ECON-GA 4091/GB 5091 — Computational Dynamics
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Problem Set 5

Due on Monday, March 6, 9:30 am, via Brightspace

For each of the problems, submit your answers and code that generates the results. A Jupyter notebook is fine, as long as the results and code are well organized, with appropriate discussion. Group discussion is encouraged but everybody has to produce code and writeup individually. You can use and adapt the available codes from Github if you wish.

1 Solving the Black–Scholes model using the implicit scheme

The provided Jupyter notebook implements the solution to the Black and Scholes (1973) model for the explicit solution method. The notebook itself provides a description of both the explicit and the implicit method, with more details in the lecture notes.

Question 1.1 Modify the code (or write new code) to solve for the Black–Scholes option price using the implicit solution method. ■

Question 1.2 Solve for the value of a call option $C(Q,t)$ and a put option $P(Q,t)$ for $t=0$ on $Q \in (80,120)$ with the following parameter values

$$T=1, r=0.02, \sigma=0.1, K=100.$$

Compare the solutions with alternatives for which you change, one by one, the following parameters: $r=0.04$ and $T=2$. Explain the economic substance of the difference in the solution compared to the benchmark calibration.

■

Question 1.3 Verify that for your solution, the put-call parity

$$P(Q,t)+Q=C(Q,t)+K\exp\left(-r\left(T-t\right)\right)$$

holds for your solution at $t=0$.

■

References

Black, Fischer and Myron Scholes (1973) "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81 (3), 637–654.