

Requirements for Statistics

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The ideal student should have followed a basic course of statistics, the following two links can be used as an example of ideal basic course of statistics:

<https://economia.uniroma2.it/ba/business-administration-economics/corso/1084/>

http://www.lse.ac.uk/resources/calendar/courseGuides/ST/2017_ST102.htm

Two suggested books for a basic course of statistics are the following:

1) P. Newbold, W.L. Carlson and B.M. Thorne (2012) Statistics for Business and Economics. Pearson

2) A. Mood, F. Graybill and D. Boes (1974) Introduction to the theory of statistics, McGraw-Hill (even if is an older textbook, but does a good job explaining motivations).

Students should be comfortable with algebra (including the connection between logarithms and exponents), basic calculus (derivatives and integration), basic concepts of probability and statistics (e.g. descriptive statistics, probability and sample spaces, independence, random variables: univariate and multivariate, Gaussian distribution, basic concept of estimation).

Example of exercises required:

1. What is the solution of the following integral $\int_2^4 \frac{1}{x^2} dx$

- a) .25
- b) 2
- c) 0.5
- d) -0.25
- e) 1

2. a is an integer chosen at random from the set {1, 3, 5, 7} b is chosen at random from the set {2, 4, 6, 8}, what is the probability a+b=9?

- a) 0.1
- b) 0.2
- c) 0.25
- d) 0.3
- e) 0.4

3. The quartile for data collected on the amount, in euros, individual customers spent in ice-creams in a summer month are the following:

Q1=2€ Q2=10.50€ Q3=15€

Which of the following statement is true?

- a) Most of the customer spend 10.50€ in ice-creams in a month
- b) The mean amount spent in ice-creams in a month is 10.50€
- c) 75% of the customer spend between 2€ and 15€ in ice-creams in a month
- d) At least half of the customers spend less than or equal to 10.50€ and at least half spend more than or equal to 10.50€

4. Given IQ scores are approximately normally distributed with a mean of 100 and standard deviation of 15, the proportion of people with IQs above 130 is approximately:

- a) 95%
- b) 68%
- c) 5%
- d) 2.5%

Exercise 5

Verify that the following function $f(x|\theta)$ is a valid probability density function. Compute expected value and variance of the random variable distributed in according to $f(x|\theta)$

$$f(x|\theta) = \theta^2 x \exp(-\theta x) \quad x > 0$$

Exercise 6

Let (X_1, X_2, X_3, X_4) be a Normal r.v. with $\mu=0, \sigma^2=1$, Specify the distribution of the following variable:
 $Y = X_1 - 2 \times X_2 + X_3 - X_4$
under the hypothesis of independence of the X_i .

Exercise 7

Suppose that a book publisher is interested in the number of fiction paperbacks adult consumers purchase per month. The publisher conducts a survey. In the survey, each adult is asked the number of fiction paperbacks he/she has purchased the previous month. The results are below

Number of books	n_j
0	10
1	12
2	16
3	12
4	8
5	6
6	2
8	2

Compute:

- a) the mean, the median, the mode and the variance of Number of books purchased
- b) the frequency of adult consumers purchasing less than 4 books in a months

Exercise 8

Given X a Normal r.v. with $\mu=10, \sigma^2=9$, find

- a) $P(X>12)$
- b) $P(X>8)$
- c) $P(X<15)$
- d) $P(9<X<13)$