

In the name of God

Department of Physics
Shahid Beheshti University

OPTIMIZATION METHODS IN PHYSICS

Exercise Set 2

(Due Date: 1400/07/30)

1. Error analysis and propagation: Using the input file, write a proper shell script and computational program to do following tasks:

A : Making directories and send each data sets to corresponding directory.

B : Compute mean, variance and mean standard deviation of each data sets. And write them in a file which contains the label of data, mean, standard deviation and mean standard deviation. Finally plot them.

C : Compute $p_i(x)$ as a function of x for each sets. To this end, use weight function " $W(x, q)$ " for $q = 0$ and $q = 1$.

D : For each data set Compute $\sigma_m(p(x))$ and Plot $p(x)$ versus x with its error-bar.

E : Determine the deviation of each $p(x)$ from Gaussian function and finally plot the deviation versus name of data set. Which series has maximum deviation and which data has minimum deviation?

F : Convolution theorem: For a kernel estimation it is useful to use $\bar{p}(x) = \mathcal{K} \otimes f = \int \mathcal{K}(x - x')p(x')dx'$. Suppose that $\mathcal{K} = \frac{1}{\sqrt{2\pi\sigma_k^2}} \exp(-x^2/2\sigma_k^2)$ with $\sigma_k = 4$. Accordingly smooth the $p(x)$ computed in the previous parts. Now use a Fourier transformation and do the smoothing in the Fourier space and then come back to real space and compare your results.

Good luck, Movahed
