Chapter 7 exercises

1. Implement code to price, by Monte Carlo simulation, a European and an American option with the payoff at exercise time t of

$$\max(0, K - S(t)^\alpha)$$

for an underlying asset $S(t)$, strike K and $\alpha > 0$. Compare the results, in particular in terms of convergence, with the results of Exercise 1 in Chapter 3.

2. Apply the technique of multiple control variates used to generate Table 7.4 in the book to the payoff in Exercise 1. Generate plots similar to Figure 7.3 for $\alpha = 0.5$ and $\alpha = 1.5$.

3. Consider the (European) option on the minimum of two assets given in Exercise 1 of Chapter 4. Price this option by Monte Carlo simulation and compare the results to the results from Exercise 1 of Chapter 4. One way to approach this problem using the library code provided on the website: The class `MBinary` implements a member function `get_payoff()`, which returns a `boost::shared_ptr` to an `MBinaryPayoff`, which is a class derived from `MCPayoff` (for a usage example see the file `MBinaryTestNewBoost.cpp`). Thus one could directly use the `MBinary` instances created in Exercise 1 of Chapter 4 to provide the `MCPayoff` instances needed to implement the Monte Carlo simulation.

4. Based on the work in Exercise 3, implement code to price an American option on the minimum of two assets, using various choices of basis functions (these can now include various polynomials in the two underlying assets, as well as the European option). Which choice of basis functions gives the best result? Does this depend on the number of training paths?

5. In Exercise 1, replace the pseudo-random number generator by a quasi-random number generator of the appropriate dimension. Produce a plot comparing convergence in the two cases.