Exam I

Duration: 120 minutes

Name:	ID:

1. Only SOA approved calculators are allowed.
2. This exam has 10 questions.
3. Show all of your work. Points will be deducted for results without work.
4. Write clearly. Justify every step in the calculations. You may lose points just writing the equation or results.
5. No credits will be given to wrong steps.

1. An investor constructs a ratio spread on a stock using 1-year call options. She buys one 70-strike option and sells two 85-strike options. You are given:
   - The continuously compounded annual risk-free interest rate is 0.03.
   - Call option prices are 7.19 for a 70-strike option and 3.12 for a 85-strike option.

   Let S be the price of the stock at the end of one year. Find maximum S that will guarantee positive profit.

2. An investor is speculating on the volatility of an index. The current price of the index is 1000. The investor buys a 3-month straddle. You are given:
   - A 3-month at-the-money call option costs 70.45.
   - A 3-month at-the-money put option costs 59.96.
   - The current price of the index is 1000.
   - The effective annual risk-free rate is 0.06.

   Let S be the price of the index at the end of 3 months.
   Determine the range of values of S for which the investor's profit is positive.

3. The current price for a stock index is 1,000. The following premiums exist for various options to buy or sell the stock index six months from now:

Strike Price	Call Premium	Put Premium
950	120.41	51.78
1000	93.81	74.20
1050	71.80	101.21

   Strategy I is to sell the 1,050-strike call and to buy the 950-strike call.
   Strategy II is to buy the 1,050-strike put and to sell the 950-strike put.

Strategy III is to buy the 950-strike call, sell the 1,000-strike call, sell the 950-strike put, and buy the 1,000-strike put.

Assume that the price of the stock index in 6 months will be between 950 and 1,050.

Determine which, if any, of the three strategies will have greater payoffs in six months for lower prices of the stock index than for relatively higher prices.

4. You are interested in borrowing $10,000 for one year by using a box spread. You are given the following option prices:

Strike Price	Call Premium	Put Premium
30	9	1
40	3	6

The continuously compounded risk-free Interest rate is 0.06.

One unit of the box spread consists of a long 30-40 bull spread of calls and a long 40-30 bear spread of puts.

Calculate the number of units of the box spread needed to achieve the financing goal, and determine whether they are bought or sold.

5. Helen owns a collared stock.

You are given:

(i) The price of the stock is 60.

(ii) The collar has strike prices 60 and 70.

(iii) The collar expires in one year.

(iv) The stock pays no dividends.

(v) The continuously compounded risk-free Interest rate is 0.02.

(vi) The price of a 60-70 bull spread with calls is 6.29.

Determine the price of the collar.

6. An investor wishes to purchase a butterfly spread consisting of a 30-42 bull spread with puts and a 42-50 bear spread with calls.

The spread has 60 long puts.

Determine the number of long calls.

7. Consider the following two strategies:

I. Buy a one-year call option with strike price 50.

II. Buy a one-year forward contract.

You are given:

(i) The continuously compounded risk-free interest rate is 0.04.

(ii) The forward price of the underlying asset is 65.

(iii) The premium for the call option is 18.

Let S be the price at the end of one year.

Determine maximum S for which the profit on strategy I is higher.

8. For a 2-day futures contract on 500 shares of an index:
   (i) The initial value of the index is 1000.
   (ii) The continuously compounded risk-free interest rate is 0.05.
   (iii) The initial margin is 10% of notional value.
   (iv) The maintenance margin is 75% of the initial margin.
   (v) The margin earns a continuously compounded annual rate of 0.04.
   The futures value is 1020 on day 1. The value of the underlying index is 1010 on day 2, expiry.
   Calculate the difference in payoff between this futures contract and a forward contract on the same underlying asset with the same expiry.

9. A certain stock costs 50 today and will pay an annual dividend of 6 for the next 4 years. An investor wishes to purchase a 4-year prepaid forward contract for this stock. The first dividend will be paid one year from today and the last dividend will be paid just prior to delivery of the stock. Assume an annual effective Interest rate of 5%.
   Calculate the price of the prepaid forward contract.

10. A nondividend paying stock's current price is 100. The 2-year forward price of the stock is 110. Determine the continuously compounded risk-free interest rate.