PLSC 724 - PRACTICE TEST ONE

1. Discuss briefly the relationship between the shape of the normal curve and the variance.

2. What is the relationship between a statistic and a parameter?

3. How is the α level related to the probability of a type 1 error?

4. The most common levels of significance used in statistical tests are the 5% and 1% levels. Why are levels such as 0.1% or 0.01% not used?

5. Changing α from .05 to .01 causes β to a) remain the same, b) increase, or c) decrease (choose the correct answer).

6. From the standpoint of types of error, what is β?

7. List two ways in which β can be reduced?

8. What is meant by the `power of the test` (in addition to being equal to 1 - β)?

9. How can the power of the test be increased, while keeping α constant?

10. List two of the first three considerations to be made in planning an experiment.

11. Assume you are going to test five different feed rations on fattening steers. You put four steers in each of twenty pens. Four repetitions of each ration are assigned to the twenty pens at random. a) Define an experimental unit; b) what, specifically, is an experimental unit in the above illustration? How many experimental units are there? c) What are the degrees of freedom for the sources of variation other than treatments? d) What is the numerical value for the denominator when calculating the standard error of a difference between two means?

12. A pharmaceutical company manufactures a pill that is said to contain 50 mg of a certain compound, together with some non-medical carrier to make it taste good. From a statistical standpoint, what does the number 50 represent?

13. Assume you have seven tractors and you want to measure differences in gas consumption while pulling a plow through soil for a specified distance. What are the experimental units?

14. Choose a subject matter area with which you are familiar and illustrate what an experimental unit is.

15. Experiments can be placed into three categories (or types), name them.

16. List one means of `error control`.

17. What are two functions of replication?

18. What is the main reason most people do not use more replicates than they do?

19. In replicated experiments, we attempt to maximize the available variation (among, within) the replicates (choose one).

20. In field experiments, what is considered to be the best shape for the replicates?

21. What effect does the number of replicates have on the standard error of a mean?

22. Define experimental error.

23. Define sampling error.

24. Let t = 2 and r = 3 in a CRD. Illustrate precisely what contributes to experimental error.

25. What is the function of randomization?

26. Show and tell how to randomize a CRD where t = 4 and r = 3. If you planned to take two samples per experimental units, how would this affect the randomization procedure?

27. Assume you have a CRD with sampling. Show, using the `dot` notation, symbols for a) the grand total, and b) a treatment total.
28. Using the following five numbers: 2, 5, 7, 7, 9, compute the variance of a mean.

29. Assume you are comparing two treatments with a paired comparison test. Which of the following sets of hypotheses are valid? There may be more than one answer.

a) null hypothesis: $\mu 1 = \mu 2 + 10$
alternate hypothesis: $\mu 1$ does not equal $\mu 2$
b) null hypothesis: $\mu 1 =$ or $> \mu 2$
alternate hypothesis: $\mu 1 < \mu 2$
c) null hypothesis: $\mu 1 = \mu 2$
alternate hypothesis: $\mu 1$ does not equal $\mu 2$
d) null hypothesis: $\mu 1 = \mu 2$
alternate hypothesis: $\mu 1$ minus $\mu 2$ does not equal 0

30. It is hypothesized that treatment A will `yield` 10 units more than treatment B. If you are to test this hypothesis against the alternative that trt. A exceeds trt. B by more than 10 units, what should you have for the null and alternate hypothesis?

31. Given that $\bar{Y}_1 =$ 16 and = 22, $\bar{Y}_2 =$ and the *LSD* =7.3, should you accept or reject the null hypothesis of no difference between means?

32. If $\bar{Y}_1 = 30$ and $\bar{Y}_2 = 52$, should the null hypothesis of $\mu_1 + 15 = \mu_2$ be accepted or rejected if tabular `t`= 2.06 and $s_{\bar{Y}_1} - s_{\bar{Y}_2} = 4$?

33. What is the formula for the least significant difference?

34. What is the basic difference between the LSD and Tukey's test?

35. Given the following data, calculate the standard error of a difference (i.e. $s_{\bar{Y}_1} - s_{\bar{Y}_2}$) between treatment means.

SOV	df	SS
Treatments	4	2304
Experimental Error	15	960
Sampling Error	20	320

36. If you were to calculate the LSD from data in problem 35, how many degrees of freedom would the tabular `*t*` have?

37. Assume you are using the *F*-test to compare treatment mean square with error mean square. Is this a one or two tailed *F*-test?

38. Under what two conditions is the CRD most appropriate?

39. Assume you have six weed control chemicals to evaluate on one variety of wheat under field conditions at Fargo. What would be the most important point to consider relative to possible uses of the CRD?

