**Testing for Statistical Significance**

A certain researcher developed the inspired hypothesis that people are taller when they are wearing shoes than when they are not wearing shoes. To test this hypothesis, he took a random sample of 15 adults, measuring the height of each individual subject first with shoes on, and then again with shoes off.

|  |  |  |
| --- | --- | --- |
| Subject | Height with shoes on (in) | Height with shoes off (in) |
| 1 | 64.8 | 63.5 |
| 2 | 70.5 | 68.8 |
| 3 | 69.3 | 67.6 |
| 4 | 55.5 | 54.1 |
| 5 | 61.4 | 59.9 |
| 6 | 69.7 | 68.6 |
| 7 | 68.8 | 66.7 |
| 8 | 64.6 | 63 |
| 9 | 63.8 | 61.8 |
| 10 | 61.9 | 59.4 |
| 11 | 69.4 | 68.4 |
| 12 | 63 | 61.1 |
| 13 | 75.5 | 73.9 |
| 14 | 69.4 | 68.2 |
| 15 | 59.1 | 58.1 |

1. Based on the information in the data table, can you

easily tell if there is a REAL difference in the heights or is

 it due to chance?

2. We can use mathematics to know the answer to #1

 for sure. We will perform a test for **statistical significance** called a **t-test**.

3. We will use Excel to help us find what is known as

The ***p-value*** (if you take AP Stats, you will learn how to

do the math that Excel will do for us to get a better understanding of what the t-test really does.) The p-value

 is called the “**confidence level**”, or how sure you are

 that your data is good.

By the way – who should someday take AP Stats????

ANSWER: anybody planning to go into science, medicine, engineering, business, law………basically anybody going into ANYTHING!!!

Back to p-values……

4. Many statisticians figure that **if we have a p-value of less than 0.05, then we can be 95% confident that our results are statistically significant.** How to run a t-test with Excel:

 a. Copy and paste the above data into Excel.

 b. Click on any open cell.

 c. Click on the “formula builder” that looks like

 d. Double-click TTEST

 e. To input into “Array 1”, select data set Height with shoes on

 f. To input into “Array 2”, select data set height with shoes off

 g. Enter 2 tails and Type 2

 h. Hit return/enter on the keyboard and Excel will display the p-value.

**If p is less than 0.05, then the difference in height with shoes on and off**

 **is statistically significant.**

In his investigation, the researcher used 15 subjects. What happens to the p-value if he uses more subjects? Try again using the following data.

5. What is the p-value now? What does this mean?

6. Based on your answer to #5, what is the moral of the story? In other words, what “rule of thumb” should we remember to follow when collecting and analyzing data?

|  |  |  |
| --- | --- | --- |
| Subject | Height with shoes on | Height with shoes off |
| 1 | 64.8 | 63.5 |
| 2 | 70.5 | 68.8 |
| 3 | 69.3 | 67.6 |
| 4 | 55.5 | 54.1 |
| 5 | 61.4 | 59.9 |
| 6 | 69.7 | 68.6 |
| 7 | 68.8 | 66.7 |
| 8 | 64.6 | 63 |
| 9 | 63.8 | 61.8 |
| 10 | 61.9 | 59.4 |
| 11 | 69.4 | 68.4 |
| 12 | 63 | 61.1 |
| 13 | 75.5 | 73.9 |
| 14 | 69.4 | 68.2 |
| 15 | 59.1 | 58.1 |
| 16 | 62.4 | 60.1 |
| 17 | 70.1 | 68.3 |
| 18 | 69.7 | 67.1 |
| 19 | 63.5 | 62.1 |
| 20 | 70.3 | 68 |
| 21 | 64.9 | 62.5 |
| 22 | 65.9 | 63.1 |
| 23 | 69.9 | 67.1 |
| 24 | 59.7 | 58.1 |
| 25 | 67.7 | 67 |
| 26 | 69.4 | 68.1 |
| 27 | 70.1 | 69.1 |
| 28 | 59.9 | 58.2 |
| 29 | 62.4 | 58.8 |
| 30 | 70.3 | 68.9 |
| 31 | 63.3 | 61.1 |
| 32 | 65.5 | 63.1 |
| 33 | 70.4 | 65.8 |
| 34 | 61.3 | 60.1 |
| 35 | 68.3 | 66.9 |
| 36 | 64.5 | 62.3 |
| 37 | 67.2 | 64.3 |
| 38 | 69 | 66.7 |
| 39 | 68.8 | 66.8 |
| 40 | 75.3 | 71.5 |