Practice exam 1 2020

Stochastic Simulation (Universiteit van Amsterdam)

Sample questions for Exam - Part I

Note on math: Wherever I expect you to include formal mathematical explanation I add a reminder about "ASCII math". But you are free to use mathematical explanation elsewhere too! Given the limitation of the online exam tools, the best is to use ASCIIMath format. You can also use pen&paper for the calculations, and when you are happy with the result type in the major steps in ASCIIMath.

You can fins more on the syntax of ASCIIMath here: http://asciimath.org (You dont need to *learn* the syntax, just try to adhere to it).

Sample questions - Aim to solve these within 40 mins.

1. We know the following about a probability density function: $X \epsilon \left(0, \frac{a}{3}\right)$, $f(X) = aX^2$

   (Write down the calculations briefly - ASCII math).

   a.) What is the value of a? b.) What is the expected value of X?

2. Show how to generate a random variable using the $U(0,1)$ distribution to have the distribution of $F(X) = \frac{X^2+X}{2}$, $X \epsilon [0,1]$:

   a.) using the inverse method b.) using the accept-reject method.

3. Suppose that you are interested in the expected outcome of a stochastic simulation, so you are estimating it using the average of n simulations. Would you use bootstrapping to decide how good this estimation is? Motivate your answer!

4. Your stochastic simulation results resemble a given distribution $F(X)$ by the look of it. After carrying out a Chi-square test on these results you come to the following conclusion: the simulation results really do follow this $F(X)$ distribution with 99% probability, therefore there is only 1% chance that they are from a different distribution. Can this conclusion be correct? Explain your answer!

5. Are there any situations when the orthogonal sampling produces consistently worse results than the LHS? Also give a distribution which can be sampled equally well with both methods!