number of pendant vertices in a binary (2)[CO1,4]

tree with n vertices has $(n-1)$ edges. (5)[CO2]

ving statement true or false? If all edges in a flow network have ies, then there is a unique path for the possible maximum flow. nswer with a (short) proof or give a counter example. (3)[CO3,4]

(b) Solve the SDE $dX(t) = X(t)\,dW(t)$ with $X(0) = 1$ and prove that its solution is $X(t) = \exp(W(t) - \frac{t}{2})$. 5 CO4

3. (a) Evaluate $\int_0^T W^3(t)dW(t)$ using Ito – Doeblin formula of version two. 5 CO4

(b) A stochastic process $\{S(t), t \geq 0\}$ is governed by $dS(t) = aS(t)dt + bS(t)dW(t)$, where a & b are constants. Find the SDE of $\sqrt{S(t)}$. 5 CO4

4. (a) Consider a portfolio of two assets a_1 & a_2 with the following statistical parameters $\mu_1 = 10\%$, $\mu_2 = 20\%$, $\sigma_1 = 12\%$, $\sigma_2 = 25\%$, $\rho_{12} = -0.6$. Obtain the equation of Markovitz curve, and using that find value of minimum risk, the expected return. 5 CO5

(b) Prove that if short sales are not allowed then the risk of the portfolio can not exceed the greater of the risks of the individual components of the portfolio. 5 CO5

5. (a) A portfolio with three securities a_1, a_2, a_3 with expected returns, $\mu_1 = 20\%$, $\mu_2 = 13\%$, $\mu_3 = 4\%$, standard deviations of returns, $\sigma_1 = 25\%$, $\sigma_2 = 28\%$, $\sigma_3 = 20\%$, and the correlation between returns, $\rho_{12} = 0.3$, $\rho_{13} = 0.15$ *and* $\rho_{23} = 0.4$. Compute the weights of individual assets in this portfolio for minimum variance. 5 CO5

(b) Using the following data: 5 CO5

Scenario	Probability	Return $K1$	Return $K2$
$\omega 1$ (recession)	0.2	−10%	30%
$\omega 2$ (stagnation)	0.5	24%	-10%
$\omega 3$ (boom)	0.3	20%	10%

Find the weights in a portfolio with expected return $\mu_P = 25\%$ and compute the risk of this portfolio

(n-1) edges. (5)[CO2]

[a] Is the following statement true or false? If all edges in a flow network have distinct capacities, then there is a unique path for the possible maximum flow. Justify your answer with a (short) proof or give a counter example. (3)[CO3,4]

1

Total no. of pages :2 Roll No._____

6th SEMESTER B.Tech (MC- Engg.)

END SEMESTER EXAMINATION MAY 2023

MC – 306 Financial Engineering

Time : 3 hrs Max. Marks: 50

Note: Q.No.1 is compulsory, answer any other three questions.
Statistical table is allowed. Assume missing data, if any.

1. (a) Let A(0)=100 , A(1)=110 , A(2)=121, and stock price can follow four possible scenario; 5 CO3

Scenario	S(0)	S(1)	S(2)
W1	50	60	72
W2	50	60	58
W3	50	45	55
W4	50	45	40

$S(i), i = 0,1,2$ is stock price at i^{th} time interval. Compute Risk Neutral Probability (RNP).

(b) Consider a portfolio of two assets a1 & a2 with no short sell, with the following statistical parameters 5 CO5
$\mu_1 = 7.5\%, \mu_2 = 15\%$, $\sigma_1 = 12\%$, $\sigma_2 = 35\%$, $\rho_{12} = -0.22$.
Find the value of minimum risk, the expected return and weight of the assets.

