ECON 4101 Econometrics
CM19 and CM 20 Homework

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```
df <- read.xlsx("../../Data/wheat.xlsx", 1, colIndex = 1:3)
str(df)
```

```
## 'data.frame':    26 obs. of  3 variables:
##  $ qty  : num  198 140 162 166 160 ...
##  $ price: num  1.47 1.3 1.59 1.44 1.89 1.49 1.94 1.52 2.15 2.09 ...
##  $ trend: num  1 2 3 4 5 6 7 8 9 10 ...
```

Part 1: CM19

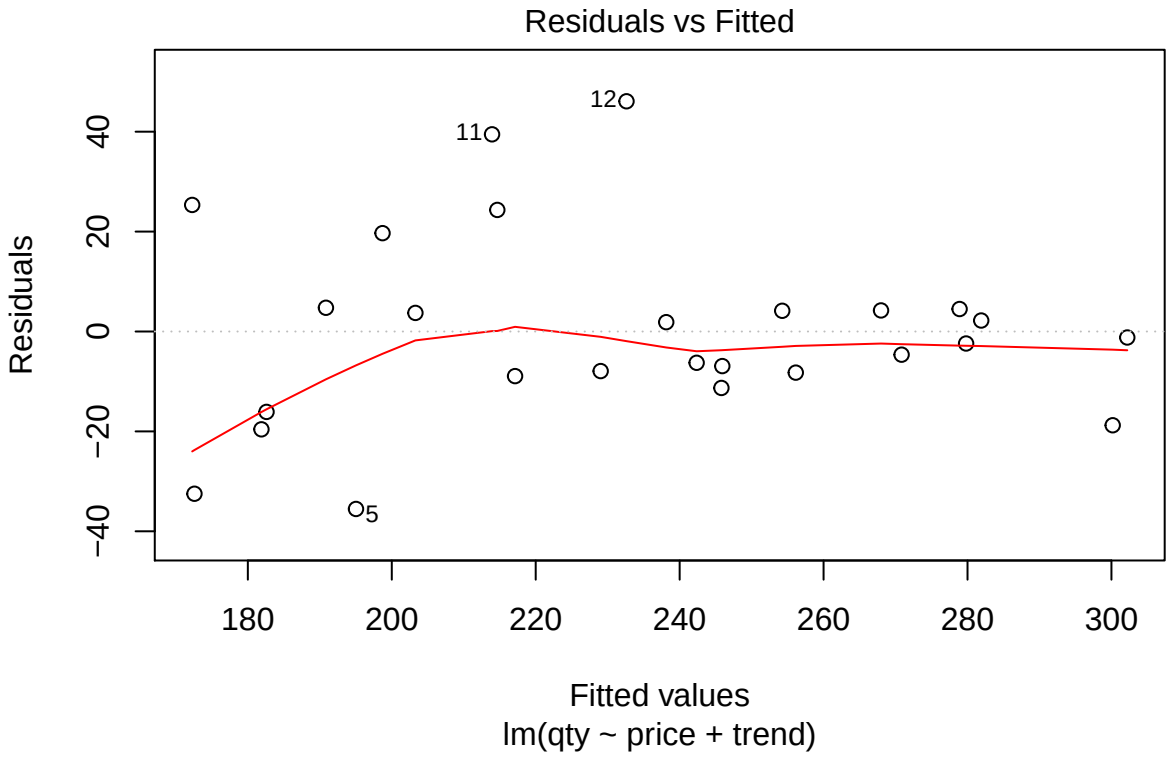
Problem 1

```
mod1 <- lm(qty ~ price + trend, df)
summary(mod1)
```

```
##
## Call:
## lm(formula = qty ~ price + trend, data = df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -35.528  -8.758  -1.802   4.430  46.083
##
## Coefficients:
##             Estimate Std. Error t value   Pr(>|t|)
## (Intercept)  139.901     23.218   6.026 0.00000382 ***
## price         19.541     17.415   1.122     0.2734
## trend          3.639      1.418   2.567     0.0172 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.97 on 23 degrees of freedom
## Multiple R-squared:  0.8089, Adjusted R-squared:  0.7923
## F-statistic: 48.67 on 2 and 23 DF,  p-value: 0.000000005431
```

Problem 2

