Correlation and Regression: Height, Arm Span, Foot Length

Some Questions We Will Attempt to Answer:

- *How well can you guess a person's Height from their Foot Prints?*
  Suppose you see footprints on the beach early in the morning when no one is there. Can you guess the heights of the people who made the prints? Is there a formula you can use? Would you have to use a different formula for women than for men?

- *How are Arm Span and Height related?*
  Are they about the same? If not, which tends to be larger? Can you predict a person's height, if you know their armspan?

- *Which is a Better Predictor of Height, Foot Length or Arm Span?*

Data and Calculations: (Record data and calculations on the following pages.)

- We will gather data on *Foot Length*, *Armspan*, and *Height* (and also record *Male* or *Female*) for about 12 people.

- Then, looking at two factors at a time, we will see if there is a *Linear Correlation* between the two, and construct a *Regression Line & Equation* for estimating one factor from the other.

  Part 1 : *Height* vs. *Foot Length*

  Part 2 : *Height* vs. *Armspan*

  Part 3 : *Height* vs. *Foot Length*, Men & Women Separately

  In Part 3, by using different symbols or colors on the scatter plot, we can see if the relationship between Height and Foot Length is different for men than for women.

You can work in small groups of about 4 people. But to get good results, you will need data from about 12 people – so exchange data with some other groups. Include at least 3 men and at least 3 women.

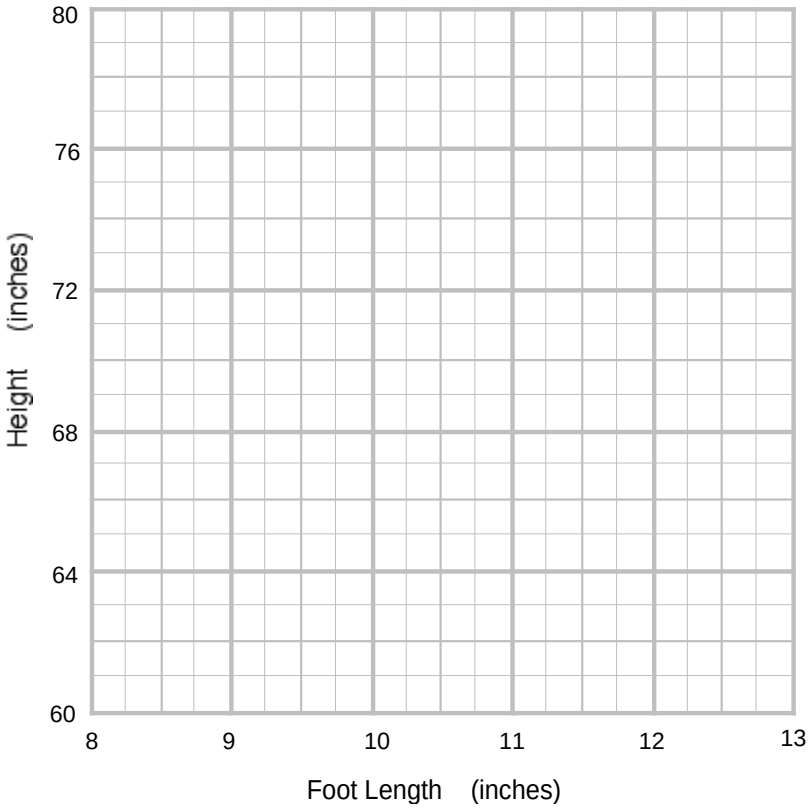
Measure everything in *inches* (use fractions or decimals if needed, especially for foot length).

Observations -- Data Collected (for about 12 people)

Foot Length	Arm Span	Height	Male or Female

Part 1: Height vs. Foot Length

Scatterplot:



Correlation Coefficient :

a. r = _____ , r^2 = _____ , and _____ % of the variation in height is "explained" by foot length.

b. Looking at the scatter plot and also r and r^2, how would you describe the relation between height and foot length? (circle one)

strong correlation, *moderate correlation,* *weak correlation,* *no clear correlation*

Equation of Regression Line :

a. Height = _____

b. Looking at the slope of the regression equation, if foot length increases by one inch, by how much would you expect height to increase?

