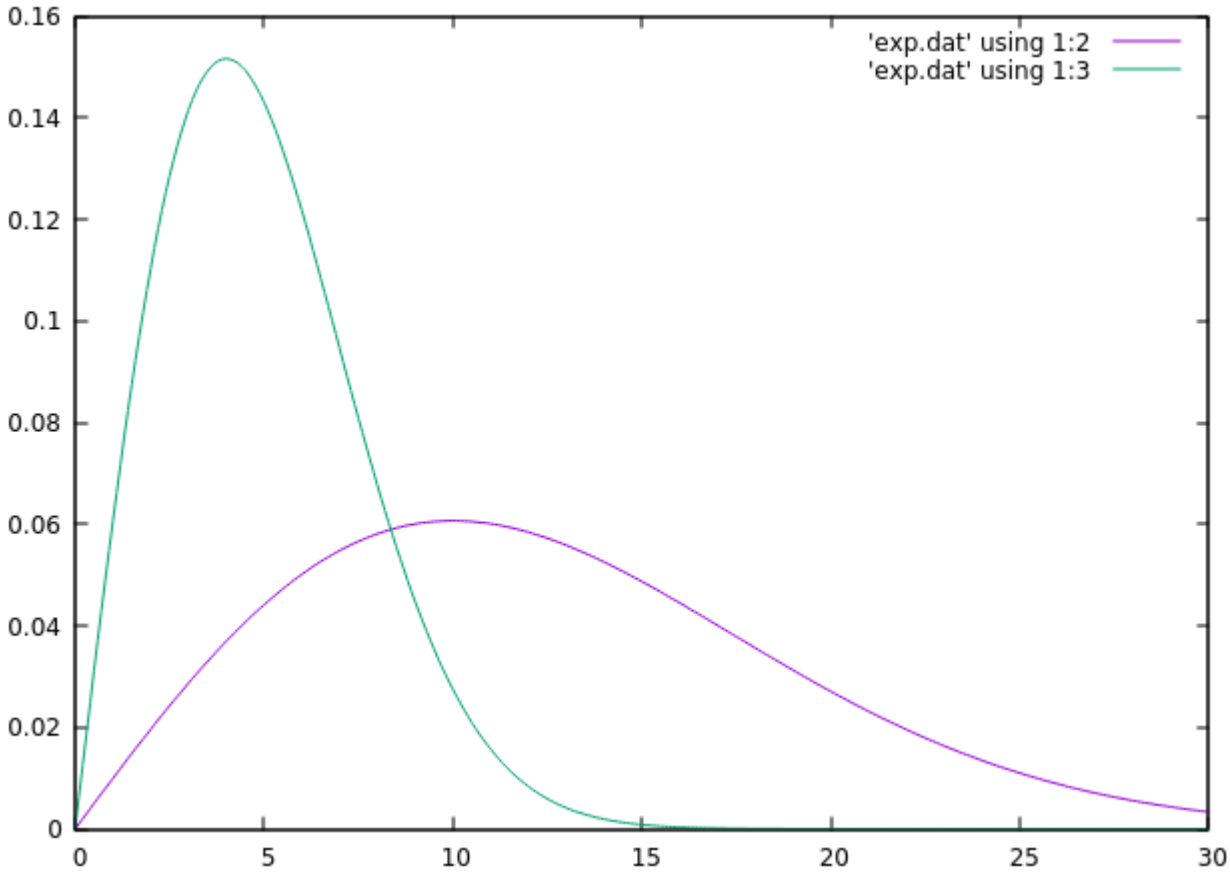
   The file should contain two space separated columns. The first column should contain `x` values and the second column will have the corresponding value of the Rayleigh probability distribution function with your choice of σ. (The Rayleigh distribution arises in the case of random complex numbers whose real and imaginary components are independently and identically distributed Gaussian with equal variance and zero mean; the absolute value of the complex number is Rayleigh-distributed.) Write your own `raypdf` function to generate the pdf of the Rayleigh distribution. Now, write a shell script `plot.sh` (which will internally use gnuplot) to read the `data.dat` file. Further, gnuplot will draw the graph of the Rayleigh distribution with the first column on the X-axis and the second column on the Y-axis. (Note that newer versions of gnuplot might well have math functions such as Rayleigh built in but afaik the one on swlab doesn't.)

1. Now that you are aware of the basic plots in gnuplot, using the same Octave code, generate 4 columns of data pertaining to 4 different values of sigma of your choice. Now your `data.dat` file should have 5 columns in total where the 1^{st} are the `x` values, and rest four are the corresponding Rayleigh pdf values for the sigmas chosen. Modify `plot.sh` to plot all the four distributions. Each of the distribution should have a different style (i.e., lines, points etc.,). All the distributions must be plotted in the same graph like the figure below.

