Week 3 Homework

This is a preview of the published version of the quiz

Started: Jul 2 at 7:47am

Quiz Instructions

Question 1

1 pts

(Lesson 2.11: Covariance and Correlation.) Suppose that the correlation between December snowfall and temperature in Siberacuse, NY is -0.5. Further suppose that $\mathbf{Var}(S) = 100$ in^2 and $\mathbf{Var}(T) = 25$ (degrees F)^2. Find $\mathbf{Cov}(S, T)$ (in units of degree inches, whatever those are).

$\rho = \frac{cov(X,Y)}{\sqrt{Var(X)Var(Y)}}$

- a. -25
- b. -5
- c. 5
- d. 25

$-0.5 = \frac{Cov(S,T)}{\sqrt{100 \times 25}}$

$Cov(S,T) = -25$

Question 2

1 pts

(Lesson 2.11: Covariance and Correlation.) If X and Y both have mean -7 and variance 4, and $\mathbf{Cov}(X, Y) = 1$, find $\mathbf{Var}(3X - Y)$.

- a. 34
- b. 36
- c. 40
- d. 41

$Var(aX + bY) = a^2 Var(X) + b^2 Var(Y) + 2ab\, Cov(X,Y)$

$Var(3X - Y) = 3^2 VarX + (-1)^2 VarY - 2(3)\, Cov(X,Y)$

$= 9(4) + 4 - 6(1) = 34$

Question 3

1 pts

(Lesson 2.12: Probability Distributions.)

You may recall that the p.m.f. of the Geometric (p) distribution is $f(x) = (1-p)^{x-1}p, x = 1, 2, \ldots$

If the number of orders at a production center this month is a Geom(0.7) random variable, find the probability that we'll have at most 3 orders.

- a. 0.027
- b. 0.14
- c. 0.86
- d. 0.973 ✓

$P(X \leq 3)$

$= P(x=1) + P(X=2) + P(X=3)$

$= 0.3^0(0.7) + 0.3^1(0.7) + 0.3^2(0.7)$

$= 0.973$

Question 4

1 pts

(Lesson 2.12: Probability Distributions.) Suppose the SAT math score of a University of Georgia student can be approximated by a normal distribution with mean 400 and variance 225. Find the probability that the UGA Einstein will score at least a 415.

- a. 0.5
- b. 0.1587 ✓
- c. 0.975
- d. 0.8413

$X \sim Norm(400, 15^2)$

$P(X \geq 415) = P\left(\frac{X-400}{\sqrt{225}} \geq \frac{415-400}{\sqrt{225}}\right)$

$= P(Z \geq 1)$

$= 1 - 0.8413 = 0.1587$

Question 5

1 pts

(Lesson 2.13: Limit Theorems.)
What is the most-important theorem in the universe?

- a. Eastern Limit Theorem
- b. Central Limit Theorem
- c. Central Limit Serum
- d. Central Simit Theorem (simit is a tasty Turkish bagel)

Question 6

1 pts

CLT: $\lim_{n\to\infty} \bar{X}_n \sim \text{Norm}(\mu, \sigma^2/n)$

(Lesson 2.13: Limit Theorems.) If $X_1, \ldots, X_{400}$ are i.i.d. from some distribution with mean 1 and variance 400, find the approximate probability that the sample mean $\bar{X}$ is between 0 and 2.

$\bar{X} \sim \text{Norm}\left(1, \frac{400}{400}\right) \equiv \text{Norm}(1, 0)$

$\mu = 1$

$\sigma^2/n = \bar{\sigma}^2 = \frac{400}{400} = 1$

- a. 0.1587
- b. 0.3174
- c. 0.6826
- d. 0.8413

$P(0 < \bar{X} < 2) = P\left(\frac{0-1}{1} < Z < \frac{2-1}{1}\right)$

$= P(-1 < Z < 1)$

$= P(Z < 1) - P(Z < -1) = 0.8413 - 0.1586$

Question 7

1 pts

(Lesson 2.14: Estimation.)
Suppose we collect the following observations: 7, −2, 1, 6. What is the sample variance?

$\bar{x} = 3, \quad n = 4$

- a. 13
- b. $\sqrt{13}$
- c. 18

$s^2 = \frac{(7-3)^2 + (-2-3)^2 + (1-3)^2 + (6-3)^2}{4-1}$

$= \frac{4^2 + (-5)^2 + (-2)^2 + 3^2}{3} = 18$

d. 28

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