Exercise No. 1

Analysis of Factorial Experiments with Unequal Cell Frequencies

1. Consider the following data.

   a. Show that data has proportionate class frequencies.

   b. Is there a reason to believe that the fertilizer and variety interact with each other? If not, test for main effects of fertilizer and variety. Use a 1% level of significance. Present detailed calculations and tests of hypotheses.

Fertilizer	Variety		
	A	B	C
X	8.10	7.50	7.30
	6.60	8.30	7.05
	7.75		
	6.35		
Y	6.95	6.90	8.30
	8.00	6.75	8.60
	7.45		
	6.75		
Z	8.60	6.85	7.35
	6.15		

2. The percentage of hardwood concentration (A) in raw pulp and vat pressure (B) are being investigated for their effects on the strength of paper. The combinations of the three levels of hardwood concentration and three levels of vat pressure are randomly assigned to equal-sized papers. The experiment is replicated four times and the following data are obtained.

   a. Show that the data has disproportionate class frequencies.

   b. Using the Method of Unweighted Means, perform analysis of variance at the 5% level of significance. Construct the ANOVA table and interpret the results. Show all computations.

   c. Assuming there is no interaction between the two factors, write the appropriate model for the experiment in matrix notation. That is, write the vector $\mathbf{Y}$ containing the strength measurements, the incidence (design) matrix $\mathbf{X}$, the vector $\boldsymbol{\beta}$ of the parameters, and the vector $\boldsymbol{\epsilon}$ of the error terms.

   d. Using Method of Fitting Constants, perform analysis of variance at the 5% level of significance. Assume there is no significant interaction between factors A and B. Construct the ANOVA table and interpret results. Show all computations.

Percent Hardwood Concentration	Vat Pressure		
	400	500	600
2	196.6	199.6	199.8
	199.4	200.4	199.9
	198.6	196	199.4
			199
4	198.5	196	198.4
	197.2	196.9	199
		198.7	200
		198	
8	197.5	195.6	198.5
	196.6	196.2	
	200.6	197	
	198.4	197.8	