Statistics and regression - Practice test 4

Name: _____ Date: _____

10 questions | 49 marks | 70 minutes

Critique claims, compare models and investigate how units and observations affect a fit.

Use a graphics calculator or appropriate digital tool for labelled tasks.

1. A survey links weekly club participation with wellbeing scores. Students choose whether to participate. [5 marks]

(a) Identify a possible confounder. [2 marks]

(b) Does a large positive r establish that joining a club causes improved wellbeing? [3 marks]

2. Two sets of paired data have r=0.85 and r=-0.85. [4 marks]

(a) Compare their linear strengths and directions. [2 marks]

(b) Compare their coefficients of determination. [2 marks]

3. A least-squares line is $\hat{y}=12+0.4x$, where x is in centimetres. A new predictor u measures the same lengths in metres. [5 marks]

(a) Rewrite the line using u. [3 marks]

(b) What happens to Pearson r? [2 marks]

4. For paired data, $\bar{x}=15$, $\bar{y}=40$, $S_{xx}=80$ and $S_{xy}=-120$. [5 marks]

(a) Find the fitted equation. [3 marks]

(b) At x=18, an observed y is 33. Find the residual. [2 marks]

5. An analyst removes a genuine extreme observation because it “makes the graph ugly”. [5 marks]

(a) Explain why this is not an acceptable statistical criterion. [2 marks]

(b) Describe a sensitivity check. [3 marks]

6. A fitted line predicts battery life from charge-cycle count. Its residuals are near zero early but increasingly negative later. [5 marks]

(a) Interpret the later negative residuals. [2 marks]

(b) What does the pattern suggest? [3 marks]

7. The exponential model $\hat{y} = 30e^{0.25x}$ was fitted on $0 \leq x \leq 6$. [5 marks]

(a) Find the multiplier and percentage increase for a one-unit rise in x. [3 marks]

(b) Classify a prediction at x=4.5 and one at x=10. [2 marks]

8. A normal thickness model has μ=2.0 mm and σ=0.08 mm. [5 marks]

(a) Find P(X<1.9). [3 marks]

(b) Find the symmetric upper limit u with P(X>u)=P(X<1.9). [2 marks]

9. A normal variable has mean 200 and SD 20. [6 marks]

(a) Find its 10th and 90th percentiles. [4 marks]

(b) What proportion lies between these two percentiles? [2 marks]

10. Using the notation $N(\mu, \sigma^2)$, a report says N(100,25) has 95% of values between 50 and 150. [4 marks]

(a) Identify the parameter error. [2 marks]

(b) Give the approximate central 95% interval. [2 marks]