Course › Final E... › Prepari... › Practic...

Practice Final Exam

The following exam was given at a previous session.

1

1/2 points (ungraded)

Statistical Reasoning

Which type of reasoning can be used for each of the following statements?

1. Based on a recent survey, the fraction of the population that prefer sweet to sour is between 73 and 76 percent.

Frequentist reasoning ▾ ✔ **Answer:** Frequentist reasoning

2. There is a 20% chance of rain tomorrow.

Frequentist reasoning ▾ ✖ **Answer:** Bayesian reasoning

3. I will bet you 20$ to 1$ that my football team would win tomorrow's match.

Frequentist reasoning ▾ ✖ **Answer:** Bayesian reasoning

4. The chance that two random people have the same birthday is at least 1/365.

Frequentist reasoning ▾ ✔ **Answer:** Frequentist reasoning

Submit You have used 2 of 2 attempts

Answers are displayed within the problem

2

2.0/2.0 points (ungraded)

Which of the following statements hold for all sets A and B?

☑ $B - A = B \cap A^c$ ✔

- [ ] $A \times B \subseteq A \cup B$
- [ ] $(A \Delta B) - B = \emptyset$
- [x] $(A \cup B) - (A \cap B) = (A - B) \cup (B - A)$ ✔

✔

Explanation

- True.
- False. Let $A = \{1\}, B = \{2\}$. Then $A \times B = \{(1,2)\}, A \cup B = \{1,2\}$
- False. $(A \Delta B) - B = A - B$.
- True.

Submit You have used 2 of 3 attempts

Answers are displayed within the problem

3

0.0/2.0 points (ungraded)

A bag contains 5 red balls and 5 blue balls. Three balls are drawn randomly without replacement. Find:

- the probability that all 3 balls have the same color,

2 ✖ **Answer:** 1/6

2

Explanation

$$P\left(\text{same color}\right) = \frac{\binom{3}{5}+\binom{3}{5}}{\binom{3}{10}} = \frac{1}{6}.$$

- the conditional probability that we drew at least one blue ball given that we drew at least one red ball.

✖ **Answer:** 10/11

Explanation

$$P\left(\text{a least one Blue , at least one Red}\right) = \frac{\binom{2}{5}\binom{1}{5}+\binom{1}{5}\binom{2}{5}}{\binom{3}{10}}.$$

$$P\left(\text{at least one Red}\right) = 1 - \frac{\binom{3}{5}}{\binom{3}{10}}.$$

$$P\left(\text{a least one Blue} \mid \text{at least one Red}\right) = \frac{P(\text{a least one Blue , at least one Red})}{P(\text{at least one Red})} = \frac{\binom{2}{5}\binom{1}{5}+\binom{1}{5}\binom{2}{5}}{\binom{2}{5}\binom{1}{5}+\binom{1}{5}\binom{2}{5}+\binom{3}{5}} = \frac{10}{11}$$

.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

4

0/2 points (ungraded)

Students who party before an exam are twice as likely to fail as those who don't party (and presumably study). If 20% of the students partied before the exam, what fraction of the students who failed went partying?

0.5 ✖ **Answer:** 1/3

0.5

Explanation

Let F be the event that a student fail, P be the event that a student partied, P be the event that a student did not party. We know that $P\left(F|P\right)=2P\left(F|NP\right), P\left(P\right)=0.2, P\left(NP\right)=0.8$

$P\left(P|F\right)=\frac{P(F|P)P(P)}{P(F)}=\frac{P(F|P)P(P)}{P(F|P)P(P)+P(F|NP)P(NP)}=\frac{1}{3}$.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

5

1/5 points (ungraded)

Random variables X and Y are distributed according to

$X \setminus Y$	1	2	3
1	0.12	0.08	0.20
2	0.18	0.12	0.30

and $Z=\max\{X,Y\}$. Evaluate:

- X and Y are independent,

Yes ✔ **Answer:** Yes

Explanation

$P\left(XY\right)=P\left(X\right)P\left(Y\right)$

- $P\left(Y\neq 3\right)$,

0 ✖ **Answer:** 0.5

0

Explanation
$P(Y \neq 3) = 0.12 + 0.08 + 0.18 + 0.12 = 0.5$

- $P(X < Y)$,

✖ **Answer:** 0.58

Explanation
$P(X < Y) = 0.08 + 0.2 + 0.3 = 0.58$

- $E[Z]$,

✖ **Answer:** 2.38

Explanation

$$P(Z = z) = \begin{cases} 0.12, & z = 1, \\ 0.38, & z = 2, \\ 0.5, & z = 3. \end{cases}$$

$E(Z) = \sum_{z=1}^{3} z \cdot P(Z = z) = 2.38$

- $V[Z]$.

✖ **Answer:** 0.4756

Explanation
$V(Z) = \sum_{z=1}^{3} (z - E(Z))^2 \cdot P(Z = z) = 0.4756$

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

6

0/3 points (ungraded)
X follows normal distribution $\mathcal{N}(\mu, \sigma^2)$ whose pdf satisfies $\max_x f(x) = 0.0997356$ and cdf satisfies $F(-1) + F(7) = 1$ Determine

- μ,

0 ✖ **Answer:** 3

0

Explanation
As $F(-1) + F(7) = 1$, -1 and 7 are symmetric with respect to μ, hence $\mu = 3$.

- σ,

✖ **Answer:** 4

Explanation
$\frac{1}{\sqrt{2\pi\sigma^2}} = 0.0997356$, hence $\sigma = 4$.

- $P(X \leq 0)$.

