

Multivariate Statistical Methods
Part I

Problem 1 **30 points**

In a study of how wheat yield/acre depends on fertilizer/acre and rainfall (in inches), suppose that data are available for only seven experimental observations:

Wheat Yield	Fertilizer (lb/Acre)	Rainfall (Inch)
40	100	10
50	200	20
50	300	10
70	400	30
65	500	20
65	600	20
80	700	30

1. Develop an estimated regression equation with wheat yield as dependent and fertilizer and rainfall as independent variables.
2. What is the estimate of wheat yield for 730 lbs/acre of fertilizer and 25 inches of rainfall?
3. Compute and interpret r^2 and r_{adj}^2 .
4. Use $\alpha = 0.05$ to test the hypothesis

$$H_0: \beta_1 = \beta_2 = 0; \quad H_1: \beta_1 \text{ and/or } \beta_2 \text{ is not equal to zero}$$

for the model $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$.

5. Use $\alpha = 0.05$ to test the significance of β_1 . Should x_1 be dropped from the model?
6. Use $\alpha = 0.05$ to test the significance of β_2 . Should x_2 be dropped from the model?

Problem 2**30 points**

Suppose you want to determine whether the brand of laundry detergent used and the temperature affects the amount of dirt removed from your laundry. To this end, you buy two different brands of detergent (“Super” and “Best”) and choose three different temperature levels (“cold”, “warm”, and “hot”). Then you divide your laundry randomly into 6 piles of size 4 and assign each pile into the combinations of (“Super”, Best”) and (“cold”, “warm”, and “hot”):

	Cold	Warm	Hot
Super	4, 5, 6, 5	7, 9, 8, 12	10, 12, 11, 9
Best	6, 6, 4, 4	13, 15, 12, 12	12, 13, 10, 13

Perform a two-way analysis of variance with interaction at the 5% significance level.