

Q1. The response time in milliseconds was determined for three different types of circuits that could be used in an automatic valve shutoff mechanism. The results from a completely randomized experiment are shown in the following table:

Circuit Type		Response Time			
1	9	12	10	8	15
2	20	21	23	20	30
3	6	15	8	16	7

- (a) Test the hypothesis that the three circuit types have the same response time. Use $\alpha = 0.01$.
- (b) Use Tukey's test to compare pairs of treatment means. Use $\alpha = 0.01$.
- (e) If you were the design engineer and you wished to minimize the response time, which circuit type would you select?
- (f) Analyze the residuals from this experiment. Are the basic analysis of variance assumptions satisfied?

Q2 (Example 3.1). In Example 3.1, both the factor and the response variable are **numerical**. Fit the **first order** linear regression model and the **quadratic model** described in the Lecture-slides 10. And test if the quadratic model is useful to predict the etch rate of the tool for a given RF setting.

The following is the data and data descriptions from the textbook.

■ **TABLE 3.1**
Etch Rate Data (in Å/min) from the Plasma Etching Experiment

Power (W)	Observations					Totals	Averages
	1	2	3	4	5		
160	575	542	530	539	570	2756	551.2
180	565	593	590	579	610	2937	587.4
200	600	651	610	637	629	3127	625.4
220	725	700	715	685	710	3535	707.0