

Syllabus for Written Test

Probability and Statistics: Introduction to probability and Sampling theorems, Counting, Conditional and Joint probability, Bayes Theorem, Mean, median, mode and standard deviation, Random variables, Discrete and Continuous distributions, Poisson, Normal and Binomial distributions, z-test, t-test, simple linear regression

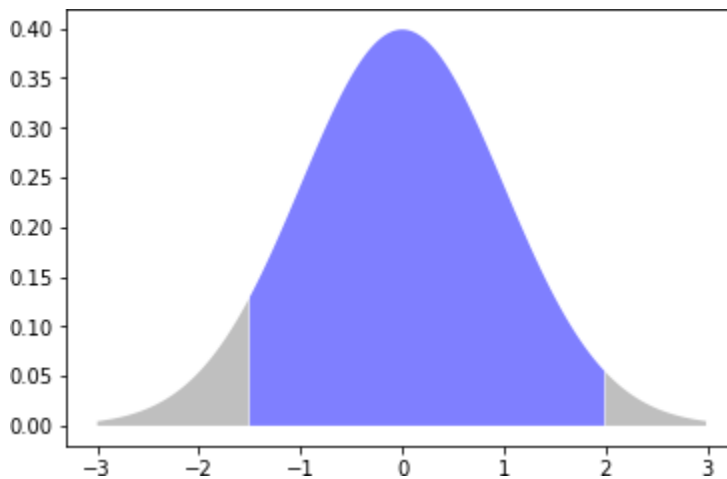
Linear Algebra: Matrix algebra and related concepts such as rank, determinant, Eigenvalues and eigenvectors, Eigenvalue decomposition, Singular value decomposition.
Linear dependence and independence of vectors, Systems of linear equations

Calculus: Functions of single variable, Limit, continuity and differentiability, Taylor series, First order equations (linear and nonlinear), Laplace transforms, maxima and minima, optimization involving single variable

General Aptitude: Verbal Aptitude, Analytical Aptitude, Quantitative aptitude and Spatial Aptitude.

Sample Question Paper

1. Which of the following methods can be used to understand correlation between categorical variables?
 - a. Select one or more:
 - b. Spearman
 - c. Kendall's Tau Rank correlation
 - d. Pearson
2. A car company purchases engine blocks from suppliers A, B, and C. Out of the 100 units supplied by A, two units were found to be defective. Similarly out of 200 and 300 units supplied by B and C, the number units found to be defective were 10 and 15 respectively. If a quality control person of the car company picks up a block and if the selected block is from A, what is the probability that the block is defective?
 - a. 0.020
 - b. 0.045
 - c. 0.330
 - d. 0.350
3. What is the area of the following blue shaded region?



- a. 0.815
- b. 0.317
- c. 0.910
- d. 0.159

4. A talent exam is conducted annually which has a mean score of 200 and a standard deviation of 30. If a student's Z-score is 1.50, what was his score in the exam?

- a. 245
- b. 230
- c. 200
- d. 170

5. The rank of the matrix A is

$$A = \begin{bmatrix} 2 & 1.5 & 2 \\ 1 & 0.75 & 0 \\ 2.25 & 3 & 1 \end{bmatrix}$$

- a. 1
- b. 2
- c. 3
- d. 0

6. The weights of 10 students of a given class were found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 kilograms. The mean weight of students in that class was found to be 64 kilograms. The t statistic is:

- a. 1.72
- b. 2.00
- c. 2.95
- d. 0.62

7. A new COVID19 test has been developed by researchers. The test gives a positive result in 96.5 % of the cases when the individual is affected by COVID19. However, it gives a positive result in 3% of the cases when the individual is healthy. The data collected on 10000 individuals shows that 23 individuals have the COVID19. Then, what is the probability that an individual with a positive test is affected by COVID19?

- a. 0.07
- b. 0.7
- c. 0.965
- d. 0.023

8. What is the Laplace transform of t^5 ?

- a. $5 / s^5$
- b. $120 / s^5$
- c. $6 / s^6$
- d. $120 / s^6$

9. Two independent random variables X and Y are uniformly distributed in the interval [-1, 1]. The probability that X+Y is less than 1 is

- a. 6/8
- b. 7/16
- c. 7/8
- d. 9/16

10. A square matrix A has zero determinant - i.e. $\det(A)=0$. Which of the following are true?
- a. $Ax=0$ has only trivial solution $x=0$.
 - b. 0 is an eigen value of A.
 - c. A has full rank
 - d. None of the above

11. Consider the initial value problem

$$\frac{dy}{dt} = t^2 + 1$$

with $y(0) = 8/3$. The value of y at $t=1$ is _____

12. The absolute maximum value of $f(x)=8x-x^4$ is _____.

13. The minima of $f(x)=8x-x^4$ is _____.

14. A researcher collected a set of 48 observations for the length of a fish. The mean length of the fish computed using the 48 observation is 20 cm. For a new fish, the length is observed to be 39 cm. With the new observation, the updated mean length of the fish is _____.

15. Which of the following 2 x 2 matrix has its eigen vectors as $v_1 = [-3, 1]^T$, $v_2 = [1, 1]^T$?

- a. $\begin{bmatrix} 4 & 2 \\ 6 & 8 \end{bmatrix}$
- b. $\begin{bmatrix} 4 & 6 \\ 2 & 8 \end{bmatrix}$
- c. $\begin{bmatrix} 4 & 8 \\ 6 & 2 \end{bmatrix}$
- d. $\begin{bmatrix} 8 & 2 \\ 6 & 4 \end{bmatrix}$

16. Write a Python Program to solve the below question

Given a string `s` containing just the characters '(', ')', '{', '}', '[', and ']', determine if the input string is valid.

An input string is valid if:

1. Open brackets must be closed by the same type of brackets.
2. Open brackets must be closed in the correct order.
3. Every close bracket has a corresponding open bracket of the same type.

Constraints:

- $1 \leq s.length \leq 10^4$
- s consists of parentheses only '()[]{}'.

Example 1:

Input: $s = "()"$

Output: true

Example 2:

Input: $s = "(]"$

Output: false

17. Write a Python Program to solve the below question.

You are given two strings s and t .

String t is generated by random shuffling string s and then add one more letter at a random position.

Return the letter that was added to t .

Constraints:

- $0 \leq s.length \leq 1000$
- $t.length == s.length + 1$
- s and t consist of lowercase English letters.

Example 1:

Input: $s = "abcd", t = "abcde"$

Output: "e"

Explanation: 'e' is the letter that was added.

Example 2:

Input: $s = "", t = "y"$

Output: "y"

