



UNIT 3. Probability Models

A. Class exercises

DEALER A car dealer knows that 15% of customers buy a certain model.

- If 8 clients test the model one day, calculate the probability that one of them buys it. What is the probability that at least two customers choose the model?
- If the selling price of this model is 15,000 euros, calculate the expected sales of the model on that day.
- Justify the probabilistic model that follows the variable "Number of clients who test the vehicle until the first sale". What is the probability that the first sale is made at the fifth customer?

SHOOTING A participant in an archery competition has a probability of failure in every shot of 8%.

- Each participant has 15 shots, and competitors are required to have fewer than three mistakes in order to pass to the final stage. Calculate the probability that this participant goes to the final.
- In the final stage, each participant makes a series of shots, and elimination occurs at the first failure. Determine the probability that this participant is not removed until the seventh shot.

[Adapted from MJ Peralta and others (2000): *Estadística. Problemas resueltos*, problem 28, page 404]

RECYCLING Of the total 156 products manufactured by a stationery company, 145 are made entirely from recycled materials.

- If a family buys 4 (randomly selected) products to the company, what is the probability that three of them have been manufactured from recycled material?
- As an incentive for ecological habits, the company provides 3 gift-bonuses for each purchase of a product made from recycled material. What is the distribution of the number of gift-bonuses won by the above family?
- If at least 9 gift-bonuses are needed in order to win a gift, what is the probability of getting a gift?

CALL The errors in the billing process of a phone company are considered a rare event. Knowing that there is a daily average of 1.2 errors, what is the probability that at least 2 calls are incorrectly billed in a week?



B. Proposed exercises

Committee An 8 member committee is to be chosen from a group of 8 men and 8 women. If the committee members are chosen at random:

- Determine the expected number of women in the committee.
- What is the probability that exactly half of the members are women?

[Adapted from Newbold, P. (2000): *Statistics for Business and Economics*, issue 44, pg. 144]

RESULT. (a) 4. (b) 0.38.

Tourism The travel agency 'BT' has estimated that the proportion of customers who cancel their travel booking is 10%.

- Define the random variable "Number of Cancellations by customers" and study its probability distribution.
- The agency has accepted a total of 12 reservations for a flight, although only 10 seats are available. Calculate the probability that some places remain vacant.
- 20 reservations have been accepted for next week, although the agency only has a total of 15 seats available. What is the probability of overbooking?

[Adapted from *Análisis de Datos Económicos II. Métodos inferenciales*, problem 3.1 page 162-163]

RESULT. (b) 0.1109. c) 0.9568

PREFABRICATED A company dedicated to the construction of prefabricated houses wants to analyze its customer market.

- 40% of people visiting the company purchase a manufactured house. If a certain week 10 people visit their facilities, calculate the probability that more than one individual purchases a house.
- Construction defects in houses are considered a rare event. Knowing that defects occur at an average rate of 0.5 per semester, what is the probability that at least 1 construction defect happens this year?

RESULT. (a) 0.95. (b) 0.63.

Lawyer A law firm has observed that in 68% of the trials the decision is favorable to their clients.

- If one examines the records of 8 trials chosen at random, what is the probability that 3 of the trials have been won? And at least 5?
- If the firm earns 1,000 euros for each trial won, what are the expected earnings of the firm in 8 trials?
- What is the expected number of trials to be held until the first win?

RESULT. (a.1) 0.06. (a.2) 0.7681. (b) 5,440. c) 1.47.