40. Write the linear model for an individual observation and define each term, for a CRD with sampling.

41. In a CRD, what is the formula for the standard error of a difference between two treatment means when $r_i \neq r_j$.

42. Given a CRD with 5 treatment, 3 repetitions of each treatment and 3 samples within each experimental unit,
   a) How many degrees of freedom are there for experimental error?

   b) How many degrees of freedom are there for sampling error?
   c) How many experimental units are there?

   d) What is the numerical value of the denominator when calculating the variance of the difference between two means (i.e. $s^2_{\bar{Y}_1} - s^2_{\bar{Y}_2}$)?
   e) What, precisely, contributes to `sampling error sum of squares`?`
43. Assume you have a CRD with 5 treatments. Each treatment is repeated 4 times and there are two samples per experimental unit. How many degrees of freedom are there for sampling error? When you compute the standard error of a difference between two means ($s_{\bar{Y}_1} - s_{\bar{Y}_2}$), what is the numerical value for the denominator?

44. Complete the following ANOVA table, given that t = 5, r = 4, and s = 3.

SOV	df	SS	MS	*F*
Treatment		600	150	
Experimental Error		750		
Sampling Error		900		

45. The data in the following table represents a CRD. Show how you would compute treatment sums of squares.

Treatment 1	Treatment 2	Treatment 3
80	51	29
69	59	37
74	43	26
83		33
		40
306	153	165

y.. = 624

46. Compute an estimate of T_3 from question 45.

47. Compute an estimate of ε_{33} from question 45.

48. How many degrees of freedom are there for experimental error in question 45.

49. Given the error sum of square in question 45 is 375, compute the standard error of the difference between two means (i.e. $s_{\bar{Y}_1} - s_{\bar{Y}_2}$) appropriate for use in computing an LSD to compare treatments 2 and 3.

50. From the following analysis of variance table, compute the variance of the mean (. $s_{\bar{Y}_1}$) and the variance of the difference between two means (i.e. $s^2_{\bar{Y}_1} - s^2_{\bar{Y}_2}$). Which one is used in computing the LSD?

SOV	df	SS
Treatments	4	2800
Experimental Error	15	3600
Sampling Error	40	4800

51. How many experimental units are there in problem 50?

52. Write the linear additive model appropriate for question 50.

53. Tell what gives rise to the experimental error sum of squares in question 50.

54. Show symbolically how to compute treatment sums of squares when each treatment is repeated the same number of times and when treatments are repeated unequally.

55. Given the treatment totals shown below, fill in the squares so that experimental error sum of squares =0.

t 1	t 2	t 3	t 4	t 5
36	18	23	34	42

56. Using information from question 55, calculate an estimate of τ_3.

57. Given that estimates of τ_1 thru τ_4 are 12, -6, 5, and -4, respectively, what is the estimate for τ_5?

58. Given that $\bar{Y}_{..} = 22$, $\tau 2 = 8$, and $\varepsilon_{23} = -3$, what is the numerical value of Y_{23}?

59. Discuss briefly the relationship between the shape of the normal curve and the variance.

60. Given that $\sigma_1^2 = 12$ and $\sigma_2^2 = 16$, which population would have the flattest normal distribution? Which would have the greatest range?

61. What is the relationship between a statistic and a parameter?

62. List three measures of central tendency and define or illustrate each.

63. Which measure of central tendency provides a minimum sum of squares?

64. What is the best measure of dispersion?

65. Explain why the Studentized Range Statistic value used in calculating the T_α value for Tukey's test increases as p (the number of treatments) increases.

66. An experiment was conducted using a CRD and the experimental error sum of square was 1.75. Given the following data and assuming the *F*-test on treatments was significant, indicate which treatment means are significantly different at the 95% level of confidence using lower case letters.

Treatment	n	Mean
A	5	2.3
B	7	2.7
C	5	2.9

67. Given the following data

SOV	df	SS	MS
Treatment	5	232.1	46.402
Experimental Error	12	15.2	1.267
Sampling Error	54	30.5	0.565
Total	71	277.8	

a. How many experimental units are there in this experiment?
b. Determine if there are significant differences between treatments at the 95% and 99% level of confidence using the appropriate *F*-test.
c. Calculate the CV for this experiment assuming Y...=434.

68. How is the precision of an experiment measured?

69. How can the precision of an experiment be increased?

70. Explain how the choice of experimental error can affect experimental error.

71. Why is the LSD value we calculate referred to as Fisher's-protected LSD?

72. What is the purpose of replication?