EXPERIMENTAL STATISTICS 7005 Initials _____
March 18, 1999 Exam 2 All sections : Geaghan

Read Carefully. Give an answer in the form of a number or numeric expression where possible. Show all calculations for possible partial credit. Us a value of 0.05 for α if not specified. t-tables, Chi square tables and F tables are provided separately. You may keep these tables.

1) 3 points – The Power of a statistical test is ... (circle the ONE best answer below).

a) The probability of erroneously rejecting the null hypothesis.

b) The probability of detecting a difference when a difference exists.

c) The probability of failing to detect a difference when a difference exists.

d) The probability of correctly concluding that no difference exists.

2) 3 points – Which of the following effect the power of a statistical t-test to detect a difference between two means? (circle the one best answer).

a) The sample size.

b) The actual size of the difference being tested.

c) The level of α chosen.

d) All of the above influence power.

3) 10 points – For each question below, circle all that apply.

a) Which of the following have an expected value of 1 (i.e. center on one).

t-test z test F test χ^2 test none of these

b) Which of the following have an expected value of 0 (i.e. center on zero).

t-test z test F test χ^2 test none of these

c) Which of the following have an expected value of n (i.e. center on the sample size).

t-test z test F test χ^2 test none of these

d) Which of the following are used to test means against hypothesized values.

t-test z test F test χ^2 test none of these

e) Which of the following are used to test variances against hypothesized values.

t-test z test F test χ^2 test none of these

4) 21 points – Complete the following questions for the t distribution.

a) $P(t \leq -1.725) =$ d.f. = 20 P value = _____

b) $P(t \geq -1.310) =$ d.f. = 30 P value = _____

c) $P(|t| \leq 2.947) =$ d.f. = 15 P value = _____

d) $P(t \leq t_0) = 0.250$ d.f. = 1 t_0 = _____

e) $P(t \geq t_0) = 0.100$ d.f. = 10 t_0 = _____

f) $P(|t| \leq t_0) = 0.900$ d.f. = 10 t_0 = _____

g) $P(|t| \geq t_0) = 0.500$ d.f. = 5 t_0 = _____

5) 18 points – Complete the following questions for the distribution indicated.

a) $P(\chi^2 \geq 23.209) =$? d.f. = 10 P value = _____

b) $P(\chi^2 \leq 34.382) =$? d.f. = 25 P value = _____

c) $P(\chi^2 \leq 3.940) =$? d.f. = 10 P value = _____

d) $P(\chi^2 \leq \chi^2_0) = 0.75$ d.f. = 10 χ^2_0 = _____

e) $P(\chi^2 \geq \chi^2_0) = 0.25$ d.f. = 1 χ^2_0 = _____

f) $P(0.1026 \leq \chi^2 \leq 5.9915) =$? d.f. = 2 P value = _____

6) 15 points – Complete the following questions for the distribution indicated.

a) P(F < 0.0254) = ? γ_{num} , γ_{den} **= 2, 8** **P value = _____**

b) P(F > 10.044) = ? γ_{num} , γ_{den} **= 2, 10** **P value = _____**

c) P(F < F_0) = 0.05 γ_{num} , γ_{den} **= 5, 10** F_0**=_____**

d) P(F > F_0) = 0.05 γ_{num} , γ_{den} **= 2, 3** F_0**= _____**

e) P(0.1924 < F < 3.173) = ? γ_{num} , γ_{den} **= 8, 30** **P value = _____**

7) 16 points – Complete the following questions for confidence intervals. All intervals are symmetric

a) P(Y_1 < μ < Y_2) = 0.80 $\overline{Y}$ **= 30,** S^2 **=144, n = 16** Y_1 **= _____ ,** Y_2 **= _____**

b) P(48.84 < $\mu_{\overline{Y}}$ < 51.16) = ? $\overline{Y}$ **= 50,** S^2 **= 81, n = 21** **P value = _____**

c) P(Y_1 < $\mu_{\overline{Y}}$ < Y_2) = 0.990 $\overline{Y}$ **= 50,** S^2 **= 81, n = 31** Y_1 **= _____ ,** Y_2 **= _____**

d) P($\chi_1^2 < \chi^2 < \chi_2^2$ **) = 0.900** $\overline{Y}$ **= 44,** S^2 **= 36, n = 21** χ_1^2 **= _____ ,** χ_2^2 **= _____**

8) 8 points – A student in Textiles wants to test the hypothesis that "a stitch in time saves nine". She purchases 12 blouses and labels them blouse 1 through blouse 12. She then makes a one inch cut on both sleeves (left and right). One of the stitches is randomly chosen for repair, and the number of stitches needed for repair is counted and recorded for each blouse. The mean number of stitches required (estimate of μ_1) was 15. Each blouse is then used and washed 8 times, and the second cut is repaired, and the number of stitches recorded for each blouse. The mean number of stitches required for repair (estimate of μ_2) turned out to be 22. The null hypothesis to be tested is $H_0: \mu_2 - \mu_1 = 9$.

What would be the best (most powerful) analysis for this experiment? Circle the one best answer.

two sample t-test paired t-test two sample z-test Chi square test

State the alternative hypothesis : H_1: = _____

State the critical value of the test statistic : _____

9) 6 points — The two questions on the last page refer to the analysis below. The variables are the number of flowers on azalea plants which have been treated with one of two fertilizers (A and B). There are 64 plants in each group. The objective is to determine if one of the fertilizers results in a greater number of flowers per plant.

```
The SAS System

TTEST PROCEDURE

Variable: Y

GROUP       N          Mean       Std Dev     Std Error       Minimum       Maximum
-------------------------------------------------------------------------------
A          64  24.66078125   4.26417647   0.53302206  15.83000000  32.40000000
B          64  27.85218750   2.26426797   0.28303350  24.10000000  34.57000000

Variances        T       DF    Prob>|T|
-----------------------------------
Unequal    -5.2881     95.9      0.0001
Equal      -5.2881    126.0      0.0000

For HO: Variances are equal, F' = 3.55    DF = (63,63)    Prob>F' = 0.0000
```

a) Which of the two tests should the investigator use? How can you determine which test to use? Give the P value for this decision and state your conclusion.

Which test should be used (circle one): Unequal Equal

P value = _____

Briefly explain why you chose the answer above.

b) What are the results of the study? Do the two fertilizers produce a different mean number of flowers per plant? What is the P value for this test.

What is the conclusion for this experiment (circle one): Accept Ho Reject Ho

P value = _____

Briefly explain your conclusion.