

MSMS 308 : Practical 04

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➔ Question

Let the components of \underline{X} correspond to the scores on tests in Arithmetic speed (X_1), Arithmetic power (X_2), Memory for words (X_3), Memory for meaningful symbols (X_4) and Memory for meaningless symbols (X_5). The observed correlations in a sample of 140 observations are given below:

$$R = \begin{bmatrix} 1.0000 & 0.4248 & 0.0420 & 0.0215 & 0.0573 \\ 0.4248 & 1.0000 & 0.1487 & 0.2489 & 0.2843 \\ 0.0420 & 0.1487 & 1.0000 & 0.6693 & 0.4662 \\ 0.0215 & 0.2489 & 0.6693 & 1.0000 & 0.6915 \\ 0.0573 & 0.2843 & 0.4662 & 0.6915 & 1.0000 \end{bmatrix}$$

- (a) Find the partial correlation coefficient between X_1 and X_2 holding other variables fixed.
- (b) Find the multiple correlation coefficient $R_{1.2345}$.

➔ R Program

```
R <- matrix(c(1.0000, 0.4248, 0.0420, 0.0215, 0.0573,
              0.4248, 1.0000, 0.1487, 0.2489, 0.2843,
              0.0420, 0.1487, 1.0000, 0.6693, 0.4662,
              0.0215, 0.2489, 0.6693, 1.0000, 0.6915,
              0.0573, 0.2843, 0.4662, 0.6915, 1.0000), nrow = 5, ncol = 5, byrow = TRUE)
```

- The partial correlation coefficient between X_1 and X_2 is $r_{12.345} = -\frac{R_{12}}{\sqrt{R_{11}R_{22}}}$.

```
cofactor <- function(mat, i, j) {
  minor <- mat[-i, -j]
  return ((-1)^(i + j) * det(minor))
}
```

```
r_12.345 <- -cofactor(R, 1, 2) / sqrt(cofactor(R, 1, 1) * cofactor(R, 2, 2))
r_12.345

## [1] 0.4314625
```

$\therefore r_{12.345} = 0.4314625$.

□ The multiple correlation coefficient between X_1 and X_2, X_3, X_4, X_5 in terms of correlation matrix R is given by

$$R_{1.2345} = \sqrt{1 - \frac{|R|}{|R_2|}}$$

.

```
R_1.2345 <- sqrt(1 - det(R) / det(R[-1, -1]))  
R_1.2345  
## [1] 0.436401
```

$\therefore R_{1.2345} = 0.436401.$