_____

Predicted Values :

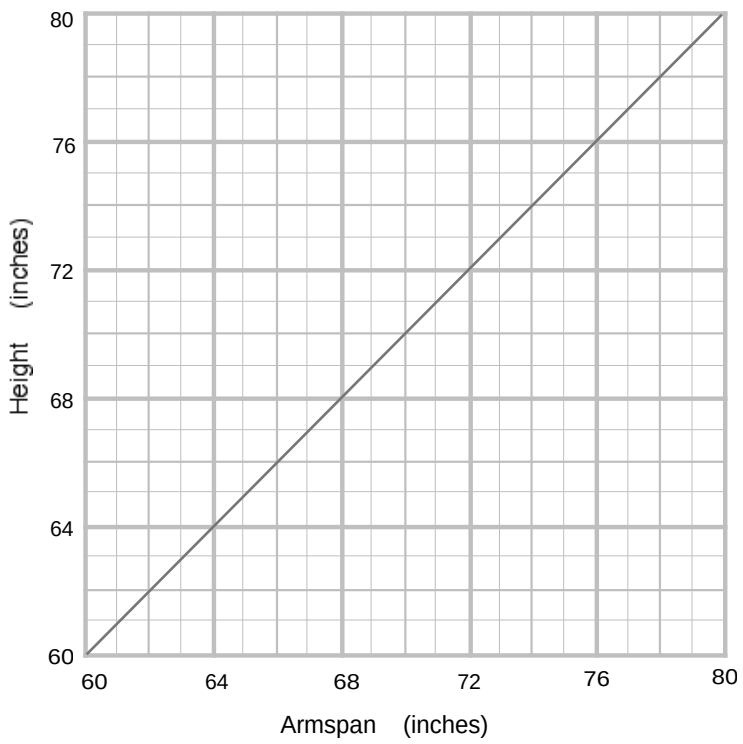
a. If a person's foot length is 9 inches, what would the regression line predict for their height? _____

b. If a person's foot length is 12 inches, what would the regression line predict for their height? _____

c. Use the two points calculated above, to draw the regression line on the scatter plot.

Part 2: Height vs. Armspan

Scatterplot:



Are Height and Armspan Equal?

Points on the diagonal line have equal height and armspan.

a. How many points lie below the diagonal line? _____

b. How many lie above the line? _____

c. According to this, height tends to be (check one)

less than armspan _____

about the same as armspan _____

greater than armspan _____

Correlation Coefficient :

a. r = _____ , r^2 = _____ ,

_____% of the variation in height is "explained" by armspan.

b. Looking at the scatter plot and also r and r^2, how would you describe the relation between height and armspan? (check one)

strong correlation _____

moderate correlation _____

weak correlation _____

no clear correlation _____

Equation of Regression Line :

a. Height = _____

b. Looking at the slope of the regression equation, if armspan increases by one inch, by how much would you expect height to increase?

_____

Predicted Values :

a. If armspan is 64, predicted height is _____

If armspan is 76, predicted height is _____

b. Use the two points calculated above, to draw the regression line on the scatter plot.

Which is better predictor? : Which seems to be a better predictor of height -- *foot length* or *armspan?*

Part 3: Height vs. Foot Length – Different for Men & Women?

