> head(iris)

sepal\_length sepal\_width petal\_length petal\_width species

1 5.1 3.5 1.4 0.2 Iris-setosa

2 4.9 3.0 1.4 0.2 Iris-setosa

3 4.7 3.2 1.3 0.2 Iris-setosa

4 4.6 3.1 1.5 0.2 Iris-setosa

5 5.0 3.6 1.4 0.2 Iris-setosa

6 5.4 3.9 1.7 0.4 Iris-setosa

sapply(iris,class)

sepal\_length sepal\_width petal\_length petal\_width species

"numeric" "numeric" "numeric" "numeric" "character"

> names(iris)

[1] "sepal\_length" "sepal\_width" "petal\_length" "petal\_width" "species"

summary(iris)

sepal\_length sepal\_width petal\_length petal\_width species

Min. :4.300 Min. :2.000 Min. :1.000 Min. :0.100 Length:150

1st Qu.:5.100 1st Qu.:2.800 1st Qu.:1.600 1st Qu.:0.300 Class :character

Median :5.800 Median :3.000 Median :4.350 Median :1.300 Mode :character

Mean :5.843 Mean :3.054 Mean :3.759 Mean :1.199

3rd Qu.:6.400 3rd Qu.:3.300 3rd Qu.:5.100 3rd Qu.:1.800

Max. :7.900 Max. :4.400 Max. :6.900 Max. :2.500

head(iris)

X TV Radio Newspaper Sales

1 1 230.1 37.8 69.2 22.1

2 2 44.5 39.3 45.1 10.4

3 3 17.2 45.9 69.3 9.3

4 4 151.5 41.3 58.5 18.5

5 5 180.8 10.8 58.4 12.9

6 6 8.7 48.9 75.0 7.2

head(iris)

age sex cp trestbps chol fbs restecg thalach exang oldpeak slope ca thal target

1 52 1 0 125 212 0 1 168 0 1.0 2 2 3 0

2 53 1 0 140 203 1 0 155 1 3.1 0 0 3 0

3 70 1 0 145 174 0 1 125 1 2.6 0 0 3 0

4 61 1 0 148 203 0 1 161 0 0.0 2 1 3 0

5 62 0 0 138 294 1 1 106 0 1.9 1 3 2 0

6 58 0 0 100 248 0 0 122 0 1.0 1 0 2 1

> iris<- read.csv("C:/Groceries\_dataset.csv")

head(iris)

Member\_number Date itemDescription

1 1808 21-07-2015 tropical fruit

2 2552 05-01-2015 whole milk

3 2300 19-09-2015 pip fruit

4 1187 12-12-2015 other vegetables

5 3037 01-02-2015 whole milk

6 4941 14-02-2015 rolls/buns

head(groceries)

Member\_number Date itemDescription

1 1808 21-07-2015 tropical fruit

2 2552 05-01-2015 whole milk

3 2300 19-09-2015 pip fruit

4 1187 12-12-2015 other vegetables

5 3037 01-02-2015 whole milk

6 4941 14-02-2015 rolls/buns

head(heart)

age sex cp trestbps chol fbs restecg thalach exang oldpeak slope ca thal target

1 52 1 0 125 212 0 1 168 0 1.0 2 2 3 0

2 53 1 0 140 203 1 0 155 1 3.1 0 0 3 0

3 70 1 0 145 174 0 1 125 1 2.6 0 0 3 0

4 61 1 0 148 203 0 1 161 0 0.0 2 1 3 0

5 62 0 0 138 294 1 1 106 0 1.9 1 3 2 0

6 58 0 0 100 248 0 0 122 0 1.0 1 0 2 1

|  |
| --- |
| head(advertising)  X TV Radio Newspaper Sales  1 1 230.1 37.8 69.2 22.1  2 2 44.5 39.3 45.1 10.4  3 3 17.2 45.9 69.3 9.3  4 4 151.5 41.3 58.5 18.5  5 5 180.8 10.8 58.4 12.9  6 6 8.7 48.9 75.0 7.2  > dim(heart)  [1] 1025 14  > summary(heart)  age sex cp trestbps chol  Min. :29.00 Min. :0.0000 Min. :0.0000 Min. : 94.0 Min. :126  1st Qu.:48.00 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:120.0 1st Qu.:211  Median :56.00 Median :1.0000 Median :1.0000 Median :130.0 Median :240  Mean :54.43 Mean :0.6956 Mean :0.9424 Mean :131.6 Mean :246  3rd Qu.:61.00 3rd Qu.:1.0000 3rd Qu.:2.0000 3rd Qu.:140.0 3rd Qu.:275  Max. :77.00 Max. :1.0000 Max. :3.0000 Max. :200.0 Max. :564  fbs restecg thalach exang oldpeak  Min. :0.0000 Min. :0.0000 Min. : 71.0 Min. :0.0000 Min. :0.000  1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:132.0 1st Qu.:0.0000 1st Qu.:0.000  Median :0.0000 Median :1.0000 Median :152.0 Median :0.0000 Median :0.800  Mean :0.1493 Mean :0.5298 Mean :149.1 Mean :0.3366 Mean :1.072  3rd Qu.:0.0000 3rd Qu.:1.0000 3rd Qu.:166.0 3rd Qu.:1.0000 3rd Qu.:1.800  Max. :1.0000 Max. :2.0000 Max. :202.0 Max. :1.0000 Max. :6.200  slope ca thal target  Min. :0.000 Min. :0.0000 Min. :0.000 Min. :0.0000  1st Qu.:1.000 1st Qu.:0.0000 1st Qu.:2.000 1st Qu.:0.0000  Median :1.000 Median :0.0000 Median :2.000 Median :1.0000  Mean :1.385 Mean :0.7541 Mean :2.324 Mean :0.5132  3rd Qu.:2.000 3rd Qu.:1.0000 3rd Qu.:3.000 3rd Qu.:1.0000  Max. :2.000 Max. :4.0000 Max. :3.000 Max. :1.0000  > sapply(heart, class)  age sex cp trestbps chol fbs restecg thalach exang  "integer" "integer" "integer" "integer" "integer" "integer" "integer" "integer" "integer"  oldpeak slope ca thal target  "numeric" "integer" "integer" "integer" "integer"  > sapply(advertising)  Error in sapply(advertising) : argument "FUN" is missing, with no default  > sapply(advertising,class)  X TV Radio Newspaper Sales  "integer" "numeric" "numeric" "numeric" "numeric"  > sapply(groceries,class)  Member\_number Date itemDescription  "integer" "character" "character"  > sapply()iris,class  Error: unexpected symbol in "sapply()iris"  > sapply(iris,class)  Member\_number Date itemDescription  "integer" "character" "character"  > head(heart)  age sex cp trestbps chol fbs restecg thalach exang oldpeak slope ca thal target  1 52 1 0 125 212 0 1 168 0 1.0 2 2 3 0  2 53 1 0 140 203 1 0 155 1 3.1 0 0 3 0  3 70 1 0 145 174 0 1 125 1 2.6 0 0 3 0  4 61 1 0 148 203 0 1 161 0 0.0 2 1 3 0  5 62 0 0 138 294 1 1 106 0 1.9 1 3 2 0  6 58 0 0 100 248 0 0 122 0 1.0 1 0 2 1 |
|  |
| |  | | --- | | > | |

