

Stat 401, Section F Homework 5
Due Date: Wednesday, September 26

1. In a series of experiments on a certain virus (mengovirus), a microbiologist measured the growth of two strains of the virus—a mutant strain and a nonmutant strain—on mouse cells in petri dishes. Replicate experiments were run on 19 different days. The data are shown below. Each number represents the total growth in 24 hours of the viruses in a single dish. The researchers are interested whether the growth in the mutant strain was larger than the growth in the nonmutant strain.

Run	Nonmutant	Mutant	Run	Nonmutant	Mutant
1	160	97	11	61	15
2	36	55	12	14	10
3	82	31	13	140	150
4	100	95	14	68	44
5	140	80	15	110	31
6	73	110	16	37	14
7	110	100	17	95	57
8	180	100	18	64	70
9	62	6	19	58	45
10	43	7			

- (a) Is this a paired experiment? Why or why not?
- (b) Would a paired t -test be appropriate for this situation? Clearly explain why or why not.
- (c) Regardless of your answer in part (a), perform (by hand) a signed-rank test to assess whether the growth in the mutant strain is larger than the growth in the nonmutant strain. Use the appropriate statistical table to obtain the p -value for your test. Show all your work and clearly state your conclusions.
- (d) Use `proc univariate` in SAS to obtain the exact p -value for your test. A text file with the data set is posted on the web site as `Mutant.txt`. Include only the relevant part of the SAS output in your HW. How does this compare to the value you found above using the appropriate approximation/table?
2. Chemotherapy for cancer often produces nausea and vomiting. The effectiveness of THC (the active ingredient of marijuana) in preventing these side effects was compared with the standard drug Compazine. Of the 46 patients who tried both drugs (but were not told which was which), 21 expressed no preference, while 20 preferred THC and 5 preferred Compazine.
- (a) Would you be able to perform a t -test to decide on the effectiveness of THC? Why or why not?
- (b) Perform (by hand) a sign test and clearly explain your conclusions.

3. Use SAS or **R** to conduct a Wilcoxon rank-sum test for the Bumpus data on the humerus lengths of sparrows that died or survived a winter storm. The data set is described on pages 29 and 30 in your textbook.
- Provide a two-sided p -value based on a normal approximation. In SAS you can use `proc npar1way wilcoxon`. Do NOT ask SAS to compute an exact p -value (i.e. don't use the line `exact wilcoxon`; in your SAS code); it takes way too long and might cause your computer to crash. In **R**, use the function `wilcox.test`. Clearly show your work, include only the relevant computer output in your HW, and don't forget to state your conclusions.
 - How does your conclusion above compare to the one on page 29 of the text? Did you expect the two conclusions to agree? Why or why not?
4. Soil respiration is a measure of microbial activity in soil, which affects plant growth. In one study, soil cores were taken from two locations in a forest: (1) under an opening in the forest canopy (the "gap" location) and (2) at a nearby area under heavy tree growth (the "growth" location). The amount of carbon dioxide given off by each soil core was measured (in mol CO₂/g soil/hr) and shown in the table below. Does the data suggest that the distribution of the microbial activity is different between the two locations? Show all your work, state meaningful conclusions and give the reasons behind the choice of the method used to answer this question.

Growth				Gap				
17	20	170	315	22	29	13	16	
22	190	64		15	18	14	6	