Assignment for Module 3

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This is a Computational Finance task on the use of the Monte Carlo scheme to price options.

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Task

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

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

for the appropriate form of payoff, to consider binary options.

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

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

Your completed assignment should centre on a short report (and **computer code** separately) to include:

- Outline of the numerical procedure used
- Results - appropriate tables, comparisons and error graphs (e.g. changing number of simulations). Remember you know the Black-Scholes price of a Binary option.
- Any interesting observations and problems encountered.
- Conclusion and references

For a Python Jupyter Notebook, a detailed notebook will become the complete report (write-up, code, results, etc). You may also use C++/C#/matlab/java/VBA.