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

TV 1 3314.6 3314.6 312.14 < 2.2e-16 \*\*\*

Residuals 198 2102.5 10.6

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> fit2 <- lm(Sales~Newspaper)

>

> anova(fit2)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

Newspaper 1 282.3 282.344 10.887 0.001148 \*\*

Residuals 198 5134.8 25.933

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> fit3 <- lm(Sales~Radio)

>

> anova(fit3)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

Radio 1 1798.7 1798.67 98.422 < 2.2e-16 \*\*\*

Residuals 198 3618.5 18.28

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> fit3 <- lm(Sales~TV+Radio)

>

> anova(fit4)

Error: object 'fit4' not found

> fit3 <- lm(Sales~Radio)

>

> anova(fit3)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

Radio 1 1798.7 1798.67 98.422 < 2.2e-16 \*\*\*

Residuals 198 3618.5 18.28

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> fit4 <- lm(Sales~TV+Radio)

>

> anova(fit4)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

TV 1 3314.6 3314.6 1172.50 < 2.2e-16 \*\*\*

Radio 1 1545.6 1545.6 546.74 < 2.2e-16 \*\*\*

Residuals 197 556.9 2.8

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Error in file(out, "wt") : cannot open the connection

> fit5 <- lm(Sales~TV+Newspaper)

>

> anova(fit5)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

TV 1 3314.6 3314.6 340.35 < 2.2e-16 \*\*\*

Newspaper 1 184.0 184.0 18.89 2.217e-05 \*\*\*

Residuals 197 1918.6 9.7

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> fit5 <- lm(Sales~TV+Newspaper+Radio)

>

> anova(fit5)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

TV 1 3314.6 3314.6 1166.731 < 2.2e-16 \*\*\*

Newspaper 1 184.0 184.0 64.756 7.97e-14 \*\*\*

Radio 1 1361.7 1361.7 479.325 < 2.2e-16 \*\*\*

Residuals 196 556.8 2.8

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> m1 <- lm(Sales~TV+Radio+Newspaper)

>

> summary(m1)

Call:

lm(formula = Sales ~ TV + Radio + Newspaper)

Residuals:

Min 1Q Median 3Q Max

-8.8277 -0.8908 0.2418 1.1893 2.8292

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.938889 0.311908 9.422 <2e-16 \*\*\*

TV 0.045765 0.001395 32.809 <2e-16 \*\*\*

Radio 0.188530 0.008611 21.893 <2e-16 \*\*\*

Newspaper -0.001037 0.005871 -0.177 0.86

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.686 on 196 degrees of freedom

Multiple R-squared: 0.8972, Adjusted R-squared: 0.8956

F-statistic: 570.3 on 3 and 196 DF, p-value: < 2.2e-16

> m2 <- lm(Sales~TV+Radio)

>

Error in file(out, "wt") : cannot open the connection

> summary(m2)

Call:

lm(formula = Sales ~ TV + Radio)

Residuals:

Min 1Q Median 3Q Max

-8.7977 -0.8752 0.2422 1.1708 2.8328

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.92110 0.29449 9.919 <2e-16 \*\*\*

TV 0.04575 0.00139 32.909 <2e-16 \*\*\*

Radio 0.18799 0.00804 23.382 <2e-16 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.681 on 197 degrees of freedom

Multiple R-squared: 0.8972, Adjusted R-squared: 0.8962

F-statistic: 859.6 on 2 and 197 DF, p-value: < 2.2e-16

> step(lm(Sales~1), direction = "forward", scope = ~TV+Radio+Newspaper)

