

Your name: _____

Your lab time (Circle one): 8:00 10:00 12:00

This is a 50-minute open-book, open-notes test. Show work where appropriate.

(3 points each) Write the letter from the list below that best matches the description. (Letters may be used more than once.)

1. _____ The estimated standard deviation of a statistic's sampling distribution.
2. _____ The distance, in standard errors, between an estimate and a hypothesized parameter value.
3. _____ The distance, in standard errors, between an estimate and the parameter it estimates.
4. _____ The distribution of values of a statistic over all possible randomizations.
5. _____ The distribution of values of a statistic over all possible random samples.
6. _____ The name of the permutation distribution when applied to a randomized experiment.
7. _____ The distribution used to approximate the randomization distribution of the t-ratio.
8. _____ The proportion of t-ratios, from all possible samples, that are as extreme or more extreme than the t-statistic.
9. _____ The normal distribution with mean zero and standard deviation one.
10. _____ The set of all possible parameter values that, when tested, lead to 2-sided p-values greater than or equal to .05.

- | | | |
|----------------------------------|-------------------------------|---------------------------------|
| A. 95% confidence interval | H. randomization distribution | O. standard normal distribution |
| B. confounding variable | I. randomization test | P. t distribution |
| C. p-value | J. resistant | Q. t-ratio |
| D. permutation distribution | K. robust | R. t-statistic |
| E. population distribution | L. sample standard deviation | S. two-sample t-test |
| F. population standard deviation | M. sampling distribution | T. variance |
| G. population variance | N. standard error | U. z-statistic |

11. **(2 points) True or False.** It is important to evaluate distributional shapes and spreads when applying the two-sample t-test in practice.

A. TRUE

B. FALSE

12. **(2 points) True or False.** A statistical computer program like S-PLUS will print the two-sample t-test results for comparing two columns of data, if asked to, even if the distributions are extremely non-normal and the spreads are extremely unequal.

A. TRUE

B. FALSE

13. **(3 points)** Calculate the rank-sum statistic from the following two groups of numbers. Show work. Circle your answer.

group 1: 5, 7, 19

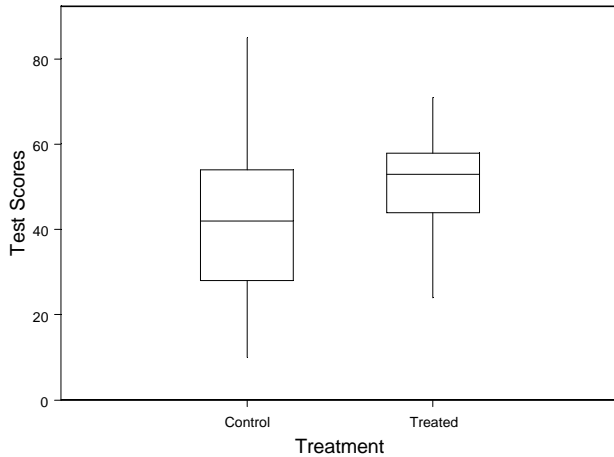
group 2: 1, 5, 3

14. **(3 points)** From the following statistics on two groups, calculate the pooled estimate of variance. Show work; circle answer.

group 1: $n_1 = 16$, $\bar{Y}_1 = 20$, $s_1^2 = 25$

group 2: $n_2 = 207$, $\bar{Y}_2 = 35$, $s_2^2 = 49$

(3 points each) An educator arranged for a third grade class of 21 students to follow a new method of reading instruction; and a different third grade class of 23 students to follow the standard (“control”) method. At the end of 8 weeks all students took a reading test. The scores for the 21 “treated” children and the 23 “control” children were compared.



Some numerical results:

Standard Two-Sample t-Test

$$t = 2.2666, df = 42,$$

$$2\text{-sided } p\text{-value} = 0.0286$$

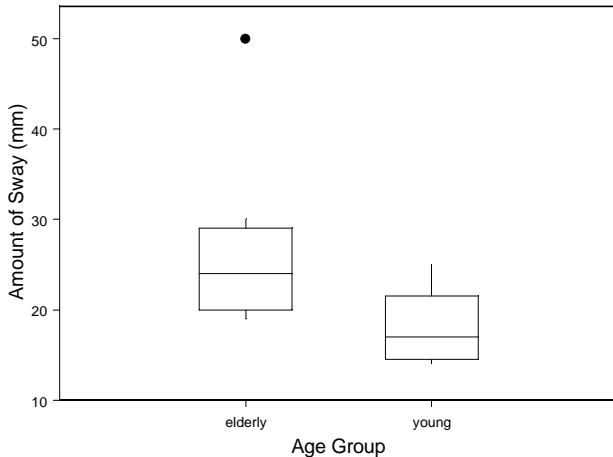
95 percent confidence interval:

$$1.09 \text{ to } 18.82$$

Circle the numbers of all the following statements that are TRUE

15. The t-tools on the log transformed scores would probably be more appropriate.
16. The study was a randomized experiment.
17. One should be concerned about the possibility of confounding variables in this experiment.
18. There is moderate evidence that the differences in reading scores in the two class rooms is greater than can be explained by chance (two-sided p-value = .0286).
19. There is moderate evidence that the new teaching method causes children to have higher reading test scores (two-sided p-value = .0286).
20. A one-sided p-value from the two-sample t-test for treatment effect is .0143.
21. For testing the hypothesis: $\mu_{\text{treated}} - \mu_{\text{control}} = 10$ points, the 2-sided p-value is less than .05.
22. A 99% confidence interval for $\mu_{\text{treated}} - \mu_{\text{control}}$ includes 18.5.
23. The difference in averages, $\bar{Y}_{\text{treated}} - \bar{Y}_{\text{control}}$, is 9.955
24. More than 75% of the treated class children scored higher than 40.

(3 points each) Each of 9 elderly and 8 young subjects stood barefoot on a special platform and was asked to maintain a stable upright position while concentrating on a task. To judge the person's balance, the platform measured how much the individual swayed (in millimeters) in reaction to a noise.



Some Numerical Results:

Standard Two-Sample t-Test

$t = 2.20$, $df = 15$, 2-sided p -value = 0.044
95 percent confidence interval: 0.28 16.15

Standard Two-Sample t-Test on Log Sway

$t = 2.63$, $df = 15$, 2-sided p -value = 0.019
95 percent confidence interval: 0.066
0.628

Wilcoxon rank-sum test

rank-sum normal statistic with correction is
 $Z = 2.17$, 2-sided p -value = 0.030

Circle the numbers of all the following statements that are TRUE

25. This is a randomized experiment
26. The rank-sum corrected Z-statistic is the same whether sway amounts are logged or not.
27. If the results of the two-sample t-test change when the “outlier” in the elderly group is removed, then that observation should be removed from the data set.
28. If the value for the outlier in the elderly group is changed from 50 to 100, the resulting Wilcoxon rank-sum p-value will be smaller than .030.
29. The two-sided p-value from the Wilcoxon rank-sum test will be smaller than .030 if the continuity correction is not used.
30. Assuming the subjects are representative of some “elderly” and “young” populations, we may conclude with 95% confidence that the median sway for the elderly population is between 7% to 87% greater than the median sway for the young population.
31. Although the study results do not prove that being older *causes* poorer balance (more sway), they are consistent with that theory.
32. The median sway for the elderly group is about 29 or 30 mm.
33. If sway was measured in centimeters rather than millimeters, the p-value from the t-test would be the same.
34. If sway was measured in centimeters rather than millimeters, the confidence interval for ratio of medians (based on the log-transformed measurements) would be the same.