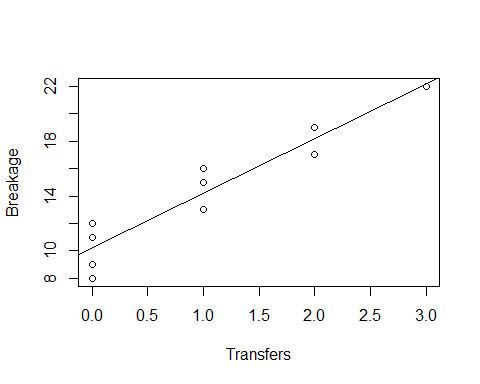
Chapter 2 Questions 6, 15, 25 Michael Streyle

##   
## Call:  
## lm(formula = Breakage ~ Transfers)  
##   
## Coefficients:  
## (Intercept) Transfers   
## 10.2 4.0



## [1] 2.306004

## [1] 0.05394531

##   
## CONFIDENCE LIMITS FOR INTERCEPT AND SLOPE:

## 2.5 % 97.5 %  
## (Intercept) 8.670370 11.729630  
## Transfers 2.918388 5.081612

##   
## HYPOTHESIS TESTS FOR INTERCEPT AND SLOPE:

## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 10.2 0.6633250 15.377079 3.178273e-07  
## Transfers 4.0 0.4690416 8.528029 2.748669e-05

##   
## CONFIDENCE LIMITS FOR INTERCEPT AND SLOPE:

## 1.25 % 98.75 %  
## (Intercept) 8.374846 12.025154  
## Transfers 2.709421 5.290579

##   
## CONFIDENCE INTERVAL FOR A MEAN RESPONSE at Transfers = 2 or 4:

## fit lwr upr  
## Transfers=2 18.2 15.97429 20.42571  
## Transfers=4 26.2 21.22316 31.17684

##   
## PREDICTION INTERVAL FOR AN INDIVIDUAL RESPONSE at Transfers = 2:

## fit lwr upr  
## 1 18.2 12.74814 23.65186

##   
## PREDICTION LIMITS FOR THE MEAN OF 3 NEW OBSERVATIONS at Transfers=2:

## fit lower upper  
## 1 18.2 15.15908 21.24092

##   
## PREDICTION LIMITS FOR THE TOTAL OF 3 NEW OBSERVATIONS at Transfers=2:

## fit lower upper  
## 1 54.6 45.47724 63.72276

##   
## WORKING-HOTELLING CONFIDENCE BAND (LIMITS) at Transfers = 2 or 4

## fit lower upper  
## 1 18.2 15.44116 20.95884  
## 2 26.2 20.03104 32.36896

##   
## ANOVA TABLE:

## Analysis of Variance Table  
##   
## Response: Breakage  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Transfers 1 160.0 160.0 72.727 2.749e-05 \*\*\*  
## Residuals 8 17.6 2.2   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## DF Sum Sq  
## Corr. Total 9 177.6

## [1] 5.317655

##   
## R SQUARED:

## [1] 0.9009009

##   
## CORRELATION COEFFICIENT:

## [1] 0.949158

Chapter 2 Questions 6 (acd), 15(ab), 25(abd)

6) a) With a 95 percent confidence interval, α = 0.05 and α/2 = 0.025, so (1- α/2) = 0.975. For this example, n = 10, so n-2 = 8. Then qt(0.975, 8) = 2.306004. The confidence interval then becomes 4.0 ± 2.306(.469) or *2.918388 ampules per transfer* ≤ *β1* ≥ *5.081612 ampules per transfer* with 95 percent confidence. The estimate is 4.0 ampules per transfer.

c) From the confint(fit, level = .95) output, the 95 percent confidence interval for *β0* is 8.670370 ampules ≤ *β0*≥ 11.729630 ampules. The estimate is 10.2 ampules which lies within our 95 percent confidence interval. When no transfers are made, there are still roughly 10 ampules broken.

d) When a consultant suggests that when no transfers are made, the number of ampules broken should not exceed 9 ampules. Using α = 0.025, a t test can be conducted. The alternatives are *H0*: *β0 ≤ 9,* and *Ha*: *β0 > 9.* The t value from the qt() function is still 2.306004, therefore if |t\*| ≤ 2.306004 then conclude *H0 .* If |t\*| > 2.306004, then conclude *Ha*. |t\*| = (10.20 – 9)/0.663 = 1.810 where 0.663 is the standard error of the intercept. Since 1.810 ≤ 2.306004, we can conclude *H0.* Using the pt() function, the p-value is 0.05394531.

15) a) The mean breakage when X=2 and when X=4 with a 99 percent confidence interval are found in the “CONFIDENCE INTERVAL FOR A MEAN RESPONSE at Transfers = 2 or 4” table in RStudio. When there are two transfers, the fit value for breakage is 18.2 ampules and the 99 percent confidence interval is between 15.97429 ampules and 20.42571 ampules. When there are four transfers, the fit value for breakage is 26.2 ampules and the 99 percent confidence interval is between 21.22316 ampules and 31.17684 ampules. With 99 percent confidence, the number of ampules broken with 2 and 4 transfers respectively, lie within the stated intervals.

b) When the next shipment has two transfers, a 99 percent prediction interval for ampules broken is between 12.74814 ampules and 23.65186 ampules. The fit value remains 18.2, however since it is a prediction interval, the interval of how many ampules will be broken in the next shipment with 2 transfers and a 99 percent prediction interval is wider than the two-transfer confidence interval in part (a).

25) a) The ANOVA table is created. Shown in knit code. The columns labeled Sum Sq and *df* (degrees of freedom) are additive.

b) To conduct an F test, with α = 0.05, the alternatives are: *H0: β1* = 0, and *Ha*: *β1* = 0. Then qf(.95, 1, 8) = 5.317655. The decision rule is then if F\* ≤ 5.317655, conclude *H0,* and if F\* > 5.317655, then conclude *Ha.* F\* is found on the ANOVA table and is 72.727, which is larger than 5.317655, so conclude *Ha.*

d) The R2 value is 0.9009009 and the r value is 0.949158. The R2 value gives the proportion of the variation in Y is accounted for by introducing X into the regression model so 90.09009% or just roughly 90%.