Start: AIC=661.8

Sales ~ 1

Df Sum of Sq RSS AIC

+ TV 1 3314.6 2102.5 474.52

+ Radio 1 1798.7 3618.5 583.10

+ Newspaper 1 282.3 5134.8 653.10

<none> 5417.1 661.80

Step: AIC=474.52

Sales ~ TV

Df Sum of Sq RSS AIC

+ Radio 1 1545.62 556.91 210.82

+ Newspaper 1 183.97 1918.56 458.20

<none> 2102.53 474.52

Step: AIC=210.82

Sales ~ TV + Radio

Df Sum of Sq RSS AIC

<none> 556.91 210.82

+ Newspaper 1 0.088717 556.83 212.79

Call:

lm(formula = Sales ~ TV + Radio)

Coefficients:

(Intercept) TV Radio

2.92110 0.04575 0.18799

>

> step(lm(Sales~TV+Radio+Newspaper), direction = "backward")

Start: AIC=212.79

Sales ~ TV + Radio + Newspaper

Df Sum of Sq RSS AIC

- Newspaper 1 0.09 556.9 210.82

<none> 556.8 212.79

- Radio 1 1361.74 1918.6 458.20

- TV 1 3058.01 3614.8 584.90

Step: AIC=210.82

Sales ~ TV + Radio

Df Sum of Sq RSS AIC

<none> 556.9 210.82

- Radio 1 1545.6 2102.5 474.52

- TV 1 3061.6 3618.5 583.10

Call:

lm(formula = Sales ~ TV + Radio)

Coefficients:

(Intercept) TV Radio

2.92110 0.04575 0.18799

>

> step(lm(Sales~TV+Radio+Newspaper), direction = "both")

Start: AIC=212.79

Sales ~ TV + Radio + Newspaper

Df Sum of Sq RSS AIC

- Newspaper 1 0.09 556.9 210.82

<none> 556.8 212.79

- Radio 1 1361.74 1918.6 458.20

- TV 1 3058.01 3614.8 584.90

Step: AIC=210.82

Sales ~ TV + Radio

Df Sum of Sq RSS AIC

<none> 556.9 210.82

+ Newspaper 1 0.09 556.8 212.79

- Radio 1 1545.62 2102.5 474.52

- TV 1 3061.57 3618.5 583.10

Call:

lm(formula = Sales ~ TV + Radio)

Coefficients:

(Intercept) TV Radio

2.92110 0.04575 0.18799

> model3=lm(Sales~TV+Radio+TV\*Radio)

Error in file(out, "wt") : cannot open the connection

> summary(m3)

Error: object 'm3' not found

> summary(model3)

Call:

lm(formula = Sales ~ TV + Radio + TV \* Radio)

Residuals:

Min 1Q Median 3Q Max

-6.3366 -0.4028 0.1831 0.5948 1.5246

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 6.750e+00 2.479e-01 27.233 <2e-16 \*\*\*

TV 1.910e-02 1.504e-03 12.699 <2e-16 \*\*\*

Radio 2.886e-02 8.905e-03 3.241 0.0014 \*\*

TV:Radio 1.086e-03 5.242e-05 20.727 <2e-16 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.9435 on 196 degrees of freedom

Multiple R-squared: 0.9678, Adjusted R-squared: 0.9673

F-statistic: 1963 on 3 and 196 DF, p-value: < 2.2e-16

> anova(model3)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

TV 1 3314.6 3314.6 3723.36 < 2.2e-16 \*\*\*

Radio 1 1545.6 1545.6 1736.22 < 2.2e-16 \*\*\*

TV:Radio 1 382.4 382.4 429.59 < 2.2e-16 \*\*\*

Residuals 196 174.5 0.9

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> par(mfrow=c(2,2))

> plot(model3)

> model3$residuals

1 2 3 4 5 6 7

0.413610006 -0.234545599 0.038785891 0.865892073 0.263080970 -1.589897606 0.955719903

8 9 10 11 12 13 14

1.028473472 -2.194718246 -0.606063904 0.003268508 0.257641208 0.074540368 0.062993944

15 16 17 18 19 20 21

0.106053063 0.414031005 0.702323688 -0.975420317 1.095047141 0.521457509 -0.294271388

22 23 24 25 26 27 28

-0.247465455 -2.089267289 -0.290725001 0.543266006 -0.872641799 0.125507682 -0.274840902

29 30 31 32 33 34 35

-0.710351355 0.712174135 -0.767702954 0.356723273 0.791453984 -0.772132046 0.735833996

36 37 38 39 40 41 42

-0.916190195 -0.413741745 1.087867786 0.505646936 -0.032373677 0.431888334 -0.418184979

43 44 45 46 47 48 49

-1.293884055 0.067056441 -0.172233026 -0.124693365 0.885856223 -0.147250160 -0.646232755

50 51 52 53 54 55 56

0.483819986 0.070965106 0.707765672 0.708433471 0.462776360 -0.619408214 1.049347927

57 58 59 60 61 62 63

-2.423506251 0.452867920 0.231759690 0.020532744 0.153896734 -0.896242767 -0.098414248

64 65 66 67 68 69 70

1.130976491 1.413997800 0.266200894 0.596206868 1.375968968 -0.271655114 -0.199036949

71 72 73 74 75 76 77

0.244204109 1.433830245 -0.375416109 0.812220146 -0.240059747 -0.436634134 -0.469482044

78 79 80 81 82 83 84

0.594286297 -2.591715599 0.841373551 0.603567876 -0.217204959 0.864799107 0.951908660

85 86 87 88 89 90 91

-0.343858657 0.366063807 0.718971016 1.080397623 1.280810523 0.770555410 1.028100350

92 93 94 95 96 97 98

-0.086412047 -0.399096870 -0.346037504 0.660626281 0.511970839 0.322976685 0.393173845

