DM Assignment 1

Brandon Palazzo

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1. The optimal price for selling car seats in a “good” location at a cost $55 to make is $163.63.

2. The optimal price for selling car seats in a “bad” location at a cost $55 to make is $135.07.

3. Good Location

```
##   Cost       Optimal Price
## A  40.00        156.13
## B  45.00        158.63
## C  50.00        161.13
## D  55.00        163.63
## E  60.00        166.13
## F  65.00        168.63
## G  70.00        171.13
## H  75.00        173.63
## I  80.00        176.13
## J  85.00        178.63
```

Bad Location

4.
```
      Cost       Optimal Price
## A  40.00        127.57
## B  45.00        130.07
## C  50.00        132.57
## D  55.00        135.07
## E  60.00        137.57
## F  65.00        140.07
## G  70.00        142.57
## H  75.00        145.07
## I  80.00        147.57
## J  85.00        150.07
```

Uploading dataset

```
library(ISLR)
SafeBabies <- Carseats[,c(1,6,7)]
```

Split the data by Shelve Location

```
SafeBabies_Split <- split(SafeBabies, SafeBabies$ShelveLoc)
SafeBabies_Bad <- SafeBabies_Split$Bad
SafeBabies_Good <- SafeBabies_Split$Good
```

Creating best fit line

```
ols_bad <- lm(Sales ~ Price, data = SafeBabies_Bad)
ols_good <- lm(Sales ~ Price, data = SafeBabies_Good)
ols_bad

##
## Call:
## lm(formula = Sales ~ Price, data = SafeBabies_Bad)
##
## Coefficients:
## (Intercept)        Price
##    11.83298     -0.05522

ols_good

##
## Call:
## lm(formula = Sales ~ Price, data = SafeBabies_Good)
##
## Coefficients:
## (Intercept)        Price
##    17.96886     -0.06578
```

Plot Bad Location Regression Model

```
plot (SafeBabies_Bad$Sales ~ SafeBabies_Bad$Price,
    main = "Bad Location Regression Model",
    xlab = "Price",
    ylab = "Sales",
    pch = 18,
    col = "red" )

abline(ols_bad)
```

Plot Good Location Regression Model

```
plot (SafeBabies_Good$Sales ~ SafeBabies_Good$Price,
    main = "Good Location Regression Model",
    xlab = "Price",
    ylab = "Sales",
    pch = 18,
    col = "blue" )

abline(ols_good)
```

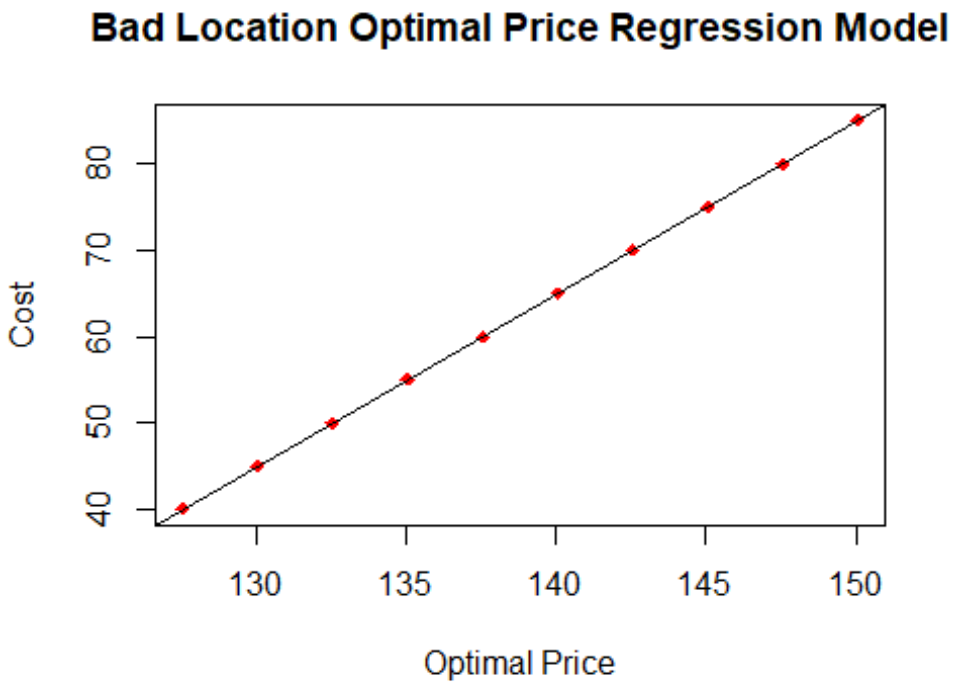
Optimal Prices for Bad Location Car Seats

```
optimal_bad_prices <- matrix(c(40,127.57,45,130.07,50,132.57,55,135.07,60,137
.57,65,140.07,70,142.57,75,145.07,80,147.57,85,150.07 ),ncol=2,byrow=TRUE)

bad_location_cost <- c(40,45,50,55,60,65,70,75,80,85)
bad_location_prices <- c(127.57,130.07,132.57,135.07,137.57,140.07,142.57,145
.07,147.57,150.07)
ols_bad_optimal <- lm( bad_location_cost ~ bad_location_prices )

colnames(optimal_bad_prices) <- c("Cost","Optimal Price")

optimal_bad_prices<- as.table(optimal_bad_prices)
optimal_bad_prices
```

```
##     Cost Optimal Price
## A  40.00        127.57
## B  45.00        130.07
## C  50.00        132.57
## D  55.00        135.07
## E  60.00        137.57
## F  65.00        140.07
## G  70.00        142.57
## H  75.00        145.07
## I  80.00        147.57
## J  85.00        150.07
```

