

Data-570 Lab 4

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Question 1

Part 1

```
reg_part1 <- lm(sales~youtube+facebook, data=marketing)
print(summary(reg_part1))

##
## Call:
## lm(formula = sales ~ youtube + facebook, data = marketing)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -10.5572  -1.0502   0.2906   1.4049   3.3994
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.50532    0.35339   9.919  <2e-16 ***
## youtube      0.04575    0.00139  32.909  <2e-16 ***
## facebook     0.18799    0.00804  23.382  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.018 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
```

Part 2

```
reg_part2 <- lm(sales~youtube+facebook+youtube:facebook, data=marketing)

facebook_cost <- 1000
youtube_increase <- 1000

print(summary(reg_part2))
```

```
##
## Call:
```

```
## lm(formula = sales ~ youtube + facebook + youtube:facebook, data = marketing)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.6039 -0.4833  0.2197  0.7137  1.8295
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   8.100e+00  2.974e-01  27.233  <2e-16 ***
## youtube       1.910e-02  1.504e-03  12.699  <2e-16 ***
## facebook      2.886e-02  8.905e-03   3.241   0.0014 **
## youtube:facebook 9.054e-04  4.368e-05  20.727  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.132 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

yt_increase <- (1.910e-02)*(1000) + (9.054e-04)*(1000^2)
fb_increase <- (2.886e-02)*(1000) + (9.054e-04)*(1000^2)
```

- i) \$1000 increase on YouTube then sales increase $0.019(1000) + 0.00091(1000^2) = 924.5$.
- ii) \$1000 increase on facebook then sales increase $0.029(1000) + 0.00091(1000^2) = 934.26$.

Part 3

```
print(summary(reg_part1))

##
## Call:
## lm(formula = sales ~ youtube + facebook, data = marketing)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -10.5572  -1.0502   0.2906   1.4049   3.3994
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.50532    0.35339   9.919  <2e-16 ***
## youtube       0.04575    0.00139  32.909  <2e-16 ***
## facebook      0.18799    0.00804  23.382  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.018 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
```

```
print(summary(reg_part2))
```

```
##
## Call:
## lm(formula = sales ~ youtube + facebook + youtube:facebook, data = marketing)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.6039 -0.4833  0.2197  0.7137  1.8295
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    8.100e+00  2.974e-01  27.233  <2e-16 ***
## youtube        1.910e-02  1.504e-03  12.699  <2e-16 ***
## facebook       2.886e-02  8.905e-03   3.241  0.0014 **
## youtube:facebook 9.054e-04  4.368e-05  20.727  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.132 on 196 degrees of freedom
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## F-statistic: 1963 on 3 and 196 DF, p-value: < 2.2e-16
```

Based on the adjusted R^2 value, we should NOT remove the interaction term because the model with the interaction produced a higher adjusted R^2 value of 0.9673 vs. 0.8962.

Question 2

```
x <- rnorm(100)
x2 <- x^2
lamda <- exp(1-x-2*x2)
n <- rpois(100, lamda)

pois_glm <- glm(n~x+x2, family = poisson)

print(coef(pois_glm))
```

```
## (Intercept)          x          x2
##  1.0289688 -0.7761848 -1.5708809
```

Question 3

```
x <- rnorm(100)
x2 <- x^2
p <- (exp(1-x-2*x2))/(1+exp(1-x-2*x2))
n <- rbinom(100, 1, prob=p)

binom_glm <- glm(n~x+x2, family = binomial)

print(coef(binom_glm))
```

```
## (Intercept)          x          x2
##  1.2206954  -0.8044984  -1.7298642
```