MTL-732 : Practice Sheet 2

1. Draw the pay-off graph of the following option(strike price in subscripts) portfolio
   $(i)\ -P_{80}+P_{100}+2C_{130}-C_{150}\quad (ii)\ C_{40}-2C_{50}+C_{60}\quad (iii)\ C_{40}-C_{60}+P_{60}-P_{40}$

2. X has short 400 shares of S at Rs 50. If S drops to Rs 32, all of the following are methods to protect his unrealized gain EXCEPT:
   (A). Buy 4, 35 calls (B) Write 4, 30 puts (C) Write 4, 35 calls

3. A company has 100 shares of ABC stock. The current price of ABC stock is Rs 30. ABC stock pays no dividends. The company would like to hedge its exposure to drops in the stock price by buying European put options expiring in 6 months with exercise price Rs 28. European call options on the same stock expiring in 6 months with exercise price Rs 28 are available for 4.10. The continuously compounded risk-free rate is 5%. Determine the cost of the hedge.

4. For European options on a stock having the same expiry and strike price, you are given: (i) The stock price is Rs 85. (ii) The strike price is 90. (iii) The continuously compounded risk free rate is 4%. (iv) The continuously compounded dividend rate on the stock is 2%. (v) A call option has premium Rs 9.91. (vi) A put option has premium Rs 12.63. Determine the time to expiry for the options.

5. Consider a European call option and a European put option on a non dividend-paying stock. You are given: (i) The current price of the stock is Rs 60. (ii) The call option currently sells for 0.15 more than the put option. (iii) Both the call option and put option will expire in 4 years. (iv) Both the call option and put option have a strike price of Rs 70. Calculate the continuously compounded risk-free interest rate.

6. An investor with no other security positions sells 1 ABC October 25 put for a premium of Rs 2, when the price of ABC stock is Rs 25 per share. The day before expiration, what is the stock price per share at which the writer will breakeven? What is the maximum gain the writer could sustain just before expiration? If Mr. Y saw himself as a bullish investor, which strategy, call buying or put buying, he might consider?

7. An investor acquires a call bull spread consisting of the call with strike K1 = Rs 100 and K2 = Rs 110 and with expiration in one year. The initial price of the 100-strike call option equals Rs 11.34, while the price of the 110-strike option equals Rs 7.74. At expiration, it turns out that the stock price equals Rs 105. Given a continuously compounded annual interest rate of 5%, what is the profit to the investor?

8. Suppose there are two call options written on the same underlying asset. Call A has a strike price of 50 and Call B has a strike price of 60. Call A premium is 5.25 and Call B premium is 6.50. Describe the arbitrage opportunity that takes advantage of these prices and prove that this is an arbitrage strategy.

9. Suppose there are options written on ABC stock with two strike prices: K1 = 60 and K2 = 65. The current premiums of the call options are C(K1)= 10 and C(K2)= 6 (i.e., the premium on the call option with a strike price of K1=60 is 10). The current put premiums are P(K1)= 3.50 and P(K2)= 4.50. The risk-free interest rate is 6% per annum. All options expire in one year. Show how you could take advantage of these prices to earn an arbitrage profit.

10. A certain stock is currently selling for Rs 50. The feeling is that for each month, for the next two months, the stock price will rise by 10% or fall by 10%. Assuming the risk free rate of 1%, calculate the price of the European call with the strike price Rs 48.

11. The current share price is 100, the risk free rate is 5% continuously compounded, and volatility 30% per annum. Construct a binomial tree and use it to value a one month European 80-put.

12. Consider a non-dividend-paying stock with the initial price of S(0) = 100. Assume that the annual risk-free continuously compounded interest rate equals $r = 0.05$. Let the annualized standard deviation of the continuously compounded stock return, i.e., the volatility be $\sigma = 0.25$. Using a one-period binomial tree, calculate the price of a one-year at-the-money European call on this underlying asset.

13. Compute the value of an American put expiring at time 3 units with strike price K = Rs 62 on a stock with initial price S(0) = Rs 60 in a binomial model with u = 1.1, d = 0.95 and r = 0.03.

14. Compare the prices of American Call and a European call with strike price K = Rs 120 expiring at time 2 units on a stock with initial price S(0) =Rs 120 in a binomial model with u = 1.2, d = 0.9 and r = 0.1.

15. For the data of above Question, suppose that a dividend of Rs 14 is paid at time 2 units. Find the price of the American Call and the European call.

16. Suppose that S(0) = 100, K = 45, $\sigma = 0.3$, r = 0.08 continuously compounded. The stock will pay a dividend 4 in exactly month from present time.
    (a) Compute the price of European and American call options using 2-period binomial model.
    (b) Are the two prices same?
    (c) Do you note any difference between two types of call options vis a vis underlying stock paying dividend or not in between investment period.

17. Consider a one period binomial model with $S(0) = 100$; $r = 0.08$; $\sigma = 30\%$.
    (a) Compute American put option value with K = 100, 110, 120.
    (b) At what strike(s) the early exercise occur (if any)?
    (c) Use put-call parity to explain why early exercise is sure to occur for all strikes greater than your answer in (b).

18. Consider the single period model in which the price of the stock today is S(0) = Rs 100. In the next period, it can go up by to 120, stay at 100 or go down at 90 (all in rupees). The price of the European Call on this stock with the strike price Rs 105 is Rs 5, and the price of the European call with strike price Rs 95 is Rs 10, with both options expiring in the next period. Replicate the pay-off of the risk free security that pays rupee 1 after one period regardless of what happens. Hence determine the risk free rate of model.