Show **all** of your work on this assignment and answer each question fully in the given context.

Please staple your assignment!

1. Chapter 4, Exercise 12, page 208 (unless directed otherwise you may use JMP; include plots as requested; skip part (f)) [5 pts each part, 20 pts total]

   The article referred to in Homework 2, 6 (Ch. 4.1 Exercise 4, pg. 140) actually considers the effects of both cutting speed and feed rate on tool life. The whole data set from the article follows and is on the website as 'tool$_life_full.csv$'.($The data for the previous assignment are the$ $x_2 =$ .01725 data only.)

   "'r tool$_life_full <- read_csv($"./tool$_life_full.csv$")

tool$_life_full$ %>% group$_by(speed, feed)$ %>% summarise$(life = paste(life, collapse = ","))$ %>% kable$(col.names =$ c("$Cutting speed$,x_1 (sfpm)", "Feed, x_2 (ipr)", "Tool life, y (min)")) "'

   a) Taylor's expanded tool life equation is $yx_1^{\alpha_1}x_2^{\alpha_2} = C$. This relationship suggests that $\ln(y)$ may well be approximately linear in both $\ln(x_1)$ and $\ln(x_2)$. Use a multiple linear regression program to fit the relationship

$$\ln(y) \approx \beta_0 + \beta_1 \ln(x_1) + \beta_2 \ln(x_2)$$

   to these data. What fraction of the raw variability in $\ln(y)$ is accounted for in the fitting process? What estimates of the parameters α_1, α_2, and C follow from your fitted equation?

   b) Compute and plot residuals (continuing to work on log scales) for the equation you fit in part a). Make at least plots of residuals versus fitted $\ln(y)$ and both $\ln(x_1)$ and $\ln(x_1)$ and make a normal plot of these residuals. Do these plots reveal any particular problems with the fitted equation?

   c) Use your fitted equation to predict first a log tool life and then a tool life, if in this machining application a cutting speed of 550 and a feed of .01650 is used.

   d) Plot the ordered pairs appearing in the data set in the (x_1, x_2)-plane. Outline a region in the plane where you would feel reasonably safe using the equation you fit in part a) to predict tool life.

2. Chapter 4, Exercise 1 (page 203) (unless directed otherwise you may use JMP; include plots as requested; skip part (f)) [5 pts each part, 25 pts total]

3. Chapter 4, Exercise 16 (unless directed otherwise you may use JMP; include plots as requested; parts (a) - (g) only) (page 211)[5 pts each, 35 pts total]

4. Chapter 4, Exercise 23 (unless directed otherwise you may use JMP; include plots as requested; skip part (h)) (page 215)[5 pts each, 35 pts total]

   Total: 95 pts