Project 5 – Estimating the Mean Difference for a Matched-Pairs Experiment Using the Bootstrap Method

Using StatCrunch to Bootstrap a Population Parameter

1. Load the paired data into the first two columns of a StatCrunch spreadsheet.
2. Compute the differences between the two columns and store them in the third column.
3. Press Applets; highlight Resampling, then Bootstrap a statistic.
   Be sure the "From data table:" radio button is selected.
   Select the column that contains the differences.
   Select "Mean" under the Statistic drop-down menu. Click Compute!.
4. Click 1000 times to generate 1000 Bootstrap samples with replacement and determine the mean difference of each sample.
5. The critical values will be labeled as 2.5th perc. and 97.5th perc.

Investigation 1

To test the belief that sons are taller than their fathers, a student randomly selects 13 fathers who have adult male children. She records the height of both the father and son in inches and obtains the following data.

Family	1	2	3	4	5	6	7	8	9	10	11	12	13
Father	70.3	67.1	70.9	66.8	72.8	70.4	71.8	70.1	69.9	70.8	70.2	70.4	72.4
Son	74.1	69.2	66.9	69.2	68.9	70.2	70.4	69.3	75.8	72.3	69.2	68.6	73.9

Type the data for the fathers in the first column and the data for the sons in the second column. Label the columns as Father and Son.

To find the differences:

- Data > Compute > Expression
- Click Build
- Click on the Father column and click "Add Column"
- Type a minus sign
- Click on the Son column and click "Add Column"
- Click Okay and then click on Compute

The differences will appear in a new column.

Investigation 1 (continued)

(a) We subtracted "Fathers' heights – Sons' heights". If sons are indeed taller than their fathers, would we expect these differences to be positive or negative? Why?

(b) Use the bootstrap method to create a 95% confidence interval for the mean difference between heights for all fathers and sons.

(c)

- If the two critical values are both negative that implies that the values from the first population (Fathers' heights) are less than the values from the second population (Sons' heights).

- If the two critical values are both positive that implies that the values from the first population (Fathers' heights) are greater than the values from the second population (Sons' heights).

- If the lower critical value is negative and the second critical value is positive that implies that a mean difference of 0 is plausible, indicating that there is no difference between the values from the first population (Fathers' heights) and the values from the second population (Sons' heights).

Based on your confidence interval, which is the correct conclusion? (Circle the correct conclusion.)

Fathers are shorter than their sons.

Fathers are taller than their sons.

We cannot prove that there is a difference between the heights of fathers and their sons.

Investigation 2

For a Research Task you obtained the price of 25 identical items at two different stores.

(a) Before doing any calculations, which store do you think has lower prices and which store do you think has higher prices?

Lower: _____   Higher: _____

(b) Type the two sets of prices into the first two columns in StatCrunch and compute the differences as you did in Investigation 1.

Which way did you subtract? _____

(c) Once you have a column containing the differences, compute the sample mean.

- Stat > Summary Stats > Columns
- Select the column containing the differences
- Select Mean under Statistics

Sample Mean Difference: _____

(d) Use the bootstrap method to create a 95% confidence interval for the mean difference between prices at the two stores.

(e) Does the confidence interval support your claim from part (a) where you stated which store had lower prices? Explain how you determined that.

- Create a StatCrunch report.
- Type all of your names on the first line.
- Save your bootstrap results for the difference between the two stores and insert them into your report.
- Save your data for the two stores & their differences and insert them into your report.
- Save the report, click the Mail link, and send me a copy at georgew@cos.edu .