

Indian Institute of Information Technology, Sri City, Chittoor

Name of the Exam: Statistical Data Analysis

Duration: 1.5 hrs

Max. Marks: 15

Instructions:

1. Write your Roll No. and Name on top of every page of the answer sheet. It is mandatory.
2. All questions are mandatory.
3. Marks are indicated in [] after each question.
4. Rough Work should be done separately, not in the answer sheet.
5. Answers should be reasoned and derived clearly, not a single word answer.
6. You are required to write the answers in A4 sheets.
7. Preferably use a ballpoint pen. The writing should be readable after scanning. (This is very important)
8. This is a proctored exam. You need to keep your video and mike on throughout the exam.
9. After finishing the writing part, you are expected to submit the scanned copy of the hand written answer sheets in one consolidated PDF format to the link provided. The link will be provided to upload the pdf.
10. Copying in any form will be dealt strictly. Both "copied to" and "copied from" will be penalized heavily.
11. Use the statistical tables provided wherever necessary.
12. Please note that the total time of the written exam is 1 hour 30 mins. You may use another 10 minutes for scanning and submitting the answer sheet. You are expected to submit the answer sheet strictly by 1hour 40 mins.

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1. Consider the average income (in lakh per annum) of City A and City B. Assume the two populations of interest are X_A and X_B where X_A follows $N(5, 1)$ and X_B follows $N(4, 1.21)$. If you take 10000 random samples each from both the populations independently, then derive the distribution of the difference between the sample means taken from the two populations $(\bar{x}_A - \bar{x}_B)$. [2]
 2. Let X_1, X_2, X_3 and X_4 are four independent random samples taken from a population with mean μ and variance σ^2 . Suppose that you have an estimator of μ of the form:

$$\Theta_1 = \frac{X_1 + kX_2 + X_3 + X_4}{8}$$

For what value of k , Θ_1 is unbiased estimator of μ . Find the variance of that unbiased estimator. [2+2]

3. Let 5 independent random samples [1.5, 2, 0.9, 1.25, 0.8] are taken from the following pdf with parameter $\theta > 0$:

$f(x) = x\theta e^{(-\frac{1}{2}\theta x^2)}$, $x \geq 0$. Find MLE of θ . Find Method of Moment Estimator of θ . [Hint: Expectation of the distribution is $\sqrt{\frac{\pi}{2\theta}}$]. [2]

4. A laptop manufacturing company is interested in the time (hours) that a laptop battery lasts after a full charge. This time is found to be normally distributed, with variance .0625. The company wants to perform a two-sided test on whether the expected battery time after charge (μ) is 5 hrs or not, using 9 samples.
- a) If the acceptance region is decided to be $4.84 \leq \text{sample mean} \leq 5.16$, calculate probability of Type I error, α .
- b) When the experiment was actually carried out, it was found that the sample mean is 5.15. Find the P-value of the test. [2+2]
5. Let 25 i.i.d. random samples were drawn from a normally distributed population with s.d. $\sigma = 0.8$ and expectation μ which is unknown. Suppose the sample mean $\bar{x} = 89$ and sample variance $s^2 = 0.5625$. Develop a 90 % confidence interval for μ . [3]