99 100 101 102 103 104 105

-1.418836512 0.538355173 -0.461435094 -1.349352959 -0.668632249 0.352869693 -0.466949819

106 107 108 109 110 111 112

1.524620429 -0.643996830 0.184918884 -1.717681638 -0.069478667 0.088392416 -0.642661867

113 114 115 116 117 118 119

0.609456266 -0.139551627 1.029102080 0.549325942 0.215474573 1.100962928 0.644307322

120 121 122 123 124 125 126

-1.319794428 1.162959373 -1.178836144 -0.082225107 0.472206440 -0.420127848 0.725654564

127 128 129 130 131 132 133

-1.751540022 0.517873676 0.599272260 0.687970710 -6.336578048 -0.035121311 -2.243912777

134 135 136 137 138 139 140

-0.315644027 0.683403194 0.104310342 0.050482744 -0.606344940 0.070921674 0.331825346

141 142 143 144 145 146 147

0.901407115 0.278173349 0.226036646 0.839513668 0.838215773 0.525437601 -0.251400363

148 149 150 151 152 153 154

-0.357298031 0.597009313 0.498354152 -0.652259310 1.191809797 0.400653179 0.443183648

155 156 157 158 159 160 161

0.348322799 -4.014988236 1.062813610 0.239336518 -1.207721665 0.470257247 0.440164338

162 163 164 165 166 167 168

0.546186678 0.323774955 0.527472418 0.615030422 -0.293809395 -0.908532596 0.181231023

169 170 171 172 173 174 175

0.031173865 -0.760813788 -0.270220762 0.269048951 -0.532729533 0.229194030 -0.417988010

176 177 178 179 180 181 182

-1.162161842 -0.317044754 0.031279478 -0.993322205 0.598803352 0.241137570 -0.161605765

183 184 185 186 187 188 189

0.363747799 -0.721146284 -0.486323129 0.587271602 0.506284662 0.112316607 -1.033537066

190 191 192 193 194 195 196

-1.002461552 0.345257593 0.510029275 -1.373705673 0.840039150 0.872643020 -0.140229642

197 198 199 200

0.507538754 0.612009645 -0.820874664 -0.200486969

> predict(model3)

1 2 3 4 5 6 7 8 9

21.686390 10.634546 9.261214 17.634108 12.636919 8.789898 10.844280 12.171527 6.994718

10 11 12 13 14 15 16 17 18

11.206064 8.596731 17.142359 9.125460 9.637006 18.893947 21.985969 11.797676 25.375420

19 20 21 22 23 24 25 26 27

10.204953 14.078542 18.294271 12.747465 7.689267 15.790725 9.156734 12.872642 14.874492

28 29 30 31 32 33 34 35 36

16.174841 19.610351 9.787826 22.167703 11.543277 8.808546 18.172132 8.764166 13.716190

37 38 39 40 41 42 43 44 45

25.813742 13.612132 9.594353 21.532374 16.168112 17.518185 21.993884 12.832944 8.672233

46 47 48 49 50 51 52 53 54

15.024693 9.714144 23.347250 15.446233 9.216180 11.329035 9.992234 21.891567 20.737224

55 56 57 58 59 60 61 62 63

20.819408 22.650652 7.923506 12.747132 23.568240 18.379467 7.946103 25.096243 15.798414

64 65 66 67 68 69 70 71 72

12.869024 16.586002 9.033799 8.903793 12.024031 19.171655 22.499037 18.055796 10.966170

73 74 75 76 77 78 79 80 81

9.175416 10.187780 17.240060 9.136634 7.369482 13.605714 7.891716 10.158626 11.196432

82 83 84 85 86 87 88 89 90

12.517205 10.435201 12.648091 22.043859 14.833936 11.281029 14.919602 11.619189 15.929445

91 92 93 94 95 96 97 98 99

10.171900 7.386412 19.799097 22.546038 10.839374 16.388029 11.377023 15.106826 26.818837

100 101 102 103 104 105 106 107 108

16.661645 12.161435 25.149353 15.468632 14.347130 21.166950 17.675380 7.843997 8.515081

109 110 111 112 113 114 115 116 117

7.017682 19.869479 13.311608 22.442662 13.490544 16.039552 13.570898 12.050674 11.984525

118 119 120 121 122 123 124 125 126

8.299037 15.255693 7.919794 14.337041 8.178836 11.682225 14.727794 20.120128 9.874345

127 128 129 130 131 132 133 134 135

8.351540 8.282126 24.100728 9.012029 7.936578 12.735121 7.943913 19.915644 10.116597

136 137 138 139 140 141 142 143 144

11.495690 9.449517 21.406345 9.529078 20.368175 9.998593 18.921827 19.873963 9.560486

145 146 147 148 149 150 151 152 153

10.561784 9.774562 13.451400 25.757298 10.302991 9.601646 16.752259 10.408190 16.199347

154 155 156 157 158 159 160 161 162

18.556816 15.251677 7.214988 14.237186 9.860663 8.507722 12.429743 13.959836 12.753813

163 164 165 166 167 168 169 170 171

14.576225 17.472528 11.284970 12.193809 8.908533 12.018769 17.068826 15.760814 8.670221

172 173 174 175 176 177 178 179 180

14.230951 8.132730 11.470806 11.917988 28.162162 20.517045 11.668721 12.793322 12.001197

181 182 183 184 185 186 187 188 189

10.258862 12.361606 8.336252 26.921146 18.086323 22.012728 9.793715 17.187683 16.933537

190 191 192 193 194 195 196 197 198

7.702462 10.454742 9.389971 7.273706 18.759961 16.427357 7.740230 9.192461 12.187990

