**Multiple Choice/Fill in the Blank**

1. Please select which of the following tests

Unpaired t-test, paired t-test, Welch’s t test, z test, chi-square test, one-way ANOVA, two-way ANOVA, MANOVA, ANCOVA, Wilcoxon-Mann-Whitney test, Kruskal-Wallis test, univariate linear regression, multiple linear regression, generalized linear model (GLM), resampling

is most appropriate for the following situations. Please only list one test per scenario. Please chose the test that is simpler test if multiple options are suitable (?), e.g. if you could use t-test, chose t-test instead of resampling. You can use each test more than once (16 points).

1. You want to see whether the number of birds seen last year in cities in Michigan is different than the number of birds seen last year in cities in Ohio. Your dependent variable is normally distributed and has equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. You want to see whether the number of birds seen last year in cities in Michigan is different than the number of birds seen last year in cities in Ohio. Your dependent variable is normally distributed but does not have equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. You want to see whether the number of birds seen last year in cities in Michigan is different than the number of birds seen last year in cities in Ohio. Your dependent variable is not normally distributed, your sample size is 100, and you do not have equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. You want to see whether the number of birds seen last year in cities in Michigan is different than the number of birds seen last year in cities in Ohio. Your dependent variable is not normally distributed, your sample size is 20, and you have equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. You want to see whether the number of birds seen last March 2016 in cities in Michigan is different than the number of birds seen in the same cities in March 2017 in Michigan. Your dependent variable is normally distributed and has equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. You want to see whether the number of birds seen last year in different cities is different across Michigan, Indiana, Ohio, and Wisconsin. Your dependent variable is normally distributed and has equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. You want to see whether the number of birds seen last year in different cities is different across Michigan, Indiana, Ohio, and Wisconsin. Your dependent variable is normally distributed and the variance of the data in Indiana is 2x larger than the variance of data from the other states and sample size is equal across states. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. You want to see whether the number of birds seen last year in different cities is different across Michigan, Indiana, Ohio, and Wisconsin. Your dependent variable is not normally distributed, your sample size is 1000, and has equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. You want to see whether the beak length of birds is associated with the wing length and the weight of birds that you saw across all of the Midwest (independent of state). Your data are normally distributed. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. You want to see whether the beak length of birds is associated with wing length, the weight of birds, and the state the bird was found in (e.g. MI, IN, OH, or WI). Your data are normally distributed. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. You want to see whether the beak length of birds is associated with the wing length of birds across all of the Midwest (independent of state). Your data are normally distributed. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. You want to see whether there is an association between whether the bird was female or male depending on beak length, wing length, and weight of the bird across all of the Midwest (independent of state) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. You want to see whether there is an association between whether the bird was female or male depending on beak length, wing length, the weight of the bird, and the state the bird was found in (e.g. MI, IN, OH, or WI). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. You want to see if the color of the birds that you saw is statistically associated with the state that it was found in (e.g. Michigan, Indiana, Ohio, and Wisconsin). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
15. You want to see whether the number of birds, squirrels, and deer seen last year in different cities is different across Michigan, Indiana, Ohio, and Wisconsin. Your dependent variables are normally distributed and have equal variance. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
16. You want to see whether the number of birds you see in different parks is associated with the area of the park (in ha), the density of trees in each park (# trees/m2), and the distance of each park to the nearest major highway (km). Your data are not normally distributed and are skewed with lots of values ranging between 0 to 10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
17. Please match which assumptions go with each of the following tests. You may put more than 1 assumption with each test and you may reuse the assumptions across multiple tests (20 points).
18. Observations are independent
19. The dependent variable is normally distributed or the sample size is > 30
20. There is equal variance across the groups that comprise your independent variable
21. The variance is either equal across groups or does not differ by more than 3x the variance of the smallest group and sample size is equal across groups
22. Sample size across your groups is equal
23. There is a linear relationship between your independent and dependent variables, though this assumption can be relaxed by altering your x variable (e.g. quadratic)
24. The errors of your model are independent (or you can correct for this using certain procedures)
25. The errors of your model are homoscedastic (or you can correct for this using certain procedures)
26. Your dependent variable is normally distributed suggesting normal errors
27. The errors of your model are normally distributed
28. t test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
29. welch’s t test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
30. paired t test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
31. chi square test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
32. one-way ANOVA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
33. two-way ANOVA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
34. Wilcoxon Mann Whitney test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
35. Linear regression \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
36. Multiple linear regression \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
37. Generalized linear model (GLM) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Open-ended Questions**

1. Say that you are interested in designing a study to examine the impact of increased biodiversity (e.g. species of plants) on ecosystem functioning (e.g. biomass production) across the 9 climate zones of the United States. How would you design an experimental study to test this? How would you design an observational study? Please address the following in each of your answers: (1) sampling strategy, (2) sample size and power, (3) ways to reduce the effect of confounding factors, and (4) whether you would need to use fixed or random effects. You can use the front and back of this page if you’d like (but we’d prefer succinct answers!). 8 points total (4 for experimental, 4 for observational). Please use the headings ‘Experimental’ and ‘Observational’ before associated text.