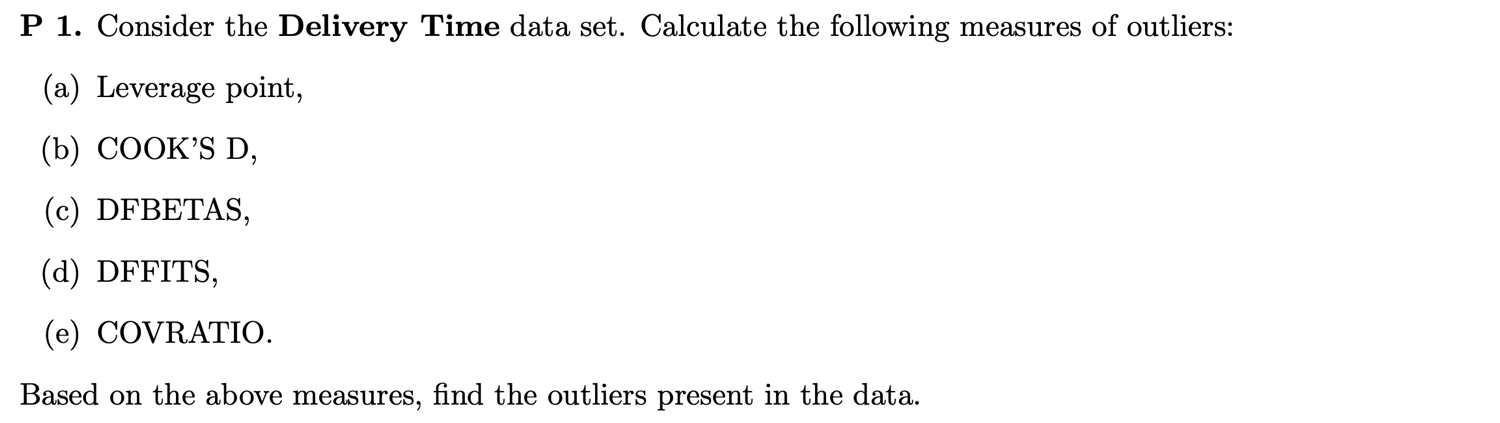
Lab 6 Solutions

**Name**: Kaushik Raj V Nadar

**Roll No.:** 208160499

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**Code:**

library(car)

library(readxl)

TimeDeliveryData <- read\_excel("TimeDeliveryData.xlsx") %>% as.data.frame()

model <- lm(Y ~ X1 + X2, data = TimeDeliveryData)

leverage\_points <- hatvalues(model)

cooks\_d <- cooks.distance(model)

dfbetas\_values <- dfbetas(model)

dffits\_values <- dffits(model)

covratio\_values <- covratio(model)

# Print the Results

leverage\_points

cooks\_d

dfbetas\_values

dffits\_values

covratio\_values

influence\_measures <- influence.measures(model)

summary(influence\_measures)

