MA473 Computational Finance

LAB 10

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QUESTION 1:

ANSWER:

Part A)

To solve the stochastic differential equation (SDE)

$$dX = uX\,dt + \sigma X\,dW,$$

using Ito's Lemma, consider a function $f(t,X) = ln(X)$. Applying Ito's Lemma, we have:

$$df = (\partial f/\partial t + \partial f/\partial X\,dX + 1/2\,\partial^2 f/\partial X^2\,(dX)^2)\,dt + \partial f/\partial X\,dW.$$

For $f(t,X) = ln(X)$, the derivatives are:

$$\partial f/\partial t = 0, \quad \partial f/\partial X = 1/X, \quad \partial^2 f/\partial X^2 = -1/X^2.$$

Substituting these into Ito's Lemma, we get:

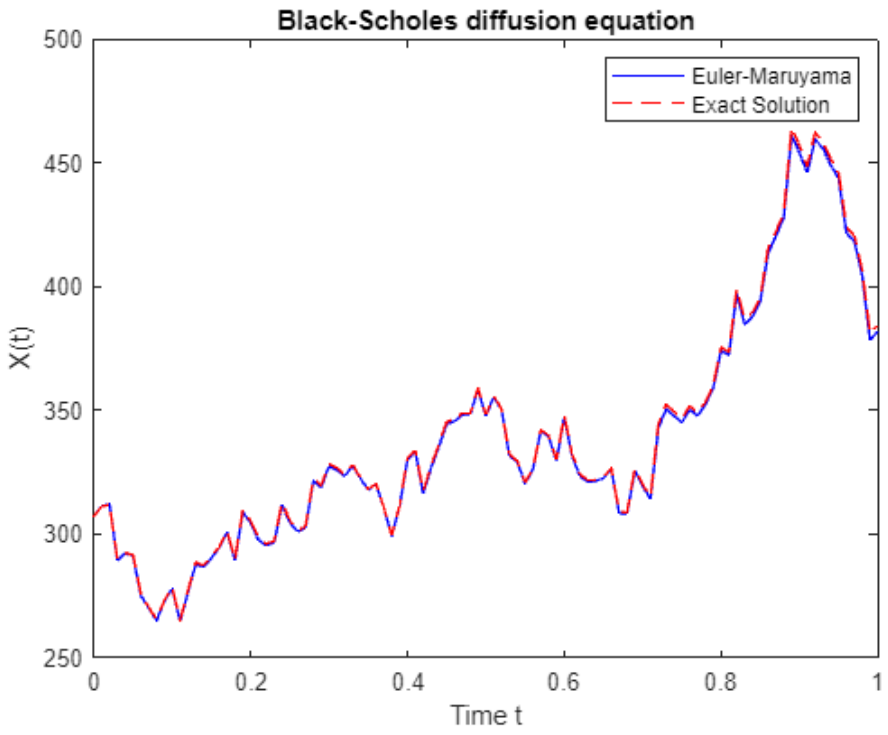
$$d(ln(X)) = (u - 1/2\,\sigma^2)\,dt + \sigma\,dW.$$

Integrating both sides from 0 to t:

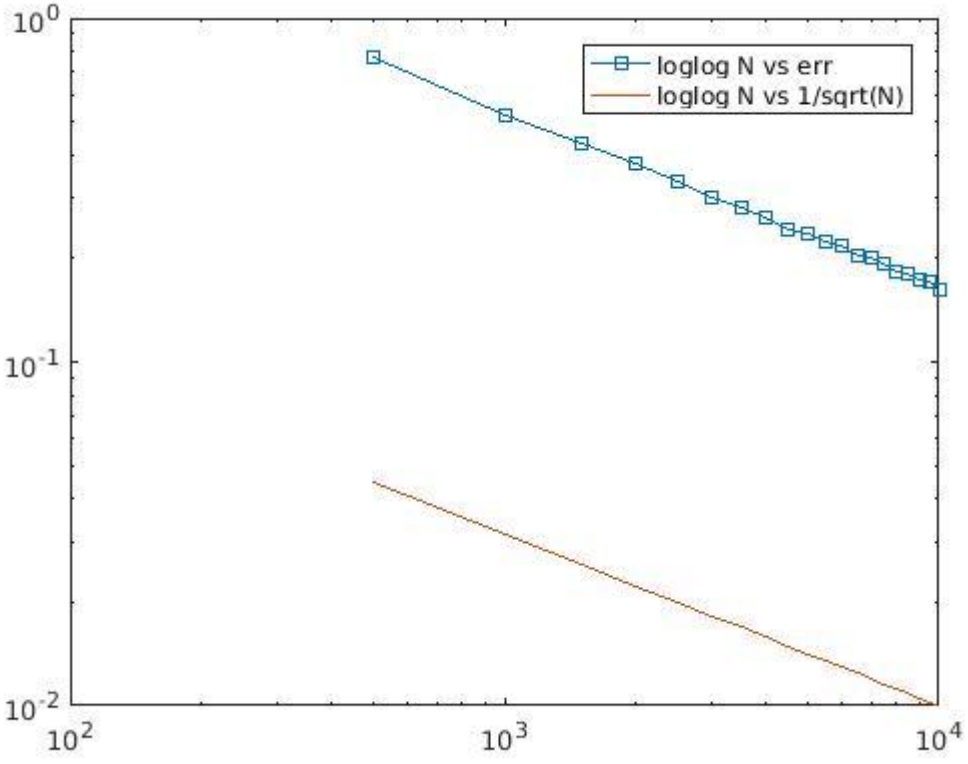
$$ln(Xt) - ln(X_0) = (u - 1/2\,\sigma^2)\,t + \sigma\,Wt.$$

Finally, exponentiating both sides gives the solution:

$$Xt = X_0\,e\text{^}\{(u - 1/2\,\sigma^2)\,t + \sigma\,Wt\}.$$



THE LOGLOG PLOTS ARE GIVEN BELOW -



QUESTION 2:

ANSWER:

THE LOGLOG PLOTS ARE GIVEN BELOW: