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PROBLEM SHEET # 8

Problem 1: Consider the following game. A fair coin is flipped, and the player receives a payoff of $ 2^k if the first head appears on the kth flip. Let the random variable X denote the payoff. What is a fair price for this game? (A fair price is such that the expected payoff minus the price equals 0.) — This problem is known as the St. Petersburg paradox.

Problem 2: The weight of eggs and the hatching (*yumurtalama*) time of chicks are important issues in poultry farming.

a) The weight of eggs (measured in grams) from hens of a certain age has a normal distribution with mean 57.8 and standard deviation 3.2. Give an interval which will cover the weight of about 95% of these eggs.

b) In a sample of 100 eggs, the first chicks hatched after an incubation (*kuluçka*) time of 450 hours, the last after 504 hours. Assuming that hatching time is approximately normally distributed, determine the standard deviation and the variance of hatching time. Also mention the unit of measurement of standard deviation and variance in this case.

Problem 3: The capacity of a lift is 630 kg, according to a plate in the lift. Assume the weight of a typical lift user is normally distributed with mean 75 kg and standard deviation 20 kg. Also assume the independence of user weights.

a) Under these assumptions, what is the probability that a single lift user weighs more than 100 kg?

b) If 8 persons enter the lift, what is the probability that that the lift capacity is exceeded?

c) A beeper goes off when the load exceeds 580 kg. Compute the probability that the beeper goes off when 6 people enter the lift.

d) Suppose 4 overweight persons are already in the lift, their total weight being 540 kg. If another person gets on the lift, what is the probability that lift capacity will be exceeded?

Problem 4: A can company reports that the number of breakdowns per 8-hour shift on its machine-operated assembly line follows a Poisson distribution with a mean of 1.5. Assume that the machine operates independently across shifts.

a) Compute the probability of no breakdowns during three consecutive 8-hour shifts.

b) What is the distribution of time length (in hours) between breakdowns, what is its expectation?

c) What is the probability there will be at least 12 hours between two breakdowns?

d) For a competitor of this company, the very same probability (i.e. the probability that there will be at least 12 hours between two breakdowns) is equal to 0.04. Do you think the company in the question should consider improving the system?