Counting and statistics - Consolidation test 5

Name: _____ Date: _____

10 questions | 54 marks | 75 minutes

Connect counting, sampling and data summaries to a quality-control decision. Explain model assumptions and support comparisons numerically.

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

1. An access code is either two distinct letters from A-F followed by one digit 0-9, or one letter from A-F followed by three distinct digits 0-9. A code may begin with any listed letter. [5 marks]

(a) Count the codes in each format. [3 marks]

(b) Count all codes and explain why adding is valid. [2 marks]

2. A workshop has 6 trainees and 4 mentors. A working group has 4 members. [6 marks]

(a) Count groups with at least one mentor. [3 marks]

(b) Count groups with exactly two mentors and two trainees, together with a choice of one group leader. [3 marks]

3. A model uses $(2x+3)^4$. [5 marks]

(a) Find the coefficient of x^2. [3 marks]

(b) Find the sum of its coefficients without a full expansion. [2 marks]

4. A school compares bus and tram journey times. A volunteer survey records times from 12 bus users and 80 tram users. [6 marks]

(a) Give two reasons to be cautious about saying one transport mode is better for every student. [3 marks]

(b) Describe a more defensible study and name the numerical variable. [3 marks]

5. The table gives weekly exercise-session counts. [6 marks]

Sessions	0	1	2	3	4
Frequency	2	4	6	4	2

(a) Find the number of observations, mean, median and mode. [3 marks]

(b) Using the sample formula, calculate the standard deviation to 3 decimal places. [3 marks]

6. One sample of 10 journeys has mean 40 min. Another sample of 15 journeys has mean 50 min. [5 marks]

(a) Find the combined mean. [3 marks]

(b) Can the combined median be found from these sample sizes and means alone? Explain. [2 marks]

7. Ordered measurements are 12,14,15,16,17,18,20,40. Use median-of-halves quartiles. [6 marks]

(a) Find median, IQR and range. [3 marks]

(b) The 40 was a recording error and should be 22. Which of these three summaries change? [3 marks]

8. A sample of 7 packages has mean 500 g and sum of squared deviations 54 g². [4 marks]

(a) Find the sample variance and standard deviation. [2 marks]

(b) Each package has a constant 20 g container. Find the mean and s of the contents. [2 marks]

9. A process is normally modelled with mean 20 mm and sd 0.5 mm. Items are within tolerance from 19.25 to 20.75 mm. Supplied $\Phi(1.5) = 0.9331928$. [5 marks]

(a) Find the modelled proportion within tolerance. [3 marks]

(b) Estimate the expected count outside tolerance among 2,000 items. [2 marks]

10. A proposed process has normal mean 20 mm and sd 0.3 mm. The tolerance is 19.25 to 20.75 mm. A previous normal model with the same mean and sd 0.5 mm predicts 0.8663856 within tolerance. Supplied $\Phi(2.5) = 0.9937903$. [6 marks]

(a) Find its predicted within-tolerance proportion and compare with the preceding model. [3 marks]

(b) Explain what would need checking before promising that proportion in production. [3 marks]