

# FINANCIAL ENGINEERING ASSIGNMENT – 1

1. Let  $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 110$  and  $S(0) = \text{Rs. } 80$ . Also, let  

$$S(1) = \begin{cases} \text{Rs. } 100, & \text{with probability } p = 0.80 \\ \text{Rs. } 60, & \text{with probability } p = 0.20. \end{cases}$$

Design a portfolio with initial wealth of Rs.100,000, split in the ratio of 3:2 between stock and bond. Compute the expected return and the risk of the portfolio so constructed.
2. Let  $B(0) = \text{Rs. } 90, B(1) = \text{Rs. } 100$  and  $S(0) = \text{Rs. } 25$  and let  

$$S(1) = \begin{cases} \text{Rs. } 30, & \text{with probability } p \\ \text{Rs. } 20, & \text{with probability } 1 - p. \end{cases}$$

Where  $0 < p < 1$ . For a portfolio with  $x = 10$  shares and  $y = 15$  bonds calculate  $V(0), V(1)$  and return on this portfolio.
3. Let  $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 110$  and  $S(0) = \text{Rs. } 80$ . Also, let  

$$S(1) = \begin{cases} \text{Rs. } 100, & \text{with probability } p = 0.80 \\ \text{Rs. } 60, & \text{with probability } p = 0.20. \end{cases}$$

Suppose that you have Rs. 10,000 to invest in a portfolio. For the above stock and bond prices, design a portfolio with an initial wealth of Rs. 1,000 split fifty-fifty between stock and bonds. Compute the expected return and risk as measured by standard deviation.
4. Let  $B(0) = \text{Rs. } 90, B(1) = \text{Rs. } 100$  and  $S(0) = \text{Rs. } 25$  and let  

$$S(1) = \begin{cases} \text{Rs. } 30, & \text{with probability } p \\ \text{Rs. } 20, & \text{with probability } 1 - p. \end{cases}$$

Where  $0 < p < 1$ . Find a portfolio whose value at time 1 is  

$$V(1) = \begin{cases} 1,160 & \text{if stock goes up} \\ 1,040 & \text{if stock goes down.} \end{cases}$$
 What is the value of this portfolio at time 0?
5. Let  $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 110$  and  $S(0) = \text{Rs. } 80$ .  

$$S(1) = \begin{cases} \text{Rs. } 100, & \text{with probability } p = 0.80 \\ \text{Rs. } 60, & \text{with probability } p = 0.20. \end{cases}$$

Also, let C and P respectively be a European call and European put with  $K = \text{Rs. } 100$  and  $T = 1$  year.

  - i. Determine  $C(0)$  and  $P(0)$ .
  - ii. Find the final wealth of an investment with initial capital of Rs.900 being invested equally in the given stock, the given call and the given put.
6. Let  $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 110$  and  $S(0) = \text{Rs. } 100$ . Also let  

$$S(1) = \begin{cases} \text{Rs. } 120, & \text{with probability } p \\ \text{Rs. } 80, & \text{with probability } 1 - p. \end{cases}$$

Find the final wealth of an investor whose initial capital of Rs. 1,000 is split fifty-fifty between stock and options, with exercise time 1 and strike price Rs. 100.
7. Spot an arbitrage opportunity (if it exists) in the following situation. Suppose that a dealer A offers to buy British pounds in an year from now at a rate of Rs.79 a pound, while dealer B would sell British pounds immediately at a rate of Rs.80 a pound. Assume that a rupee can be borrowed at an annual rate of 4% and a British pound can be invested in a bank at 6% annual interest.
8. Let  $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 110, S(0) = \text{Rs. } 50$ . Determine the forward price F of a forward contract on the given stock.
9. An investor writes a put option with strike price of Rs.30. The price of option is Rs.4. Under what circumstances does the investor make a gain?
10. The current price of silver is Rs.5000 per 100gm. The storage cost is Rs.0.50 per gm per year payable quarterly in advance. Assuming that constant interest rate of 9% compounded quarterly, calculate the forward price of silver for 1kg for delivery in 6 months.