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Mathematics 214: Introduction to Statistics
Spring Semester 1998
Exam 3
April 17, 1998

This Examination contains 16 questions 6 points worth each. You start with 4 points, and the highest possible score is 100. Fill in your answers on this cover sheet by placing an X through one letter for each problem except the first two problems. Write the answers for 1 and 2 in the corresponding empty boxes of the list below. Books and notes are not allowed.

1						
2						
3	a	b	c	c m d	e	
4	a	b	c	c m d	e	
5	a	b	c	c m d	e	
6	a	b	c	c m d	e	
7	a	b	c	c m d	e	
8	a	b	c	c m d	e	

hline 9	a	b	c	d	e	
10	a	b	c	d	e	
11	a	b	c	d	e	
12	a	b	c	d	e	
13	a	b	c	d	e	
14	a	b	c	d	e	
15	a	b	c	d	e	
16	a	b	c	d	e	

Total | |

Sign the pledge:

"On my honor, I have neither given nor received unauthorized aid on this Exam."

Signature: ________________________________

GOOD LUCK

1. Find $P(Z \leq 2)$ where Z is a standard normal random variable. **Write your answer on the cover sheet!**

2. Assume X is a normal random variable with mean 3 and standard deviation 2. Find $P(-1 \leq X \leq 5)$. **Write your answer on the cover sheet!**

3. A fair die is tossed 600 times. What is the approximate probability that at most 90 times a "six" comes up?

a) $\frac{9}{60}$ **b)** 0.3508 **c)** 0.1492 **d)** $\frac{9}{10}$ **e)** 0.8508

4. The grade-point averages of a large population of college students are approximately normally distributed with mean equal to 2.4 and standard deviation equal to 0.5. Suppose that three students are randomly selected from the student body. What is the probability that all three will possess a grade-point average in excess of 3.0?

a) $(0.3849)^3$ **b)** $(0.1151)^3$ **c)** $(0.8849)^3$ **d)** $1-(0.1151)^3$ **e)** $1-(0.8849)^3$

5. The fracture strengths of a certain type of glass average 14 (in thousands of pounds per square inch) and have a standard deviation of 2. What is the probability that the average fracture strength for 100 pieces of this glass exceeds 14.5?

a) 0.0202 **b)** 0.4938 **c)** 0.9938 **d)** 0.0062 **e)** 0.4013

The following table is to be used for the questions 6) – 9).

		X_1			
		0	1	2	
	-1	0.2	0.15	0.1	
X_2	0	0.1	0.05	0.05	
	1	0.2	0.1	0	
	2	0.05	0	0	

6. Find $P(X_1 = 2)$.

a) 0.05 **b)** 0 **c)** 0.15 **d)** 0.1 **e)** 0.3

7. Find $E(X_2)$.

a) 1 **b)** -0.05 **c)** 0.6 **d)** -0.1 **e)** .15

8. Find $E(X_1X_2)$.

a) 0 **b)** 1 **c)** -0.25 **d)** -0.15 **e)** 0.6

9. Find $P(X_1 = 2 \,|\, X_2 = 0)$.

a) 0.03 **b)** 0.05 **c)** $\frac{1}{3}$ **d)** $\frac{1}{11}$ **e)** $\frac{1}{4}$

10. Let X and Y be random variables with variances $V(X) = 1$ and $V(Y) = 9$ respectively. Assume $Cov(X, Y)$, the covariance of X and Y, is 2. Then the variance of $2X - Y$ is

a) 3 **b)** -9 **c)** -5 **d)** 21 **e)** 5

11. Let X and Y be random variables with variances $V(X) = 1$ and $V(Y) = 9$ respectively. Assume $Cov(X, Y)$, the covariance of X and Y, is 2. Then the correlation coefficient ρ between X and Y is

a) $\frac{2}{3}$ **b)** $\frac{4}{3}$ **c)** $\frac{2}{9}$ **d)** $\frac{4}{9}$ **e)** $\frac{2}{\sqrt{3}}$

12. The times to failure of four turbine blades in jet engines, in 10^3 hours, were as follows:

$$3.2,\ 1.8,\ 2.6,\ 4.4$$

The sample mean of these data is

a) $\frac{3}{4}$ **b)** 3 **c)** 12 **d)** 4 **e)** $\frac{11}{4}$

13. The times in minutes between eruptions for three of the eruptions of the geyser *Old Faithful* on August 1, 1985 were 77, 80, 80. The sample mean of these data is 79. Find the sample variance.

a) 3 **b)** 2 **c)** 6 **d)** 6244 **e)** 3123.5

14. The diameter measurements of an electric cable, taken at 100 points along the cable, yield a sample mean of 2.1 centimeters and a sample standard deviation of 0.3 centimeter. Construct a 90% confidence interval for the average diameter of the cable.

a) $0.3 \pm 1.645 \dfrac{2.1}{10}$ **b)** $2.1 \pm 1.96 \dfrac{0.09}{10}$ **c)** $2.1 \pm 1.645 \dfrac{0.3}{100}$

d) $2.1 \pm 1.645 \dfrac{0.3}{10}$ **e)** $2.1 \pm 1.96 \dfrac{0.3}{10}$

15. Suppose that a random sample of only 15 black cherry trees has been taken to estimate the average volume of a black cherry tree in the Allegheny National Forest. Assume that the sample mean for the volumes (in cubic feet) of the 15 trees is $\bar{x} = 30.2$ and the sample variance is $s^2 = 268.96$ $(= 16.4^2)$. If we assume further that the distribution of the volumes of all the black cherry trees is normal, then a confidence interval for the average volume of a tree in this forest with confidence coefficient 0.98 is:

a) $30.2 \pm 1.345 \dfrac{16.4}{\sqrt{15}}$ **b)** $30.2 \pm 2.33 \dfrac{16.4}{\sqrt{15}}$ **c)** $30.2 \pm 29.1413 \dfrac{16.4}{\sqrt{15}}$

d) $30.2 \pm 2.624 \dfrac{16.4}{\sqrt{14}}$ **e)** $30.2 \pm 2.624 \dfrac{16.4}{\sqrt{15}}$

16. Suppose $n = 13$ observations are taken on normally distributed measurements. The sample variance is $s^2 = 5$. A confidence interval for the variance σ^2 with confidence coefficient 0.99 is approximately given by

a) $\left(\dfrac{60}{21.03}, \dfrac{60}{5.23}\right)$ **b)** $\left(\dfrac{60}{28.3}, \dfrac{60}{3.07}\right)$ **c)** $\left(-\dfrac{60}{28.3}, \dfrac{60}{28.3}\right)$

d) $\left(\dfrac{60}{29.82}, \dfrac{60}{3.57}\right)$ **e)** $\left(-\dfrac{60}{3.07}, \dfrac{60}{28.3}\right)$