MATHEMATICS FOR MACHINE LEARNING

LAB 5– 5%

Solve the following probability questions. You can use Python or solve them on a paper (Or you can solve some using Python and some on paper). If you are using Python to solve, please make sure to attach the output in your submissions. Like the other labs, please hand in PDF and/or Python code with output.

1) 3 vertices (corners) of a regular hexagon are randomly joined. What is the probability that an equilateral triangle is formed?

2) 3 persons A, B, C independently fire at a target. What is the probability that (i) Exactly one of them hits the target, (ii) At least one of them hits the target? Given: Probability of hitting the target. P(A) = 1/6, P(B) = 1/4, P(C) = 1/3

3) The probability that a teacher gives a surprise test is 0.55. If a student remains absent for two days. What is the probability that he misses exactly one test, and at most one test?

4) A box contains 2 defective pens and 3 working pens. Pens are tested one by one until both defective ones are discovered. What is the probability that the testing procedure comes to an end at the end of (i) 2nd testing, (ii) 3rd testing?

5) If there are 40 people in a room, what is the probability that everyone has different birthdays? Assume 365 possible birthdays in a year.

6) An amoeba has a 25%, 25%, and 50% chance of producing 0, 1, or 2 offspring, respectively. Each of the amoeba's descendants also has the same probabilities. What is the probability that the amoeba's lineage dies out?

7) The entries in a 2 x 2 matrix are integers that are independently chosen for each entry. The probability that the entry is odd is p. If the probability that the value of the determinant is even is 0.5, find p.

8) A drunker takes either a step forward or backward. The probability that he takes a forward step is 0.4. Find the probability that at end of 11 steps he is 1 step away from the starting point?

9) A coin is twice as likely to land head as a tail in a series of independent tosses. Find the probability that 3rd head occurs on the 5th toss.

10) An HIV test is 99% accurate (both ways). Only 0.3% of the population is HIV +. What is the probability that a random person is HIV + given that the person tests +?

11) Cards are dealt one by one from a pack of 52 well-shuffled cards. What is the probability that exactly 'k' cards are dealt before the 1st ace appears?

12) All face cards are removed from a pack of 52 well-shuffled cards. From the remaining 40 cards, 4 cards are drawn randomly. What is the probability that 4 cards are from different suits and denominations?