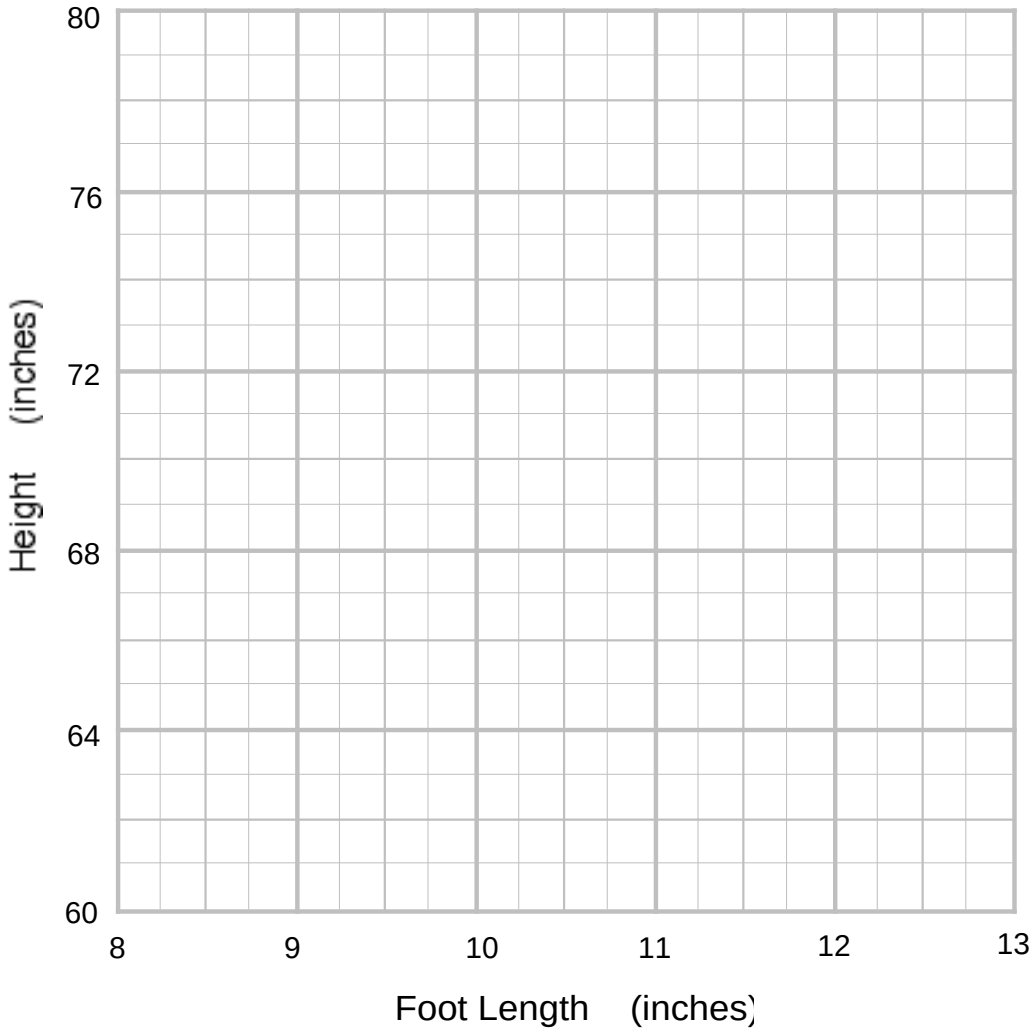
This is similar to Part 1, but this time we will separate the data for men and women. You can do this either by hand or using Minitab.

Scatterplot:

a. Make a scatterplot with Foot Length on the horizontal axis and Height on the vertical axis, using different symbols for men and for women. After you have determined the regression lines for the men and the women, add those to your scatterplot.

You can hand in a hand-sketched graph on the grid below (or the one in Part 1, if you used different symbols there for men and women), or you can attach a print-out of a Minitab graph.

To do this with Minitab, use **Graph > Scatterplot > With Regression and Groups.** The "Categorical variable for grouping" will be the column in which you recorded gender.



Men indicated by:

Women indicated by:

b. Does one group (men or women) show a higher correlation between Height and Foot Length than the other group? If so, which group?

c. Do the regression lines look noticeably different (indicating that different prediction formulas should be used for men and women)?

Separate the data for men & women:

In Minitab, you can use "Sort" (in the Data menu), "Copy", and "Paste"to move the data for men and women into separate columns or into separate worksheets.

Or, you can "unstack" the data as follows.:

Data > Unstack Columns ; then in the dialog box:
Unstack the data in : (select all columns), **Using subscripts in :** (select the gender column), then click **OK.**

Now you can use **Stat > Regression > Fitted Line Plot**, to get a complete report for men, and (separately) a complete report for women.

Correlation & Regression for Men:

a. The percentage of the variation in height "explained" by foot length is _____ (look at R^2).

b. The regression equation is: Height = _____

c. If foot length increases by one inch, the predicted height would increase by _____ (look at slope).

d. The predicted height for a man with a foot length of 10.5 inches, would be _____

Correlation & Regression for Women:

a. The percentage of the variation in height "explained" by foot length is _____ (look at R^2).

b. The regression equation is: Height = _____

c. If foot length increases by one inch, the predicted height would increase by _____ (look at slope).

d. The predicted height for a woman with a foot length of 10.5 inches, would be _____

Comparison: Is there a significant difference in strength of correlation and / or regression equations for men and women?