

# MSMS 308 : Practical 02

## Multivariate Analysis

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### Question

1. Determine the correlation matrix  $R = ((\rho_{ij}))$ , if  $N = 25$  and

$$S = \begin{bmatrix} 95.2933 & 52.8683 & 69.6617 & 46.1117 \\ 52.8683 & 54.3660 & 51.3117 & 35.0533 \\ 69.6617 & 51.3117 & 100.8067 & 56.5400 \\ 46.1117 & 35.0533 & 56.5400 & 45.0233 \end{bmatrix}.$$

2. Calculate sample mean vector  $\bar{\mathbf{X}}$  and sample variance-covariance matrix  $S$  for the following data.

Patient Number	Drug A	Drug B
1	1.9	0.7
2	0.8	-1.6
3	1.1	-0.2
4	0.1	-0.2
5	-0.1	-0.1
6	4.4	3.4
7	5.5	3.7
8	1.6	0.8
9	4.6	0
10	3.9	2.0

## ➡ R Program

**1** Calculating correlation matrix :  $R = \Lambda \cdot S \cdot \Lambda$  where  $\Lambda$  is a diagonal matrix with elements being  $\frac{1}{\sigma_{ii}}$ .

```
S <- matrix(c(95.2933, 52.8683, 69.6617, 46.1117,
             52.8683, 54.3660, 51.3117, 35.0533,
             69.6617, 51.3117, 100.8067, 56.5400,
             46.1117, 35.0533, 56.5400, 45.0233), nrow = 4, ncol = 4, byrow = TRUE)
```

```
L <- diag(1 / sqrt(diag(S))); L
```

```
##           [,1]      [,2]      [,3]      [,4]
## [1,] 0.1024398 0.0000000 0.0000000 0.0000000
## [2,] 0.0000000 0.1356239 0.0000000 0.0000000
## [3,] 0.0000000 0.0000000 0.09959907 0.0000000
## [4,] 0.0000000 0.0000000 0.0000000 0.1490326
```

```
R <- L %*% S %*% L; R
```

```
##           [,1]      [,2]      [,3]      [,4]
## [1,] 1.0000000 0.7345147 0.7107522 0.7039816
## [2,] 0.7345147 1.0000000 0.6931193 0.7085109
## [3,] 0.7107522 0.6931193 1.0000000 0.8392521
## [4,] 0.7039816 0.7085109 0.8392521 1.0000000
```

**2** Calculating sample mean vector and sample dispersion matrix :

```
X <- matrix(c(1.9, 0.7,
             0.8, -1.6,
             1.1, -0.2,
             0.1, -0.2,
             -0.1, -0.1,
             4.4, 3.4,
             5.5, 3.7,
             1.6, 0.8,
             4.6, 0,
             3.9, 2.0), nrow = 10, ncol = 2, byrow = TRUE)
```

```
X_bar <- colMeans(X); X_bar
```

```
## [1] 2.38 0.85
```

```
S <- cov(X); S
```

```
##           [,1]      [,2]
## [1,] 4.152889 2.664444
## [2,] 2.664444 2.867222
```