Problem Set 8

1

0.0/1.0 point (graded)

If $\{X_1, \ldots, X_n\}$ are the observed values of n sample items, which of the following are unbiased estimators for distribution mean?

- [ ] X_1
- [ ] $\frac{1}{n}\sum_{i=1}^{n} X_i$
- [ ] $\sqrt{\frac{1}{n}\sum_{i=1}^{n} X_i^2}$

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2

0.0/1.0 point (graded)

If $\{X_1, \ldots, X_n\}$ are the observed values of n sample items and

$$S^2 = \frac{1}{n-1}\sum_{i}^{N}(X_i - \overline{X})^2$$

Which of the following holds?

- [ ] S^2 is an unbiased estimator for variance
- [ ] $\sqrt{S^2}$ is an unbiased estimator for standard deviation

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3

0.0/2.0 points (graded)

According to the U.S. Department of Agriculture, ten to twenty earthworms per cubic foot is a sign of healthy soil. The soil of a garden is checked by digging 8 holes, each of one-cubic-foot, and counting the earthworms, and the following counts are found: 5, 25, 15, 10, 7, 12, 16, 20. Use the unbiased estimators discussed in the video to estimate

- the true mean,

- the true variance.

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4

0.0/1.0 point (graded)

Recall that the standard-deviation estimate is the square root of the (Bessel corrected) sample variance.

Find the sample standard deviation of 5 length measurements of the diameter of a sphere: 63.7mm, 63.5mm, 63.6mm, 63.6mm, 63.9mm.

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5

0.0/1.0 point (graded)

Let $\overline{X}_1, \overline{X}_2$ and S_1^2, S_2^2 be the sample means and "raw" sample variances of two samples, respectively. Let $\overline{X}$ and S^2 be the sample mean and sample variance of the union of the two samples. Which of the following hold?

- if $\overline{X}_1 \leq \overline{X}_2$, then $\overline{X}_1 \leq \overline{X} \leq \overline{X}_2$
- if $\overline{X}_1 = \overline{X}_2$ and $S_1^2 \leq S_2^2$, then $S_1^2 \leq S^2 \leq S_2^2$
- none of the above

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6

0.0/3.0 points (graded)

$\{X_1, X_2, X_3\}$ are the observed values of 3 sample items following Bernoulli distribution $B_{0.9}$. Let $X_{\max}$ be the maximum of $\{X_1, X_2, X_3\}$, let $X_{\min}$ be the minimum of $\{X_1, X_2, X_3\}$, let S_1 be the median of $\{X_1, X_2, X_3\}$, and S_2 be $\frac{1}{2}(X_{\max} + X_{\min})$. Calculate the following

- $E[S_1]$

- $E[S_2]$

- Which of S_1 and S_2 is an unbiased estimator for distribution mean?

- S_1
- S_2
- both
- neither

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7

0.0/1.0 point (graded)

A sample of size n has sample mean 20.20. After adding a new observed value 21, the sample mean increases to 20.25. What is n?

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8

0.0/1.0 point (graded)

To estimate the average alcohol consumption of UCSD students, we take three random samples of 40, 45 and 50 students respectively, and their sample means turn out to be 3.15, 3.20 and 2.76 pints per week respectively. What is the sample mean of the collection of all three samples?

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9

0.0/2.0 points (graded)

Let $\overline{X}_n$ and S_n^2 be the sample mean and the sample variance of $\{X_1, \ldots, X_n\}$. Let $\overline{X}_{n+1}$ and S_{n+1}^2 be the sample mean and the sample variance of $\{X_1, \ldots, X_n, \overline{X}_n\}$. Which of the following hold

- for sample means,

- $\overline{X}_n > \overline{X}_{n+1}$
- $\overline{X}_n < \overline{X}_{n+1}$
- $\overline{X}_n = \overline{X}_{n+1}$

- for sample variances?

- $S_n^2 > S_{n+1}^2$
- $S_n^2 < S_{n+1}^2$
- $S_n^2 = S_{n+1}^2$

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10

0.0/1.0 point (graded)

Let S be an estimator for parameter p of binomial distribution $B_{p,n}$. If S is unbiased and only takes positive values, give an upper bound for $P(S \geq 0.5)$ for a random selected sample from $B_{0.3,20}$.

Hint: Markov inequality

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