Probability Theory Homework 2

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1 Problem 1

Problem. Two shooters take turns shooting at a target until the first hit. The probability of hitting for the first shooter is 0.2, and for the second is 0.3. What is the probability that the first shooter will make more shots than the second?
  Solution.

2 Problem 2

Problem. There are 5 white and 6 black balls in the first urn, and 4 white and 8 black balls in the second urn. Three balls are drawn at random from the first urn and placed into the second urn. After this, four balls are drawn at random from the second urn. Find the probability that all four balls drawn from the second urn are white. Hint: remember about conditional probability!
  Solution.

3 Problem 3

Problem. An insurance company categorizes its policyholders into risk classes: Class I (low risk), Class II (medium risk), and Class III (high risk). Among these clients, 50% are in the first class, 30% in the second, and 20% in the third. The probability of an insurance payout being necessary for the first risk class is 0.01, 0.03 for the second, and 0.08 for the third. What is the probability that a policyholder who received a monetary payout belongs to the low-risk group?
  Solution.

4 Problem 5

Problem. If you get a positive result on a COVID test that only gives a false positive with probability 0.001 (true positive with probability 0.999), what's the chance that you've actually got COVID, if:
  a) the prior probability that a person has COVID is 0.01;
  b) the prior probability that a person has COVID is 0.0001.

Solution.

5   Problem 6

Problem. There are two baskets. The first basket contains one white ball, and the second basket contains one black ball. One basket is chosen randomly and a white ball is put into the chosen basket. The balls in this basket are shuffled. Then one ball is extracted from this basket, and it turns out to be white. What is the posterior probability that the second ball drawn from this basket is also white?

Solution.