

Company Name: Dolat Capital

OT Questions:

1) Three players A, B and C, take turns in the specified order to throw a dart at a dartboard; the first to hit the bull wins in one throw, the probability that A hits the bull is  $1/16$ . the corresponding probabilities for B and C are  $1/2$  and  $1/8$  respectively. Find the expected number of throws in the game.

- a) 9
- b) 8
- c) 10
- d) None of the above

2) triangle ABC has the side lengths a, b, c and the angles A, B,C are a lies opposite to A, where b lies opposite to B, and c lies opposite to C. If  $a(1-2 \cos A) + b(1 - 2 \cos B) + c(1 - 2 \cos C) = 0$ , then the triangle ABC is

- a) Scalene triangle
- b) Isosceles
- c) Equilateral
- d) Neither Equilateral nor isosceles

3) in a horse farm raising and training horses for races there are 25 horses. A bookie arrives at the farm with the intention of selecting the three fastest horses for an upcoming race. The farm has a training ground with 5 racing tracks. The bookie does not have a timer. What is the minimum number of races required for the Bookie to be able to select the 3 fastest horses.

- a) 8
- b) 5
- c) 7
- d) 6

4) Solve the following differential equation.

$$(5xy+4y^2+1)dx + (x^2+2xy)dy = 0.$$

5) Find the eigenvalues and normalized eigen-vectors of the 3x3 matrix. let x and y belong to R.

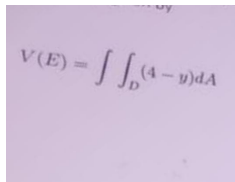
x+y	0	x
0	x+y	0
x	0	x+y

6) Consider the following function:

$$f(x) = \begin{cases} cx^2 & 0 < x < 3 \\ 0 & \text{otherwise} \end{cases}$$

- Find the value of  $c$  such that  $f(x)$  is a density function.
- Hence find the distribution function  $F(x)$  assuring that  $f(x)$  is the density function for a random variable  $X$

7) Find the volume of the solid  $E$  bounded above by the plane  $z = 4 + y$  and below by the region  $D$  enclosed within the circle  $x^2 + y^2 = 4$ . The volume of  $E$  is given by


$$V(E) = \iint_D (4 - y) dA$$

8) The yield  $y$  of a chemical process is a random variable whose value is considered to be a linear function of the temperature  $x$ . The following data of corresponding values of  $x$  and  $y$  is found.

Temperature in °C ( $x$ )	0	25	50	75	100
Yield in grams ( $y$ )	14	38	54	76	95

The average and standard deviation of temperature and yield are  $\bar{x} = 50$ ,  $\sigma_x = 39.52847$ ,  $\bar{y} = 55.4$ ,  $\sigma_y = 31.66702$ .

Which of the following statement is true?

9) Consider the following statements for time series:

- A time series must have i) regularly placed time stamps and ii) the distribution of a time series must belong to the class of Levy Distributions
- For a stationary time-series, the mean must be zero and the standard deviation must be a function of the lag.
- For a stationary time series the auto-correlation must be zero.
- For a stationary time series the auto correlation must be a function of the form  $e^{-k \log}$ , where  $k$  is the log.
- In time-series analysis a GARCH model is used usually when heteroskedasticity is demonstrated.

1) Any time series with a  $\alpha$ -stable distribution is useful for building Auto-Regression models.

Which of the following are correct?

10) Let  $a < 0 < b < e$  and  $t_a, t_b$  be the hitting times (time when the Brownian particles first hits that level) of these levels for one dimensional Brownian motion. Compute  $P(t_b < t_a < t_e)$

11) Consider the simple linear regression model through the origin with heteroskedastic errors, with the variances proportional to the squares of the explanatory variables:  $y_i = b x_i + e_i$ , where  $E(e) = 0$ ,  $\text{var}(e) = (\sigma x)^2$ ,  $e_i$  are uncorrelated and  $x_i = 0$

#### INTERVIEW QUESTIONS:

- 1) The probability of at least one accident happening in an hour is  $3/4$ . What is the probability of at least one happening in half an hour?
- 2) In a knockout tournament of 16 players. What is the probability that player  $p_1$  and  $p_2$  fight in round 3?
- 3) What is the expected throws of getting two consecutive heads?
- 4) I have 10\$ and you have 10\$. We play a game of rising a fair coin. If I win I get 1\$ from you and vice versa. Till one loses all money. What is the expected payoff of the game?

Now, let's say the coin is biased towards me. You can either put all the amount for her (10\$) or play the game 1\$ at a time like before. What would you do?

- 5) A rod is of length 1 unit. We break the rod into 3 smaller rods. What is the probability of the 3 smaller rods forming a triangle?
- 6) We have a uniform variable  $x$  and  $y$  varying between zero and 1. What is the probability of  $x+y < 1$ ?
- 7) Let's say you have a  $n \times n$  grid. We have an infection. If two sides of a square in a grid is infected the square becomes infected. What is the minimum number of squares that need to be infected at the start to make the whole grid infected?