(c) The stock price is Rs.100. The continuously compounded risk free interest rate is 8% and the annual volatility is 20%. European Call options are written with a strike price of Rs.90 and time to expiration of 3 months. The stock will pay a dividend continuously at the rate of 2%. Use the Black – Scholes formula to find the price of one such call option. 5 CO3

(d) $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ. Prove that $\{N(t) - \lambda t, t \geq 0\}$ is a martingale. 5 CO4

2. (a) A stock price following SDE $dS(t) = \mu S(t)dt + \sigma S(t)dW(t)$ has an expected return of 16% and a volatility of 30%. The current price is Rs.38. What is the probability that a European call option on the stock with an exercise price of Rs.40 and a maturity date in 3 months will be exercised? 5 CO4

(b) Solve the SDE $dX(t) = 2X(t)\,dW(t)$ with $X(0) = 2$. 5 CO4

3. (a) Evaluate $\int_0^T Sin(2W(t))dW(t)$ using Ito – Doeblin formula of version two. 5 CO4

(b) A stochastic process $\{S(t), t \geq 0\}$ is governed by $dS(t) = aS(t)dt + bS(t)dW(t)$, where a & b are constants. Find the SDE of $\sqrt{S(t)}$. 5 CO4

4. (a) Consider a portfolio of two assets a_1 & a_2 with the following statistical parameters $\mu_1 = 5\%$, $\mu_2 = 15\%$, $\sigma_1 = 15\%$, $\sigma_2 = 30\%$, $\rho_{12} = 0.5$. Obtain the equation of Markovitz curve, and using that find value of minimum risk, the expected return. 5 CO5

(b) Prove that if short sales are not allowed then the risk of the portfolio can not exceed the greater of the risks of the individual components of the portfolio. 5 CO5

5. (a) A portfolio with three securities a_1, a_2, a_3 with expected returns, $\mu_1 = 20\%$, $\mu_2 = 13\%$, $\mu_3 = 4\%$, standard deviations of returns, $\sigma_1 = 25\%$, $\sigma_2 = 28\%$, $\sigma_3 = 20\%$, and the correlation between returns, $\rho_{12} = 0.3$, $\rho_{13} = 0.15$ and $\rho_{23} = 0.4$. If risk free interest rate is 10% then compute the weight vector for market portfolio. 5 CO5

(b) Derive the expression of the line which converts into Capital Market line. 5 CO5

Total no. of pages :2

Roll No. mc/09

6th SEMESTER

B.Tech (MC- Engg.)

END SEMESTER EXAMINATION

MAY 2024

MC – 306 Financial Engineering

Time : 3 hrs

Max. Marks: 50

Note: Q.No.1 is compulsory, answer any other three questions.
Statistical table is allowed. Assume missing data, if any.

1. (a) The current stock price is Rs. 250. A six month call option on this stock with strike price Rs. 255 is priced in two steps. It is given that continuously compounded risk free rate is 4%, stock pays no dividend and the volatility of the stock is 20%. Determine the price of call options. 5 CO3

(b) Consider a portfolio of two assets a1 & a2 with no short sell, with the following statistical parameters 5 CO5
$\mu_1 = 10\%, \mu_2 = 15\%$, $\sigma_1 = 18\%$, $\sigma_2 = 36\%$, $\rho_{12} = 0.2$.
Find the value of minimum risk, the expected return and weight of the assets.

(c) The stock price is Rs.85. The continuously compounded risk free interest rate is 6% and the annual volatility is 20%. European Call options are written with a strike price of Rs.85 and time to expiration of 3 months. The stock will pay a dividend continuously at the rate of 1%. Use the Black – Scholes formula to find the price of one such call option. 5 CO3

(d) Let $X(t) = \mu t + \sigma W(t), -\infty < \mu < \infty, 0 < \sigma < \infty$ *and* $W(t)$ *is a stsndard B.M.* be a stochastic process. Find the condition such that $\{X(t), t \geq 0\}$ is a martingale. 5 CO4

2. (a) A stock price following SDE $dS(t) = \mu S(t)dt + \sigma S(t)dW(t)$ has an expected return of 15% and a volatility of 40%. Find the distribution of the stock price in 2year. Find the expected price after 2 year if the current price is Rs.50. 5 CO4