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Total No. of Pages : 02

Total No. of Questions : 08

**M.Tech. (CSE Engg.) (2018 Batch) (Sem.-1)**  
**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

Subject Code : MTCS-101-18

M.Code : 75153

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

**1. Attempt any FIVE questions out of EIGHT questions.**

**2. Each question carries TWELVE marks.**

- Q.1. (a) You have 800 rupees and play the following game. A box contains two white balls and two black balls. You draw the balls out one at a time without replacement until all the balls are gone. On each draw, you bet half of your present fortune that you will draw a white ball. What is your expected final fortune?
- (b) A number is chosen at random from the set  $S = \{-1, 0, 1\}$ . Let  $X$  be the number chosen. Find the expected value, variance, and standard deviation of  $X$ .
- Q.2. (a) What is the objective of Principal Components Analysis (PCA) method? Explain the steps of PCA method in detail.
- (b) What is the problem of overfitting in statistical models? How to overcome this problem?
- Q.3. Differentiate between following with the help of suitable examples:
- (a) Classification and Regression
- (b) Exponential families and Transformation Group families of distribution
- Q.4. (a) Suppose that a connected planar graph has six vertices, each of degree four. Into how many regions is the plane divided by a planar representation of this graph? Show that a simple graph that has a circuit with an odd number of vertices in it cannot be colored using two colors.
- (b) Define an Euler circuit and an Euler path in an undirected graph. How can it be determined whether an undirected graph has an Euler path and/or Euler circuit? Give example.

- Q.5. (a) Explain the use of various mathematical models and concepts for the distributed systems in detail.
- (b) How many ways are there to select four pieces of fruit from a bowl containing apples, oranges, and pears if the order in which the pieces are selected does not matter, only the type of fruit and not the individual piece matters, and there are at least four pieces of each type of fruit in the bowl?
- Q.6. What is Markovchain? How to specify a Markovchain? Mention the Markov property.
- Q.7. (a) Consider the results of 10 tosses of a coin: H, T, T, T, T, H, T, H, T, T. Estimate the probability of head (H) for this coin. Also, estimate the standard error of your estimate.
- (b) Derive method of moments and maximum-likelihood estimators for parameter  $\lambda$  based on a Poisson( $\lambda$ ) sample of size  $n$ .
- Q.8. Write short notes on the following :
- (a) Conditional expectation
- (b) Probabilistic inequalities
- (c) Recent trends in distribution functions
- (d) Interval Estimation

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**