Exercise 1. Purchase of Medications for Hypertension and Diabetes in a Pharmacy

In a pharmacy, it is known that 30% of patients buy medications only for hypertension, 45% buy medications for diabetes, and 25% buy both for hypertension and diabetes.

a) Calculate the probability that a patient has purchased at least one medication for each disease.
b) Calculate the probability that a patient has purchased medications only for diabetes.
c) Calculate the probability that a patient has purchased a medication for hypertension if they did not purchase a medication for diabetes.
d) Can the purchase of medications for hypertension and diabetes be considered independent events? Explain your reasoning.

Exercise 2. Early Detection Test for Prostate Cancer

A new blood test has been developed to detect prostate cancer. This cancer has a prevalence of 12%, and in previous trials, it was found that 15% of patients who had prostate cancer tested positive, and 92% of patients who did not have prostate cancer tested negative.

a) Calculate the sensitivity, specificity, and positive and negative predictive values of the test.
b) Construct the table of true positives, true negatives, false positives, and false negatives.
c) Would this test be more suitable for confirming a cancer diagnosis or for ruling it out? Justify your answer.
d) If the test is applied to 300 patients, how many of them are expected to have the correct diagnosis?

Exercise 3. Side Effects in a Vaccine

In a flu vaccination campaign, it was observed that, on average, 2 out of every 500 vaccinated people experience side effects.

a) In a vaccination center where 1500 people are vaccinated daily, what is the probability that more than 6 vaccinated individuals will experience side effects on any given day?
b) During a week, what is the probability that on more than 3 days, there will be more than 6 vaccinated individuals with side effects?

Exercise 4. Blood Sugar Levels

Blood sugar levels are a key parameter in the diagnosis and control of diabetes. In healthy patients, fasting blood sugar levels tend to follow an approximately normal distribution with a mean of 100 mg/dL and a standard deviation of 20 mg/dL.

a) A patient is considered to be diagnosed with prediabetes if their fasting blood sugar levels exceed 125 mg/dL. What is the probability that a randomly selected patient will be diagnosed with prediabetes?
b) It has been determined that 25% of patients with higher blood sugar levels must follow a specific diet to avoid high blood sugar levels. What blood sugar level should a patient have in order to need this diet?
c) In prediabetic patients, the probability that one of them will have a blood sugar level above 150 mg/dL is 24.20%. If it is known that the standard deviation of blood sugar levels in these patients is 30 mg/dL, what is the mean blood sugar level in prediabetic patients?