Name: _____ Period: _____

Statistics Practice Lab

Background: One of the most familiar numbers in biology is the typical body temperature for healthy humans—37 °C, or 98.6 °F—a figure that has been accepted for more than 100 years. Anyone who has ever tried to measure his or her own internal body temperature, however, is aware of issues that can bring into question the accuracy of the measured body temperature. Many variables can affect a body temperature measurement. For example, temperature measurements taken from different parts of the body can generate a range of readings for a single person, as can the readings from different instruments, such as a digital thermometer, an infrared thermometer, or a glass-and-mercury thermometer. And this amount of variability doesn't even take into account that an individual's body temperature actually varies on both a daily and a monthly basis due to biological rhythms.

Question: Is 98.6°F actually the average body temperature for humans?

Hypotheses: H_o:

H_A:

Experimental Design: You have randomly selected 130 healthy 18- to 40-year-old adults—65 males and 65 females. You then measured their body temperature, orally, at the same time of day to a 10th of a degree precision.

1. Name two ways that would have improved the results of this experimental design…AKA, two ways that would have made your sample more representative of the true population.
    a. .
    b. .
2. Go to my website and open the data set from today's class.
3. Use excel to fill in the following for the body temperature column:
    a. Mean ("=average (highlight column)"): _____
    b. Median ("=median(highlight column"): _____
    c. Std. Devedation ("=STDEV(highlight column"): _____
4. At what temperature range should we consider someone's temperature to be "normal." Let's consider any temperature within 1σ from the mean to be normal (look back at question 3). Is 98.6 still considered "normal" or "abnormal?"

5. Hmmm…let's figure out if we think 98.6 is really the human body temperature. We know the mean (3a), but we are missing an important piece of information…standard error! In order to calculate this, we need to use the formula. Figure out what the standard error is. Do you notice anything about the standard deviation vs. the standard error? Why?

$$\frac{s}{\sqrt{n}}$$

6. Like the standard deviation measure, the standard error measure defines boundaries of probabilities. Remember from the earlier discussion that the sample standard error is equivalent to the standard deviation of the sample mean distribution. Therefore, there is around 68% probability that the true population mean lies within the boundaries of the sample mean ±1 sample standard error. We would write that: "(mean) ± (std. dev) for a 68% confidence interval." Write is out in this format below.

7. In science we do not use a 68% confidence interval. We want to be MORE sure than that. The standard is 95%, so that we can consider our results more valid and encompassing. Write question 6 over but with a 95% confidence interval. Now you need to do 2σ.

8. Now you need to do is see if the data is normally distributed. You need to know this in order to pick which graph and/or statistical tests to use. Because you have continuous data, we will have to make it discrete in order to build a histogram. Go to http://www.shodor.org/interactivate/activities/Histogram/ and paste the FIRST COLUMN (body temperature) into the text box at the bottom of the page, and fill in the following variables: Interval size: 0.2; Min. x-axis value: 0; Min. y-axis value: 2. Next, update the y-axis.
9. Is this data normally distributed? Use the numbers from question 3 and the histogram graph as evidence. Tell me what parametric/normal means.

10. Find the following information.
    a. Mean male body temperature: _____
    b. Mean female body temperature: _____
11. Make a simple table in excel. You should have your rows reading "male" and "female" and your column reading "mean" with the appropriate numbers filled in. Make a graph of the male vs. female body temperature means. Can you really tell from this is your data is significantly different? What are you missing?

12. Go to http://www.socr.ucla.edu/htmls/SOCR_Analyses.html. Paste in the data without the headings into the top left cell. Once you have done that, label the columns. Click the "mapping" tool and label your dependent variable "body temp" and your independent variable "gender." Click calculate (it is automatically set on one-way ANOVA, which is what you want). Look at the results. Over on the right side is your p-value. Anything below 0.05 is considered significant. Now you can answer whether or not there is a significant difference between genders. Write your conclusion in terms of the p-value and confidence interval.

13. Is there a significant relationship between body temperature and heart rate? Repeat question number #10 except with the body temp and heart rate data. Make sure to include the p-value in your reasoning.

14. Look up what a one-way ANOVA is. Explain it to me.