Name: Feng Zheng

Student ID: 16269815

Midterm-Chapter 3

ISLR 3.7 Problem 1:

Question: Describe the null hypotheses to which the p-values given in Table 3.4 correspond. Explain what conclusions you can draw based on these p-values. Your explanation should be phrased in terms of sales, TV, radio, and newspaper, rather than in terms of the coefficients of the linear model.

Table

Description automatically generated

Answer:

|  |  |
| --- | --- |
| Null Hypotheses: | Alternative Hypotheses: |
| H0: B0 equal 0 | H1: B0 not equal zero |

At B0 the intercept was 2.9 and the p value was < 0.0001. This means sales will not be zero when absence of TV, radio & newspaper advertising.

|  |  |
| --- | --- |
| Null Hypotheses: | Alternative Hypotheses: |
| H0: B0 e H0: B1 and B2 equal 0qual 0 | H1: B0 not H1: B1 and B2 not equal zero equal zero |

In both case p < 0.0001. So, we will reject H0 and this means TV and radio do some impact on sales.

|  |  |
| --- | --- |
| Null Hypotheses: | Alternative Hypotheses: |
| H0: B3 equal 0 | H1: B3 not equal zero |

In this case p = 0.8599. So H0 could be true. This means newspaper do not impact on sales.

ISLR 3.7 Problem 3:

Question: Suppose we have a data set with five predictors, X1 = GPA, X2 = IQ, X3 = Level (1 for College and 0 for High School), X4 = Interaction between GPA and IQ, and X5 = Interaction between GPA and Level. The response is starting salary after graduation (in thousands of dollars). Suppose we use least squares to fit the model, and get ˆ β0 = 50, ˆβ1 = 20, ˆβ2 =0.07, ˆβ3 = 35, ˆβ4 =0.01, ˆβ5 = −10.

1. Which answer is correct, and why?
   1. For a fixed value of IQ and GPA, high school graduates earn more, on average, than college graduates.
   2. For a fixed value of IQ and GPA, college graduates earn more, on average, than high school graduates.
   3. For a fixed value of IQ and GPA, high school graduates earn more, on average, than college graduates provided that the GPA is high enough.
   4. For a fixed value of IQ and GPA, college graduates earn more, on average, than high school graduates provided that the GPA is high enough.

Answer:

c is correct because the regression formula shown below.

Salary = 50 + 20 \* GPA + 0.07 \* IQ + 35 \* Level + 0.01 \* GPA\*IQ – 10 \* GPA\*Level

Level = 1 (College)

Salary = 50 + 10 \* GPA + 0.07 \* IQ + 35 \* 1 + 0.01 \* GPA\*IQ – 10 \* GPA\*Level

Level = 0(High School)

Salary = 50 + 20 \* GPA + 0.07 \* IQ + 35 \* 0 + 0.01 \* GPA\*IQ – 10 \* GPA\*Level

85 + 10 \* GPA > 50 + 20 \* GPA

High School salary was more than College when GPA > 3.5

1. Predict the salary of a college graduate with IQ of 110 and a GPA of 4.0.

Answer:

Salary = 50 + 20 \* GPA + 0.07 \* IQ + 35 \* Level + 0.01 \* GPA\*IQ – 10 \* GPA\*Level

= 50 + 20 \* 4 + 0.07 \* 110 + 35 \* 1 + 0.01 \* 4 \* 110 – 10 \* 4 \* 1

= 137.1 k

= $137,100

1. True or false: Since the coefficient for the GPA/IQ interaction term is very small, there is very little evidence of an interaction effect. Justify your answer.

Answer:

False. The coefficient value for an interaction term between x1 and x2 will depend on the scales of x1, x2, and salary.