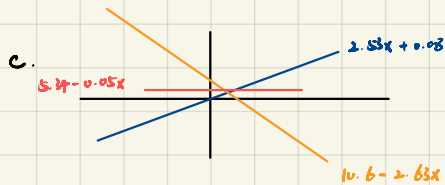MA 214 Homework 7.

12.46.

a. $Y = -2.55 + 3.82 X_1 + 2.63 X_2 - 1.29 X_1 X_2$

b. A linear trend for both X_1 and X_2 and an interaction term $X_1 X_2$.

Interaction term $X_1 X_2 \rightarrow$ Create a surface that is not a simple plane, but a more complex shape that can twist and bend in the $X_1 - X_2$ plane.

The sign of the interaction term is negative, which suggests that the effect of increasing one of the variables X_1 or X_2 decreases as the other variable increases. This could result in a saddle-shaped or twisted plane surface.

c.

d. In the context of a regression model, saying X_1 and X_2 interact means that the effect of X_1 on the response variable y is not constant but depends on the value of X_2, and vice versa.

The term $-1.29 X_1 X_2$ is an interaction term.

The graph in part c shows three lines. If X_1 and X_2 did not interact, we would expect these lines to be parallel because changing the value of X_2 would simply shift the line up or down without changing the shape. However, the lines are not parallel, indicating that the slope of the relationship between y and X_1 changes with different levels of X_2. This would be a graphical representation of the interaction between X_1 and X_2.

e. $H_0 : \beta_{X_1 \cdot X_2} = 0$ \qquad $H_a : \beta_{X_1 \cdot X_2} \neq 0$

f. Given: p-value for the interaction term $X_1 X_2$ is 0.000.

p-value < alpha = 0.01

Reject the H_0.

This means that we have strong evidence to suggest that there is an interaction between X_1 and X_2.

Therefore, the effect of X_1 on the response variable Y depends on the value of X_2, and vice versa.

12.50

a. "Sentiform (x_1)" and "Sentiform × Interest $(x_1 \cdot x_2)$" have p-values less than 0.05, which means they are statistically significant at the 0.05 level. Therefore, we can conclude that the overall model is statistically useful in predicting y because at least one predictor is statistically significant.

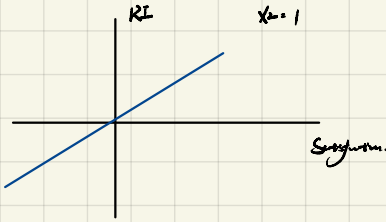b. The p-value for the interaction term $x_1 \cdot x_2$ is less than 0.05.
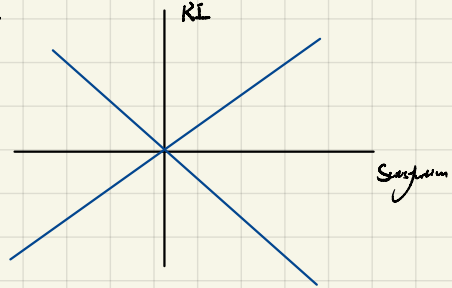
$$p\text{-value} < 0.05$$
$$\text{Reject } H_0.$$

This means we have strong evidence to support that there is an interaction between Sentiform (x_1) and Retailer Interest (x_2). Therefore, the effect of Sentiform on the willingness of the consumer to shop at a retailer's store in the future depends on the level of Retailer Interest, and vice versa.
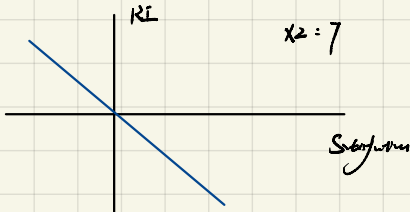
c.

RI $x_2 = 1$

Sentiform.

e.

RI

Sentiform.

The slope of the relationship between sentiform and repurchase intentions changes depending on the level of retailer interest.

d.

RI $x_2 = 7$

Sentiform

12.38.

a. Minority Female as the base level

# of Dummy variables = # of categories −1
$$= 2$$

D_1: Represents Blonde Caucasian category. If the solicitor is a Blonde Caucasian, $D_1 = 1$. If not (either BC or MF), $D_1 = 0$.

D_2: Represents Brunette Caucasian category. If the solicitor is Brunette Caucasian, $D_2 = 1$. If not (either Blonde Caucasian or MF), $D_2 = 0$.

Base level (MF) being represented when D_1 and $D_2 = 0$

b. $E(y) = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \varepsilon$

c. $E(y \mid \text{Blonde Cau}) = \beta_0 + \beta_1$
        $\beta_2 = 0$

d. $E(y \mid \text{Blonde Cau} - MF) = (\beta_0 + \beta_1) - \beta_0 = \beta_1$

e. $\beta_1 > 0$: β_1 represents the difference in MC between Blonde Caucasian and MF solicitors. A positive β_1 would indicate that Blonde Caucasian solicitors, on average, raise more funds than MF solicitors.

$\beta_2 = 0$: β_2 represents the difference in MC between Brunette Caucasian and MF solicitors. A β_2 of zero would indicate that there is no difference in the mean contribution levels between Brunette Caucasian and MF solicitors.

β_0 could be either positive or negative and closely related to the theory.

f. The research findings are:

- The β estimate for the Black Cocaine chang variable is positive and significantly different from 0 (p-value < 0.01)

  This suggests that Black Cocaine solutions, on average, raise more funds than MF, which aligns with the theory.

- The β estimate for the Brown Cocaine chang variable is positive but not significantly different from 0 (p-value > 0.01).

  This suggests that there is no significant difference in the mean contribution levels between Brown Cocaine and MF solutions, which also aligns with the theory.

In conclusion, the research findings support the theory.