Topic test | Probability

Probability - Applications test

Name: _____ Date: _____

16 questions | 47 marks | 60 minutes

Apply probability and evaluate simulation choices.

A scientific calculator may be used.

1. A uniform random four-digit code may begin with zero and may repeat digits. How many possible codes are there? [2 marks]

2. A four-digit code is chosen uniformly from digits 0-9. Repeats and a leading zero are allowed. Find $P(\text{the code is } 0000)$. [2 marks]

3. Six volunteers fill two different roles. Count the possible assignments. [2 marks]

4. Six volunteers form a two-person group with no different roles. Count the groups and explain why this differs from assigning two different roles to six people. [3 marks]

5. Two counters are drawn from 3 red and 2 blue. [4 marks]

(a) Find $P(\text{two red})$ without replacement. [2 marks]

(b) Find $P(\text{two red})$ with replacement. [2 marks]

6. Using the club table, find the probability a chosen student belongs to neither club. [2 marks]

Invented membership data for 60 students.

Music membership	Drama	Not drama	Total
Music	8	12	20
Not music	10	30	40
Total	18	42	60

7. A raffle has 50 student tickets,30 teacher tickets and 20 community tickets. Draw two tickets without replacement. Find $P(\text{both student})$. [3 marks]

8. A raffle has 50 student tickets, 30 teacher tickets and 20 community tickets. Two tickets are drawn uniformly without replacement. Find $P(\text{exactly one teacher ticket})$. [3 marks]

9. Two fair dice are rolled. Given at least one die shows 6, find $P(\text{sum } 7)$. [3 marks]

10. A simulation uses independent uniform random digits 0-9, with 0-5 meaning success. In 20 digits there are 13 successes. Estimate the success probability and compare it with the model probability. [3 marks]

11. A simulation generates sums 2-12 uniformly and reports $P(\text{sum } 7)$ near $\frac{1}{11}$. Explain why this is not a fair two-dice simulation. [3 marks]

12. $P(A) = 0.7$, $P(B) = 0.5$ and $P(A \cap B) = 0.4$. [4 marks]

(a) Find $P(A \mid B)$. [2 marks]

(b) Are the events independent? [2 marks]

13. In a survey,18 of 30 regular walkers and 22 of 40 other students join a sports club. Compare club membership rates. [3 marks]

14. A survey finds that 18 of 30 regular walkers and 22 of 40 other students join a sports club. Does this prove that walking causes club membership? Explain one limitation. [3 marks]

15. Assume rain on two days is independent and each day has rain probability 0.3. Find $P(\text{rain on at least one day})$. [3 marks]

16. Design and describe a simulation to estimate $P(\text{two red counters})$ from 3 red and 2 blue without replacement. State what to record and how to form the estimate. [4 marks]