

# University of Ferrara

## Degree Course in “Economics, Markets and Management”

STATISTICAL METHODS for ECONOMICS and BUSINESS – 5 June 2017

### Q01

Which of the following values is the determinant of  $A = \begin{pmatrix} 1 & -0.5 \\ 0.5 & 2 \end{pmatrix}$ ?

- a) 3.00.
- b) 1.75.
- c) 2.25.

### Q02

Which of the following matrices is the inverse of  $A = \begin{pmatrix} 1 & -0.5 \\ 0.5 & 2 \end{pmatrix}$ ?

$$\begin{pmatrix} 0 & 0.05 \\ -0.05 & -1 \end{pmatrix}$$

(a)

$$\begin{pmatrix} 1 & -2 \\ 2 & 0.5 \end{pmatrix}$$

(b)

$$\begin{pmatrix} 0.89 & 0.22 \\ -0.22 & 0.44 \end{pmatrix}$$

(c)

### Q03

Given the matrix  $B = \begin{pmatrix} -1 & 0 & 0.5 \\ -0.5 & 0 & -2 \end{pmatrix}$ , which of the following matrices corresponds to the sum  $A+B$ ?

a)  $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ .

b) Impossible.

c) None of the above.

### Q04

Let us consider data concerning GDP percentage growth (GDPG), percentage exports of goods and services (EGS), percentage gross domestic investment (GDI) and percentage inflation (INF) of some European countries (statistical units). These data were used to estimate the regression model  $GDPG_i = \beta_0 + \beta_1 EGS_i + \beta_2 GDI_i + \beta_3 INF_i + \epsilon_i$ , where  $i$  denotes the country. The results of the linear regression analysis ( $\alpha=0.10$ ) are the following:

	Coefficients	p-value
Intercept	1.08	0.152
EGS	0.22	0.009
GDI	0.35	0.095
INF	-1.08	0.109

According to the significance of the estimated coefficients, the explanatory variables useful to predict the GDP growth are:

- a) EGS, GDI and INF.
- b) EGS and GDI.
- c) EGS.

**Q05**

According to the significance of the estimated coefficients, which of the following statements is true?

- a) GDP growth would increase by 0.22% if percentage exports increased by 1%.
- b) GDP growth would increase by 22% if percentage exports increased by 1%.
- c) Percentage exports would increase by 0.22% if GDP growth increased by 1%.

**Q06**

According to the significance of the estimated intercept, what would be the GDP growth in case of null value of all the explanatory variables?

- a) 1.08%.
- b) 0%.
- c) None of the above.

**Q07**

Given the following observed values  $x_1=3, x_2=5, x_3=3, x_4=6, x_5=2, x_6=6$ , what's the minimum and the maximum for the transformed values  $z_u = [x_u - \min(x_1, \dots, x_6)] / [\max(x_1, \dots, x_6) - \min(x_1, \dots, x_6)]$ ,  $u=1, \dots, 6$ .

- a) 0 and 1.
- b) 0.25 and 0.75.
- c) 1 and 6.

**Q08**

Given the transformed values  $z_{u1}, z_{u2}, \dots, z_{uk}$  (rescaling method), according to the NPC methodology, which of the following functions is a suitable combination for the aggregation of the  $k$  (transformed) informative variables:  $y_u = \Psi(z_{u1}, z_{u2}, \dots, z_{uk})$ ?

- a)  $y_u = \sum_{v=1}^k w_v \cdot \ln(1 - z_{uv})$ .
- b)  $y_u = \sum_{v=1}^k w_v \cdot \ln\left(\frac{z_{uv}}{1 - z_{uv}}\right)$ .
- c) none of the previous combinations satisfies the required properties.

**Q09**

Let us consider the following data related to the economic performance of three European countries. The weights reflect the degrees of importance of the partial indicators as performance measures.

	<b>GDP growth</b>	<b>Inflation</b>	<b>Employment</b>
<b>Weight</b>	0.5	0.2	0.3
<b>Italy</b>	0.8%	0.10%	88.1%
<b>Germany</b>	1.7%	0.12%	95.4%
<b>France</b>	1.3%	0.11%	89.6%

Replace Inflation with (100%-Inflation) and apply the comparison with the maximum and the multiplicative aggregation to compute the global score of economic performance of the three countries. What are the values of the three composite indices of economic performance?

- a) Italy: 0.670, Germany: 1.000, France: 0.858.
- b) Italy: 0.775, Germany: 0.991, France: 0.922.
- c) Italy: 0.548, Germany: 0.894, France: 0.656.

**Q10**

The main goal of Principal Component Analysis is...

- a) To find homogeneous groups of statistical units.
- b) To predict the values of a dependent variable as a function of one or more explanatory variables.
- c) To reduce the number of informative variables.

**Q11**

Which of the following properties are met by the Principal Components?

- a) Their variances are equal to one.
- b) They are uncorrelated.
- c) They minimize the Euclidean distance between units.

**Q12**

Let us consider the following output of a Factor Analysis related to the first three factors:

Factor	Eigenvalue	% Variance	Cumulative %
1	7.214	72	72
2	1.324	13	13
3	1.102	11	11

According to method based on the eigenvalues, how many of these three factors must be considered, to reduce the number of informative variables by replacing the original variables with factors?

- a) 2
- b) 3
- c) it cannot be said

**Q13**

Which of the following statements concerning the distance between two statistical units in Cluster Analysis is true?

- a) The distance between the two units takes values between 0 and 1.
- b) The distance between the two units is invariant with respect to linear transformations.
- c) The distance between the two units is null if and only if the two vectors of observed values on the two units are equal.

**Q14**

What is the farthest neighbour method in Cluster Analysis?

- a) A method to compute the distance between two statistical units.
- b) A method to detect the distance between two groups of units (clusters).
- c) A method to detect the two farthest groups of units (clusters).

**Q15**

Let WD denote the deviance within the groups, TD denote the total deviance and  $g$  the number of groups in Cluster Analysis. Which of the following statements about the index  $R^2=1-WD/TD$  is true?

- a)  $R^2$  decreases as  $g$  decreases.
- b)  $R^2$  increases as  $g$  decreases.
- c)  $R^2$  is not a monotonic function of  $g$ .