STAT 303 Sections 503–504 Exam 2, Spring 1996

Name: ____________________________

ID#: ____________________________

Form A

Read the following carefully!!

1. Do not begin work until you are told to do so.
2. If there are K correct answers to a multiple choice question, only your first K answers will be considered.
3. There is a total of 100 points. The exam is worth 25% of your final grade.
4. You will have 60 minutes to finish this exam.
5. You must work alone on this exam and use no books, notes, or any other materials. This is a closed book, closed notes exam.
6. Good luck!

1. (8 points) What should the following test statistics be close to if a null hypothesis is true?

   Z ______ t ______ χ^2 ______ F ______

2. (5 points) When do we reject the null hypothesis that a set of $K > 2$ population means are the same?

   (a) When the p-value is greater than α.
   (b) When the between sample sum of squares is significantly larger than the within sample sum of squares as measured by the F statistic.
   (c) When the within sample sum of squares is significantly larger than the between sample sum of squares as measured by the F statistic.
   (d) When the confidence interval includes zero.

3. (5 points) Suppose I have independent random samples of size 100 and 150 from a $0-1$ population having proportion of 1's denoted by π. If $p_1 = 0.53$ and $p_2 = 0.48$, what is the pooled estimate of π?

For the next four problems, refer to Figures 1–4 and fill in the requested information. Use $\alpha = 0.05$. *Make sure to give the scientific meaning of the parameter.*

4. (7 points) A teacher has been told by her principal that 20% of the students in her school are left handed. To test this, she studies her class and finds that 8 of her 30 students are left handed. Is this enough evidence to conclude that the principal is wrong?

   (a) Figure:
   (b) Parameter:
   (c) H_0 :
   (d) H_a :
   (e) Test statistic:
   (f) p-value:
   (g) Scientific conclusion:

5. (7 points) A researcher collects random samples of sizes 30 and 50 from populations of male and female IQ's and finds sample means of 105 and 110 with sample variances of 200 and 275, respectively. Can the researcher reasonably conclude that female IQ's are more variable than male IQ's?

   (a) Figure:
   (b) Parameter:
   (c) H_0 :
   (d) H_a :
   (e) Test statistic:
   (f) p-value:
   (g) Scientific conclusion:

6. (7 points) To study the effect of a drug, a researcher randomly selects 25 rats, times them in completing a maze, then injects each one with the drug, and times them again in the maze. He finds an average decrease in the time to complete the maze of 2 seconds with a standard deviation for the decreases of 3 seconds. Can he reasonably conclude that the drug decreases the time to complete the maze on the average?

   (a) Figure:
   (b) Parameter:
   (c) H_0 :
   (d) H_a :
   (e) Test statistic:
   (f) p-value:
   (g) Scientific conclusion:

7. (7 points) Random samples of 100 men and 100 women are polled about whether they favor Clinton or Dole and it is found that 45 men and 55 women favor Clinton. Is there a gender gap, that is, do more women than men favor Clinton?

   (a) Figure:
   (b) Parameter:
   (c) H_0 :
   (d) H_a :
   (e) Test statistic:
   (f) p-value:
   (g) Scientific conclusion:

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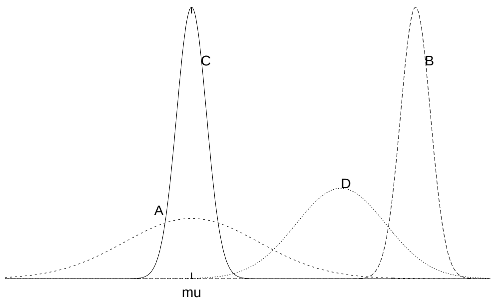
8. (5 points) What would be a Type I error in Problem 7?

9. (5 points) Interpret scientifically the p-value in Problem 5.

