Exam Date: 05-06-2023

Indian Institute of Information Technology Sri City (IIITS)

Name of the Exam: PS_END-SEM Duration: 1.5 hrs Max. Marks: 25

Instructions:

1. **All questions are mandatory.**
2. **Marks are indicated in [ ] after each question.**
3. **Rough Work should be done separately, not in the answer sheet.**
4. **Answers should be reasoned and derived clearly, not a single word answer.**
5. **Preferably use a ballpoint pen.**
6. **You can use a calculator.**
7. **z - table, χ^2 - table, and t - table are provided in the last two pages.**

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1. A company has to choose among three pension plans. Management wishes to know whether the preference for plans is independent of job classification. The opinions of a random sample of 500 employees are shown in the following table:

[4 M]

Job Classification	Plan 1	Plan 2	Plan 3	Totals
Salaried workers	160	140	40	340
Hourly workers	40	60	60	160
Totals	200	200	100	500

Test $\mathbf{H_0}$ that the preference for pension plans is independent of job classification using $\alpha = 0.05$.

2. An experiment was performed in which 15 drivers produced by a particular club maker were selected at random and their coefficients of restitution measured. In the experiment the golf balls were fired from an air cannon so that the incoming velocity and spin rate of the ball could be precisely controlled. It is of interest to determine if there is evidence (with $\alpha = 0.05$) to support a claim that the mean coefficient of restitution exceeds 0.82. The observations follow:

0.8411 0.8191 0.8182 0.8125 0.8750 0.8580 0.8532 0.8483 0.8276 0.7983 0.8042 0.8730 0.8282 0.8359 0.8660.

[4 M]

3. The heights (in cm) were recorded for 10 students from the population of all students in the IIIT Sri City, chosen at random, as 160, 162, 169,175, 172, 170, 178, 180, 177, 165. Find 99 % confidence interval for the mean and standard deviation of the population's height, assuming it to be normal. [5 M]

4. Given a independent and identically distributed random sample of size n is having uniform distribution X=$\{X_1, X_2, X_3, \ldots, X_n\} \sim unif(0, \theta)$. Show that $T_n = 2\overline{X}$ is a consistent estimator of θ. [3 M]

5. Given a independent and identically distributed random sample of size n is having geometric distribution $X_1, X_2, X_3, \ldots, X_n \sim Geo(p)$. Derive Maximum likelihood estimate of p. [3 M]

6. If $X_1, X_2, X_3, \ldots, X_n$ are random observations on a Bernoulli variable X taking value 1 with probability θ and the value 0 with probability (1 – θ). Show that

$$\frac{\sum_{i=1}^{n} X_i\left(\sum_{i=1}^{n} X_i - 1\right)}{n(n-1)}$$

is an unbiased estimator of θ^2. [4 M]

7. Suppose a random sample of 9 observations is taken from a normal distribution with mean 0. Let $\overline{X}$ and S^2 denote the sample mean and variance. Determine the probability that the value of $\frac{\overline{X}}{S}$ exceeds 0.966.

[2 M]

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