**Math 365 Mathematical Modeling** **Homework 6**

Ch 3.5 Multiple Regression, Problem 3.5.1

**Homework Problem 3.5.1** (Slightly modified)

In an attempt to predict the final grade of students in an Introduction to Statistics class, the professor gives each student a 20 point pretest at the beginning of the year. The table below gives the final grade (4 = A, 3 = B, etc), pretest score, ACT score, and year (1 = freshman, 2 = sophomore, etc) of the 10 students.

|  |  |  |  |
| --- | --- | --- | --- |
| **year** | **ACT** | **pretest** | **grade** |
| 1 | 25 | 9 | 84.5 |
| 2 | 20 | 8 | 82.3 |
| 2 | 18 | 18 | 69.2 |
| 4 | 17 | 10 | 65.1 |
| 3 | 20 | 6 | 80.1 |
| 3 | 22 | 8 | 85.9 |
| 1 | 30 | 16 | 88.1 |
| 4 | 28 | 11 | 90.7 |
| 4 | 27 | 15 | 87.2 |
| 3 | 31 | 19 | 92.7 |

1. Determine which variable - pretest score, ACT score, or year – is the best single-variable predictor of the final grade? Fill out the table below and use the *R*2 and the adjusted *R*2 values to determine which variable is “best” at predicting the final grade. Does the year of the student appear to be related to the grade at all? From the residuals found in Excel, how far off in terms of a letter grade (or more) can the models be in their predictions?

|  |  |  |
| --- | --- | --- |
| **Model** | ***R*2 value** | **Adj *R*2 value** |
| Pretest | 0.018 | -0.104 |
| ACT | 0.768 | 0.739 |
| Year | 0.004 | -0.120 |

From the regression analysis, there doesn’t seem to be a correlation in grade from the year of the student which can be seen from the value in the above table. The category that best predicts grade has the highest value and this category is the ACT category. As well as the value being high in the ACT category, the adjusted value is also the greatest out of the three categories. The model tends to tend to deviate about around 4.5% in the grade.

2. Consider all four different combinations of two or three predictor variables. Fill out the table below and use the *R*2 and the adjusted *R*2 values to determine which combination is “best” at predicting the selling price. Based on your results, does it seem worthwhile to give the pretest as a way of predicting the final grade?

|  |  |  |
| --- | --- | --- |
| **Model** | ***R*2 value** | **Adj *R*2 value** |
| Pretest and ACT | 0.873 | 0.837 |
| Pretest and Year | 0.209 | -0.259 |
| ACT and Year | 0.768 | 0.702 |
| Pretest, ACT and Year | 0.873 | 0.810 |

From the above table, the model that best represents how to predict final grade is the Pretest and ACT model. This model does the best job because it has the highest R squared value out of all the models. It seems like the year of the student doesn’t matter in determining the final grade where as the pretest does a good job at measuring that. Therefore the pretest should be implemented but the year of the student should not be taken into account.

3. State the multiple regression equation that predicts grade in terms of pretest and ACT scores. Then use it to predict the letter grade of a student with pretest score of 18 and ACT score of 28.

(1)

Equation (1) has the multiple regression equation that predicts the grades in terms of pretest and ACT scores. Where is the ACT variable and the is the pretest variable. Putting in 18 for the pretest and 28 for the ACT score, the predicted grade is

(2)

Giving the predicted value with the given parameters.