EXAM OF STATISTICS
(PROBABILITY AND RANDOM VARIABLES)

Pharmacy/Biotechnology 1st year — Version B — **February 4, 2022**

Duration: 1 hour.

(2.5 pts.) 1. The weight of male Wistar rats in a laboratory follows a normal distribution with mean 400 grams and standard deviation 30 grams.

(a) What is the probability that a random rat weighs exactly 400 grams?

(b) What is the probability that a random rat weighs more than 450 grams?

(c) If a rat is chosen randomly, what is the probability that its weight is an outlier?
Remark: The normal range of data is $(Q_1 - 1.5IQR, Q_3 + 1.5IQR)$.

(d) Give an interval of weights centered on the mean in which 95% of the male Wistar rats are found.

Solution

(2.5 pts.) 2. To evaluate a possible displacement of the patella at the Abruna Joms physiotherapy clinic, the Glide Test is used. After applying the test to 1000 patients we observed that 200 suffered from patella displacement and got a positive outcome, 13 suffered from patella displacement and got a negative outcome and 8 did not suffer patella displacement and got a positive outcome.

(a) Represents the data obtained by the Glide test in a table or a tree.

(b) Compute the sensitivity and specificity of the Glide test.

(c) Is the Glide test useful for diagnosing patella displacement?

(d) Is the Glide test useful for ruling out patella displacement?

(e) What is the probability of getting a right diagnose?

Solution

(2.5 pts.) 3. The new drug Recalnal for mitigating kidney stones produces side effects in the form of liver damage in 5% of patients taking Recalnal. The drug is administered to 10 patients.

(a) Justify the type of distribution followed by the variable that measures the number of patients with liver damage.

(b) What is the probability that at least 2 of them have liver damage?

(c) Let E_n be the event that at least one of n patients suffers liver damage when receiving Recalnal. In drug feasibility experiments $P(E_n)$ is used as a criterion about how safe the drug is. What is the minimum value of n such that $P(E_n) > 0.9$?

In the experimental phase of Recalnal, an average of 3 doses per minute are administered to volunteers.

(d) Justify the type of distribution followed by the variable that measures the number of doses administered every 5 minutes.

(e) What is the probability that 13 doses are administered in 5 minutes?

Solution

(2.5 pts.) 4. In a population there are 20% of patients who have suffered from disease A but not B, 30% of patients who have suffered from B but not A, and 90% of patients who have not suffered from both diseases (but may have suffered from one).

(a) What percentage of people have suffered the disease A? And the disease B?

(b) Compute the probability of suffering some of the diseases.

(c) Calculate the probability of not suffering from disease B if disease A has not been suffered.

(d) What percentage of patients with disease B should there be in the population for both diseases to be independent?

Solution