Plot Optimal Price Bad Location Regression Model

```
plot (bad_location_cost ~ bad_location_prices,
    main = "Bad Location Optimal Price Regression Model",
    xlab = "Optimal Price",
    ylab = "Cost",
    pch = 18,
    col = "red" )

abline(ols_bad_optimal)
```



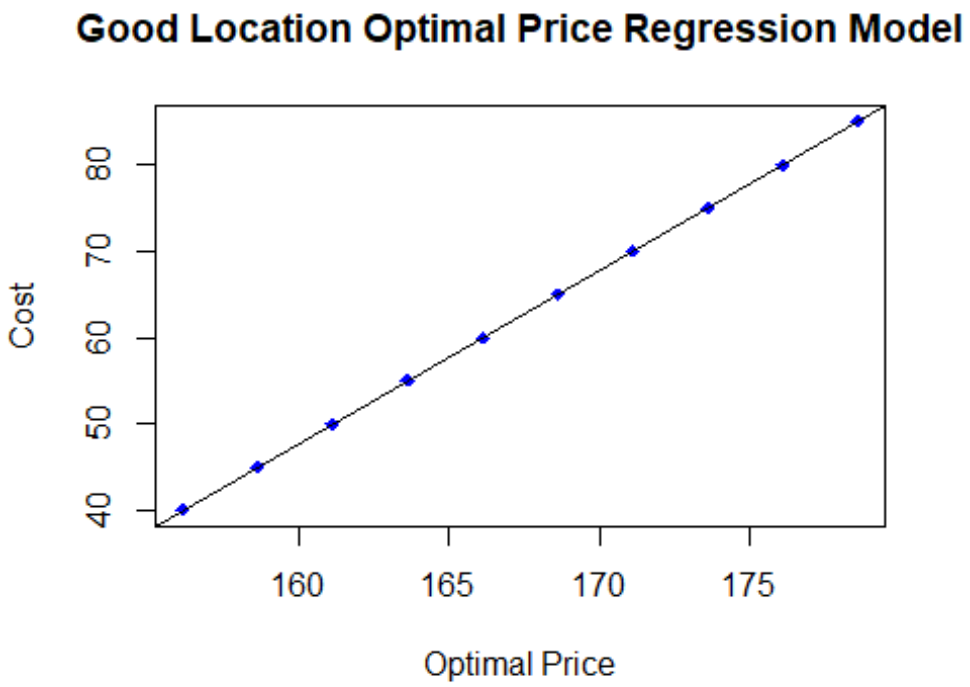
Optimal Prices for Good Location Car Seats

```
optimal_good_prices <- matrix(c(40,156.13,45,158.63,50,161.13,55,163.63,60,16
6.13,65,168.63,70,171.13,75,173.63,80,176.13,85,178.63 ),ncol=2,byrow=TRUE)

good_location_cost <- c(40,45,50,55,60,65,70,75,80,85)
good_location_prices <- c(156.13,158.63,161.13,163.63,166.13,168.63,171.13,17
3.63,176.13,178.63)
ols_good_optimal <- lm( good_location_cost ~ good_location_prices )


colnames(optimal_good_prices) <- c("Cost","Optimal Price")

optimal_good_prices<- as.table(optimal_good_prices)
optimal_good_prices
```

```
##     Cost Optimal Price
## A  40.00        156.13
## B  45.00        158.63
## C  50.00        161.13
## D  55.00        163.63
## E  60.00        166.13
## F  65.00        168.63
## G  70.00        171.13
## H  75.00        173.63
## I  80.00        176.13
## J  85.00        178.63
```