199 200

26.320875 13.600487

> predict(model3, as.data.frame(TV = 50, Radio = 50, Newspaper = 50))

Error in as.data.frame(TV = 50, Radio = 50, Newspaper = 50) :

argument "x" is missing, with no default

> predict(model3, interval = 'confidence')

fit lwr upr

1 21.686390 21.441154 21.931626

2 10.634546 10.332002 10.937089

3 9.261214 8.827791 9.694638

4 17.634108 17.426756 17.841460

5 12.636919 12.447024 12.826814

6 8.789898 8.294507 9.285289

7 10.844280 10.616925 11.071635

8 12.171527 12.030203 12.312850

9 6.994718 6.557141 7.432295

10 11.206064 10.930860 11.481268

11 8.596731 8.319413 8.874050

12 17.142359 16.974324 17.310394

13 9.125460 8.831403 9.419516

14 9.637006 9.418920 9.855092

15 18.893947 18.711264 19.076630

16 21.985969 21.702297 22.269641

17 11.797676 11.554935 12.040418

18 25.375420 25.030271 25.720570

19 10.204953 10.024482 10.385424

20 14.078542 13.946652 14.210433

21 18.294271 18.118998 18.469545

22 12.747465 12.429276 13.065655

23 7.689267 7.415333 7.963202

24 15.790725 15.585629 15.995821

25 9.156734 8.930208 9.383260

26 12.872642 12.483804 13.261480

27 14.874492 14.731828 15.017157

28 16.174841 15.953440 16.396242

29 19.610351 19.403449 19.817254

30 9.787826 9.592717 9.982935

31 22.167703 21.901096 22.434310

32 11.543277 11.392264 11.694289

33 8.808546 8.541697 9.075395

34 18.172132 17.935544 18.408721

35 8.764166 8.494395 9.033937

36 13.716190 13.272815 14.159565

37 25.813742 25.446034 26.181449

38 13.612132 13.260941 13.963323

39 9.594353 9.381565 9.807141

40 21.532374 21.290783 21.773965

41 16.168112 16.009528 16.326695

42 17.518185 17.352200 17.684170

43 21.993884 21.728488 22.259280

44 12.832944 12.595744 13.070143

45 8.672233 8.440054 8.904412

46 15.024693 14.885315 15.164072

47 9.714144 9.503695 9.924593

48 23.347250 23.053829 23.640672

49 15.446233 15.235921 15.656545

50 9.216180 8.989454 9.442906

51 11.329035 11.058142 11.599928

52 9.992234 9.791278 10.193191

53 21.891567 21.631985 22.151149

54 20.737224 20.479967 20.994480

55 20.819408 20.590500 21.048317

56 22.650652 22.347287 22.954017

57 7.923506 7.659257 8.187755

58 12.747132 12.609896 12.884368

59 23.568240 23.244505 23.891976

60 18.379467 18.206093 18.552842

61 7.946103 7.607421 8.284785

62 25.096243 24.752298 25.440188

63 15.798414 15.570143 16.026685

64 12.869024 12.706329 13.031718

65 16.586002 16.362615 16.809390

66 9.033799 8.791457 9.276141

67 8.903793 8.681634 9.125953

68 12.024031 11.870953 12.177109

69 19.171655 18.976923 19.366387

70 22.499037 22.219274 22.778800

71 18.055796 17.888205 18.223387

72 10.966170 10.800461 11.131879

73 9.175416 8.904641 9.446192

74 10.187780 9.981166 10.394393

75 17.240060 17.073358 17.406761

76 9.136634 8.731556 9.541712

77 7.369482 6.969485 7.769479

78 13.605714 13.458491 13.752936

79 7.891716 7.614225 8.169206

80 10.158626 9.958244 10.359009

81 11.196432 11.020516 11.372348

82 12.517205 12.183818 12.850592

83 10.435201 10.260698 10.609704

84 12.648091 12.334282 12.961900

85 22.043859 21.776935 22.310782

86 14.833936 14.672953 14.994919

87 11.281029 11.102560 11.459498

88 14.919602 14.696885 15.142320

89 11.619189 11.457196 11.781183

90 15.929445 15.648887 16.210002

91 10.171900 9.961298 10.382502

92 7.386412 6.987692 7.785132

93 19.799097 19.599561 19.998633

94 22.546038 22.282285 22.809790

95 10.839374 10.670463 11.008284

96 16.388029 16.235508 16.540550

97 11.377023 11.112862 11.641185

98 15.106826 14.959563 15.254090

99 26.818837 26.424323 27.213350

100 16.661645 16.448068 16.875222

101 12.161435 11.863261 12.459609

102 25.149353 24.815604 25.483102

103 15.468632 15.124625 15.812639

104 14.347130 14.185790 14.508471

105 21.166950 20.937967 21.395932

106 17.675380 17.428588 17.922171

107 7.843997 7.546097 8.141897

108 8.515081 8.227879 8.802283

109 7.017682 6.567574 7.467789

110 19.869479 19.655123 20.083834

111 13.311608 13.043949 13.579266

112 22.442662 22.179278 22.706046

113 13.490544 13.330246 13.650841

114 16.039552 15.870841 16.208262

115 13.570898 13.251833 13.889963

116 12.050674 11.829652 12.271697

117 11.984525 11.830532 12.138519

118 8.299037 7.992684 8.605390

119 15.255693 15.069464 15.441921

120 7.919794 7.655807 8.183782

121 14.337041 14.201101 14.472980

122 8.178836 7.939968 8.417704

123 11.682225 11.362459 12.001992

124 14.727794 14.553903 14.901684

125 20.120128 19.914447 20.325808

126 9.874345 9.673866 10.074825

127 8.351540 7.989265 8.713815

