# MTH 1210
# Lab 5 Hypothesis Test for a Population Mean μ.

## Part A: One-Mean t Test for a Population Mean μ.

We'll be interested in testing whether there is convincing evidence against the null hypothesis

$$H_0: \mu = \mu_0$$

when we have a random sample of size $n$ from a population whose mean and standard deviation μ and σ are *unknown*.

If $n$ is small, then the *one-mean t test* requires that the population be *normal*. If $n$ is large ($n \geq 30$), though, the $t$ test is valid even if the population isn't normal.

The ***one-mean t test statistic*** is

$$t = \frac{\bar{x} - \mu_0}{s / \sqrt{n}} \ .$$

When $H_0$ is true, $t$ follows a *t-distribution* with *n-1 d.f.*, from which p-values can be obtained as tail areas.

A study was designed to see if increased dietary calcium intake reduces blood pressure. Ten men were given a calcium supplement for 12 weeks. Blood pressure was measured both before and after the twelve-week period. The following data are the changes in blood pressure for the $n = 10$ subjects:

-7 -5 -5 -17 8 5 -1 -10 -11 2

A *negative* value means the blood pressure *decreased*. A *positive* value means it *increased*. The file **blood_pressure.mpx** contains the data shown above.

1. Open the Minitab worksheet **blood_pressure.mpx**.
2. Calculate the value of the sample mean change in blood pressure $\bar{x}$ .
3. **Please answer Question 1 on the Answer Sheet.**
4. Now carry out *one-mean t test* to decide if there's *statistically significant* evidence that blood pressure decreases, on average:

STAT > BASIC STATISTICS > 1-SAMPLE T …

In the dialog box: ONE OR MORE SAMPLES, EACH IN A COLUMN:
Select the variable (double click).
Check the box next to "Perform hypothesis test"
HYPOTHESIZED MEAN: Enter the null-hypothesized mean $\mu_0$.

< OPTIONS >
Select the appropriate direction (<, ≠, or >) for the alternative hypothesis from the drop-down list.
< OK >

< OK >

The desired calculation will appear in the Session window.

5. **Please answer Questions 2, 3, 4, 5, 6, and 7 on the Answer Sheet.**

## Part B: One-Mean t Test for a Population Mean μ (Cont'd).

People tend to be more generous after receiving good news. Are they less generous after receiving bad news? The average tip left by adult Americans is **20%**. A sample of $n = 20$ patrons at a restaurant was given a message on their bill warning them that tomorrow's weather will be bad, and the tip percentages they left was recorded. Here are their tips as a percentage of the total bill:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 18.0 | 19.1 | 19.2 | 18.8 | 18.4 | 19.0 | 18.5 | 16.1 | 16.8 | 18.2 |
| 14.0 | 17.0 | 13.6 | 17.5 | 20.0 | 20.2 | 18.8 | 18.0 | 23.2 | 19.4 |

We want to decide if the data provide statistically significant evidence that the mean tip percentage is less than 20 when patrons receive a message warning them that tomorrow's weather will be bad. The file **bad_weather_tips.mpx** contains the data shown above.

1. Open the Minitab worksheet **bad_weather_tips.mpx**.
2. Calculate the value of the sample mean tip percentage $\bar{x}$ .
3. **Please answer Question 1 on the Answer Sheet.**
4. Now carry out *one-mean t test* to decide if there's *statistically significant* evidence that the mean tip percentage is less than 20 using the instructions in **Step 4** of **Part A**.
5. **Please answer Questions 2, 3, 4, 5, 6, and 7 on the Answer Sheet.**