10. (6 points) A group of researchers are having an argument about which of four possible point estimators of μ they should use in a complicated statistical problem. They ask a statistician for help and she produces the plot below of the sampling distributions of each of the four estimators (labeled A through D). Which of the estimators is (are)

    (a) Unbiased:
    (b) Minimum variance:
    (c) Best:



11. (5 points) Circle the number that is bigger, $F_{.60,10,10}$ or $F_{.40,10,10}$.

12. (5 points) If I have a random sample of size n from a $\mathrm{N}(\mu, \sigma^2)$ population, what is

$$\Pr(t_{.75,n-1} \le \frac{\bar{X} - \mu}{s/\sqrt{n}} \le t_{.25,n-1})?$$

13. (6 points) The O-rings in the space shuttle are supposed to have a certain diameter and this diameter should be correct to a very small tolerance since damage could result to the shuttle if they are the wrong size. Which two of the following statements are true?

    (a) If we test the null hypothesis that the variance of the O-ring sizes is at least a certain amount, then 0.10 would be a reasonable value for α.
    (b) A Type II error for the test in (a) would be that we conclude the O-rings are bad when they really aren't.
    (c) We would use the F statistic in the test in (a).
    (d) The Central Limit Theorem says we can act as though sample means of O-ring sizes are normally distributed even though the sizes themselves may not be normally distributed.

14. (6 points) Which two statements below are true about One-Way ANOVA?

    (a) The name 'One-Way ANOVA' is actually misleading because the procedure is really comparing means not variances.
    (b) We shouldn't use the procedure if the largest standard deviation divided by the smallest one is greater than 2.
    (c) The procedure consists of comparing a number measuring how different the means of the I samples are to a number measuring how much natural variability there is in all the responses.
    (d) The p-value for a two sided test is twice the p-value for a one sided test.

15. (6 points) Which two of the following items are true?

    (a) If we reject H_0 at $\alpha = .05$, then we also reject H_0 at $\alpha = .01$.
    (b) If the 99% confidence interval for the ratio of variances turns out to be (1.2,2.3), then we would reject the null hypothesis of equal variances for $\alpha = .01$.
    (c) Using a larger sample size makes it harder to make a Type I error.
    (d) A 95% confidence interval is narrower than a 99% confidence interval.
    (e) In a right sided test for the mean of a normal population, if the test statistic is greater than 0, then the p-value is half what it would be if we were doing a two-sided test instead.

16. (10 points) Why are we 95% confident that a 95% confidence interval for a parameter contains the true value of the parameter? (Don't just say that the probability it contains the true value is .95).

Figure 1:

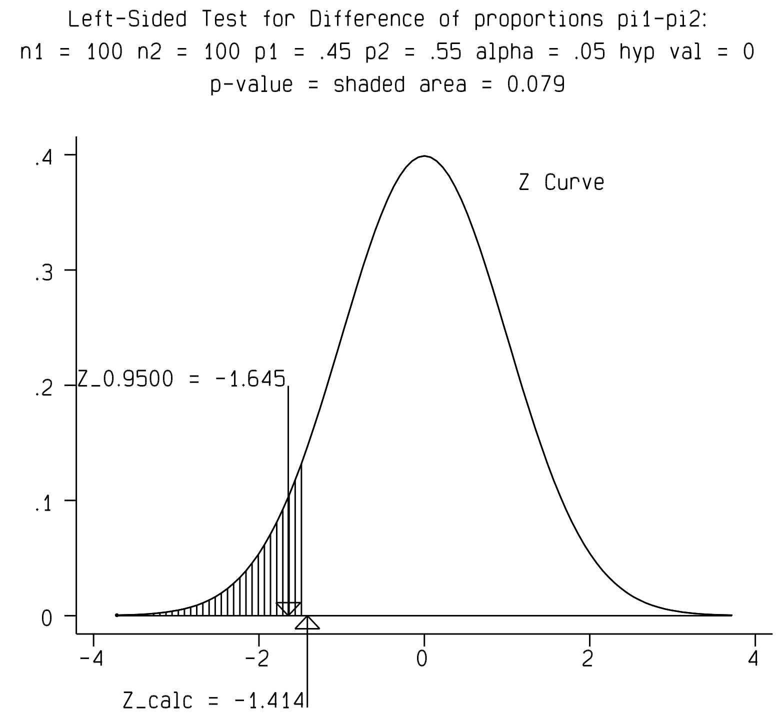


Figure 2:

