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Exercises for Computational Methods in Solid State Theory
SS 2013

Exercise Set 5
(Due date: Monday, June 19, 2013)

Exercise 5 (**Monte Carlo**) (10 points)

a) **Monte Carlo integration.**
   Calculate the following definite integrals a la Monte Carlo:

$$(1) \qquad I_1 = \int_0^1 dx \ \frac{1}{\sqrt{x}},$$

$$(2) \qquad I_2 = \int_0^3 dx \ \exp(-x^2).$$

   Give the result including the standard deviation using the three-sigma rule. Show your estimates using 10^3, 10^5, and 10^7 samples.

b) **Monte Carlo sampling (i).**
   Sample values from an exponential distribution e^{-x} between $x = 0$ and $x = 1$ using

   - inverse sampling.
   - the rejection-sampling algorithm.

c) **Monte Carlo sampling (ii).**
   Modify the rejection-sampling algorithm to sample from tabulated data. Sample:

   - polar scattering angles from the given differential cross section for elastic scattering (DCES) of electrons by atoms,
   - energy losses from the given differential inelastic inverse mean free path (DIIMFP) for 500-eV electrons moving in polycrystalline Al.

   Make a histogram of the sampled values and compare it with the original distributions.