UNIVERSITY OF THE PUNJAB

Roll No. in Fig. ....

B.S. 4 Years Program / Sixth Semester – 2019

Roll No. in Words. ....

Paper: Multivariate Techniques (Theory)

Course Code: STAT-314 Part – I (Compulsory) Time: 30 Min. Marks: 10

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Signature of Supdt.:

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the correct option. **(10x1=10)**

i. Let $A = \begin{bmatrix} 3 & 2 \\ 3 & 8 \end{bmatrix}$. What are the eigenvalues of A?

a- 3 and 2 b- 9 and 2 c- -2 and -9 d- 2 and 3

ii. Dimension of a matrix with 6 columns and 4 rows is

a- $6 - 4$ b- 4×6 c- 6×4 d- $4 + 6$

iii. Let A and B be two n × n matrices such that A and B are similar. Let λ be an eigenvalue of A. Which of the following statements is wrong?

a- λ is an eigenvalue of A^T c- λ is an eigenvalue of B^T

b- λ is an eigenvalue of A^{-1} d- λ is an eigenvalue of B

iv. The eigenvalues of a 4 × 4 matrix A are 2,-3,13 and 7. Then $|\det(A)|$ is

a- 546 b- 19 c- 25 d- cannot be determined

v. If the inverse of a matrix exists, it is classified as

a- non-singular matrix b- singular matrix c- unidentified matrix d- linear matrix

vi. For matrices A, B and identity matrix I, AB=I=BA then:

a- B is inverse of A b- A is inverse of B c- $A^{-1} = B, B^{-1} = A$ d- all of these

vii. For a matrix A, $A^3 = I$ where I is an identity matrix.Then, A^{-1} is equal to:

a- A^2 b- A^{-2} c- A d- I

viii. If $|\det(A)| = 0$ then A is:

a- identity matrix b- singular matrix c- non-singular matrix d- none of these

ix. If A is a symmetric matrix then A^T is:

a- A b- $|\det(A)|$ c- identity matrix d- diagonal matrix

x. The determinant of the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 100 & 1 & 0 \\ 100 & 200 & 1 \end{bmatrix}$ is :

a- 100 b- 200 c- 1 d- 0

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B.S. 4 Years Program / Sixth Semester – 2019

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Paper: Multivariate Techniques (Theory)
Course Code: STAT-314 Part – II

Time: 2 Hrs. 30 Min. Marks: 50

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.2 For the data matrix, $\mathbf{A} = \begin{bmatrix} 1 & 2 \\ 2 & -2 \end{bmatrix}$

(i) Obtain eigen values and eigen vectors of A.

(ii) Calculate A^{-1} and obtain eigen values and eigen vectors of A^{-1}. Compare the results with those obtained in (i).

Q.3 If a random sample of size n is taken from a multivariate normal population of random vector $\mathbf{x}$ of order $(p \times 1)$ with mean μ and covariance matrix Σ. Find the maximum likelihood estimators of μ and Σ.

Q.4 For the data matrix, $\mathbf{X} = \begin{bmatrix} 1 & 2 & 5 \\ 4 & 1 & 6 \\ 4 & 0 & 4 \end{bmatrix}$

Calculate

(i) sample means of $b^T X$ and $c^T X$

(ii) sample variances of $b^T X$ and $c^T X$

(iii) sample covariance of $b^T X$ and $c^T X$

where

$$b^T X = [2 \;\; 2 \;\; -1][X_1 \;\; X_2 \;\; X_3]^T,$$

$$c^T X = [1 \;\; -1 \;\; 3][X_1 \;\; X_2 \;\; X_3]^T.$$

Q.5 State and derive any two properties of Wishart distribution.