128 8.282126 7.975030 8.589222

129 24.100728 23.766210 24.435246

130 9.012029 8.777303 9.246756

131 7.936578 7.552429 8.320727

132 12.735121 12.333699 13.136544

133 7.943913 7.685245 8.202580

134 19.915644 19.713830 20.117458

135 10.116597 9.808542 10.424652

136 11.495690 11.116478 11.874902

137 9.449517 9.117847 9.781187

138 21.406345 21.162889 21.649801

139 9.529078 9.318424 9.739732

140 20.368175 20.127083 20.609267

141 9.998593 9.811392 10.185794

142 18.921827 18.733708 19.109946

143 19.873963 19.673174 20.074753

144 9.560486 9.335951 9.785022

145 10.561784 10.387581 10.735987

146 9.774562 9.543496 10.005629

147 13.451400 13.150624 13.752177

148 25.757298 25.377335 26.137261

149 10.302991 9.978868 10.627113

150 9.601646 9.393255 9.810037

151 16.752259 16.448377 17.056142

152 10.408190 10.215632 10.600748

153 16.199347 16.045898 16.352795

154 18.556816 18.355553 18.758080

155 15.251677 15.102606 15.400748

156 7.214988 6.887078 7.542898

157 14.237186 13.972284 14.502089

158 9.860663 9.624354 10.096973

159 8.507722 8.175511 8.839933

160 12.429743 12.289617 12.569869

161 13.959836 13.812353 14.107319

162 12.753813 12.539607 12.968020

163 14.576225 14.418055 14.734395

164 17.472528 17.292709 17.652346

165 11.284970 11.125735 11.444204

166 12.193809 11.863597 12.524022

167 8.908533 8.579084 9.237981

168 12.018769 11.755092 12.282446

169 17.068826 16.899893 17.237760

170 15.760814 15.415117 16.106510

171 8.670221 8.418172 8.922270

172 14.230951 14.094092 14.367811

173 8.132730 7.890748 8.374711

174 11.470806 11.266428 11.675184

175 11.917988 11.611116 12.224860

176 28.162162 27.706509 28.617815

177 20.517045 20.299887 20.734202

178 11.668721 11.467795 11.869647

179 12.793322 12.357560 13.229085

180 12.001197 11.817591 12.184802

181 10.258862 10.029656 10.488069

182 12.361606 12.080612 12.642600

183 8.336252 8.040766 8.631739

184 26.921146 26.521661 27.320631

185 18.086323 17.870077 18.302569

186 22.012728 21.739074 22.286382

187 9.793715 9.564041 10.023390

188 17.187683 17.032653 17.342714

189 16.933537 16.621006 17.246068

190 7.702462 7.404626 8.000297

191 10.454742 10.124619 10.784865

192 9.389971 9.168255 9.611686

193 7.273706 6.882186 7.665226

194 18.759961 18.544673 18.975249

195 16.427357 16.256071 16.598643

196 7.740230 7.388711 8.091748

197 9.192461 8.949645 9.435277

198 12.187990 11.991653 12.384328

199 26.320875 25.942362 26.699387

200 13.600487 13.326103 13.874871

> predict(model3, as.data.frame(TV = 50, Radio = 50, Newspaper = 50))

Error in as.data.frame(TV = 50, Radio = 50, Newspaper = 50) :

argument "x" is missing, with no default

> pairs(Advertising,panel=panel.smooth)

Error in pairs.default(Advertising, panel = panel.smooth) :

only one column in the argument to 'pairs'

> predict(model3, as.data.frame cblind(TV = 50, Radio = 50, Newspaper = 50))

Error: unexpected symbol in "predict(model3, as.data.frame cblind"

> predict(model3, as.data.frame cblind((TV = 50, Radio = 50, Newspaper = 50))

Error: unexpected symbol in "predict(model3, as.data.frame cblind"

> predict(model3, as.data.frame cblind((TV = 50, Radio = 50, Newspaper = 50)))

Error: unexpected symbol in "predict(model3, as.data.frame cblind"

> predict(model3, as.data.frame (cblind(TV = 50, Radio = 50, Newspaper = 50)))

Error in cblind(TV = 50, Radio = 50, Newspaper = 50) :

could not find function "cblind"

> predict(model3, as.data.frame(cbind(TV = 50, Radio = 50, Newspaper = 50)))

1

11.86453

> pairs(Advertising,panel=panel.smooth)

Error in pairs.default(Advertising, panel = panel.smooth) :

only one column in the argument to 'pairs'

> cov(Advertising,method="pearson") #covariance

Error in cov(Advertising, method = "pearson") :

supply both 'x' and 'y' or a matrix-like 'x'

> pairs(Advertising,panel=panel.smooth)\

Error: unexpected '\\' in "pairs(Advertising,panel=panel.smooth)\"

> pairs(Advertising,panel=panel.smooth)

Error in pairs.default(Advertising, panel = panel.smooth) :

only one column in the argument to 'pairs'

> pairs(advertising,panel=panel.smooth)

> cov(advertising,method="pearson") #covariance

X TV Radio Newspaper Sales

X 3350.00000 88.02739 -95.11005 -195.31156 -15.58719

TV 88.02739 7370.94989 69.86249 105.91945 350.39019

Radio -95.11005 69.86249 220.42774 114.49698 44.63569

Newspaper -195.31156 105.91945 114.49698 474.30833 25.94139

Sales -15.58719 350.39019 44.63569 25.94139 27.22185

> cor(Advertising,method="pearson")

