STAT 3332 Statistics for Life Sciences

Fall 2007

Midterm Test 2

• Do **not** turn in the question sheets. **Only the answer sheet** will be accepted.
• There are **14** questions. Total points **100**: **7** per question, and **2** for *printing* name.
• Allotted time: **75** minutes.
• For each question, choose or give the **best answer**. Explanations (clearly indicating for which question) provided **neatly** on the front or back of the answer sheet may count for **partial credit** if needed.

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1. Let random variable X have a continuous probability distribution with density function $f(x)$. Then $P(a \le X \le b) =$

$f(a)f(b)$ $\quad$ $\boxed{\int_a^b f(x)dx}$ $\quad$ $\int_{-\infty}^{\infty} f(x)dx$ $\quad$ $f(a)+f(b)-2f(a)f(b)$ $\quad$ $f(b)/f(a)$

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2. (Continuation) Suppose $f(3.4) = 0.46$. Then $P(X = 3.4) =$

$f(3.4) = 0.46$ $\quad$ $\boxed{0}$ $\quad$ $1 - f(3.4) = 0.54$ $\quad$ 3.4 $\quad$ none of these

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3. The standard normal distribution, $N(0, 1)$, satisfies

(A) $P(N(0,1) \ge 1) < 0.50$
(B) $P(N(0,1) \le -1) = P(N(0,1) \ge +1)$
(C) the density is never zero
$\boxed{\text{(D)}}$ each of (A), (B), (C)
(E) none of (A), (B), (C)

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4. Let $X_1, \ldots, X_n$ be a random sample from a population having mean 10 and variance 35. Let $\overline{X}$ denote the sample mean. The Central Limit Theorem lets us approximate $P(12 \le \overline{X} \le 16)$ by

(A) $16 - 12 = 4$ $\quad$ $\boxed{\text{(B)}}$ $P\left(12 \le N(10, \frac{35}{n}) \le 16\right)$ $\quad$ (C) $P(12 \le N(0,1) \le 16)$ $\quad$ (D) none of these

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5. (Continuation) If the population mean μ is unknown, but the variance is known to be 35, then an approximate 95% Confidence Interval for μ based on $\overline{X}$ is given by

$$\overline{X} \ \pm \ 1.96 \times K,$$

where $K =$

(A) $\frac{1}{\sqrt{35}}$ $\quad$ (B) 1 $\quad$ (C) $\sqrt{35}$ $\quad$ $\boxed{\text{(D)}}$ $\sqrt{\frac{35}{n}}$

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6. (Continuation) If the population is actually Normal and the mean is known to be $\mu = 3$ but the variance σ^2 is unknown and estimated by the sample variance s^2, an approximate 95% Confidence Interval for σ^2 is given by

$$\left(\frac{Q}{\chi^2_{n-1,\ 0.975}} \ , \ \frac{Q}{\chi^2_{n-1,\ 0.025}} \right),$$

where $Q =$

(A) 0 $\quad$ (B) 1 $\quad$ $\boxed{\text{(C)}}$ $(n-1)\, s^2$ $\quad$ (D) $\overline{X}$

Over for Questions 7-14

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7. Let X_1 and X_2 be any random variables. Then $E(3X_1 - 4X_2) =$

$\boxed{\text{(A)}}$ $3E(X_1) - 4E(X_2)$ (B) $E(X_1^3) + E(X_2^4)$ (C) $\frac{3E(X_1)}{4E(X_2)}$ (D) $\frac{E(X_1)\times E(X_2)}{12}$

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8. For large n, the Binomial$(n, 0.3)$ distribution is best approximated by

(A) Poisson(0.3) $\boxed{\text{(B)}}$ Normal$(0.3n, 0.21n)$. (C) Normal$(0.3n, n(0.3)^2)$.

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9. Consider testing the null hypothesis $H_0 : \mu = 5$ versus the *two-sided* alternative $H_1 : \mu \neq 5$, for a population with mean μ and variance 16. Let the data be a sample $X_1, \ldots, X_n$ from this population, and suppose that the test procedure is to reject H_0 for sufficiently extreme values of

$$T = \frac{\overline{X} - 5}{4/\sqrt{n}}.$$

If for the given data T comes out to be $T_0 = -0.89$, then the relevant p-value is

(A) $P(N(0,1) < -0.89)$ (B) $P(N(0,1) > -0.89)$ $\boxed{\text{(C)}}$ $2 \times P(N(0,1) < -0.89)$

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10. If a testing decision is made using a test statistic T with the rejection region

"Reject H_0 if $T > 31$",

then the associated Type I error probability is

(A) $P(T > 31 \,|\, H_0 \text{ false})$ (B) $P(T \leq 31 \,|\, H_0 \text{ true})$ $\boxed{\text{(C)}}$ neither of these

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11. (Continuation) The associated Type II error probability, for an alternative hypothesis H_1, is

(A) $P(T > 31 \,|\, H_1 \text{ true})$ (B) $P(T > 31 \,|\, H_0 \text{ true})$ $\boxed{\text{(C)}}$ neither of these

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12. For random sampling of size n from any population with mean μ and variance σ^2,

(A) the sample mean $\overline{X}$ has mean μ

(B) the sample mean $\overline{X}$ has standard deviation $\frac{\sigma}{\sqrt{n}}$

(C) the standardized sample mean $\frac{\overline{X}-\mu}{\sigma/\sqrt{n}}$ has mean 0 and variance 1

$\boxed{\text{(D)}}$ each of (A), (B), (C) is true

(E) none of (A), (B), (C) is true

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13. Random number tables are used in statistics for

(A) avoiding bias in selecting a sample

(B) avoiding bias in assigning treatments

$\boxed{\text{(C)}}$ both of these

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14. In hypothesis testing, a very low p-value suggests that

$\boxed{\text{(A)}}$ if H_0 true, the observed data is unusual

(B) if H_1 true, the observed data is unusual

(C) both of these

- When you are finished, *please hand in* **only** *the answer sheet.*
- *KEEP THE QUESTION SHEETS.*

- Please **depart quietly**, and *leave the vicinity before discussing the test.*

Thank you for your attention to these details.