Plot Optimal Price Bad Location Regression Model

```
plot (good_location_cost ~ good_location_prices,
    main = "Good Location Optimal Price Regression Model",
    xlab = "Optimal Price",
    ylab = "Cost",
    pch = 18,
    col = "blue" )

abline(ols_good_optimal)
```



Calculations for optimal prices for both good and bad locations

Bad Location

$b0 = 11.833$
$b1 = -0.055$
$Cost = 45$

1. $b_1x^2 + b0X - (b1)(cost)x - (b0)(cost)$

$f(x) -0.055x^2 + 11.833x - (-2.475x) - 532.485$

$f(x) = -0.055x^2 + 14.308x - 532.485$

$f'(x) = -0.11x + 14.308$

$0 = -0.11x + 14.308$

$-14.308 = -0.11x$

$x = 130.07$

$Cost = 50$

2. $f(x) = -0.055x^2 + 11.833x - (-0.055)(50)x - (11.833)(50)$

$-0.055x^2 + 11.833x - (-2.75x) - 591.65$

$f(x) = -0.055x^2 + 14.583x - 591.65$

$f'(x) = -0.11x + 14.583$

$0 = -0.11x + 14.583$

$0.11x = 14.583$

$x = 132.57$

$Cost = 55$

3. $f(x) = -0.055x^2 + 11.833x - (-0.055)(55)x - (11.833)(55)$

$-0.055x^2 + 11.833x - (-3.025x) - 650.815$

$f(x) = -0.055x^2 + 14.858x - 650.815$

$f'(x) = -0.11x + 14.858$

$0 = -0.11x + 14.858$

$0.11x = 14.858$

$x = 135.07$

Bad Location

$b0 = 11.833$

$b1 = -0.055$

$Cost = 60$

4. $f(x) = -0.055x^2 + 11.833x - (-0.055)(60)x - (11.833)(60)$

$-0.055x^2 + 11.833x - (-3.3x) - 709.98$

$f(x) = -0.055x^2 + 15.133x - 709.98$

$f'(x) = -0.11x + 15.133$

$0 = -0.11x + 15.133$

$0.11x = 15.133$

$x = 137.57$

$Cost = 65$

5. $f(x) = -0.055x^2 + 11.833x - (-0.055)(65)x - (11.833)(65)$

$-0.055x^2 + 11.833x - (-3.575x) - 769.145$

$f(x) = -0.055x^2 + 15.408x - 769.145$

$f'(x) = -0.11x + 15.408$

$0 = -0.11x + 15.408$

$0.11x = 15.408$

$x = 140.07$

$Cost = 70$

6. $f(x) = -0.055x^2 + 11.833x - (-0.055)(70)x - (11.833)(70)$

$-0.055x^2 + 11.833x - (-3.85x) - 828.31$

$f(x) = -0.055x^2 + 15.683x - 828.31$

$f'(x) = -0.11x + 15.683$

$0 = -0.11x + 15.683$

$0.11x = 15.683$

$x = 142.57$

Bad Location

$b_0 = 11.833$
$b_1 = -0.055$
Cost = 75

7. $f(x) = -0.055x^2 + 11.833x - (-0.055)(75)x - (11.833)(75)$

$-0.055x^2 + 11.833x - (-4.125x) - 887.475$

$f(x) = -0.055x^2 + 15.958x - 887.475$

$f'(x) = -0.11x + 15.958$

$0 = -0.11x + 15.958$

$0.11x = 15.958$

$x = 145.07$

Cost = 80

8. $f(x) = -0.055x^2 + 11.833x - (-0.055)(80)x - (11.833)(80)$

$-0.055x^2 + 11.833x - (-4.4x) - 946.64$

$f(x) = -0.055x^2 + 16.233x - 946.64$

$f'(x) = -0.11x + 16.233$

$0 = -0.11x + 16.233$

$0.11x = 16.233$

$x = 147.57$

Cost = 85

9. $f(x) = -0.055x^2 + 11.833x - (-0.055)(85)x - (11.833)(85)$

$-0.055x^2 + 11.833x - (-4.675x) - 1,005.805$

$f(x) = -0.055x^2 + 16.508x - 1,005.805$

$f'(x) = -0.11x + 16.508$

$0 = -0.11x + 16.508$

$0.11x = 16.508$

$x = 150.07$

Bad Location

$b_0 = 11.833$
$b_1 = -0.055$
Cost = 40

10. $f(x) = -0.055x^2 + 11.833x - (-0.055)(40)x - (11.833)(40)$

$-0.055x^2 + 11.833x - (-2.2x) - 473.32$

