University of Ferrara

Degree Course in "Economics, Markets and Management"

Q01

Given the matrix $A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 2 & -2 \\ 3 & 1 & 0 \end{pmatrix}$ and the vector $b = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$, what is the result of Ab?

$$\begin{pmatrix} 4 \\ -1 \\ 3 \end{pmatrix} \qquad\qquad \begin{pmatrix} 1 & 0 & 1 \\ 0 & -2 & 2 \\ 3 & 1 & 0 \end{pmatrix} \qquad\qquad 2\begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$$

        (a)   (b)   (c)

Q02

Which of the following matrices is the transposed of A?

$$\begin{pmatrix} 1 & 0 & 3 \\ 0 & 2 & 1 \\ 1 & -2 & 0 \end{pmatrix} \qquad \begin{pmatrix} -1 & 0 & -1 \\ 0 & -2 & 2 \\ -3 & -1 & 0 \end{pmatrix} \qquad \begin{pmatrix} -0.5 & -0.25 & 0.5 \\ 1.5 & 0.75 & -0.5 \\ 1.5 & 0.25 & -0.5 \end{pmatrix}$$

        (a)   (b)   (c)

Q03

Is A singular?

a) Yes.
b) No.
c) Cannot be said.

Q04

Let us consider data concerning a customer satisfaction survey about urban bus service. A sample of customers was asked to indicate their general satisfaction (SAT), and their specific satisfaction for punctuality (PUN), cleanliness (CLE) and network coverage (COV). General and specific satisfactions were expressed with the rating method (numeric value from 1 to 10).

These data were used to estimate the model $SAT_i = \beta_0 + \beta_1 PUN_i + \beta_2 CLE_i + \beta_3 COV_i + \epsilon_i$, where i denotes the customer. The results of the linear regression analysis ($\alpha=0.05$) are the following:

	Coefficients' estimates	p-value
Intercept	2.150	0.048
PUN	0.458	0.001
CLE	0.184	0.064
COV	0.235	0.035

According to the significance of the estimated coefficients, the explanatory variables useful to predict the general satisfaction SAT are:

a) PUN, CLE and COV.
b) PUN and CLE.
c) PUN and COV.

Q05
According to the significance of the estimated coefficients, which of the following statements is true?
a) A +1 increase in the satisfaction for punctuality, all else being equal, determines an increase in the general satisfaction equal to +0.458.
b) A +1 increase in the satisfaction for cleanliness, all else being equal, determines an increase in the general satisfaction equal to +0.184.
c) None of the above

Q06
According to the significance of the estimated intercept, what would be the general satisfaction predicted value in case all the explanatory variables take value 5?
a) 4.565.
b) 6.535.
c) 5.615.

Q07
Let us consider the following data concerning the survey described in Q04. For each of three customers, the partial satisfaction values for the three aspects punctuality (PUN), cleanliness (CLE) and network coverage (COV) are reported. The weights reflect the degrees of importance of the partial aspects according to the marketing manager.

	PUN	CLE	COV
Weight	0.45	0.20	0.35
Toni	8	4	5
Bepi	6	6	6
Nane	7	3	7

According to the rescaling type method (min=1, max=10, $c_1=0.01$, $c_2=0.02$) the transformed values of PUN, CLE and COV in the interval (0,1) for Tony are:
a) 0.995, 0.334 and 0.005 respectively.
b) 0.777, 0.334 and 0.445 respectively.
c) 0.845, 0.259 and 0.278 respectively.

Q08
Apply Fisher, Tippett and additive functions to combine the transformed values obtained in Q07 and compute the satisfaction composite indicators for Tony. Use the natural logarithm in the Fisher's formula. Which of the following are the indicators value?
a) Fisher: 0.905, Tippett: 0.350, Additive: 0.472.
b) Fisher: 0.824, Tippett: 0.777, Additive: 0.572.
c) Fisher: 0.963, Tippett: 0.350, Additive: 0.572.

Q09
By comparing the satisfaction composite indicators of Tony, Bepi and Nane, using Fisher, Tippett and additive combinations, consider the three rankings of satisfaction (one for each combining function). Which of the following statements is true?
a) Nane is the most satisfied customer, according the additive aggregation rule.
b) Tony is the most satisfied customer, according to all the aggregation rules.
c) Bepi is not the least satisfied customer, according the additive aggregation rule.

Q10
Which of the following statements about Principal Component Analysis (PCA) and Factor Analysis (FA) is false?
a) For both of them the goal consists in reducing the dataset dimensionality with respect to the number of variables.
b) In FA there are common factors and unique factors; in PCA there are not unique factors.
c) Both the analyses are based on the maximum likelihood approach.

Q11
Let us consider the following output of a Factor Analysis related to the first four factors:

Factor	Eigenvalue	% Variance	Cumulative %
1	3.549	44	44
2	1.518	19	63
3	1.063	13	76
4	0.852	11	87

According to the method based on the eigenvalues, how many of these four factors must be considered, to reduce the number of informative variables by replacing the original variables with factors?
a) 2
b) 3
c) 4

Q12
If we want that the factors jointly explain at least 80% of the total variability of data, what's the minimum number of factors to be consider?
a) 2
b) 3
c) 4

Q13
Given the three vectors which represent the three-dimensional satisfaction of Bepi, Tony and Nane in Q07, which of the following are the Manhattan distances between Toni, Bepi and Nane?
a) d(Toni, Bepi)= 5, d(Toni, Nane)= 4, d(Bepi, Nane)= 5.
b) d(Toni, Bepi)= 3.00, d(Toni, Nane)= 2.45, d(Bepi, Nane)= 3.32.
c) d(Toni, Bepi)= 2, d(Toni, Nane)= 2, d(Bepi, Nane)= 3.

Q14
Considering the distances of Q13 and thinking of the three customers as three different clusters with one statistical unit, according to the farthest neighbour method, which couple of customers must be aggregated into one cluster?
a) Toni and Bepi.
b) Toni and Nane.
c) Bepi and Nane.

Q15
Which of the following graphs is used to represent the output of a cluster analysis performed with a hierarchical method?
a) Scree plot.
b) Scatter diagram.
c) Dendogram.