Statistics II Lab 5

Submission Instructions: Welcome to Lab 5. Upon completion, you *should upload* your **Word Document** and **Minitab Project files** to Blackboard by 11:59 PM of the due date.

Problems 100 points
Two Sample Testing Lab

- One Sample t test and t Interval

- Two Sample - Unpaired t tests and t Intervals

In this Lab you will learn to:

- Construct hypotheses for all of the above tests.

- Interpret the results of all of the above tests using both CI's and p-values.

  If the data can be assumed to be Normally distributed, we will perform parametric tests and construct parametric confidence intervals.

  Parametric tests assume that the data is normally distributed and use the mean as the measure of location and standard deviation (vairance) as the measure of spread.

Answer the following questions using Minitab. Copy your results to a Word document with the questions stated clearly using statistical symbols where necessary. Also provide explanations as needed.

1. **Exercises**

   (a) Perform the appropriate statistical test to formally answer the questions in this Lab. In each case,
      i. you should verify that the data is Normally distributed.
      ii. whether the test is one sample or two sample?
      iii. which test is appropriate?
      iv. whether the test is:
         A. one tailed - if the question specifies a direction
         B. two tailed - if the question asks if there is a difference
      v. interpret the output
         For Example:
         A. Sufficient evidence of a difference at the given Confidence Level (usually 95%) or equivalently Significance Level (5%) i.e. **Statistically significant difference**
            - if the Confidence Interval does not include zero
            - the p-value will be less than the significance level
         B. Insuffience evidence at the given Confidence Level (usually 95%) or equivalently Significance Level (5%) i.e. **Non-significant difference**
            - if the Confidence Interval does includes zero

- the p-value will be greater than the significance level

(b) Do your answers tie in with your subjective impressions?

2. **Questions**

By the end of this Lab: Make sure that you are confident with:

- Getting appropriate graphs and numerical summaries
- Drawing subjective impressions
- Checking whether data is normally distributed
- All the new test and confidence intervals from this lab

(a) The birth weights (kgs) of 36 babies born after normal pregnancies of 40 weeks were:

$$
\begin{array}{ccccccccc}
3.5 & 4.1 & 2.8 & 3.2 & 2.8 & 3.1 & 3.4 & 3.0 & 2.3 \\
3.8 & 2.7 & 3.7 & 3.9 & 2.6 & 2.7 & 3.1 & 2.2 & 2.9 \\
3.2 & 3.7 & 3.3 & 4.3 & 3.4 & 3.5 & 4.6 & 3.1 & 3.4 \\
3.5 & 3.5 & 3.8 & 2.4 & 3.0 & 3.6 & 4.0 & 2.9 & 3.3
\end{array}
$$

Is the mean weight different from 3.6kgs?

(b) Drug levels (in ng/ml) in blood samples from two groups of subjects gave values of:

$$
\begin{array}{llllllllll}
\text{Group 1:} & 3.3 & 3.7 & 3.5 & 4.1 & 3.4 & 3.5 & 4.0 & 3.8 & 3.2 & 3.7 \\
\text{Group 2:} & 3.2 & 3.6 & 3.1 & 3.4 & 3.0 & 3.4 & 2.8 & 3.1 & 3.3 & 3.6
\end{array}
$$

Is there a difference in the means?

(c) In an experiment to detect any relationship between the heights of Aberdonian fathers and their eldest sons, eight pairs of fathers and sons were selected at random from the city population and their exact heights recorded, in inches, as follows:

$$
\begin{array}{lcccccccc}
\text{Father's height:} & 63.1 & 74.5 & 70.4 & 72.1 & 65.9 & 67.1 & 68.8 & 66.8 \\
\text{Son's height:} & 65.6 & 67.9 & 69.6 & 70.8 & 64.5 & 68.2 & 71.5 & 63.4
\end{array}
$$

Is there a difference in height between fathers and sons?

(d) Concentrations of two drugs A and B were measured in the same subjects following equal oral doses of a drug on different days. The pairs (A,B) concentrations are $(9,9)(8,8)(4,7)(4,8)(3,5)(3,6)(3,7)(1,6)(2,2)$ ng/ml after 1 hour
Does B result in higher concentrations than A?