MTH 324, Homework #7, Fall 2022 Name _____

Instructions: Show work or attach R code used to perform calculations (or any other technology used). Be sure to answer all parts of each problem as completely as possible, and attach work to this cover sheet with a staple.

1. A random sample of 15 automobile mechanics certified to work on a certain type of car was selected, and the time (in minutes) necessary for each one to diagnose a particular problem was determined, resulting in the following data.

30.6	30.1	15.6	26.7	27.1	25.4	35.0	30.8
31.9	53.2	12.5	23.2	8.8	24.9	30.2	

Use the Wilcoxon test at significance level 0.10 to decide whether the data suggests that true average diagnostic time is less than 30 minutes.

2. Both a gravimetric and a spectrophotometric method are under consideration for determining phosphate content of a particular material. Twelve samples of the material are obtained, each is split in half, and a determination is made on each half using one of the two methods, resulting in the following data.

Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gravimetric	54.7	58.5	66.8	46.1	52.3	74.3	92.5	40.2	87.3	74.8	63.2	68.5
Spectrophotometric	55.0	55.7	62.9	45.5	51.1	75.4	89.6	38.4	86.8	72.5	62.3	66.0

Use the Wilcoxon test to decide whether one technique gives on average a different value than the other technique for this type of material.

3. The accompanying data resulted from an experiment to compare the effects of vitamin C in orange juice and in synthetic ascorbic acid on the length of odontoblasts in the guinea pigs over a 6-week period. Use the Wilcoxon rank-sum test at a level of 0.01 to decide whether true average length differs for the two types of Vitamin C. Also compute an appropriate P-value.

Orange Juice	**8.2**	**9.4**	**9.6**	**9.7**	**10.0**	**14.5**	**15.2**	**16.1**	**17.6**	**21.5**
Ascorbic Acid	4.2	5.2	5.8	6.4	7.0	7.3	10.1	11.2	11.3	11.5

4. An experiment was carried out to compare the abilities of two different solvents to extract creosote impregnated in test logs. Each of eight logs was divided into two segments and then one segment was randomly selected for application of the first solvent, with the other segment receiving the second solvent.

Log	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Solvent 1	3.92	3.79	3.70	4.08	3.87	3.95	3.55	3.76
Solvent 2	4.25	4.20	4.41	3.89	4.39	3.75	4.20	3.90

Calculate a confidence interval using a confidence level of roughly 95% for the difference between the true average amount extracted using the first solvent and the true average amount extracted using the second solvent.

5. The accompanying data refers to concentration of the radioactive isotope strontium-90 in milk samples obtained from five randomly selected dairies in each of 4 different regions.

Region	**1**	6.4	5.8	6.5	7.7	6.1
	2	7.1	9.9	11.2	10.5	8.8
	3	5.7	5.9	8.2	6.6	5.1
	4	9.5	12.1	10.3	12.4	11.7

Test at level 0.10 to see whether true average strontium-90 concentration different for at least two of the regions. (Use Friedman's ANOVA.)

6. In a test to determine whether soil pretreated with small amounts of Basic-H (a Shaklee product) makes the soil more permeable to water, soil samples were divided into blocks, and each block received each of 4 treatments under study. The treatments were (A) water with 0.001% Basic-H flooded on control soil, (B) water without Basic-H on control soil, (C) water with Basic-H flooded on soil pretreated with Basic-H, and (D) water without Basic-H flooded on soil pretreated with Basic-H. Test at level 0.01 to see whether there are any effects due to the different treatments. (Use Friedman's ANOVA.)

BLOCKS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	37.1	31.8	28.0	25.9	25.5	25.3	23.7	24.4	21.7	26.2
B	33.2	25.3	20.2	20.3	18.3	19.3	17.3	17.0	16.7	18.3
C	58.9	54.2	49.2	47.9	38.2	48.8	47.8	40.2	44.0	46.4
D	56.7	49.6	46.4	40.9	39.4	37.1	37.5	39.6	35.1	36.5