Friday Quiz 5 - Solutions - STAT 324

### **Question 3 – 3 pts**

**Prompt:** In the seals study, what does the coefficient for ColonyD (10.55) mean in context? Be specific about the reference group and the interpretation of the shift.

#### **Solution:**

The coefficient for ColonyD (10.55) represents the estimated difference in baseline dive depth between Colony D and the reference group, Colony A. When Age = 0, seals in Colony D are predicted to dive 10.55 meters deeper than those in Colony A. Since all colonies share the same slope for Age, this difference is purely a vertical shift in the intercept.

#### **Rubric (3 pts):**

* **1 pt** — Identifies the reference group (Colony A)
* **1 pt** — Correctly states it’s a difference in intercept or baseline dive depth
* **1 pt** — Includes context of Age = 0 or explains what the shift means in terms of the outcome

### **Question 7 – 3 pts**

**Prompt:** Interpret the coefficient for WebsiteVisitors in the business model. Specify the null and alternative hypotheses.

#### ️ **Solution:**

The coefficient for WebsiteVisitors (0.89) means that for every additional unique visitor to the website, weekly sales revenue is expected to increase by $0.89, assuming advertising spend remains constant.

**Hypotheses:**

* **Null Hypothesis (H₀):** The coefficient for WebsiteVisitors is 0 (no linear relationship between visitors and sales).
* **Alternative Hypothesis (H₁):** The coefficient for WebsiteVisitors is not 0 (there is a linear relationship).

#### **Rubric (3 pts):**

* **1 pt** — Correctly interprets the coefficient in context
* **1 pt** — Correctly states null hypothesis
* **1 pt** — Correctly states alternative hypothesis

### **Question 9 – 3 pts**

**Prompt:** Provide and interpret the full regression model. Also, how would you evaluate the fit of the business model using R-squared and adjusted R-squared? Is this model a good predictor of sales?

#### **Solution:**

**Full model:**

**Interpretation:**

* Each $1 increase in advertising spend increases sales by $5.78, holding visitors constant.
* Each additional visitor increases sales by $0.89, holding ad spend constant.
* The intercept (12580.5) represents the predicted sales when both inputs are 0.

**Model fit:**

* **R² = 0.6529**: About 65% of the variation in sales is explained by the model.
* **Adjusted R² = 0.6494**: Adjusts for number of predictors; still quite high.
* Yes, this is a good model for prediction based on these values and significance of predictors.

#### **Rubric (3 pts):**

* **1 pt** — Writes full model with correct coefficients
* **1 pt** — Provides contextual interpretation of coefficients and intercept
* **1 pt** — Evaluates R²/Adjusted R² and states it is a good model

### **Question 10 – 3 pts**

**Prompt:** Using the business model, what is the predicted sales revenue for a week with $1,000 in advertising spend and 2,000 website visitors? Show your work and interpret the result. What assumptions about the values did you make?

#### **Solution:**

$$ \hat{SalesRevenue} = 12580.5 + 5.78(1000) + 0.89(2000) \\ = 12580.5 + 5780 + 1780 = 20140.5 $$

**Interpretation:** With $1,000 in advertising spend and 2,000 visitors, the model predicts weekly sales revenue of **$20,140.50**.

**Assumptions:**

* AdvertisingSpend and WebsiteVisitors are measured in raw units (USD) are within the min and max.

#### **Rubric (3 pts):**

* **1 pt** — Correct formula and substitution
* **1 pt** — Correct numerical result and interpretation
* **1 pt** — States clear assumption(s) about variable scales or applicability

Let me know if you want this exported to a .md file or formatted for Canvas rubrics.