Error in cor(Advertising, method = "pearson") :

supply both 'x' and 'y' or a matrix-like 'x'

> cor(advertising,method="pearson")

X TV Radio Newspaper Sales

X 1.00000000 0.01771469 -0.11068044 -0.15494414 -0.05161625

TV 0.01771469 1.00000000 0.05480866 0.05664787 0.78222442

Radio -0.11068044 0.05480866 1.00000000 0.35410375 0.57622257

Newspaper -0.15494414 0.05664787 0.35410375 1.00000000 0.22829903

Sales -0.05161625 0.78222442 0.57622257 0.22829903 1.00000000

> cor(TV,Sales)

[1] 0.7822244

>

> model4=lm(Sales~TV+I(TV\*TV))

>

> summary(model4)

Call:

lm(formula = Sales ~ TV + I(TV \* TV))

Residuals:

Min 1Q Median 3Q Max

-7.6844 -1.7843 -0.1562 2.0088 7.5097

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 6.114e+00 6.592e-01 9.275 < 2e-16 \*\*\*

TV 6.727e-02 1.059e-02 6.349 1.46e-09 \*\*\*

I(TV \* TV) -6.847e-05 3.558e-05 -1.924 0.0557 .

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.237 on 197 degrees of freedom

Multiple R-squared: 0.619, Adjusted R-squared: 0.6152

F-statistic: 160.1 on 2 and 197 DF, p-value: < 2.2e-16

>

> anova(model4)

Analysis of Variance Table

Response: Sales

Df Sum Sq Mean Sq F value Pr(>F)

TV 1 3314.6 3314.6 316.4072 < 2e-16 \*\*\*

I(TV \* TV) 1 38.8 38.8 3.7036 0.05574 .

Residuals 197 2063.7 10.5

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> par(mfrow=c(2,2))

>

> plat(model4)

Error in plat(model4) : could not find function "plat"

> plot(model4)

> x = 1:10

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 5.471

> x = 1:10

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 5.4745

> hist(M, main ="histogram of median")

> x = 1:10

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)hist(M, main ="histogram of median")

Error: unexpected symbol in "mean(M)hist"

> x = 1:10

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M) hist(M, main ="histogram of median")

Error: unexpected symbol in "mean(M) hist"

> x = 1:10

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 5.5465

> hist(M, main ="histogram of median")

> x = 10\*rexp(11)

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 7.72598

>

> hist(M, main ="histogram of median")

>

> poly\_order = c(1:10)

> MSE = rep(0, 10)

> Table1 = data.frame(poly\_order, MSE)

> for (i in 1:10) {

+ m <- lm(mpg~poly(horsepower, i), data=Auto)

+ Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2)

Error: unexpected symbol in:

" m <- lm(mpg~poly(horsepower, i), data=Auto)

Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2"

> poly\_order = c(1:10)

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+ Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2)

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" m <- lm(mpg~poly(horsepower, i), data=Auto)

Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2"

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> MSE = rep(0, 10)

> Table1 = data.frame(poly\_order, MSE)

> for (i in 1:10) {

+ m <- lm(mpg~poly(horsepower, i), data=Auto)

+ Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2)

Error: unexpected symbol in:

" m <- lm(mpg~poly(horsepower, i), data=Auto)

Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2"

> poly\_order = c(1:10)

> MSE = rep(0, 10)

> Table1 = data.frame(poly\_order, MSE)

> for (i in 1:10) {

+ m <- lm(mpg~poly(horsepower, i), data=Auto)

+ Table1[i,2]=mean((mpg -predict(m, Auto))^2)

+ }

Error: object 'mpg' not found

> attach(Auto)

> poly\_order = c(1:10)

> MSE = rep(0, 10)

> Table1 = data.frame(poly\_order, MSE)

> for (i in 1:10) {

+ m <- lm(mpg~poly(horsepower, i), data=Auto)

+ Table1[i,2]=mean((mpg -predict(m, Auto))^2)

+ }

> plot(Table1$poly\_order , Table1$MSE , type = "b",

+ main = "Train error",

+ xlab = "order/degree of polynomial",

+ ylab = "MSE")

>

>

> poly\_order = c(1:10)

> MSE = rep(0, 10)

> Table1 = data.frame(poly\_order, MSE)

> for (i in 1:10) {

+ m <- lm(mpg~poly(horsepower, i), data=Auto)

+ Table1[i,2]=mean((mpg -predict(m, Auto))^2)

+ }

> plot(Table1$poly\_order , Table1$MSE , type = "b",

+ main = "Train error",

+ xlab = "order/degree of polynomial",

+ ylab = "MSE")

>

>

> set.seed(1)

> tr.id = sample(1:nrow(Auto),nrow(Auto)/2)

> train=Auto[tr.id , ]

> dim(Auto)

[1] 392 9

>

> model3 = lm(mpg~poly(horsepower, 2), data=Auto, subset = tr.id)

> #we select only the training set using "subset"

> coef(model3)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.54955 -123.58813 47.71889

>

> mpg\_hat <- predict (model3 ,Auto[-tr.id,])

> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

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> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

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>

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> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> model3 = lm(mpg~poly(horsepower, 2), data=Auto, subset = tr.id)

> #we select only the training set using "subset"

> coef(model3)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.54955 -123.58813 47.71889

>

> mpg\_hat <- predict (model3 ,Auto[-tr.id,])

> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> mpg\_hat <- predict (model3 ,Auto[-tr.id,])

> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2) # calculating validation MSE

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> model3 = lm(mpg~poly(horsepower, 2), data=Auto, subset = tr.id)

