## Instructions for attempting the multiple choice questions:

A. All the below problems are part of the question 1 and responses for each of them needs to be filled in the csv which was provided in the zip file along with this problem.
B. There are 15 multiple choice problems in this in the test paper.
C. The marking scheme is +1 for each correct answer. There is no negative marking.
D. As part of your submission for this question you need submit a zip file containing the csv that was provided to you in the zip file of the question 1 along with your responses.
E. You need to fill your responses under the column name **Response**. A sample submission would look like this :

| Problem | Response |
|---|---|
| 1 | b |
| 2 | c,d |
| 3 | a |

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**1.** You have bought one share of stock A and want to hedge it by shorting stock B. How many shares of B should you short to minimize the variance of the hedged position? Assume that the variance of stock A's returns is $\sigma^2_A$, and the variance of stock B's returns $\sigma^2_B$**.** Their correlation coefficient is ρ

a. ρ ***** ( $\sigma^2_A$ / $\sigma^2_B$ )
b. ρ ***** ( $\sigma^2_B$ / $\sigma^2_A$ )
c. ρ ***** ( $\sigma_A$ / $\sigma_B$ )
d. ρ ***** ( $\sigma_B$ / $\sigma^2_A$ )

2. Which of the following is a reasonable way to select the number of principal components "k"?

a. Choose k to be the smallest value so that at least 99% of the variance is retained.
b. Choose k to be 99% of m (k = 0.99*m, rounded to the nearest integer).
c. Choose k to be the largest value so that 99% of the variance is retained.
d. Use the elbow method

3. Suppose you pick up 3 points randomly on the circumference of a circle and draw a triangle using them. What is the probability that the triangle is a right-angled one?

a. 0
b. 1/2
c. 1/3
d. None of the above

4. Given below are two statements:

If two variables V1 and V2 are used for clustering, then consider the following statements for k means clustering with k=3:

Statement 1: If V1 and V2 have correlation of 1 the cluster centroid will be in a straight line

Statement 2: If V1 and V2 have correlation of 0 the cluster centroid will be in a straight line

Choose the correct answer from the options given below:

a. Both statement 1 and 2 are True
b. Both statement 1 and 2 are false
c. Statement 1 is correct but statement 2 is false
d. Statement 2 is correct but statement 1 is false

5. Suppose only 80% of all drivers in a certain city regularly wear a seat belt. A random sample of 500 drivers is selected. What is the probability that more than 400 of them wear a seat belt?

a. 0.5
b. 0.52
c. 0.48
d. None of the above

6. Which of the following Machine Learning techniques can learn the XOR function

a. Linear Regression
b. SVM
c. Single Perceptron
d. Decision Tree.

7. There is a huge rush outside of a theatre to purchase Pathan tickets. The owner announces the following scheme, "The first person to have same birthday as someone standing anywhere before him in the line will get a free popcorn." Where will you stand to maximize your chances?

a. 23
b. 24
c. 20
d. 22

8. Consider ants A1, A2,.., A70 being dropped one by one (at very small intervals with A1 being dropped the first) from the left side of a road and ants B1,B2,….B100 being dropped from the right side of the road. The ants As and Bs start moving towards each other after being dropped. Assuming all the ants undergo perfectly elastic collisions, the sum of the number of collisions undergone by ants A37, B23, B42, B68 and B79 would be?

a. 450
b. 437
c. 432
d. None

9. Consider we're sampling 100 points uniformly inside a square of edge length 2 units. Consider a circle of radius 1 inscribing the square. What is the probability that more than 78 points lie inside the circle?

a. 0.5
b. 0.552
c. 0.455
d. 0.513

10. Consider 3 players A, B and C. They play a game in which they start with N stones and each person picks 1-5 stones in turns (starting with A). The person who picks up the last stone loses. The person just before it wins and the person before that comes 2nd. Assuming each player plays optimally, who would win if we start with N=15?

    a. A
    b. B
    c. C
    d. Cannot be determined

11. A stock S is worth $100 now at t=0. At t=1, S goes either to $110 with probability=2/3 or to $80 with probability 1/3. If interest rates are zero. Value an at the money European call on S expiring at t=1?

    a. 20/3
    b. 0
    c. 10/3
    d. 1/3

12. You are trapped in a small room with four walls. Each wall has a button that is either in ON/OFF setting. You have no way of telling what the current setting is. When you press a button, you change its setting. If you can get all the buttons to have the same setting i.e. either all four are OFF or all four are ON, you are immediately set free.

    In each move, you can press either 2 buttons simultaneously or just 1 button.
    As soon as this occurs, if you haven't been set free, the whole room spins around you violently, leaving you completely disoriented so that you can never tell which side is which.

    The starting position is chosen completely at random (except not all four ON or all four OFF). Given any and every possible scenario, using optimal strategy, what is the least number of moves needed to unquestionably guarantee escape from the room?

    a. 5
    b. 9
    c. 7
    d. None of the above

13. 25 Knights are seated at a round table. Three of them are randomly chosen to be sent off to slay a troublesome dragon. Find the probability that atleast two of the three had been sitting next to each other.

    a. 11/46
    b. 1/6
    c. 7/23
    d. 16/23

14. If 3 real numbers are chosen randomly and uniformly from [0, 1], what is the probability that the square of any one of the numbers is greater than the sum of squares of the other two numbers?

    a. $(12-\pi)/12$
    b. $\pi/12$
    c. $\pi/4$
    d. $3\pi/4$

15. In Machine Learning, which of the following is correct about L1 and L2 regularization?

    a. The L2 regularization tends to spread error among all the terms, while L1 regularization is binary in nature, with many variables either being assigned 1 or 0 in weighing.
    b. The L1 and L2 regularization correspond to set a Laplacian and a Gaussian prior respectively to the terms.
    c. L1 is more robust to outliers in data than L2 regularization.
    d. None of the above statements is true