

Broad outline of the course on Monte Carlo Methods

1. Random numbers – discrete and continuous. How to generate uniform variates on a computer – notion of pseudo random numbers.

Linear Congruential generator, its limitations and other techniques. Tests of randomness.

2. Statistical distributions – density functions, mass functions, and cumulative distributions. Generating various distributions on computer – transformation method, acceptance rejection method and comparison. Box-Muller and other special techniques.

3. Generating random numbers and distributions in ROOT.

4. The basics of Monte Carlo method, multidimensional integration using Monte Carlo Method.

5. More advanced techniques in MC integration – importance sampling and stratified sampling. How MC event generators work.

6. Markov Chain Monte Carlo. Its utilization in HEP (time permitting).

All the topics will be covered with hands on examples after a short theoretical introduction. Prerequisite of the course is knowledge of C++. Basic knowledge of ROOT is highly recommended. Every participant should have access to a computer with linux OS, appropriate version of gcc compiler and ROOT (with Roofit enabled) installed.

Suggested text books:

Numerical Recipes in C++ (or C), Second edition - by William H. Press et. al. (Cambridge University Press)

Chapter 7.

Statistical Data Analysis - by Glen Cowan (Oxford Science Publications)

Chapters 1,2, and 3. (a reading of chapter 5 is also useful)