MSG800/MVE170 Basic Stochastic Processes Fall 2010

Exercise Session 1, Tuesday 2 November

Chapters 1-2 in Hsu's book

No scheduled problems for these chapters. However, students who feel insecure about any of the topics covered in Sections 1.1-1.8 and/or Sections 2.1-2.8 in Hsu's book should look for corresponding solved problems in Hsu's book, as well as possibly a few supplementary problems for own work.

Chapter 3 in Hsu's book

Solved problems. Problems 3.20, 3.30, 3.34 and 3.40 in Hsu's book.

Supplementary problems for own work. Problems 3.57 and 3.68 in Hsu's book.

Computer problem for own work. Calculate the integral $\int_0^1 (\sin(1/x))^2\,dx$ numerically by means of the so called Monte-Carlo method, which is to say, generate a very great number n (=as many as you can) independent bivariate random variables $\{(X_i, Y_i)\}_{i=1}^n$ that all have a common unifom distribution over the unit square with PDF $f_{X,Y}(x, y) = 1$ for $0 \le x, y \le 1$ and $f_{X,Y}(x, y) = 0$ elsewhere and check how great a fraction of these random numbers that satisfy $(\sin(1/X_i))^2 \ge Y_i$. Also dicuss (theoretically and/or heuristically) why this method should give the correct value for the integral as $n \to \infty$.

The above described Monte-Carlo method for numerical calculation of integrals has the interesting feature that the spead of convergence (which is $1/\sqrt{n}$) will be completely independent of which function it is that we are integrating. Therefore the method is particularly suitable for ill-behaved irregular functions [like, e.g., $(\sin(1/x))^2$] for which classical deterministic numerical integration procedures can be expected to perform very poorly, or even break down completely.

Chapter 4 in Hsu's book

Solved problems. Problems 4.17, 4.18, 4.25, 4.45, 4.49, 4.58, 4.59 and 4.77 in Hsu's book.

Supplementary problems for own work. Problems 4.90, 4.96 and 4.100 in Hsu's book.