**Output:**

> leverage\_points

1 2 3 4 5 6

0.10180178 0.07070164 0.09873476 0.08537479 0.07501050 0.04286693

7 8 9 10 11 12

0.08179867 0.06372559 0.49829216 0.19629595 0.08613260 0.11365570

13 14 15 16 17 18

0.06112463 0.07824332 0.04111077 0.16594043 0.05943202 0.09626046

19 20 21 22 23 24

0.09644857 0.10168486 0.16527689 0.39157522 0.04126005 0.12060826

25

0.06664345

> cooks\_d

1 2 3 4 5

1.000921e-01 3.375704e-03 9.455785e-06 7.764718e-02 5.432217e-04

6 7 8 9 10

1.231067e-04 2.171604e-03 3.051135e-03 3.419318e+00 5.384516e-02

11 12 13 14 15

1.619975e-02 1.596392e-03 2.294737e-03 3.292786e-03 6.319880e-04

16 17 18 19 20

3.289086e-03 4.013419e-04 4.397807e-02 1.191868e-02 1.324449e-01

21 22 23 24 25

5.086063e-02 4.510455e-01 2.989892e-02 1.023224e-01 1.084694e-04

> dfbetas\_values

(Intercept) X1 X2

1 -0.187267279 0.4113118750 -0.434862094

2 0.089793299 -0.0477642427 0.014414155

3 -0.003515177 0.0039483525 -0.002846468

4 0.451964743 0.0882802920 -0.273373097

5 -0.031674102 -0.0133001129 0.024240457

6 -0.014681480 0.0017921068 0.001078986

7 0.078071285 -0.0222783194 -0.011018802

8 0.071202807 0.0333823324 -0.053823961

9 -2.575739806 0.9287433421 1.507550618

10 0.107919369 -0.3381628707 0.341326746

11 -0.034274535 0.0925271540 -0.002686252

12 -0.030268935 -0.0486664488 0.053973390

13 0.072366473 -0.0356212226 0.011335105

14 0.049516699 -0.0670868604 0.061816778

15 0.022279094 -0.0047895025 0.006838236

16 -0.002693186 0.0644208340 -0.084187552

17 0.028855555 0.0064876499 -0.015696507

18 0.248558020 0.1897331043 -0.272430555

19 0.172558506 0.0235737344 -0.098968842

20 0.168036548 -0.2149950233 -0.092915080

21 -0.161928685 -0.2971750929 0.336406248

22 0.398566309 -1.0254140704 0.573140240

23 -0.159852248 0.0372930389 -0.052651959

24 -0.119720216 0.4046225960 -0.465446949

25 -0.016816024 0.0008498979 0.005592192

> dffits\_values

1 2 3 4 5

-0.570850478 0.098618619 -0.005203676 0.500801817 -0.039458989

6 7 8 9 10

-0.018779374 0.078990030 0.093760764 4.296080927 0.398713071

11 12 13 14 15

0.217953207 -0.067670223 0.081259033 0.097362643 0.042584374

16 17 18 19 20

-0.097159801 0.033915978 0.365309285 0.186167873 -0.671771402

21 22 23 24 25

-0.388501185 -1.195036104 -0.307538544 -0.571139627 -0.017626149

> covratio\_values

1 2 3 4 5 6 7

0.8710782 1.2149209 1.2756813 0.8759964 1.2396032 1.1999120 1.2397501

8 9 10 11 12 13 14

1.2056413 0.3422132 1.3054035 1.1717266 1.2906069 1.2070490 1.2276758

15 16 17 18 19 20 21

1.1918460 1.3692181 1.2192451 1.0692145 1.2152541 0.7598217 1.2376914

22 23 24 25

1.3980787 0.8896761 0.9476321 1.2310981

> summary(influence\_measures)

Potentially influential observations of

lm(formula = Y ~ X1 + X2, data = TimeDeliveryData) :

dfb.1\_ dfb.X1 dfb.X2 dffit cov.r cook.d hat

9 -2.58\_\* 0.93 1.51\_\* 4.30\_\* 0.34\_\* 3.42\_\* 0.50\_\*

22 0.40 -1.03\_\* 0.57 -1.20\_\* 1.40 0.45 0.39\_\*

**A close-up of text

Description automatically generatedCode:**

library(car)

library(dplyr)

library(readxl)

Acetylene\_Data <- read\_excel("Acetylene\_Data.xlsx") %>% as.data.frame()

# Normalize the dataset

acetylene\_norm <- lapply(Acetylene\_Data, function(x) ((x - mean(x)) / sqrt((length(x) - 1) \* var(x)))) %>% as.data.frame()

# Create interaction and second-order terms

acetylene\_final <- cbind(acetylene\_norm,

X1X2 = acetylene\_norm$X1 \* acetylene\_norm$X2,

X1X3 = acetylene\_norm$X1 \* acetylene\_norm$X3,

X2X3 = acetylene\_norm$X2 \* acetylene\_norm$X3,

X1\_sq = acetylene\_norm$X1^2,

X2\_sq = acetylene\_norm$X2^2,

X3\_sq = acetylene\_norm$X3^2)

# Calculate correlation matrix

corr <- cor(acetylene\_final)

# Print correlation matrix

cat("Correlation Matrix: ")

corr

# Calculate VIF

model <- lm(Y ~ ., data = acetylene\_final)

vif\_values <- vif(model)

# Print VIF values

cat("VIF Values: ", vif\_values)

