5.3) Full Model: $Sales = \beta_0 + \beta_1(PDI) + \beta_2 Q_1 + \beta_3 Q_2 + \beta_4 Q_3 + \varepsilon$

$H_0: \beta_2 = \beta_3 = \beta_4 = 0$, no seasonal effect

$H_A:$ Not $\exists$, there is a seasonal effect

F-test against reduced Model: $Sales = \beta_0 + \beta_1(PDI) + \varepsilon$

$\therefore F^* = 73.8$; $df_R = 38$; $df_F = 35$; $p\text{-Val} = 3.24 \cdot 10^{-5}$

$\therefore$ reject H_0

5.4) Full Model:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 \cdot \text{"1960"} + \beta_5 \text{"1970"} +$
$\quad \beta_6 \cdot \text{"1960"} X_1 + \beta_7 \cdot \text{"1970"} \cdot X_1 +$
$\quad \beta_8 \cdot \text{"1960"} \cdot X_2 + \beta_9 \cdot \text{"1970"} \cdot X_2 +$
$\quad \beta_{10} \cdot \text{"1960"} \cdot X_3 + \beta_{11} \cdot \text{"1970"} \cdot X_3 + \varepsilon$

$H_0: \beta_4 = \beta_5 = \ldots = \beta_{11} = 0$, no yearly effects

$H_A:$ Not $\exists$, year effects Y

F-test against reduced Model: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$

$\therefore F^* = 9.43$; $df_R = 146$; $df_F = 138$; $p\text{-Val} = 2.48 \cdot 10^{-10}$

$\therefore$ reject H_0

5.7) b) Full Model: $Y = \mu_0 + \mu_1 F_1 + \mu_2 F_2 + \mu_3 F_3 + \varepsilon$

c) $H_0: \mu_1 = \mu_3 = \mu_4 = 0$, no fertilizer effect

$H_A:$ Not $\exists$, fertilizer effects yield

F-test against reduced Model: $Y = \mu_0 + \varepsilon$

$\therefore F^* = 5.14$; $df_R = 39$; $df_F = 36$; $p\text{-Val} = 4.61 \cdot 10^{-3}$
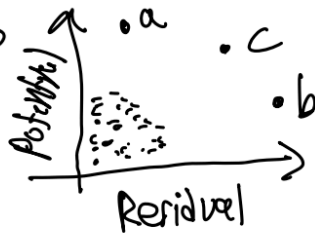
$\therefore$ reject H_0

e) F_1 is most influential because $\hat{\mu}_1 \geq \hat{\mu}_3 \geq \hat{\mu}_2$ in the full model

4.6) a) (1) outliers, (2) colinearity (3) $\varepsilon_i \sim N(0, \sigma^2)$ (4) linear & equal variance
(5) identify high leverage/outlier points (6&7) influential points

b & c) See examples in lecture notes

4.8) See Figure 4.8 and corresponding discussion as a reference.

For example,

a = high leverage
b = outlier
c = influential
  = both high leverage & outlier

Model #1: outliers : 1, 13, 15, 17
           High leverage: 21
           Influential: 9, 10

Model #2: outliers: 3, 7
           High leverage: 8, 14
           Influential: 9, 21

Model #3: outliers: 3
           High leverage: 7
           Influential: 9, 15