Worked answers | Probability

Designing and interpreting simulations

6 questions | 15 marks

Equivalent correct methods earn the corresponding marks.

1. Describe a random-digit simulation of a 30% chance. [2 marks]

Three of ten uniform digits represent success.

Answer: Use 0,1,2 for success and 3-9 for failure.

2. A simulation gives 47 events in 250 trials. Find relative frequency. [2 marks]

47/250=0.188.

Answer: 0.188.

3. Explain why generating one uniform integer 2-12 does not simulate two dice sums. [2 marks]

Sum 7 has 6 pairs;sum 2 has 1.

Answer: Real sums have unequal numbers of ordered pairs.

4. Design a simulation of two counters drawn without replacement from 3 red and 2 blue. [3 marks]

This prevents reuse within a trial.

Resetting between trials restores the original experiment.

Answer: Shuffle five labelled items, three red and two blue, then take the first two; reshuffle for each new trial.

5. Runs of 100 and 1000 trials estimate P(A) as 0.66 and 0.604. If the theoretical probability is 0.6, which is closer and by how much? [3 marks]

Calculate $|0.66-0.6|=0.06$ and $|0.604-0.6|=0.004$.

Compare their errors: $0.06-0.004=0.056$.

Answer: The 1000-trial estimate is closer. The absolute errors are 0.06 and 0.004, so its error is smaller by 0.056.

6. Does a larger run guarantee that every 1000-trial simulation estimate is closer to the theoretical probability than every 100-trial estimate? Explain. [3 marks]

It compares only two particular runs.

Random fluctuations can make a larger finite run less accurate.

Answer: No.