

University of California, Los Angeles  
Department of Statistics

Statistics C183/C283

Instructor: Nicolas Christou

**Homework 6**

**Exercise 1:**

Suppose a stock has annual expected return and standard deviation  $\mu = 0.20$  and  $\sigma = 0.25$ . The current price of the stock is  $s = \$50$ . Suppose that  $\Delta t = 1$  week.

- a. Find the distribution of the return of the stock during  $\Delta t$ .
- b. Simulate the path of the stock from now until 1 year from now (52 weeks). Submit the random samples and the plot of the price of the stock against time.

**Exercise 2:**

Suppose that a stock price has an expected return of  $\mu = 0.16$  per year and standard deviation  $\sigma = 0.30$  per year. Suppose at the end of a certain day the price of the stock is  $s = \$50$ . Find:

- a. The expected stock price at the end of the next day.
- b. The standard deviation of the stock price at the end of the next day.

**Exercise 3:**

A stock price follows the lognormal distribution. Its current price is \$38, its annual expected return is  $\mu = 0.16$ , and its annual standard deviation is  $\sigma = 0.35$ .

- a. What is the probability that a European call option on this stock with an exercise price of 40 and expiration date 6 months from now will be exercised?
- a. What is the probability that a European put on this stock with an exercise price of 40 and expiration date 6 months from now will be exercised?

**Exercise 4:**

Using the lognormal distribution result of the price of a stock at time  $T$  show that:

$$P\left(Se^{(\mu - \frac{\sigma^2}{2})(T-t) - 1.96\sigma\sqrt{T-t}} \leq S_T \leq Se^{(\mu - \frac{\sigma^2}{2})(T-t) + 1.96\sigma\sqrt{T-t}}\right) = 0.95.$$

Suppose the current price of a stock is  $s = \$40$ , and the annual expected return and standard deviation  $\mu = 0.10$ ,  $\sigma = 0.15$ . Find:

- a. A 95% confidence interval for the price of the stock in 2 months.
- b. The expected price of the stock in 2 months.
- c. The standard deviation of the price of the stock in 2 months.

**Exercise 5:**

Determine the value of the following call using the Black-Scholes model. The stock's current price is \$95 with  $\sigma = 0.6$ . The call's exercise price is \$105, and it expires in 8 months from now. Assume that the continuously compounded riskless rate of interest is 0.08.

**Exercise 6:**

Using the lognormal property of stock prices estimate the annual volatility of APPLE (ticker is AAPL) using the adjusted daily closing prices for the period 01-March-2013 to 31-May-2013. You can access the data in R as follows:

```
s1 <- read.csv("http://ichart.finance.yahoo.com/table.csv?
s=AAPL&a=02&b=01&c=2013&d=04&e=31&f=2013&g=d&ignore=.csv", sep=";", header=TRUE)
```