

Math 211 Signature Assignment

1. To study about **the** relationship between height and weight, you need to collect a sample of nine people using a systematic sampling method.

a) The population is about 600. I am going to collect samples from around my block and ask every 5th household from my house. I only need one sample from each household.

- Since the sample size is very small (less than 30), this does not accurately represent my population.

b) Collect the sample and record the data.

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9
Height (inches)	72	62	74	32	68	50	73	67	46
Weight (lbs)	153	95	215	14	141	89	205	139	92

2. (CLO 1) Construct a confidence interval to estimate the mean height and the mean weight by completing the following:

a) Find the sample mean and the sample standard deviation of the height.

$$\bar{x} = \frac{\sum x_i}{n} = \frac{72 + 62 + 74 + 32 + 68 + 50 + 73 + 67 + 46}{9} = 60.444 \text{ inches}$$

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

$$= \sqrt{\frac{1}{8}[(72 - 60.444)^2 + (62 - 60.444)^2 + (74 - 60.444)^2 + (32 - 60.444)^2 + (68 - 60.444)^2 + (50 - 60.444)^2 + (73 - 60.444)^2 + (67 - 60.444)^2 + (46 - 60.444)^2]}$$

$$= 14.5955$$

b) Find the sample mean and the sample standard deviation of the weight.

$$\bar{x} = \frac{\sum x_i}{n} = \frac{153 + 95 + 215 + 14 + 141 + 89 + 205 + 139 + 92}{9} = 127 \text{ lbs}$$

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

$$\sqrt{\frac{1}{8}[(153 - 127)^2 + (95 - 127)^2 + (215 - 127)^2 + (14 - 127)^2 + (141 - 127)^2 + (89 - 127)^2 + (205 - 127)^2 + (139 - 127)^2 + (92 - 127)^2]}$$

$$= 62.556$$

c) Construct and interpret a confidence interval to estimate the mean height.

$$\bar{x} = 60.444, s = 14.5955, n = 9, \alpha = 0.05, t_c = 2.306$$

$$CI = \bar{x} \pm t_c \left(\frac{s}{\sqrt{n}} \right) = 60.444 \pm 2.306 \left(\frac{14.5955}{\sqrt{9}} \right) = 60.444 \pm 11.2191$$

$$= (49.225, 71.663)$$

We are 95% confident that the population mean height lies between 49.225 and 71.663 inches.

d) Construct and interpret a confidence interval to estimate the mean weight.

$$\bar{x} = 127, s = 62.556, n = 9, t_c = 2.306$$

$$CI = \bar{x} \pm t_c \left(\frac{s}{\sqrt{n}} \right) = 127 \pm 2.306 \left(\frac{62.556}{\sqrt{9}} \right) = 127 \pm 48.0847$$
$$= (78.915, 175.085)$$

We are 95% confident that the population mean weight lies between 78.915 and 175.085 lbs.

3. (CLO 2) Test a claim that the mean height of people you know is not equal to 64 inches using the p-value method or the traditional method by completing the following:

a) State H_0 and H_1 .

$$H_0: \mu = 64$$

$$H_1: \mu \neq 64 \text{ (claim)}$$

b) Find the p-value or critical value(s).

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{60.444 - 64}{\frac{14.5955}{\sqrt{9}}} = -0.7309$$

$$P\text{-value} = 0.2428 * 2 = 0.4856$$

c) Draw a conclusion in context of the situation.

Fail to reject H_0 since the p-value is greater than 0.05. There is not sufficient evidence to support the claim that the mean height of people is not 64 inches.

