

Homework 2

1. Suppose that we have an Asian call option whose strike price $K = 40$, and the stock price is currently at $\$40$ as well. The option expires in 24 months. Furthermore, suppose that the volatility of the stock is 30% per annum and the risk-free interest rate is 2.5% per annum.
 - (a) Suppose that there are totally 504 trading days in the 24 months period and the option depends on the average of the closing prices of all trading days. Using a Monte Carlo method with 10000 replications to determine the price of the option and compute a 95% confidence interval.
 - (b) Compute the values of delta and vega by using the pathwise method and the value of gamma by using the likelihood ratio method on delta.
2. Suppose that we have an American put option whose strike price $K = 40$, and the stock price is currently at $\$40$ as well. The option expires in 18 months. Furthermore, suppose that the volatility of the stock is 25% per annum and the risk-free interest rate is 2.5% per annum. Use the least-squares method to determine the price of the option. You may use 10000 replications, 378 time intervals and use polynomials up to order 4 as basis functions.
3. A bank has sold for $\$1,200,000$ a European call option on 100,000 shares of a non-dividend paying stock, with $S_0=100$, $K=100$, $r=5\%$, $\sigma=35\%$, $T=5$ months. The Black-Scholes-Merton value of the option is $\$997,000$. The company wants to use a delta-hedging strategy to lock in the profit. Suppose that the rebalancing is done every month. Please calculate the cost of hedging in the following scenario. The prices of the stock and the option and the corresponding delta are all for only a single share of the stock.

	Stock	Call	Delta
T=0	100	9.970	0.581
T=1	93	5.318	0.430
T=2	87	2.219	0.262
T=3	96	4.116	0.438
T=4	105	7.382	0.717
T=5	112	12.000	1.000

The homework is due on November 15. You may hand it in to the professor before the class starts.