STAT 3332 Statistics for Life Sciences

Fall 2006

Midterm Test 2

Your Name (Please **PRINT**):

Your *Signature*:

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

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

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2. (Continuation) And $P(X = 23) =$ (encircle best answer)

$f(23)$ $\quad$ * 0 $\quad$ $1/23$ $\quad$ -23

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3. Let $N(0,1)$ denote a standard normal random variable. Then $P(-1 \le N(0,1) \le +1) =$ (encircle best answer)

0 $\quad$ $1/2$ $\quad$ * $1 - 2\,P(N(0,1) > 1)$ $\quad$ 1

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4. For sampling from a *Normal* population with mean μ and variance σ^2, (encircle best answer)

(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 a standard normal distribution

* (D) each of (A), (B), (C) is true

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

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5. The correlation $\rho_{XY} = \mathrm{Cov}(X,Y)/\sigma_X\sigma_Y = E[(X-\mu_X)(Y-\mu_Y)]/\sigma_X\sigma_Y$ between X and Y (encircle best answer)

(A) measures how closely X and Y have a quadratic relationship

* (B) can take negative values

(C) equals 0 for X and Y the same random variable

(D) each of (A), (B), (C) is true

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

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6. For sampling of size 30 from a *Normal* population with *unknown* mean μ and *unknown* variance σ^2, a 90% confidence interval for μ based on the sample mean $\overline{X}$ and the sample standard deviation s is (encircle best answer)

$\overline{X} \pm 2\,s$ $\quad$ $\overline{X} \pm t_{29,0.10}\,s$ $\quad$ $\overline{X} \pm t_{29,0.10}\,\frac{s^2}{30}$ $\quad$ * $\overline{X} \pm t_{29,0.95}\,\frac{s}{\sqrt{30}}$

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7. For sampling of size 30 from any population with mean μ and variance σ^2, the sample variance $s^2 = (29)^{-1}\sum_{i=1}^{30}(X_i - \overline{X})^2$ has mean $E(s^2) =$ (encircle)

μ * σ^2 $\frac{\sigma^2}{\sqrt{30}}$ 29

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8. For sampling of size 30 from a *Normal* population with mean μ and variance σ^2, and with s^2 the sample variance, the sampling distribution of $\frac{29s^2}{\sigma^2}$ is (encircle best answer)

normal t * chi-square binomial

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9. Among 400 randomly selected voters, 40 ($\hat{p} = 0.10$) favored Kinky. To form a confidence interval for the population proportion p of Kinky fans, approximate the distribution of $\hat{p}$ by (encircle)

$N(0,1)$ $N(0.1,1)$ $N(0.1, 0.01)$ * $N\left(0.1, \frac{0.09}{400}\right)$

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10. Random numbers are used in statistics for (encircle best answer)

* selecting the sample the mean of the data Poisson approximation

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11. In hypothesis testing, the p-value measures (encircle best answer)

linearity Type I error * evidence against H_0 power

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12. In hypothesis testing, if the p-value is less than the selected Type I error probability (or significance level) α, then H_0 is (encircle best answer)

accepted decided by flipping a coin * rejected left undecided

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13. *Opthalmology.* In a study of an eye drop, each participant randomly received either the active drug (A) or a placebo (P) in the left (L) eye and the other in the right (R) eye. Each participant scored each eye. To best analyze the data, compute for each participant the differences (encircle)

$L - A$ $L - P$ $L - R$ $P - R$ * $P - A$

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14. Consider testing $H_0 : \mu = 3$ versus $H_1 : \mu > 3$ with σ unknown, based on the sample mean $\overline{X}$. To compute the p-value we need to know the distribution of $\frac{\overline{X}-3}{s/\sqrt{n}}$ (encircle best answer)

* when H_0 is true when H_1 is true in each of these cases

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15. An interval estimate of $\mu_1 - \mu_2$ is to be constructed based on $\overline{X}_1 - \overline{X}_2$ and sample variances s_1^2 and s_2^2 from independent samples of equal size $N(\mu_1, \sigma^2)$ and $N(\mu_2, \sigma^2)$ with σ^2 unknown. The most appropriate estimator of σ^2 to use is (encircle best answer)

s_1^2 s_2^2 maximum of s_1^2 and s_2^2 * average of s_1^2 and s_2^2

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16. (Continuation) In the same problem, but with normality of the populations *not assumed*, the most appropriate estimator of σ^2 to use is (encircle best answer)

s_1^2 s_2^2 maximum of s_1^2 and s_2^2 * average of s_1^2 and s_2^2 $s_1 \times s_2$