> #we select only the training set using "subset"

> coef(model3)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.54955 -123.58813 47.71889

>

> mpg\_hat <- predict (model3 ,Auto[-tr.id,])

> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> mpg\_hat <- predict (model3 ,Auto[-tr.id,])

> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2)

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> poly\_order = c(1:10)

> MSE = rep(0, 10)

> Table1 = data.frame(poly\_order, MSE)

> for (i in 1:10) {

+ m <- lm(mpg~poly(horsepower, i), data=Auto)

+ Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2)

Error: unexpected symbol in:

" m <- lm(mpg~poly(horsepower, i), data=Auto)

Table1[i,2]=mean((mpg -predict(m, Auto))ˆ2"

> set.seed(1)

> tr.id = sample(1:nrow(Auto),nrow(Auto)/2)

> train=Auto[tr.id , ]

> dim(Auto)

[1] 392 9

>

> model3 = lm(mpg~poly(horsepower, 2), data=Auto, subset = tr.id)

> #we select only the training set using "subset"

> coef(model3

+ model3 = lm(mpg~poly(horsepower, 2), data=Auto, subset = tr.id)

Error: unexpected symbol in:

"coef(model3

model3"

> model3 = lm(mpg~poly(horsepower, 2), data=Auto, subset = tr.id)

> coef(model3)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.54955 -123.58813 47.71889

> mpg\_hat <- predict (model3 ,Auto[-tr.id,])

> mpg\_validation <- Auto[-tr.id,"mpg"]

> mean((mpg\_validation-mpg\_hat)ˆ2))

Error: unexpected symbol in "mean((mpg\_validation-mpg\_hat)ˆ2"

> library (boot)

> model4=glm(mpg~poly(horsepower, 2) ,data=Auto)

> coef(model4)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.44592 -120.13774 44.08953

>

> lm\_fit=lm(mpg~poly(horsepower, 2) ,data=Auto)

> coef(lm\_fit)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.44592 -120.13774 44.08953

> cv\_error=rep(0,10)

> for (i in 1:10){

+ glm.fit=glm(mpg~poly(horsepower,i),data=Auto)

+ cv\_error[i]=cv.glm(Auto,glm.fit)$delta[1]

+ }

> cv\_error

[1] 24.23151 19.24821 19.33498 19.42443 19.03321 18.97864 18.83305 18.96115 19.06863 19.49093

>

>

> cv\_error=rep(0,10)

> for (i in 1:10){

+ glm.fit=glm(mpg~poly(horsepower,i),data=Auto)

+ cv\_error[i]=cv.glm(Auto,glm.fit)$delta[1]

+ }

>

> lm\_fit=lm(mpg~poly(horsepower, 2) ,data=Auto)

> coef(lm\_fit)cv\_err =cv.glm(Auto ,model4)

Error: unexpected symbol in "coef(lm\_fit)cv\_err"

> cv\_error=rep(0,10)

> for (i in 1:10){

+ glm.fit=glm(mpg~poly(horsepower,i),data=Auto)

+ cv\_error[i]=cv.glm(Auto,glm.fit)$delta[1]

+ }

>

> cv\_err =cv.glm(Auto ,model4)

> cv\_err$delta

[1] 19.24821 19.24787

>

>

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> cv\_err$delta

[1] 19.24821 19.24787

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>

>

>

>

> cv\_err =cv.glm(Auto ,model4)

> cv\_err$delta

[1] 19.24821 19.24787

>

>

>

>

>

> lm\_fit=lm(mpg~poly(horsepower, 2) ,data=Auto)

> coef(lm\_fit)x = 10\*rexp(11)

Error: unexpected symbol in "coef(lm\_fit)x"

> x = 10\*rexp(11)

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 10.65097

> sd(m)

Error in is.data.frame(x) :

'list' object cannot be coerced to type 'double'

> sd(M)

[1] 4.550688

> hist(M, main ="histogram of median")

> x = 1:10

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 5.4585

> sd(M)

[1] 1.441564

> hist(M, main="Histogram of median")

> library (boot)

> model4=glm(mpg~poly(horsepower, 2) ,data=Auto)

> coef(model4)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.44592 -120.13774 44.08953

> lm\_fit=lm(mpg~poly(horsepower, 2) ,data=Auto)

> coef(lm\_fit)

(Intercept) poly(horsepower, 2)1 poly(horsepower, 2)2

23.44592 -120.13774 44.08953

> cv\_err =cv.glm(Auto ,model4)

> cv\_err$delta

[1] 19.24821 19.24787

> str(cv\_err)

List of 4

$ call : language cv.glm(data = Auto, glmfit = model4)

$ K : num 392

$ delta: num [1:2] 19.2 19.2

$ seed : int [1:626] 10403 74 -114373402 -1044149242 -1491282274 406308018 -2031844435 -725490952 1213533215 -1111364207 ...

> cv\_error=rep(0,10)

> for (i in 1:10){

+ glm.fit=glm(mpg~poly(horsepower,i),data=Auto)

+ cv\_error[i]=cv.glm(Auto,glm.fit)$delta[1]

+ }

> cv\_error

[1] 24.23151 19.24821 19.33498 19.42443 19.03321 18.97864 18.83305 18.96115 19.06863

[10] 19.49093

> x = 10\*rexp(11)

> n = length(x)

> B = 1000

> M = rep(NA, B)

> M[1] = median(x)

> for(i in 2:B)M[i] = median(sample(x, replace=TRUE))

> mean(M)

[1] 8.106701

>

> sd(M)

[1] 2.47766

> hist(M, main="Histogram of median")