Simulation Methods in Financial Mathematics
Computer Lab 13

Goal of the lab:

- To practice using Quasi Monte Carlo methods for pricing financial options.

In this lab we use Sobol sequences for computing approximate option prices.

1. Consider the problem of finding the price of the average strike option considered in lab 10 with total error that is less than 0.1 when a simple average is used for approximating the average stock price. Compute this price by using our usual procedure (knowing that the weak convergence rate is 1). Repeat the final computation with random numbers replaced by a suitable Sobol sequence. What is a reasonable estimate for the total error of the last computation?

2. Consider the market model and option from problem 2, lab 5. Repeat the computations of the lab by using a suitable Sobol sequence instead of random numbers.

3. **Homework 6** (deadline 03.12.2020). When volatility is not constant, then we have to use a numerical method for generating the stock prices and an approximation for the average stock price. Implement MC for pricing Asian options by using Milstein's method for generating the option prices and simple arithmetic average for computing the values of the average stock price. Note that combination of those methods gives us a method with weak convergence rate 1. Use this method for computing the price of the option with pay-off function $p(s, a) = \max(2s - 3a + 15, 0)$ in the case $S0 = 50$, $r = 0.02$, $D = 0.03$, $T = 0.8$, $\sigma(t, s) = 0.4 + \frac{1}{5} \ln \left(2 - \frac{50}{s+30} \right)$, with the total error that is less than 0.05 with the probability 0.9. Use the simple version of stratified sampling variance reduction method for computing the final answer.