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PROBLEM SHEET # 7

Problem 1: An urn contains 9 balls, 6 are white and 3 are black. Two balls are randomly drawn. Find the probability that both are white, when:

a) the balls are drawn without replacement,

b) the balls are drawn with replacement.

c) Give an example of an application of an urn model in the social sciences.

Problem 2: A DVD shelf contains 50 DVDs, 10 of which are defective. A random sample of five DVDs is selected without replacement from the shelf. Let $X =$ *number of defective DVDs among the five selected.*

a) Determine the distribution of X.

b) Compute the probability that there is exactly one defective DVD in the sample.

Problem 3: An insurance company (the *Sir Huckleberry Insurance Company*) offers a policy against frustration in lottery. The conditions of the insurance policy are:

- You select which six numbers to play for 52 consecutive weeks in a national lottery you choose.
- If, during these 52 weeks, your chosen numbers don't even produce a twin match (double, two hits), send your lottery tickets to the insurance company and you will receive 10000 euros from the insurance company.

The premium for this insurance company is 28 euros.

a) If you play a lottery 6/49, compute the probability that the insurance amount will be paid out.

b) If you play a lottery 6/45 (available, for example, in Austria), compute the probability that the insurance amount will be paid out.

Problem 4: Experience shows that the probability that a randomly selected student, in an exam, will try to cheat is 1/10. If cheating, he/she will be caught with probability 3/5 (there are several groups in the exam!), and if caught will face disciplinary action with probability 1/3.

a) Compute the probability that a randomly selected student will be cheating and be caught.

b) Compute the probability that a randomly selected student will be cheating, be caught, and be facing disciplinary action because of cheating.

c) A large class of 250 students is being given the exam. What is the (approximate) distribution of the random variable $X =$ *number of students facing disciplinary action because of cheating after the exam*? (Give reasons for your answer.)

d) Using your result of part c), compute the probability that, in the class of 250, at least one student will be facing disciplinary action because of cheating after the exam.

e) Now consider a small class of 5 students. What is the distribution of the random variable $X =$ *number of students facing disciplinary action because of cheating after the exam*? (Give reasons for your answer.)

f) Using your result of part e), compute the probability that, in the class of 5, at least one student will be facing disciplinary action because of cheating.