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Using the GUESS Method to Solve Problems (Statistics)

Problem solving courses like those in Math, Chemistry, Physics, Engineering and Statistics require a lot of practice and application of concepts in order for students to be successful. At the same time, some students struggle with these types of courses because they do not know where to start, or they do not have a method for completing the recommended practice problems. The GUESS method (Given, Unknown, Equations, Set-up, Solve) is an easy to remember acronym that breaks practice problems into five basic steps. Consider the following sample problem.

Sample Statistics Question: The correlation between student midterm scores and final exam scores is 0.55. The mean of all midterm scores for all students is 85 with a standard deviation of 6, while the mean of all final exam scores is 70 with a standard deviation of 9. Wendy scored 93 on the midterm. What value can we predict for her final exam score?

Given:

In this particular example, you have been **given** Wendy's mid-term score (93), the mean grade for all of the midterms ($\bar{x}$=85), the standard deviation for all of the midterms (S_x=6), the mean grade for the final exams ($\bar{y}$=70), and the standard deviation for the final exams (S_y=9). You also have been **given** the correlation coefficient (r=0.55), which tells you that there is not a particularly strong correlation between midterm scores and final exam scores. Nonetheless, you have been **given** plenty of information.

Given:	Correlation (r) = 0.55 Midterm mean ($\bar{x}$) = 85 Midterm Standard deviation (Sx) = 6 Final exam mean ($\bar{y}$) = 70 Final exam Standard deviation (Sy) = 9 Wendy's Midterm score (x) = 93

Unknown:

The question is asking for Wendy's final exam score, so obviously this is an **unknown**. You can predict her final exam score, but you will need to calculate the least squares regression line in order to do so. After consulting the list of equations (step 3), you will hopefully also notice that other unknowns include the intercept (b_0) and the slope (b_1).

Unknown:	Intercept (b_0) =? Slope (b_1) =? Wendy's Final exam score ($\hat{y}$) =?

Equations:

In Statistics 1000, the course instructor often provides a formula sheet at the outset of the course. By consulting the **equations** on the formula sheet, you will quickly see that you have been provided with the formulas to calculate both slope ($b_1 = r * S_y/S_x$) and intercept ($b_0 = \bar{y} - b_1\bar{x}$). You will need to figure out both of these unknowns in order to figure out the line of least squares regression. Fortunately, you have been given ($\bar{y}$, $\bar{x}$, r, S_y, and S_x), which are required for these two **equations**. With the help of the notes, you can use the least squares regression formula ($\hat{y} = b_0 + b_1x$) to predict Wendy's final exam score ($\hat{y}$) once you have calculated both the slope (b_1) and the intercept (b_0).

Equations:	$b_1 = r * \frac{s_y}{s_x}$ $b_0 = \bar{y} - b_1\bar{x}$ $\hat{y} = b_0 + b_1x$

Set-up:

It is important to use the formulas in proper sequence because the unknown slope (b1) is needed to calculate the unknown intercept (b_0). Once you have calculated the slope (b1), you can calculate the intercept (b_0), which will provide all of the required information to calculate the line of least squares regression as part of the last step.

Set-up:	$b_1 = 0.65 * \frac{9}{6}$ $\boldsymbol{b_1} = \mathbf{0.825}$ $b_0 = 70 - 0.825*(85)$ $\boldsymbol{b_0} = -0.125$

Solve:

Once you have calculated both the slope (0.825) and the intercept (-0.125), you can take Wendy's midterm score of (x= 93) and use these numbers to predict that her final exam score will be 76.6

Solve:	$\hat{y} = b_0 + b_1x$ $\hat{y} = (-0.125) + 0.825 * 93$ $\hat{y} = 76.6$