

STAT 515 - Spring 2003 - Exam 2 - (Modified for Fall 2003 Practice)

Part I: Answer 7 of the following 8 questions. If you complete more than 7, I will grade only the first 7. Five points each.

- 1) X is a normal random variable with $\mu=25$, $\sigma^2=25$, and $\sigma=5$. Find $P(X \leq 30)$.
- 2) Z is a standard normal random variable. Find z_0 such that $P(Z \geq z_0) = .0778$.
- 3) (Circle the correct answers) Because $E(\bar{x})=\mu$, the **parameter / statistic** \bar{x} **is /is not** an unbiased estimate of the **parameter / statistic** μ .
- 4) Suppose that a circuit board factory produces 6% defective products. Use the central limit theorem to approximate the probability that 20 or more defectives are observed in a sample of 200.
- 5) Define what is meant by "Type II error".
- 6) Define what is meant by "the p-value (or observed significance level) of a test".
- 7) A sample of size 20 gives $\bar{x}=18.45$ and $s=1.84$. Construct a 95% confidence interval for μ .
- 8) (Circle the correct answers) If you increase the sample size, you will likely **increase / decrease** the width of a confidence interval. If you increase the confidence coefficient $(1-\alpha)$ you will **increase / decrease** the width.

Part II: Answer every part of the next two problems. Read each problem carefully, and show your work for full credit. Twenty points each.

- 1) Before a production run of anesthesia is allowed to ship, the FDA requires that the manufacturer demonstrate that the single-use vials of serum from that run were produced with a standard deviation of less than 0.05 ounces.
 - a) State the appropriate null and alternate hypotheses for testing if the manufacturer will be allowed to ship the current batch of anesthesia. Be sure to identify what the parameter(s) you are using mean in terms of the problem (e.g. if you use $\mu, p, \sigma^2, s^2, \bar{x}, \hat{p}$ say what the symbol stands for.)
 - b) A sample of size 16 is obtained. The sample has standard deviation 0.04. Test the hypothesis in a at an $\alpha=0.10$ level and state whether the manufacturer should ship this run or not.
 - c) Besides the sample being randomly chosen, what other assumption(s) are required to trust the test in part B? If possible, check that the assumption(s) hold. If it is not possible from what is given, say what you would need to have in order to check the assumption(s).
- 2) Doctors are removed from an HMO's list of preferred providers if it is found that fewer than 75% of all their patients report having received "excellent" or "very-good" service. This is checked as part of a larger annual audit that examines of a random sample of 100 patient files from the past 12 months.
 - a) State the appropriate null and alternate hypotheses for testing whether the HMO will remove the doctor from their list of preferred providers. Be sure to identify what the parameter(s) you are using mean in terms of the problem (e.g. if you use $\mu, p, \sigma^2, s^2, \bar{x}, \hat{p}$ say what the symbol stands for.)
 - b) The 100 selected files for one physician revealed 69 patients reporting "excellent" or "very-good" service. Report the p-value for this data for testing the hypotheses you gave in part a. In addition, state your conclusion at the $\alpha=0.05$ level.
 - c) Besides the sample being randomly chosen, what other assumption(s) are required to trust the test in part B? If possible, check that the assumption(s) hold. If it is not possible from what is given, say what you would need to have in order to check the assumption(s).