✖ **Answer:** 0.226627352376868

Explanation
$P(X \leq 0) = F(0) = \Phi(\frac{0-3}{4}) = 0.2266$

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

7

0/2 points (ungraded)
A hen lays eight eggs weighing 60, 56, 61, 68, 51, 53, 69, and 54 grams, respecitvely. Use the unbiased estimators discussed in class to estimate the weight distribution's

- mean,

0.1 ✖ **Answer:** 59

0.1

Explanation
$\hat{\mu} = \frac{1}{8} \sum_{i=1}^{8} x_i$.

- variance.

✖ **Answer:** 45.7142857143

Explanation

$S^2 = \frac{1}{7}\sum_{i=1}^{8}(x_i - \hat{\mu})^2$.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

8

0/2 points (ungraded)

A biologist would like to estimate the average life span of an insect species. She knows that the insect's life span has standard deviation of 1.5 days. According to Chebyshev's Inequality, how large a sample should she choose to be at least 95% certain that the sample average is accurate to within ± 0.2 days?

5 ✖ **Answer:** 1125

5

Explanation

$P(|X - \mu| \geq 0.2) = \frac{\sigma^2}{0.2^2} \geq 0.05$ As $\sigma^2 = \frac{1.5^2}{N}$, where N is the number of samples, we have $N \geq 1125$.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

9

0/2 points (ungraded)

Suppose that an underlying distribution is approximately normal but with unknown variance. You would like to test $H_0 : \mu = 50$ vs. $H_1 : \mu < 50$. Calculate the p-value for the following 6 observations: 48.9, 50.1, 46.4, 47.2, 50.7, 48.0.

- less than 0.01
- between 0.01 and 0.025
- between 0.025 and 0.05 ✔
- between 0.05 and 0.1
- more than 0.1 ✖

Explanation

The sample mean $\overline{X} = 48.55$, and the sample variance is $S^2 = 2.78$. Hence the T-test statistics is $T = \frac{\overline{X}-\mu}{S/\sqrt{n}} = -2.13$, where $n = 6$.

The p values is $P_{H_0}\left(\overline{X} \le \mu\right) = F_{n-1}\left(T\right) = 0.0432$

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Answers are displayed within the problem

10

0/4 points (ungraded)

20% of the items on a production line are defective. Randomly insptect items, and let X_1 be the number of inspections till the first defective item is observed, and X_5 be the number of inspections till the fifth defective item is observed. In both cases, X_1 and X_5 inlcude the defective item itself (e.g. if the items are $\{good, good, defective\}$, X_1 is 3). Calculate

$E\left(X_5\right)$,

✖ **Answer:** 25

Explanation

$E\left(X_5\right) = \frac{n}{p} = 25.$

$V\left(X_5\right)$,

5

✖ **Answer:** 100

5

Explanation

$E\left(X_5\right) = \frac{n(1-p)}{p^2} = 100.$

$E\left(X_5 | X_1 = 4\right)$,

✖ **Answer:** 24

Explanation

Geometric distribution is memoryless. $E\left(X_5 | X_1 = 4\right) = E\left(X_4 + 4\right) = 24$

$V\left(X_5 | X_1 = 4\right)$.

✖ **Answer:** 80

Explanation

$V(X_5|X_1 = 4) = V(X_4 + 4) = V(X_4) = 80$

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Answers are displayed within the problem

11

0/5 points (ungraded)

Model Selection

A k-piece-constant function is define by $k-1$ thresholds $-100 < t_1 < t_2 < \cdots < t_{k-1} < 100$ and k values $a_1, a_2, \ldots, a_k$. Let

$$f(x) = \begin{cases} a_1, & -100 \leq x < t_1, \\ a_2, & t_1 \leq x < t_2, \\ \vdots & \\ a_i, & t_{i-1} \leq x < t_i, \\ \vdots & \\ a_k, & t_{k-1} \leq x \leq 100. \end{cases}$$

be a k-piece-constant function. Suppose you are given n data points $((x_1, y_1), \ldots, (x_n, y_n))$ each of which is generated in the following way:

1. first, x is drawn according to the uniform distribution over the range $[-100, 100]$.

2. second y is chosen to be $f(x) + \omega$ where ω is drawn according to the normal distribution $\mathcal{N}(0, \sigma)$

You partition the data into a training set and a test set of equal sizes. For each $j = 1, 2, \ldots$ you find the j-piece-constant function g_j that minimizes the root-mean-square-error (RMSE) on the training set. Denote by $train(j)$ the RMSE on the training set and by $test(j)$ the RMSE on the test set.

Which of the following statements is correct?

- [ ] $train(j)$ is a monotonically non-increasing function. ✔
- [x] $test(j)$ is a monotonically non-increasing function.
- [ ] $test(j)$ has a minimum close to $j = k$ ✔
- [ ] $train(j)$ has a minimum close to $j = k$
- [ ] if $j > n/2$, $train(j) = 0$ ✔

✖

Submit You have used 3 of 3 attempts

Answers are displayed within the problem

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What is the deadline to pass Final Exam? 4
Hi, dear Team! What is the deadline to pass Final Exam?

Exam duration 4
Hi Team, Could you please tell how long is the final exam? I couldn't find this information anywhere unfortunately. Thanks i...

Question 10 : Lecture coverage 2
Hi team, Did we cover this in this course? If yes , please point me to the lecture video , many thanks. In my understanding, ...

Question 11

Hi, Could you please point out which week/ topic has covered this question? Sorry I am quite confused with this question. T... 3