IE 522 HW04

Q1

7 Points

Consider a basket call option on two assets. For the first asset,

- the current asset price is $100,
- it doesn't pay dividend,
- volatility is 50% per year.

For the second asset,

- the current asset price is $150,
- dividend yield is 3% per year,
- volatility is 40% per year.

The risk free interest rate is 1% per year with continuous compounding. Assume the Black-Scholes-Merton model for both assets. The log returns of the two assets are correlated with coefficient 0.1. The strike price of the basket call is $K = \$250$. The maturity of the option is 1 year.

Q1.1

1 Point

Suppose $S_T = S_{1T} + S_{2T}$ is approximated by a lognormal random variable $e^{\mu+\sigma Z}$. Using the moment matching method, find μ and σ. Keep four digits after the decimal point.

mu = 5.4579, sigma = 0.3337

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Save Answer ***Unsaved Changes**

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Q1.2

1 Point

When the moment matching method is used, what's the approximate option value? Keep two digits after the decimal point.

0.00

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Q1.3

1 Point

When the Monte Carlo method is used to evaluate the option, with $n = 10,000$, estimate the standard deviation of the discounted payoff $e^{-rT}(S_{1T} + S_{2T} - K)^+$. Round your answer to the nearest integer.

59.

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Q1.4

1 Point

When you increase n by 4 times, does the standard deviation of $e^{-rT}(S_{1T} + S_{2T} - K)^+$ decreases by 2 times?

No, since it is not standard error, so it will not have to divided bt sqrt(n), which make it unchanged even it the n increase.

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Q1.5

1 Point

Suppose you start from a sample size of $n = 10,000$ and keep quadrupling the sample size. For what n, the standard error of the sample mean of discounted payoffs is less than $0.01? What's the corresponding standard error? Keep 3 digits after the decimal point.

40960000, 0.009.

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Q1.6

1 Point

For the n you obtain in question 1.5, what's the estimated option value? What's the 95% confidence interval for the option value?

32.44214, [32.42385, 32.46042]

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Q1.7

1 Point

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Use the same parameters as in question 1. Consider a basket put option with payoff $\max(0, K - S_{1T} - S_{2T})$. Suppose the Monte Carlo method is used to evaluate this contract. For the same n you use in 1.5-1.7, what's the estimated option value? What's the 95% confidence interval for the option value?

33.79735, [33.79734, 33.79735]

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Q2

1 Point

Given a random variable U that is uniform on $(0, 1)$, how can you simulate from a continuous distribution with cdf $F(x) = 1 - \left(\frac{c}{x}\right)^a, x \geq c$ for some $a, c > 0$? Show details.

Enter your answer here

Please select file(s) Select file(s)

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Q3

1 Point

Suppose the $1 - \alpha/2$ quantile of an $F_{p,q}$ distribution is 5. What is the $\alpha/2$ quantile of an $F_{q,p}$ distribution? Show details.

Enter your answer here

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Save Answer

Q4

1 Point

Suppose Y has a χ^2_k distribution. What's the limiting distribution of $(Y-k)/\sqrt{2k}$ as $k \to +\infty$? Show details.

Enter your answer here

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