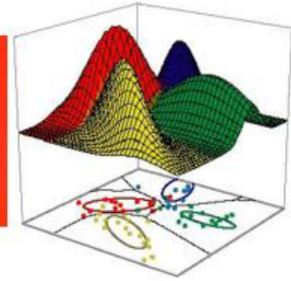


Pattern Classification



Instructor: Thirimachos Bourlai

Homework 1

Due 08/29/22, 12.30 p.m.

Name: _____

***Instructions:** Solve the problems using a pen and submit right before next Wednesday's class.*

- **Problem 1:** A jar contains black and white marbles. Two marbles are chosen without replacement. The probability of selecting a black marble and then a white marble is 0.34. The probability of selecting a black marble on the first draw is 0.47. What is the probability of selecting a white marble on the second draw, given that the first marble drawn was black?
- **Problem 2:** A machine produces parts that are either good (90%), slightly defective (2%), or obviously defective (8%). Produced parts get passed through an automatic inspection machine, which can detect any part that is obviously defective and discard it. What is the probability that a part is good given that it passed the inspection machine?
- **Problem 3:** Your neighbor has 2 children. You learn that he has a son, Joe. What is the probability that Joe's sibling is a brother? Joe's sibling is equally likely to have been born male or female suggests that the probability the other child is a boy is $1/2$. Is this correct?
- **Problem 4:** Suppose that five good fuses and two defective ones have been mixed up. To find the defective fuses, we test them one-by-one, at random and without replacement. What is the probability that we are lucky and find both defective fuses in the first two tests?
- **Problem 5:** Six cards are selected at random (without replacement) from a standard deck of 52 cards. What is the probability there will be no pairs? (Two cards of the same denomination)
- **Problem 6:** Consider the parts problem again, but now assume that a one-year warranty is given for the parts that are shipped to customers. Suppose that a good part fails within the first year with probability 0.01, while a slightly defective part fails within the

first year with probability 0.10. What is the probability that a customer receives a part that fails within the first year and therefore is entitled to a warranty replacement?

- **Problem 7:**

- Urn 1 contains 5 white balls and 7 black balls.
- Urn 2 contains 3 whites and 12 black.
- A fair coin is flipped; if it is Heads, a ball is drawn from Urn 1, and if it is Tails, a ball is drawn from Urn 2.
- Suppose that this experiment is done, and you learn that a white ball was selected. What is the probability that this ball was in fact taken from Urn 2? (i.e., that the coin flip was Tails)