

Assignment #4

Due: **Wednesday, November 19th at 12pm in the box marked Stat 333 inside room MS 315.**

Assignments will not be accepted if they are passed in after this time.

Assignments must be understandable (logically correct as well as legible).

Marks will be deducted if the assignment does not have a cover page with your name, and pages that are stapled!

1. A group of twelve patients are treated using pacemaker therapy and their Health Related Quality of Life (HRQL) is measured again six months later. The baseline (before pacemaker therapy) and 6 month values of overall perception of health are presented below. Examine whether there is a difference in HRQL six months after pacemaker implantation. Make sure that you examine your data graphically to make sure that all the underlying assumptions of your test are met. Set up the appropriate test. Make sure to include graphs and reasoning.

ID	Baseline	Six months
1	40	36
2	45	49
3	50	53
4	60	58
5	40	50
6	75	76
7	70	66
8	70	69
9	65	61
10	67	65
11	65	71
12	59	58

2. In the fetus, there is a connection between the aorta and the artery going to the lungs called the ductus arteriosus that permits the heart to bypass the nonfunctioning lungs and circulate blood to the placenta to obtain oxygen and nourishment and dispose of waste. After the infant is born and begins breathing, these functions are served by the lungs and the ductus arteriosus closes. Occasionally, especially in the premature infants the ductus arteriosus remains open and shunts blood around the lung. This shunting prevents the infant from getting rid of the carbon dioxide and taking on oxygen. A study was designed to test whether the drug indomethacin was superior to placebo in treating this condition. It is very likely that the outcome (with or without drugs) depend on gestational age, age after birth fluid intake, other illnesses, and other drugs the infant is receiving. For these reasons, the investigators decided to pair infants who are as alike as possible in each of these identified variables, and randomly treat one member of the pair with indomethacin and the other with placebo, then judge the results as improved or not. If they looked at the placebo group and then looked at the treatment group, 27 improved with the treatment group and 13 did not improve given the treatment. Is the drug superior to the placebo?
3. When labor has to be induced, the mother's cervix can fail to soften and enlarge, prolonging the labor and perhaps requiring delivery by cesarean. A study was designed to investigate whether the cervix can be softened and dilated by treating it with a gel containing prostaglandin E_2 . The investigators randomly applied this gel to the cervixes of 21 women who were having labor induced and a placebo gel to another 21 women who were having labor induced. The two groups of women were of similar ages, heights, weeks of gestation, and initial extent of cervical dilation before applying the gel. The labor of women treated with prostaglandin E_2 averaged 8.5 hours and the labor of control women averaged 13.9 hours. The standard deviation for these two groups were 4.7 and 4.1 hours respectively.
 - (a) Assuming that the standard deviation in the two groups are not different, is there evidence that the prostaglandin gel shortens labor?

- (b) Calculate the 95% confidence interval for the mean difference in labor between the two groups
- (c) What other assumption did you use in your analysis?
4. In a study of hypnotic suggestion, 16 male volunteers were randomly allocated to an experimental group and a control group. Each subject participated in a two-phase experimental session. In the first phase, respiration was measured while the subject was awake and at rest. In the second phase, the subject was told to imagine that he was performing muscular work, and respiration was measured again. For subjects in the experimental group, hypnosis was induced between the first and second phases; thus, the suggestion to imagine muscular work was “hypnotic suggestion” for experimental subjects and “waking suggestion” for control subjects. The accompanying table shows the measurements of total ventilation (litres of air per minute per square meter of body area) for all 16 subjects.

Experimental Group			Control Group		
Subject	Rest	Work	Subject	Rest	Work
1	5.74	6.24	9	6.21	5.50
2	6.79	9.07	10	4.50	4.64
3	5.32	7.77	11	4.86	4.61
4	7.18	16.46	12	4.78	3.78
5	5.60	6.95	13	4.79	5.41
6	6.06	8.14	14	5.70	5.32
7	6.32	11.72	15	5.41	4.54
8	6.34	8.06	16	6.08	5.98

- (a) Use a t test to compare the mean resting values in the two groups. Use a non-directional alternative and let $\alpha = 0.05$.
- (b) Use suitable paired and unpaired t tests to investigate
- the response of the experimental group to suggestion
 - The response of the control group to suggestion
 - The difference between the responses of the experimental and control groups. Use directional alternatives (suggestion increases ventilation, and hypnotic suggestion increase it more than waking suggestion)
- Let $\alpha = 0.05$ for each test performed above.
- (c) Repeat the investigations of part (b) using suitable nonparametric tests (sign and Wilcoxon-Mann-Whitney test).
- (d) Use suitable graphs to investigate the reasonableness of the normality condition underlying the t test of part (b). How does this investigation shed light on the discrepancies between the results of parts (b) and (c)?