Hometask 18

Q1. Suppose a study is conducted on the relationship between student's scores in Mathematics and Physics. Assume the scores are jointly normally distributed with:

$$\mu_{Math} = 70, \quad \mu_{Physics} = 75$$
$$\sigma_{Math} = 10, \quad \sigma_{Physics} = 12$$
$$\rho = 0.7 \quad \text{(correlation coefficient)}$$

Answer the following:

(a) Write the joint probability density function for Math and Physics scores

(b) Find the probability that a randomly selected student scores more than 80 in both Math and Physics

(c) If a student scored 80 in Math, what is the expected Physics score? Also, calculate the conditional variance of Physics score given Math.

(d) Calculate the probability that a student scoring 80 in Math scores more than 85 in Physics.

(e) If 200 students are surveyed, estimate how many students you expect to score more than 90 in Physics alone.

Q2. Write a Python program that simulates 10,000 student scores from the given bivariate normal distribution. Creates a scatter plot of Math vs Physics scores. Calculates the sample correlation coefficient and compare with theoretical $\rho = 0.7$. Calculates the proportion of students scoring above 80 in both subjects.