

Hindi Vidya Prachar Samiti's
Ramniranjan Jhunjhunwala College of Arts, Science and Commerce
(Empowered Autonomous)

Programme: MSc. (Statistics)

Part-1

Semester-2

Practical based on Multivariate Analysis & its application
Practical 4

1) A statistics class takes two exams X (Exam 1) and Y (Exam 2) where the scores follow a bivariate normal distribution with parameters:

$\mu_x = 70$ and $\mu_y = 60$ are the marginal means and $\sigma_x = 10$ and $\sigma_y = 15$ are the marginal standard deviations, $\rho = 0.6$ is the correlation coefficient.

Suppose we select a student at random. What is the probability that –

- (a) the student scores over 75 on Exam 2?
- (b) the student scores over 75 on Exam 2, given that the student scored $X = 80$ on Exam 1?
- (c) the sum of his/her Exam 1 and Exam 2 scores is over 150?
- (d) the student did better on Exam 1 than Exam 2?
- (e) $P(5X - 4Y > 150)$?

2) For the above example use the function `mvnrm()` available in package 'MASS' to generate 500 random samples.

$$\begin{pmatrix} X \\ Y \end{pmatrix} \sim N_2 \left(\begin{pmatrix} \mu_x \\ \mu_y \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{pmatrix} \right)$$

3) Generate 200 random samples from Bivariate Normal distribution having $\mu_1 = 1$, $\mu_2 = 1$, $\sigma_1 = 2$, $\sigma_2 = 8$ and having population correlation between the variables as 0.6 using the following methods. Set seed:123.

- i) `mvnrm()` function
- ii) singular value decomposition method
- iii) Gibbs sampling algorithm
- iv) As a joint distribution of two random variables, one conditioned on the other

4) Use inbuilt IRIS dataset of R

- a) Calculate Canonical Correlation.
- b) Determine the canonical covariate.
- c) Plot the Canonical Correlation.

5) Perform Discriminant analysis on Wine data present in rattle package and comment on the result.
