Homework 6

In this homework you will use independent sample t-test/nonparametric tests and also get some JMP practice.

(1a) Suppose you do several independent sample t-test to compare population means. Given the information below, which test gives the smallest standard error.

  (A) The population standard deviation is 1, $m = 50$ and $n = 50$.

  (B) The population standard deviation is $\sqrt{0.5}$, $m = 40$ and $n = 40$

  (C) The population standard deviation is $\sqrt{0.5}$, $m = 40$ and $n = 60$.

  (D) The population standard deviation is 1, $m = 45$ and $n = 55$.

(b) Xuan draws 300 samples, each sample is of size 30. For each sample, Xuan constructs a 95% CI, on average how many of these confidence intervals will contain the true mean?

(2) A few years ago, a student society campaigned for people to use the stairwell in Blocker building. The society wants to investigate whether the campaign has <u>increased</u> the frequency of stairwell use.

They random interview 10 people before the campaign and then randomly a <u>different</u> 10 people after the campaign (everything is independent).

They ask each person, on average, how often in one day do they use the stairwell.

The JMP output is give below. Note that **1 = Before** the Campaign and **2 = After** the Campaign.

Before	1	1	1	1	1	1	1	1	1	1
frequency	3.277	3.48	3.036	1.217	2.753	3.4	0.79	7.8	2.981	1.779
After	2	2	2	2	2	2	2	2	2	2
frequency	3.985	3.94	5.487	5.328	2.258	3.207	2.921	3.752	5.048	4.634

  Input the data into JMP.

(i) State the null and alternative hypothesis of interest.

(ii) What are the results of the independent sample t-test at the 5% level?

(iii) What are the results of the Wilcoxon sum rank test at the 5% level?

(iv) Explain why there is a difference between the conclusions of the independent sample t-test and the Wilcoxon sum rank test.

(3) Recently, scientists investigated whether 12 weeks of blueberry concentrate supple-
mentation **improved** cognitive function in healthy older adults. Participants were
randomised to consume either 30 mL blueberry concentrate providing 387 mg antiox-
idants (22 participants) or an isoenergetic placebo (21 participants). To check for
baseline differences. At the start of the study (before either the blueberry concentrate
or placebo was taken) the participants were given various tasks. For the congnitive
test, at the **start** of the study 9 out of 22 in the blueberry group passed the test
whereas 9 out of 21 in the placebo group passed the test (the corresponding **p-value
for the difference is 55%**).

After 12 weeks the participants were given another cognitive test. At the **end** of the
study 21 out of 22 in the blueberry group passed the test whereas 11 out of 21 in
the placebo group passed the test (the corresponding **p-value for the difference is
0.107%**).

Using these results what can one conclude about the the role that Blueberries play in
cognitive function (write maximum 3 lines)?

(4) There has been some speculation that the order in which twin babies are born depends
on the size of the babies head. To see whether size of the head has an influence on the
order of the twin babies, the head size of 10 sets of twins was measured together with
the order in which they were born.

This is clearly matched data, and the difference between the first born and the second
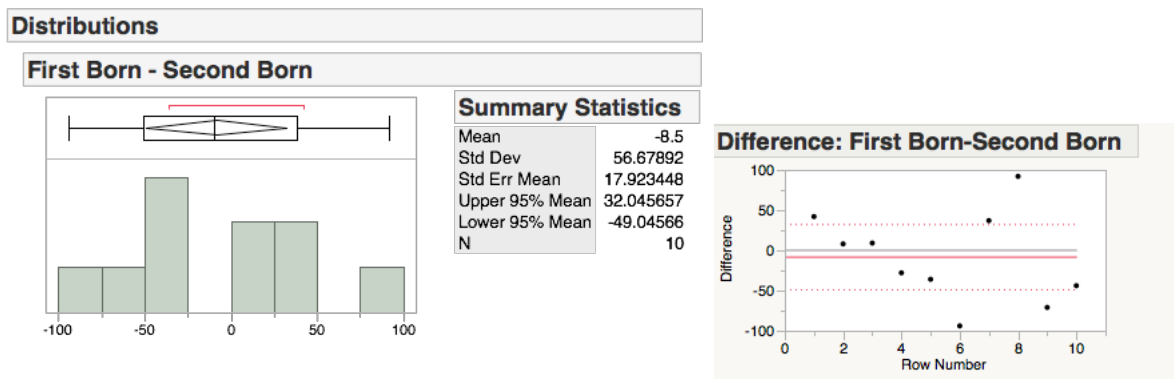born heads is measured. A summary of the differences is given below.

Figure 1: Left: Summary Statistics. Right: Plot of differenced data.

(a) Using the data, test the hypothesis
$H_0 : \mu_{First} - \mu_{Second} = 0$ vs $H_A : \mu_{First} - \mu_{Second} \neq 0$ (use the t-distribution and make
plot).