

University of Ferrara

Degree Course in “Economics, Markets and Management”

STATISTICAL METHODS for ECONOMICS and BUSINESS – 19 September 2017

Q01

Given the matrices $A = \begin{pmatrix} 3 & -1 \\ 9 & 2 \\ 4 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 \\ 0 & 1 \\ 1 & 2 \end{pmatrix}$, and the scalar $\lambda = 5$, what's the result of the product λB ?

$$\begin{pmatrix} 0.5 & 4 \\ 0 & 2 \\ 0.5 & 4 \end{pmatrix}$$

(a)

$$\begin{pmatrix} 5 & 10 \\ 0 & 5 \\ 5 & 10 \end{pmatrix}$$

(b)

Impossible

(c)

Q02

Given the same matrices of the previous question, and denoting with A' the transposition of A , what's the result of the product $A'B$?

$$\begin{pmatrix} 7 & 23 \\ -2 & -2 \end{pmatrix}$$

(a)

$$\begin{pmatrix} 1 & -1 & 1 \\ 13 & 2 & 13 \\ 2 & -1 & 2 \end{pmatrix}$$

(b)

Impossible

(c)

Q03

Given the same matrices of the previous question, what's the result of $A + \lambda B$?

$$\begin{pmatrix} 5 & 3 \\ 9 & 4 \\ 6 & 3 \end{pmatrix}$$

(a)

$$\begin{pmatrix} 8 & 9 \\ 9 & 7 \\ 9 & 9 \end{pmatrix}$$

(b)

Impossible

(c)

Q04

In the multiple linear regression analysis, when all the explanatory variables take value 0, the predicted value of the dependent variable is equal to...

- a) 0.
- b) estimated intercept.
- c) sum of the estimated slope coefficients.

Q05

Let us consider the following results of a multiple linear regression analysis, where the net profit of companies Y (millions of euros) is function of the R&D investments (X_1), marketing investments (X_2) and mean sales price (X_3), ($\alpha=0.05$):

	Coefficients	p-value
Intercept	2.45	0.009
X_1	0.89	0.018
X_2	0.25	0.101
X_3	-0.52	0.002

Which of the following statements is true?

- The intercept is not significant.
- An increase in the mean sales price has a significant positive effect on profit.
- Marketing investments is the only explanatory variable that has no significant effect on profit.

Q06

The residuals of the regression model are...

- the differences between observed and predicted values of the dependent variable.
- the differences between observed and predicted values of the explanatory variables.
- the differences between observed values and sample mean of the dependent variable.

Q07

What does “standardization” mean?

- Transformation of a variable X into a new variable Z such that if $X=target$ then $Z=1$.
- Transformation of a variable into a new one that takes values between 0 and 1.
- Transformation of a variable into a new one with mean and variance equal to 0 and 1 respectively.

Q08

If the weight of an informative variable X_v is equal to 0, what’s the consequence on the composite indicator value when the additive method is applied for the aggregation?

- The indicator value is equal to zero.
- The indicator value does not depend on X_v .
- The indicator value cannot be computed.

Q09

To determine the performance ranking of 50 universities, the following informative variables are considered: percentage of non-abandonment of students (X_1), mean degree mark (X_2) and employment rate of graduates (X_3). The weights of the three variables are $w_1=0.2$, $w_2=0.3$ and $w_3=0.5$ respectively. The ranks of a given university are 48, 40 and 35 respectively (increasing rank transformation). What’s the composite indicator value for that university, by applying the normalized rank transformation and the additive aggregation?

- 0.39.
- 0.78.
- 0.89.

Q10

Let us consider the application of a Principal Component Analysis on a dataset with 15 response variables. What’s the number of Principal Components?

- 10.
- 1.
- 15.

Q11

Which of the following properties characterize the Principal Components?

- a) They are uncorrelated.
- b) They are quadratic function of the observed variables.
- c) They take values from 0 to 1.

Q12

Which of the following is the R command to perform factor analysis?

- a) *fa()*
- b) *factor()*
- c) *factanal()*

Q13

The following table reports the marks of three students in the exams of Statistics, Mathematics, Econometrics and Quantitative Finance.

Student	Statistics	Mathematics	Econometrics	Quantitative Finance
Rossi	30	28	30	25
Verdi	25	24	23	22
Bianchi	28	21	28	29

What is the Manhattan distance between Rossi and Bianchi concerning the performance in the mentioned exams?

- a) 15.
- b) 19.
- c) 9.95.

Q14

What are the nearest students according the performance in the mentioned exams and the Manhattan distance?

- a) Rossi and Verdi.
- b) Rossi and Bianchi.
- c) Verdi and Bianchi.

Q15

Given k informative variables, what is the centroid of a cluster with n statistical units?

- a) The vector of the n means of the observed data, computed with respect to the k variables.
- b) The mean of the nk values observed on the n statistical units for all the k variables.
- c) The vector of the k means of the informative variables computed with respect to the statistical units of the cluster.