4. (CLO 3) Create a scatterplot with the height on the x-axis and the weight on the y-axis. Find the correlation coefficient between the height and the weight What

does the correlation coefficient tell you about your data? Construct the equation of the regression line and use it to predict the weight of a person who is 68 inches tall. Scatterplot

X	Y	XY	X ²	Y ²
72	153	11016	5184	23409
62	95	5890	3844	9025
74	215	15910	5476	46225
32	14	448	1024	196
68	141	9588	4624	19881
50	89	4450	2500	7921
73	205	14965	5329	42025
67	139	9313	4489	19321
46	90	42320	2116	8464
Total=544	1143	75182	34586	176467

$$r = \frac{n \sum XY - \sum X * \sum Y}{\sqrt{[n \sum X^2 - (\sum X)^2] * [n \sum Y^2 - (\sum Y)^2]}} = \frac{9 * 75182 - 544 * 1143}{\sqrt{(9 * 34586 - 544^2) * (9 * 176467 - 1143^2)}} = 0.921$$

The correlation coefficient between the height and weight is $r = 0.921$. This shows that the linear relationship between height and weight is very strong and positive.

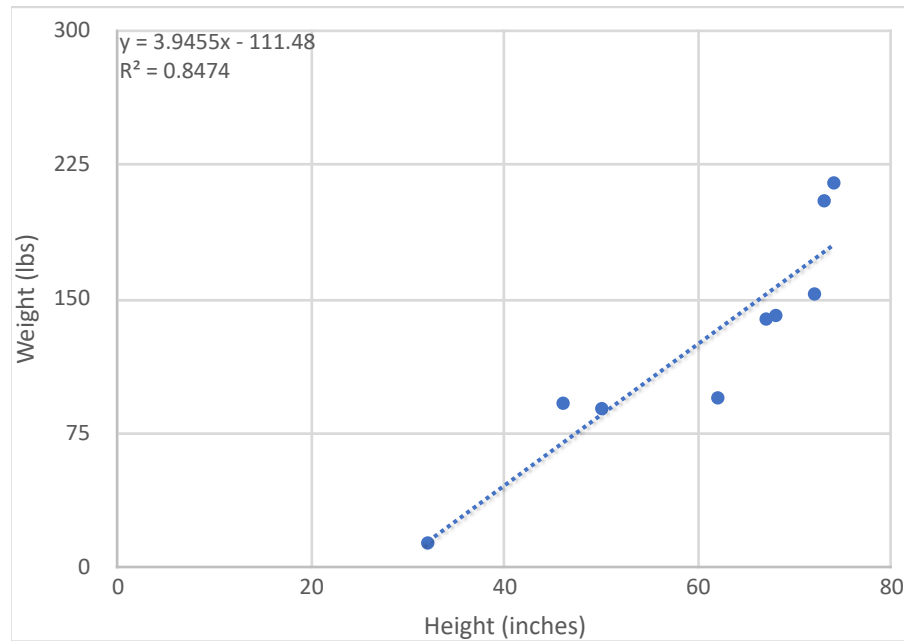
Regression equation: $\hat{y} = a + bx$

$$a = \frac{\sum X * \sum X^2 - \sum X * \sum XY}{n \sum X^2 - (\sum X)^2} = \frac{1143 * 34586 - 544 * 75182}{9 * 34586 - 544^2} = -111.483$$

$$b = \frac{n \sum XY - \sum X * \sum Y}{n \sum X^2 - (\sum X)^2} = \frac{(9 * 75812 - 544 * 1143)}{9 * 34586 - 544^2} = 3.945$$

$$\hat{y} = -111.483 + 3.945x$$

$$\hat{y} = -111.483 + 3.945 * 68 = 156.777 \text{ lbs}$$



5. Write a paragraph or two about what you have learned from this process. When you read, see, or hear a statistic in the future, what skills will you apply to know whether you can trust the result?

Regression analysis is used to determine the linear relationship between two variables, whether it is positive or negative. In this case, we found that height and weight have a positive relationship. This means that as the height increases, the weight also increases and vice versa.

I have also learned that we can use a small sample to draw conclusion about the whole population through hypothesis testing. I believe it is cheap and more practical to work with a sample instead of a whole population. When I hear a statistic in future, I will carry out hypothesis testing to determine it is true or false.