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| **Module:** | ST2053 |
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| **Chapter:** | 5 |

**Maximum 2 pages! Do not delete the page number in the footer.**

**(a)**

quality.df <- read.table("P:\\ST2053\\Previous Exam Datasets\\18-19\\Q5 Quality Means.txt", header = TRUE)

attach(quality.df)

quality.lm <- lm(MeanWeight ~ Week, data = quality.df, weights= n)

summary(quality.lm)

Weighted regression is required because the weight of the item is a mean based on differing ni.

If the ith response yi(Weight of item) is an average of ni equally variable observations, then

Var(yi) = [σ](https://en.wiktionary.org/wiki/%CF%83)^2/ni = [σ](https://en.wiktionary.org/wiki/%CF%83)^2/wi,

then wi = ni

The estimate of coefficient β1 in this model is 1.0804.

This means an increase in Week of 1 is associated with an increase in Weight of 1.0804.

**(b)**

SS(lof) in un-weighted regression model equals Residual Sum of Squares in the weighted regression model.

df(lof) in the un-weighted regression model equals the Residual Degrees of Freedom in the weighted regression model.

summary(quality.lm)

n = sum(n)

SS.lof = 294.6 # RSS of weighted model

DF.lof = 8 # residual degrees of freedom in weighted

RSS = 737.55

SS.pe = RSS - SS.lof # 442.95

p = 1

DF.pe = (n-(p+1)) - DF.lof # 33

F = (SS.lof/DF.lof)/(SS.pe/DF.pe)

qf(0.99, DF.lof, DF.pe)

#=3.106108

F = 2.743481

F < qf(0.99, 8, 33)

The Fit is adequate

**(c)**

sigma = 6

RSS = 737.55

degree\_freedom = n-(p+1)

observed\_chisq = RSS/(sigma^2) # 20.4875

qchisq(0.95, 41) # 56.94

Observed\_chisq < qchisq(0.95, 41)

This test shows no evidence of lack of fit.