Self-Assessment #2 - Solutions

MGT 6203 - Data Analytics in Business

Georgia Tech, Summer 2020

Install and load the dataset named Carseats (in the ISLR package) into R.

library("ISLR")  
data("Carseats")

Model1 = lm(Carseats$Sales~Carseats$Price)  
summary(Model1)

##   
## Call:  
## lm(formula = Carseats$Sales ~ Carseats$Price)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.5224 -1.8442 -0.1459 1.6503 7.5108   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 13.641915 0.632812 21.558 <2e-16 \*\*\*  
## Carseats$Price -0.053073 0.005354 -9.912 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.532 on 398 degrees of freedom  
## Multiple R-squared: 0.198, Adjusted R-squared: 0.196   
## F-statistic: 98.25 on 1 and 398 DF, p-value: < 2.2e-16

print("Question1")

## [1] "Question1"

summary(Model1)$adj.r.squared

## [1] 0.195966

print("Question2")

## [1] "Question2"

summary(Model1)$coefficients[2]

## [1] -0.05307302

print("Question3")

## [1] "Question3"

summary(Model1)$coefficients[6]

## [1] -9.911997

print("Question4")

## [1] "Question4"

print("Since the p value is less that 0.05, the estimated Coefficient is statistically different from 0")

## [1] "Since the p value is less that 0.05, the estimated Coefficient is statistically different from 0"

Carseats$Bad\_Shelf<-ifelse(Carseats$ShelveLoc=="Bad",1,0)  
Carseats$Good\_Shelf<-ifelse(Carseats$ShelveLoc=="Good",1,0)  
  
Model2<-lm(Carseats$Sales~Carseats$Price+Carseats$Bad\_Shelf+Carseats$Good\_Shelf)  
summary(Model2)

##   
## Call:  
## lm(formula = Carseats$Sales ~ Carseats$Price + Carseats$Bad\_Shelf +   
## Carseats$Good\_Shelf)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.8229 -1.3930 -0.0179 1.3868 5.0780   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 13.863824 0.487021 28.467 < 2e-16 \*\*\*  
## Carseats$Price -0.056698 0.004059 -13.967 < 2e-16 \*\*\*  
## Carseats$Bad\_Shelf -1.862022 0.234748 -7.932 2.23e-14 \*\*\*  
## Carseats$Good\_Shelf 3.033825 0.245178 12.374 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.917 on 396 degrees of freedom  
## Multiple R-squared: 0.5426, Adjusted R-squared: 0.5391   
## F-statistic: 156.6 on 3 and 396 DF, p-value: < 2.2e-16

print("Question5")

## [1] "Question5"

summary(Model2)$coefficients[3]

## [1] -1.862022

print("Question6")

## [1] "Question6"

summary(Model2)$coefficients[1]

## [1] 13.86382

print("Question7")

## [1] "Question7"

summary(Model2)$coefficients[1]+summary(Model2)$coefficients[3]

## [1] 12.0018

print("Question8")

## [1] "Question8"

print("The coefficient of Good\_Shelf captures the difference in sales of carseats if they are located in the Good shelf location compared to that of carseats located in the Medium shelf location.")

## [1] "The coefficient of Good\_Shelf captures the difference in sales of carseats if they are located in the Good shelf location compared to that of carseats located in the Medium shelf location."

#setwd("~/Desktop/PriceDemand.csv")  
PriceDemand = read.csv("PriceDemand.csv", header = TRUE)  
Model3<-lm(PriceDemand$Qty~PriceDemand$Price)  
summary(Model3)

##   
## Call:  
## lm(formula = PriceDemand$Qty ~ PriceDemand$Price)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -338.04 -153.96 -5.62 156.90 676.23   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3501.99 225.57 15.525 < 2e-16 \*\*\*  
## PriceDemand$Price -393.63 44.14 -8.918 9.38e-12 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 214.3 on 48 degrees of freedom  
## Multiple R-squared: 0.6236, Adjusted R-squared: 0.6158   
## F-statistic: 79.52 on 1 and 48 DF, p-value: 9.377e-12

print("Question9")

## [1] "Question9"

print("One dollar increase in price decreases demand by 394 units")

## [1] "One dollar increase in price decreases demand by 394 units"

PriceDemand$Price\_ln<-log(PriceDemand$Price)  
Model4<-lm(PriceDemand$Qty~PriceDemand$Price\_ln)  
summary(Model4)

##   
## Call:  
## lm(formula = PriceDemand$Qty ~ PriceDemand$Price\_ln)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -319.34 -135.82 -0.56 147.41 560.01   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 4723.8 322.4 14.65 < 2e-16 \*\*\*  
## PriceDemand$Price\_ln -1993.9 199.2 -10.01 2.46e-13 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 198.8 on 48 degrees of freedom  
## Multiple R-squared: 0.6761, Adjusted R-squared: 0.6693   
## F-statistic: 100.2 on 1 and 48 DF, p-value: 2.457e-13

#For small p, approximately log([100 + p]/100) ≈ p/100. For p = 1, this means that b1/100 can be interpreted approximately as the expected increase in Y from a 1% increase in X  
  
print("Question10")

## [1] "Question10"

print("When price increases by 1%, quantity decreases by 19.94 units")

## [1] "When price increases by 1%, quantity decreases by 19.94 units"

PriceDemand$Qty\_ln<-log(PriceDemand$Qty)  
Model5<-lm(PriceDemand$Qty\_ln~PriceDemand$Price)  
summary(Model5)

##   
## Call:  
## lm(formula = PriceDemand$Qty\_ln ~ PriceDemand$Price)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.245148 -0.091984 -0.000218 0.104754 0.264779   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 8.48937 0.13359 63.550 < 2e-16 \*\*\*  
## PriceDemand$Price -0.23550 0.02614 -9.009 6.88e-12 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1269 on 48 degrees of freedom  
## Multiple R-squared: 0.6284, Adjusted R-squared: 0.6206   
## F-statistic: 81.16 on 1 and 48 DF, p-value: 6.877e-12

#Interpretation of the estimated coefficient b1 is that a one-unit increase in X will produce an expected increase in log Y of b1 units. In terms of Y itself, this means that the expected value of Y is multiplied by e^b1.  
#For small values of b1, approximately e^b1 ≈ 1+b1. We can use this for the following approximation for a quick interpretation of the coefficients: 100\*b1 is the expected percentage change in Y for a unit increase in X.  
print("Question11")

## [1] "Question11"

print("When price increases by $0.1, quantity decreases (on average) by 2.35%")

## [1] "When price increases by $0.1, quantity decreases (on average) by 2.35%"

Model6<-lm(PriceDemand$Qty\_ln~PriceDemand$Price\_ln)  
summary(Model6)

##   
## Call:  
## lm(formula = PriceDemand$Qty\_ln ~ PriceDemand$Price\_ln)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.23437 -0.08879 -0.00340 0.09432 0.20484   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 9.2011 0.1946 47.273 < 2e-16 \*\*\*  
## PriceDemand$Price\_ln -1.1810 0.1202 -9.822 4.55e-13 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.12 on 48 degrees of freedom  
## Multiple R-squared: 0.6677, Adjusted R-squared: 0.6608   
## F-statistic: 96.46 on 1 and 48 DF, p-value: 4.552e-13

#Increasing log(Price) by 0.01 changes log(Qty) by b1 \* 0.01 units which implies increasing Price by 1% changes Qty by b1 %  
print("Question12")

## [1] "Question12"

print("When price increases by 1%, quantity decreases (on average) by 1.18%")

## [1] "When price increases by 1%, quantity decreases (on average) by 1.18%"