Assignment for Module 3

April 2022

Instructions: This is a mini project on the use of the Monte Carlo scheme to price exotic options to be completed using Python. C++ is also allowed, but Excel/VBA is not permitted. As this is the half way point of the CQF, this assessment is designed for delegates to show independence and maturity in interpretation of a slightly open ended problem. It will test

- finding and understanding the relevant lectures, Python labs and tutorials in module 3; as well as the Python primer.
- ability to experiment and demonstrate initiative in mathematical and numerical methods.
- willingness to work outside narrow instruction that are typical of maths based tests/exams.

Queries to riaz.ahmad@fitchlearning.com

Task

Use the expected value of the discounted payoff under the risk-neutral density \mathbb{Q}

$$V(S,t) = e^{-r(T-t)} \mathbb{E}^{\mathbb{Q}} \left[\mathbf{Payoff}(S_T) \right]$$

for the appropriate form of payoff, to consider Asian and lookback options.

Use the **Euler-Maruyama** (only) scheme for initially simulating the underlying stock price. As an initial example you may use the following set of sample data

Today's stock price $S_0 = 100$ Strike E = 100Time to expiry (T - t) = 1 year volatility $\sigma = 20\%$ constant risk-free interest rate r = 5%

Then vary the data to see the affect on the option price. Your completed assignment should centre on a report to include:

- Outline of the finance problem and numerical procedure used
- Results appropriate tables and comparisons.
- Any interesting observations and problems encountered.
- Conclusion and references

For a Python Jupyter Notebook, a detailed notebook will become the complete report (writeup, code, results).

Score key

60-65 Pass

66-70 Good

71-79 Very Good

80-89 Excellent

90-95 Outstanding

96+ Exceptional

Note: An assessment of this form differs from mathematical exercises that can attract full marks. The key above is provided for this reason.