

Exam 1 Solutions - STAT 324

Question Prompt

Write out the full regression equation for Model 2 using the estimated coefficients. Be as clear and explicit as possible, including the names of the variables and their estimated values. Then, interpret the coefficient for `email_clicks` in context.

Solution

1. Regression Equation (in context):

$$\hat{y}_i = 119.1 + 1.172x_{1i} + 0.03553x_{2i} + 0.05249x_{3i}$$

\hat{y}_i - `ticket_sales` (predicted number of ticket sales in a marketing campaign)

x_{1i} - `email_clicks` (number of email clicks in a marketing campaign)

x_{2i} - `social_media_mentions` (number of social media mentions in a marketing campaign)

x_{3i} - `ad_spend` (amount spent on ads in a marketing campaign)

2. Interpretation of `email_clicks`:

Holding `social_media_mentions` and `ad_spend` constant, for each additional email click in a marketing campaign, the model predicts an increase of approximately **1.172 units** in `ticket_sales`.

Rubric (15 Points Total)

Criteria	Points
Equation Format – Writes full regression equation with all three predictors	5
• Includes correct coefficient for Intercept	1
• Includes correct coefficient for email_clicks	1
• Includes correct coefficient for social_media_mentions	1
• Includes correct coefficient for ad_spend	1
• Uses correct notation for predicted value (hat or “predicted ticket_sales”)	1
Interpretation of email_clicks – Must include:	8
• Contextual variable name (“email clicks” or “email_clicks”)	1
• Correct interpretation of slope (per 1 unit increase)	2
• Direction of effect (increase in ticket_sales)	2
• Holding all else constant or similar phrase (“controlling for other predictors”)	2
• Units (some mention of “ticket sales” or campaign outcome in units)	1
Clarity and Completeness – Well-written, not ambiguous, labeled variables	2

Question Prompt

Using Model 2, predict the value of `ticket_sales` for a marketing campaign where there were **150 email clicks**, **223 social media mentions**, and **\$623 in ad_spend**. Show your work.

Explain what your answer means in the context of the problem.

Then, explain whether this prediction should be trusted.

Solution

Step 1: Use the Model 2 Equation

$$\hat{y}_i = 119.1 + 1.172x_{1i} + 0.03553x_{2i} + 0.05249x_{3i}$$

Plug in the values:

$$\hat{y}_i = 119.1 + 1.172(150) + 0.03553(223) + 0.05249(623)$$

$$= 119.1 + 175.8 + 7.92419 + 32.69627$$

$$\hat{y}_i \approx 335.52$$

Step 2: Interpret the Prediction

Based on the regression model, a campaign with 150 email clicks, 223 social media mentions, and \$623 spent on ads is expected (average) to generate approximately **336 ticket sales**.

Step 3: Should the Prediction Be Trusted?

Yes, this prediction can be reasonably trusted because the input values (150 email clicks, 223 social media mentions, and \$623 in ad spend) likely fall **within the range of the observed data** used to build the model. Since the prediction is not an extrapolation beyond the observed values and the model has a strong R^2 of 0.74, the estimate is likely reliable.

Rubric (15 Points Total)

Criteria	Points
Correct Use of the Regression Equation	5
• Substitutes values into the full model equation correctly	2
• Performs correct arithmetic (may round slightly)	2
• Final prediction is clearly stated	1
Interpretation in Context	5
• Clearly explains the predicted value as ticket sales	2
• Refers to the specific input values used (email clicks, mentions, ad spend)	2
• Uses plain language and connects it to a marketing campaign	1
Assessment of Whether Prediction Should Be Trusted	5
• Mentions range/realism of input values (within observed data)	2
• Explains why prediction is likely valid (not extrapolated, strong model fit, etc.)	2
• Reasoning is thoughtful and clearly written	1