$f(x) = -0.055x^2 + 14.033x - 473.32$

$f'(x) = -0.11x + 14.033$

$0 = -0.11x + 14.033$

$0.11x = 14.033$

$x = 127.57$

Good Location

$b_0 = 17.969$
$b_1 = -0.066$
Cost = 40

1. $f(x) = -0.066x^2 + 17.969x - (-0.0166)(40)x - (17.969)(40)$

$-0.066x^2 + 17.969x - (-2.64)x - 718.76$

$f(x) = -0.066x^2 + 20.609x - 718.76$

$f'(x) = -0.132x + 20.609$

$0 = -0.132x + 20.609$

$0.132x = 20.609$

$x = 156.13$

Cost = 45

2. $f(x) = -0.066x^2 + 17.969x - (-0.066)(45)x - (17.969)(45)$

$-0.066x^2 + 17.969x - (-2.97x) - 808.605$

$f(x) = -0.066x^2 + 20.939x - 808.605$

$f'(x) = -0.132x + 20.939$

$0 = -0.132x + 20.939$

$0.132x = 20.939$

$x = 158.63$

Good Location

$b_0 = 17.969$

$b_1 = -0.066$

Cost = 50

3. $f(x) = -0.066x^2 + 17.969x - (-0.066)(50)x - (17.969)(50)$

$-0.066x^2 + 17.969x - (-3.3x) - 898.45$

$f(x) = -0.066x^2 + 21.269x - 898.45$

$f'(x) = -0.132x + 21.269$

$0 = -0.132x + 21.269$

$0.132x = 21.269$

$x = 161.13$

Cost = 55

4. $f(x) = -0.066x^2 + 17.969x - (-0.066)(55)x - (17.969)(55)$

$-0.066x^2 + 17.969x - (-3.63)x - 988.295$

$f(x) = -0.066x^2 + 21.599x - 988.295$

$f'(x) = -0.132x + 21.599$

$0 = -0.132x + 21.599$

$0.132x = 21.599$

$x = 163.63$

Cost = 60

5. $f(x) = -0.066x^2 + 17.969x - (+0.066)(60)x - (17.969)(60)$

$-0.066x^2 + 17.969x - (-3.96x) - 1,078.14$

$f(x) = -0.066x^2 + 21.929x - 1,078.14$

$f'(x) = -0.132x + 21.929$

$0 = -0.132x + 21.929$

$0.132x = 21.929$

$x = 166.13$

Good Location

$b_0 = 17.969$
$b_1 = -0.066$
Cost = 65

6. $f(x) = -0.066x^2 + 17.969x - (-0.066)(65)x - (17.969)(65)$

$-0.066x^2 + 17.969x - (-4.29x) - 1{,}167.985$

$f(x) = -0.066x^2 + 22.259x - 1{,}167.985$

$f'(x) = -0.132x + 22.259$

$0 = -0.132x + 22.259$

$0.132x = 22.259$

$x = 168.63$

Cost = 70

7. $f(x) = -0.066x^2 + 17.969x - (-0.066)(70)x - (17.969)(70)$

$-0.066x^2 + 17.969x - (-4.62x) - 1{,}257.83$

$f(x) = -0.066x^2 + 22.589x - 1{,}257.83$

$f'(x) = -0.132x + 22.589$

$0 = -0.132x + 22.589$

$0.132x = 22.589$

$x = 171.13$

Cost = 75

8. $f(x) = -0.066x^2 + 17.969x - (-0.066)(75)x - (17.969)(75)$

$-0.066x^2 + 17.969x - (-4.95x) - 1{,}347.675$

$f(x) = -0.066x^2 + 22.919x - 1{,}347.675$

$f'(x) = -0.132x + 22.919$

$0 = -0.132x + 22.919$

$0.132x = 22.919$

$x = 173.63$

Good Location

Cost = 80

$b_0 = 17.969$
$b_1 = -0.066$

9. $f(x) = -0.066x^2 + 17.969x - (-0.066)(80)x - (17.969)(80)$

$-0.066x^2 + 17.969x - (-5.28x) - 1,437.52$

$f(x) = -0.066x^2 + 23.249x - 1,437.52$

$f'(x) = -0.132x + 23.249$

$0 = -0.132x + 23.249$

$0.132x = 23.249$

$x = 176.13$

Cost = 85

10. $f(x) = -0.066x^2 + 17.969x - (-0.066)(85)x - (17.969)(85)$

$-0.066x^2 + 17.969x - (-5.61x) - 1,527.365$

$f(x) = -0.066x^2 + 23.579x - 1,527.365$

$f'(x) = -0.132x + 23.579$

$0 = -0.132x + 23.579$

$0.132x = 23.579$

$x = 178.63$