   Note: There is no restriction on number of data points to be generated, they should be sufficient to get a good amount of distribution being covered

2. Your final plot must be saved automatically as `plot.png` when `plot.sh` is executed and your plot should have a Legend stating the value of sigma, title of the plot, X-axis name, Y-axis name

3. When we execute `./plot.sh` on our `data.dat`, all the above mentioned things must be present and the saved plot.png must look similar to the figure below



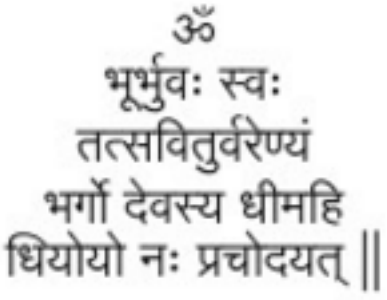
B. LaTeX

LaTeX is an extremely powerful document preparation system which is used by researchers everywhere to write their papers; most IITB students use it to write their resumes. TeX math mode is the raison d'etre (aka USP) of LaTeX. Equations come out looking correct. As an aside TeX is sort of guaranteed to be bug free. The author, Stanford Professor Donald Knuth, will send you a reward check if you find a bug. He doubles the reward for every next bug, so you might want to wait to discover the next bug :)

Here, we will show two features of LaTeX that you might consider interesting. We will dive deeper in the outlab.

0. In this task, we are going to use XeLaTeX to write the Gayatri Mantra (given below), in LaTeX. XeLatex assumes its input is Unicode, otherwise it's just like LaTeX, pretty much. You can use this Devanagiri online key board for this purpose.

1. Write a file `main.tex` which contains the following text exactly. Please pay attention to the characters, this may not be the same as what you find on the Internet.



For getting your degree, IIT asks you to write your name in Devanagiri, so sign off this text with something like
written on .... by <your name in Devanagiri> e.g. written on 10/9/2016 by आदित्या [1]

2. In the `main.tex` file, also write the formula for the Rayleigh probability distribution function. Also mention the σ values you used in the previous tasks in the form of a table. (Later, you can try to write the same formula in Microsoft Word or Google Docs and see why you might prefer LaTeX. This is not to say that you won't dislike TeX initially; the power of LaTeXcomes in making large documents such as the textbook you are using for CS 215. We hope you will write one.)

3. After you have added the formula, include the figure `plot.png` generated in task A in to `main.tex`.

C. Beamer

While LaTeX is used to write project reports, sometimes we will need to summarize the report in a presentation. This is where Beamer comes in. Beamer is a document class of LaTeX and is meant to make presentations using the same style as your report. In fact, the general idea is to do copy-pasting. In this lab, you are going to make a slide show of all the labs you have done so far highlighting the challenges, (hard lessons you learned), what you wish you could have learnt (future work), and something you are proud of. This will also enable you to revise the topics.

0. Use `Beamer.tex` for the file name and do the following

1. The first page of the presentation should be a title page. It must be titled 'Compilation of reflection essays: A CS251 presentation by Group XX". The author list must carry the names of all the group members along with their roll numbers and email addresses below their names. Include a date tag/field in the LaTeX document so that the date changes when you remake the presentation on a different date.

2. The next slide should be an Overview listing of 2 (may be favourite/tough) of all the 5 labs covered and the topics covered in them.

3. There should be 2 different sections, at least one for each lab, (which means at least 2 slides) with 2 or more bullet points. The bullets should get displayed one at a time i.e., not all at once, and it should comprise of the reflection essay for that corresponding lab

4. Include minimum 4 references (at the appropriate places) mentioned in the reflection essays (we will use the Bibliography tool called BibTex). Use the file name `biblio.bib`. It's important to know how to refer on the net, so please look for style guidelines such as APA style guidelines. Also you should have at least 2 references to books (and ideally also references to papers).

[1] Incidentally, this can also be done using a tool named `devnag`. You can have a look at it after you are done with the lab.

Submission Guidelines

1. When you submit, please document individual percentages such as Student 1: 80%, Student 2:100%, Student 3:10% in the readme.txt. In this example, the second student will get full marks (10/10) and the first student will receive 8/10.

2. Do include a readme.txt (telling us whatever you want to tell me). (The reflection essay is not required for inlab, but is required for outlab.) Do include group members (name, roll number), group number, honour code, citations etc.

3. The folder and its compressed version should both be named `lab06_groupXY_inlab` for example folder should be named `lab06_group06_inlab` and the related `tar.gz` should be named `lab06_group06_inlab.tar.gz`.

4. The submission folder should contain 3 subfolders taskA, taskB and taskC

5. The subfolder taskA should contains 2 files plot.sh and plot.png

6. The subfolder taskB should contain main.tex

7. The subfolder taskC should Beamer.tex and biblio.bib

8. Your submission folder should look something like this:

```
lab06_groupXY_inlab
├── taskA
│   ├── plot.sh
│   └── plot.png
├── taskB
│   └── main.tex
├── taskC
│   ├── Beamer.tex
│   └── biblio.bib
└── readme.txt
```

How We will Grade You [30 Marks]

1. Task A [**10 Marks**]

   - `plot.sh` : 6 Marks
   - `plot.png` : 4 Marks

2. Task B [**10 Marks**]

   - Devanagari Script : 4 Marks
   - Rayliegh pdf and other values : 4 Marks
   - `plot.png` in main.pdf : 2 Marks

3. Task C [**10 Marks**]

   - Title : 1 Marks
   - Overview : 1 Marks
   - Sections(2.5 for each) : 5 Marks
   - Bibliography : 3 Marks