

In the name of God

Department of Physics  
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ADVANCED COURSE ON COMPUTATIONAL PHYSICS AND  
OPTIMIZATION

Exercise Set 7

(Due Date: 1403/02/20)

1. Decaying simulation: suppose the probability of decaying are  $p = \lambda\Delta t$  and  $p = \lambda\Delta t/t$ . For both of them write down programs that simulate these phenomena.
2. Using Stone throwing method, compute the value of pi ( $\pi$ ). Check your algorithm for various values of sampling,  $N$ .
3. Solve the following integration numerically:

$$\langle v_z^2 \rangle = \int_{-\infty}^{+\infty} dv_x \int_{-\infty}^{+\infty} dv_y \int_{-\infty}^{+\infty} dv_z v_z^2 p_v(\vec{v})$$

here  $p_v(\vec{v}) = \left(\frac{\beta m}{2\pi}\right)^{3/2} \exp\left(-\frac{\beta m \vec{v}^2}{2}\right)$ . Suppose that  $\beta m = 2$ . Could your estimate you result before doing integration?

4. Based on Variational theorem in the quantum mechanics, write a variational Monte-Carlo program to estimate the ground state of 1D harmonic oscillator.

Good luck, Movahed

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