STAT 423/523 Spring 2020 Homework 3

1.

a. I=4 treatments, J=10

b. Ho: $u_1=u_2=u_3=u_4$ vs Ha: Ho is false
u_i is the true average Fe percentage for the iron formation type i

c. Analysis of Variance for Fe

Source	DF	SS	MS	F	P
formation	3	509.1	169.7	10.85	<0.0001
Error	36	563.1	15.6		
Total	39	1072.3			

d. Since the p-value is small than 0.01, we reject the Ho and conclude the average Fe percentages are not all the same for the four iron formations.

e.

(1) The plot of residuals versus fitted values suggests that the treatment variance is larger when the response is low or high. There is evidence that variance is not constant across treatments.
Or:
If you know the rule of thumb, the max deviation / min deviation < 4, no violation of equal variance. (If you are comfortable with coding, you can run the Levene's test to check the p-value = 0.7229 >0.01, fail to reject the assumption of equal variance.)

(2) The normal probability plot shows a nonlinear pattern (concave up, then concave down). This indicates the violation of normality.

2.

a.

Source	Df	SS	MS	F	P-Value
Treatment	2	0.1336	0.0668	4.42	0.027
Error	18	0.2718	0.0151		
Total	20	0.4054			

get p-value by R command 1-pf(4.42, 2, 18)

b. $\alpha = .05$, I = 3, J = 4, I(J-1) = 18
$Q_{(0.05, 3, 18)} = 3.609$, w = 3.609 * sqrt (0.0151/7) = 0.1676
The Tukey's interval

u_1-u_2 (21.714 — 21.525) ± 0.1676 = (0.0214, 0.3566) *

u_2-u_3 (21.525 — 21.750) ± 0.1676 = (—0.3926, —0.0574) *

u_1-u_3 (21.714 — 21.750) ± 0.1676 = (—0.2036, 0.1316)

* Differed means, no zero within the interval

c. The T-methods of underscoring

List left to right, min -> max

$\bar{x}_2$ $\bar{x}_1$ $\bar{x}_3$

21.525 21.714 21.750

21.525 + w = 21.6926 < 21.714 → no underline $\bar{x}_2$ and $\bar{x}_1$

21.714 + w = 21.8816 > 21.750 → underline $\bar{x}_3$ and $\bar{x}_1$

Stop as reach the end