Homework No. 3 – Tests to look at Differences

Introduction

Hypothesis testing is an important part of inferential statistics, and one of the three categories of statistical tests defined by Dytham (2003). There are six basic steps to conducting a hypothesis test:

1. State the null hypothesis *Ho*.
2. Choose an appropriate alternative hypothesis *Ha*; keep in mind that it might be one-sided.
3. Choose a significance level of size α.
4. Select the appropriate test statistic, and establish the critical region (e.g., $t_{critical}$).
5. Compute the value of the test statistic from the sample data (e.g., $t_{calculated}$).
6. Make a decision, which can be worded two ways:
    a. reject *Ho* if the test statistic has a value in the critical region; otherwise, fail to reject *Ho.*
    b. reject *Ho* if the probability associated with the test statistic is larger than the significance level of size α.

Objectives

In this assignment you will practice conducting hypothesis tests to look at differences.

Instructions

Find the solutions to the questions on the following page using Microsoft Excel. Submit your answers in a professional memo. Also, for each question, summarize the appropriate statement or value to go with the six steps to conducting hypothesis tests.

Product

Summarize your results, including any tables or figures, in a professional memo no longer than one double-sided page. Include a very concise description of your procedure. Professionalism counts!

You must put your Lab Section on your memo and address the memo to your TA.

Due Date

This assignment is due at the beginning of class on Monday, 8 February 2010.

Questions

Unless otherwise specified, use $\alpha = 0.05$.

One: To determine safety of lake fish for consumption, an established maximum concentration of a heavy metal is set as 10 ppb. A random sample of 100 fish from sport anglers is collected, and found to have an average concentration of 10.03 ppb with a standard deviation of 0.12 ppb. Are the fish within the safety limit?

Two: In the first quarter of 2009 the mean value for sugar maple from timber sales in your management unit was $661.23 per MBF. This spring, a sample of eight timber sales showed bid prices for sugar maple were, per MBF, $757.56, $687.95, $806.65, $657.40, $666.13, $676.87, $655.00 and $673.80. Test the hypothesis that the average this year is greater than the average last year. Use $\alpha = 0.025$ and assume the population is approximately normally distributed.

Three: The Michigan DNR wants to determine if winter use of conifer stands by deer is enhanced by marking guides that favour retention of conifers. A sample of treated mixed northern hardwood stands are selected, and ten 3 m by 100 m transects are walked in each stand to count the number of groups of deer pellets found. The total number of pellets in each stand is then recorded. The data are as follows:

Treatment	*Pellet Groups*						
No retention	102	86	98	109	92		
Retention	81	165	97	134	201	87	114

Test the hypothesis that the average number of pellet groups in the retention treatment exceeds that in the no retention group by more than 10. Use $\alpha = 0.1$.

Four: A forest consultant is trying to decide between two methods for measuring tree height. The two options are clinometer plus tape reel ("manual") and an electronic hypsometer/clinometer device ("electronic") that is more expensive. Twelve field staff were asked to measure the time taken to measure the height of a sample of trees using the two methods. The time taken, in minutes per tree, was recorded as follows:

Method	***Staff Member No.***											
	1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***
manual	4.2	4.7	6.6	7.3	6.7	4.5	5.7	6.0	7.4	4.9	6.5	5.2
electronic	4.2	4.9	6.2	6.9	6.8	4.4	5.7	6.0	6.9	4.7	6.5	4.9

Using $\alpha = 0.05$, can we conclude that height measurements are faster using the electronic tool?

Five: Growth of tamarack seedlings in sterile soils is measured, where the trees are fertilized with a nutrient solution. One group receives the full nutrient mixture, and the other the mixture without molybdenum. We are interested in whether adding molybdenum results in greater growth. Test this, using $\alpha = 0.05$.

	Growth (cm/year)						
With Mo	4.5	6.2	5.8	6	7.1	6.8	7.2
Without Mo	3.2	4.5	3.8	4	3.7	3.2	4.1