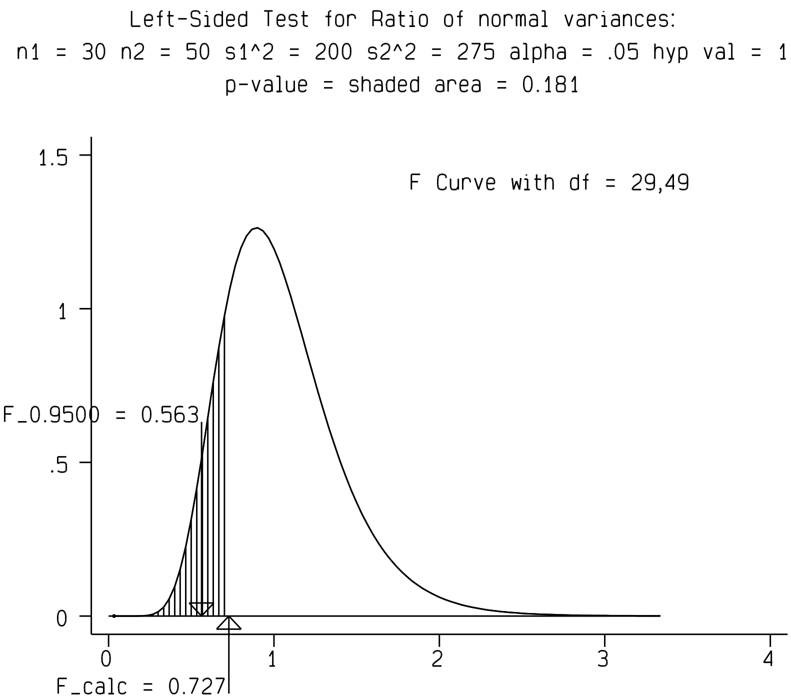


Figure 3:

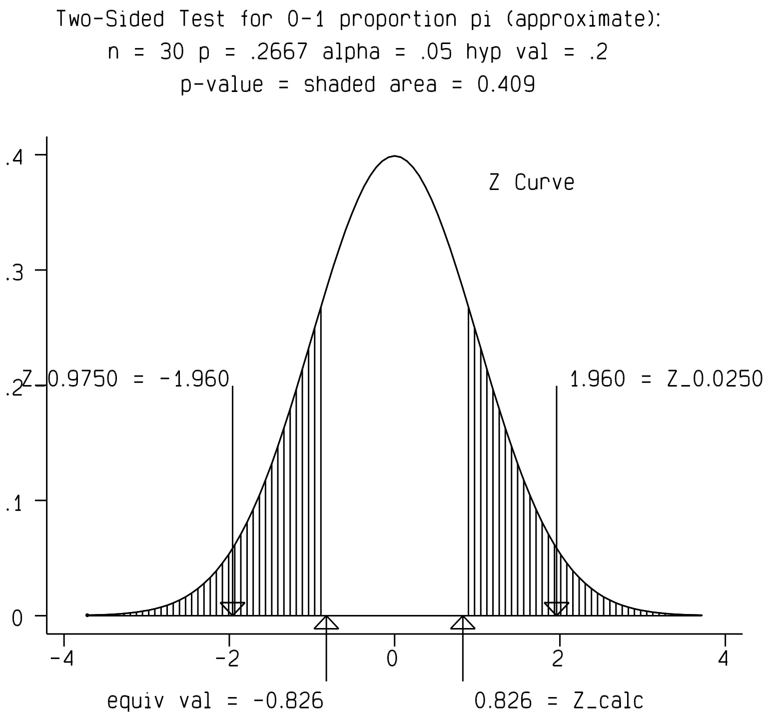


Figure 4: