

SPINOFF 6C

Correlation and Regression Applied to Biomass in a Lunar Base Station

In a lunar base station, a Biomass Production Chamber (BPC) is used to grow food, generate water, and produce oxygen, all at the same time. The Biomass Production Chamber contains trays of wheat, soybeans, lettuce, potatoes, and tomatoes. These food sources (called **biomass**) are grown in a hydroponic system with roots fed by a nutrient-rich liquid mixture (instead of soil). In one NASA experiment, it was found that in order to provide enough oxygen for *one* crew member, an area of 10 m² of biomass was needed. In a second experiment, *two* crew members needed 40 m² of biomass for their oxygen. These results are summarized in the table below along with results from other experiments. Also, similar experimental results for producing water are shown in the second table below.

Oxygen

Number of Crew Members	1	2	4	5	5	7	10
Growing Area of Biomass (m ²)	10	40	50	40	80	120	160

Water

Number of Crew Members	1	2	4	5	5	7	10
Growing Area of Biomass (m ²)	6	4	12	11	15	17.5	28

- 1) Construct a scatterplot describing the sample data for oxygen as listed in the first table.
- 2) Using a scientific calculator with two-variable statistics, a graphing calculator, or a computer program, find the equation of the regression line for the oxygen data.
- 3) Using the oxygen data, find the value of the linear correlation coefficient r .
- 4) Using the result from Exercise 3 and assuming a significance level of $\alpha = 0.05$, test the null hypothesis that there is no linear correlation between the crew size and the area of biomass needed. Use the alternative hypothesis that there is a linear correlation. Write a statement summarizing your conclusion.
- 5) Repeat Exercises 1 through 4 using the water data as given in the second table.