

1. QUESTION 1 25 pts

Four different designs for a digital computer circuit are being studied to compare the amount of noise present. The following data have been obtained. You are also provided with a partial ANOVA table.

Circuit design	Noise observed					sample mean
1	19	20	19	30	8	19.2
2	80	61	73	56	80	70.0
3	47	26	25	35	50	36.6
4	95	46	83	78	96	79.8

Table 1:

Analysis of Variance

Source	DF	SS	MS	F-Value
Circuit Design		12042		
Error		2949		
Total		14991		

Is there a difference in noise observed due to circuit design? Answer this by using the F test with $\alpha = 0.05$. Remember to write down the null and alternative hypotheses.

2. QUESTION 2

30 pts

The manufacturer wants to obtain 95% **simultaneous** confidence intervals for all pairwise differences. Use Tukey's method to obtain these.

3. QUESTION 3

20 pts

Provide clear explanations below to obtain full credit.

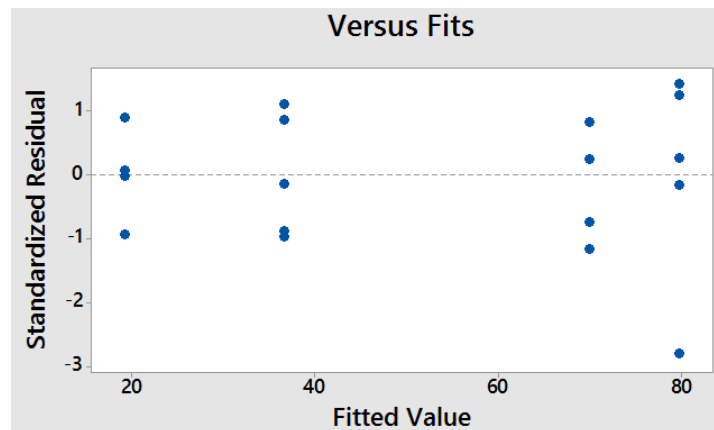
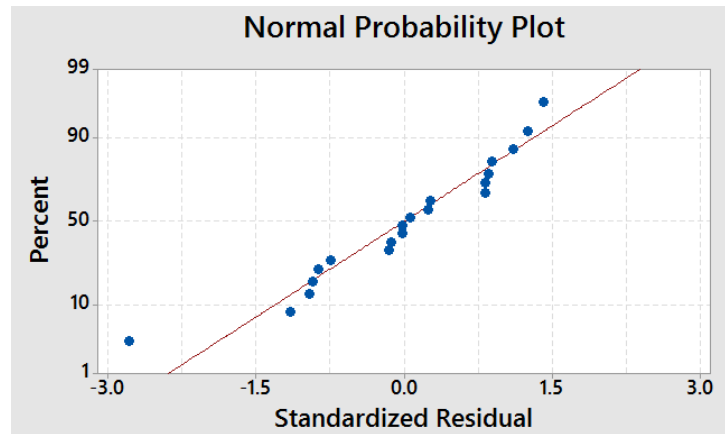
- (a) Why are the confidence intervals you obtained in problem 2 better than 95% **individual** confidence intervals for each pairwise difference?

- (b) Why are the confidence intervals you obtained in problem 2 better than 95% **simultaneous** confidence intervals for all pairwise differences using Bonferroni's method?

4. QUESTION 4

25 pts

You are provided below with residual plots for the data in problem 1.



- (a) State the assumptions of the one-way ANOVA model.
- (b) Analyze the provided residuals and draw conclusions about adequacy of the model for this data. If you need any additional plots to fully analyze the residuals, state this as part of your answer with explanations.