Statistics and regression - Practice test 2

Name: _____ Date: _____

10 questions | 53 marks | 70 minutes

Analyse a service-data study, compare fits and explain predictions and uncertainty.

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

1. A delivery study records route distance x and delivery time y. [5 marks]

Paired measurements

Distance (km)	Time (min)
2	18
4	23
6	29
8	31
10	38
12	41

(a) Identify the response when predicting travel time. [2 marks]

(b) Describe one way to collect comparable observations. [3 marks]

2. Use the delivery data supplied in Question 1. [8 marks]

Paired measurements

Distance (km)	Time (min)
2	18
4	23
6	29
8	31
10	38
12	41

(a) Use technology to find the least-squares line y on x. [3 marks]

(b) Calculate r and r^2. [3 marks]

(c) Predict the time for a 7 km route. [2 marks]

3. For the fitted delivery line from Question 2, consider the 8 km observation with time 31 min. [5 marks]

(a) Find its residual. [3 marks]

(b) Does the model overestimate or underestimate this observation? [2 marks]

4. A rival report fits x on y and rearranges its line, claiming that the result must equal y on x. [5 marks]

(a) Explain the flaw. [3 marks]

(b) When would both fits describe the same line? [2 marks]

5. Two candidate delivery models have residuals $A = (-2, 1, 3, -2)$ and $B = (-1, -1, 2, 0)$. [5 marks]

(a) Compute each squared-error sum. [2 marks]

(b) Select the smaller-error fit and give a limitation of this criterion. [3 marks]

6. Adding a distant 50 km route changes a model slope from 2.1 to 3.8 min/km. [5 marks]

(a) What does this suggest about the route? [2 marks]

(b) What should be checked before excluding it? [3 marks]

7. A machine's response is modelled by $\ln(\hat{y}) = 3.2 + 0.15x$. [5 marks]

(a) Write the model as $\hat{y} = Ab^x$. [3 marks]

(b) Interpret the percentage change per x-unit. [2 marks]

8. A model from distances 2-12 km predicts time for routes of 9 km and 60 km. [5 marks]

(a) Classify each prediction. [2 marks]

(b) Explain a practical reason the long-route relationship might differ. [3 marks]

9. Delivery time on one fixed route is normal with mean 32 min and SD 4 min. [6 marks]

(a) Find the probability of a time exceeding 38 min. [3 marks]

(b) Find a time that 90% of deliveries are expected to finish within. [3 marks]

10. A manager says, “The 90th-percentile time means every group of ten deliveries has exactly one late delivery.” [4 marks]

(a) Explain why this is incorrect. [2 marks]

(b) For 250 comparable deliveries, state the expected number exceeding that cutoff. [2 marks]