# HS Statistics and Probability Assignment

This assignment is **strongly aligned** to the standards.

Assignment Image 1

Restaurant Bill and Party Size

Task: The owner of a local restaurant selected a random sample of dinner tables at his restaurant. For each table, the owner recorded the total amount of the dinner bill and the number of people at the table. The data are given in the table below. A scatterplot of the data is also shown. a. Does the relationship between number of people and the bill appear to be weak, moderate, or strong?
b. Does the relationship between number of people and the bill appear to be linear?
c. The equation of the line of best fit is Bill= 5.80 + 11.15x People. Sketch this line on the scatterplot.
d. Interpret the slope of the line of best fit in the context of this problem.
e. Note that the points in the scatterplot do not all lie on the line. What could explain this variability?
f. Use the equation of the line of best fit to estimate how much would you predict the bill to be for a party of 8?
g. There was one party of 8 whose bill was $82.50. Did they pay more than or less than the predicted amount? How much more or how much less did they pay?
h. The difference calculated in part (g) is called a residual. When each residual is calculated and plotted against the corresponding number of people, the resulting plot is called a residual plot. The residual plot for this data set is shown on the next page.

Assignment Page 3

Residual plot is shown.
Explain how one could use the residual plot in order to determine if a linear model is an appropriate way to describe the relationship between number of people and the amount of the bill.
i. A random sample of several pizza restaurants in the area was selected. Data was collected on the diameter and price of the smallest cheese pizza sold at the restaurant. The line of best fit was fit to the data and the corresponding residual plot is given below. Does there appear to be a linear relationship between the diameter and the price of a cheese pizza in this area? Use the residual plot to explain your answer.

Overview

High school students explain why a linear model is most appropriate for a given data set and then answer questions about the situation and the math involved. They are then exposed to a second context through a residual plot where a linear model is not appropriate, and they need to explain how they know given the residuals. The assignment is strongly aligned to the standard because it requires students to fit a model to data, assess the fit of the model by analyzing residuals, and solve problems in the context of the data.

Related Standards

We looked at how well the assignment aligned to the following standard:

KY.HS.SP.6 Represent data on two quantitative variables on a scatter plot and describe how the explanatory and response variables are related.

1. Calculate an appropriate mathematical model, or use a given mathematical model, for data to solve problems in context.
2. Informally assess the fit of a model (through calculating correlation for linear data, plotting, calculating and/or analyzing residuals)

Why is this assignment Strongly aligned?

In eighth grade, students first work with bivariate data (measurement data on two related variables). They create scatter plots, find linear equations that best fit the data, and use their equations to answer real-world questions. These concepts are extended in high school when students work with bivariate data that might have a non-linear relationship. This assignment allows students to work with bivariate data in a manner appropriate for high school.

The assignment appropriately allows students to build their conceptual understanding by asking them to use functions fitted to data to solve problems in the context of the data and informally assess the fit of a function by analyzing residuals (all aligned with standard KY.HS.SP.6).

[**Practice Standards**](https://tntp.org/student-work-library/view/strongly-aligned-high-school-statistics-and-probability-assignment)  
The assignment gives students a strong opportunity to engage with Mathematical Practice Standard #4 (“Model with mathematics”), which suggests that students “apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.” In this task, students are asked to use a function to describe how one quantity of interest depends on another in an authentic, if simulated, context. The assignment also allows students to engage with Mathematical Practice Standard #2 (“Reason abstractly and quantitatively”) by asking questions that require them to fluently move from the decontextualized symbolic representation of the situation to the contextualized situation where they pay attention to the meaning of the quantities.