**Output:**

> acetylene\_norm

Y X1 X2 X3

1 0.27978969 0.28022427 -0.22544387 -0.231055577

2 0.30582925 0.28022427 -0.15704118 -0.231055577

3 0.31233914 0.28022427 -0.06583759 -0.235136028

4 0.26893987 0.28022427 0.04816689 -0.222894673

5 0.24724023 0.28022427 0.20777317 -0.218814222

6 0.18214132 0.28022427 0.48138393 -0.231055577

7 -0.17590268 -0.04003204 -0.32576781 -0.002550282

8 -0.09995395 -0.04003204 -0.22544387 -0.018872089

9 -0.03485504 -0.04003204 -0.06583759 -0.067837509

10 -0.02400522 -0.04003204 0.04816689 -0.116802929

11 0.04109369 -0.04003204 0.20777317 -0.051515703

12 0.05194350 -0.04003204 0.48138393 0.005610621

13 -0.45799795 -0.36028835 -0.32576781 0.356529466

14 -0.41459868 -0.36028835 -0.22544387 0.470782113

15 -0.33864995 -0.36028835 -0.06583759 0.421816693

16 -0.14335322 -0.36028835 0.20777317 0.372851273

> acetylene\_final

Y X1 X2 X3 X1X2

1 0.27978969 0.28022427 -0.22544387 -0.231055577 -0.063174843

2 0.30582925 0.28022427 -0.15704118 -0.231055577 -0.044006749

3 0.31233914 0.28022427 -0.06583759 -0.235136028 -0.018449290

4 0.26893987 0.28022427 0.04816689 -0.222894673 0.013497533

5 0.24724023 0.28022427 0.20777317 -0.218814222 0.058223085

6 0.18214132 0.28022427 0.48138393 -0.231055577 0.134895461

7 -0.17590268 -0.04003204 -0.32576781 -0.002550282 0.013041150

8 -0.09995395 -0.04003204 -0.22544387 -0.018872089 0.009024978

9 -0.03485504 -0.04003204 -0.06583759 -0.067837509 0.002635613

10 -0.02400522 -0.04003204 0.04816689 -0.116802929 -0.001928219

11 0.04109369 -0.04003204 0.20777317 -0.051515703 -0.008317584

12 0.05194350 -0.04003204 0.48138393 0.005610621 -0.019270780

13 -0.45799795 -0.36028835 -0.32576781 0.356529466 0.117370347

14 -0.41459868 -0.36028835 -0.22544387 0.470782113 0.081224798

15 -0.33864995 -0.36028835 -0.06583759 0.421816693 0.023720516

16 -0.14335322 -0.36028835 0.20777317 0.372851273 -0.074858253

X1X3 X2X3 X1\_sq X2\_sq X3\_sq

1 -0.0647473801 0.0520900627 0.078525641 0.050824937 5.338668e-02

2 -0.0647473801 0.0362852397 0.078525641 0.024661931 5.338668e-02

3 -0.0658908217 0.0154807893 0.078525641 0.004334588 5.528895e-02

4 -0.0624604969 -0.0107361442 0.078525641 0.002320050 4.968204e-02

5 -0.0613170553 -0.0454637249 0.078525641 0.043169691 4.787966e-02

6 -0.0647473801 -0.1112264424 0.078525641 0.231730492 5.338668e-02

7 0.0001020930 0.0008307999 0.001602564 0.106124668 6.503940e-06

8 0.0007554882 0.0042545967 0.001602564 0.050824937 3.561557e-04

9 0.0027156738 0.0044662581 0.001602564 0.004334588 4.601928e-03

10 0.0046758594 -0.0056260344 0.001602564 0.002320050 1.364292e-02

11 0.0020622786 -0.0107035809 0.001602564 0.043169691 2.653868e-03

12 -0.0002246046 0.0027008628 0.001602564 0.231730492 3.147907e-05

13 -0.1284534116 -0.1161458245 0.129807692 0.106124668 1.271133e-01

14 -0.1696173089 -0.1061349402 0.129807692 0.050824937 2.216358e-01

15 -0.1519756387 -0.0277713943 0.129807692 0.004334588 1.779293e-01

16 -0.1343339684 0.0774684917 0.129807692 0.043169691 1.390181e-01

> cat("Correlation Matrix: ")

Correlation Matrix:

> corr

Y X1 X2 X3 X1X2

Y 1.00000000 0.9450377 0.37003503 -0.91397769 -0.36615167

X1 0.94503771 1.0000000 0.22362776 -0.95820405 -0.13241739

X2 0.37003503 0.2236278 1.00000000 -0.24023098 0.03868762

X3 -0.91397769 -0.9582041 -0.24023098 1.00000000 0.19498531

X1X2 -0.36615167 -0.1324174 0.03868762 0.19498531 1.00000000

X1X3 0.42055075 0.4428236 0.19226267 -0.66052652 -0.26485039

X2X3 0.41877316 0.2055387 -0.02306559 -0.27411884 -0.97448134

X1\_sq -0.24850590 -0.2707456 -0.14771083 0.50096224 0.24631222

X2\_sq -0.03803937 0.0309599 0.49754636 -0.01751058 0.39789760

X3\_sq -0.55517440 -0.5767868 -0.22390584 0.76515318 0.27476802

X1X3 X2X3 X1\_sq X2\_sq X3\_sq

Y 0.4205507 0.41877316 -0.2485059 -0.03803937 -0.5551744

X1 0.4428236 0.20553866 -0.2707456 0.03095990 -0.5767868

X2 0.1922627 -0.02306559 -0.1477108 0.49754636 -0.2239058

X3 -0.6605265 -0.27411884 0.5009622 -0.01751058 0.7651532

X1X2 -0.2648504 -0.97448134 0.2463122 0.39789760 0.2747680

X1X3 1.0000000 0.32351596 -0.9722442 0.12583104 -0.9721670

X2X3 0.3235160 1.00000000 -0.2792725 -0.37460454 -0.3585293

X1\_sq -0.9722442 -0.27927248 1.0000000 -0.12359068 0.8936644

X2\_sq 0.1258310 -0.37460454 -0.1235907 1.00000000 -0.1579789

X3\_sq -0.9721670 -0.35852931 0.8936644 -0.15797895 1.0000000

> cat("VIF Values: ", vif\_values)

VIF Values: 375.2478 1.740631 680.28 31.03706 6563.345 35.61129 1762.575 3.164318 1156.766