```
plot(mod1, 1)
```



Problem 3

```
gqtest(qty ~ price + trend, order.by = -df$trend, data = df)
```

```
##
##  Goldfeld-Quandt test
##
## data:  qty ~ price + trend
## GQ = 11.109, df1 = 10, df2 = 10, p-value = 0.0003642
## alternative hypothesis: variance increases from segment 1 to 2
```

Problem 4

```
se.uncorrected <- confint(mod1)
se.uncorrected
```

```
##                   2.5 %     97.5 %
## (Intercept)  91.8716477 187.930220
## price       -16.4852003  55.566203
## trend         0.7064496   6.571717
```

```
# se.corrected <- mod1$coefficients + qt(.975,
# df=mod1$df.residual)*sqrt(diag(vcovHC(mod1, 'HC0'))) %*% t(c(-1,1));
# se.corrected
se.robust <- coefci(mod1, vcov = vcovHC(mod1, "HC0"))
se.robust
```

```
##                   2.5 %     97.5 %
```

```
## (Intercept)  89.0517303 190.750138
## price       -20.8044941  59.885497
## trend         0.3159286   6.962238
```

```
coeftest(mod1, vcov = vcovHC(mod1, "HC0"))
```

```
##
## t test of coefficients:
##
##             Estimate Std. Error t value    Pr(>|t|)
## (Intercept) 139.9009    24.5808  5.6915 0.000008539 ***
## price        19.5405    19.5030  1.0019     0.32681
## trend         3.6391     1.6064  2.2653     0.03322 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Part 2: CM20

Problem 1

Approach 1: Weighted Least Squares

```
df1 <- df[1:13, ]
df2 <- df[14:26, ]

m1 <- lm(qty ~ price + trend, df1)
e1.sd <- sd(m1$residuals)
m2 <- lm(qty ~ price + trend, df2)
e2.sd <- sd(m2$residuals)

w <- rep(c(1/e1.sd, 1/e2.sd), each = 13)
mod.wle <- lm(qty ~ price + trend, df, weights = w)
summary(mod.wle)
```

```
##
## Call:
## lm(formula = qty ~ price + trend, data = df, weights = w)
##
## Weighted Residuals:
##     Min      1Q  Median      3Q     Max
## -7.4751 -2.1070  0.3799  2.3962  9.6890
##
## Coefficients:
##             Estimate Std. Error t value     Pr(>|t|)
## (Intercept)  138.905     17.143   8.103 0.0000000344 ***
## price         20.974     12.538   1.673      0.10790
## trend          3.380      1.063   3.180      0.00418 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.471 on 23 degrees of freedom
## Multiple R-squared:  0.8564, Adjusted R-squared:  0.8439
## F-statistic: 68.57 on 2 and 23 DF,  p-value: 0.0000000002033
```

```
confint(mod.wle)
```

```
##                  2.5 %     97.5 %
## (Intercept) 103.442323 174.368234
## price        -4.961831  46.909894
## trend         1.180860   5.578848
```

Approach 2: Feasible General Least Squares

```
mod1 <- lm(qty ~ price + trend, df)
e <- mod1$residuals
le2 <- log(e^2)
mod2 <- lm(le2 ~ price + trend, df)
ghat <- mod2$fitted.values
hhat <- exp(ghat)
w <- 1/sqrt(hhat)
mod.fgls <- lm(qty ~ price + trend, df, weights = w)
summary(mod.fgls)
```

```
##
## Call:
## lm(formula = qty ~ price + trend, data = df, weights = w)
##
## Weighted Residuals:
##     Min      1Q  Median      3Q     Max
## -9.9768 -3.2783  0.0922  2.5084 14.4108
##
## Coefficients:
##             Estimate Std. Error t value     Pr(>|t|)
## (Intercept)  143.740     17.136   8.388 0.0000000188 ***
## price         21.805     12.441   1.753       0.0930 .
## trend          3.042      1.099   2.768       0.0109 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.829 on 23 degrees of freedom
## Multiple R-squared:  0.8319, Adjusted R-squared:  0.8173
## F-statistic:  56.9 on 2 and 23 DF,  p-value: 0.000000001244
```

```
confint(mod.fgls)
```

```
##                  2.5 %     97.5 %
## (Intercept) 108.2912880 179.188518
## price        -3.9317757  47.542208
## trend         0.7685339   5.314862
```

Problem 2