

Exercise walk-through

5.1.1

Probability

AQA · GCSE · Mathematics

16. Experimental probability, fairness and expected outcomes · Foundation

Experimental probability, fairness and expected outcomes · Foundation

A spinner lands red 18 times in 60 spins, giving estimated $P(\text{red}) = 18/60 = 0.3 = 30\%$. Using this estimate predicts $0.3 \times 200 = 60$ red results in 200 future spins. If red, blue and green are exhaustive with probabilities 0.3, 0.45 and p , then $p = 1 - 0.75 = 0.25$. A fair coin has theoretical $P(\text{head}) = 0.5$; 100 tosses give expected heads 50, but 48 or 54 is possible. An experiment with 6 heads in 10 tosses estimates 0.6; one with 502 heads in 1000 estimates 0.502. These illustrative runs are not proof that error falls at every stage.

29. Venn diagrams, unions and two-way counts · Foundation

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In a class of 30, 18 cycle, 12 swim and 7 do both. Cycling only is 11 and swimming only 5; at least one is $11+7+5=23$, leaving 7 neither. A random student has probability $7/30$ of both and $23/30$ of at least one. The two-way table has cycle-and-swim 7, cycle-not-swim 11, not-cycle-swim 5 and neither 7. The cycle row totals 18, swim column totals 12 and grand total 30. The outcomes both, cycling only, swimming only and neither are mutually exclusive and exhaustive, so their probabilities sum to 1.

36. Conditional probability with tables and expected frequencies · Higher

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Using a class of 30 with 18 cyclists, 12 swimmers and 7 doing both, $P(\text{swim given cycle})=7/18$, while $P(\text{cycle given swim})=7/12$. The unconditional swim probability is $12/30=0.4$. For an expected cohort of 1000, suppose 20% have a condition; a test is positive for 90% with it and 10% without it. Expected positive counts are 180 from 200 with the condition and 80 from 800 without it. Of 260 positive tests, the conditional proportion with the condition is $180/260=9/13\approx 0.6923$, not 90%. These are stated illustrative model rates, not claims about a real diagnostic test.

Exercises 2.1·2.3

2.1 (Foundation) Find the probability of two red from 3 red and 2 blue without replacement.

2.2 (Foundation) Find the probability of blue on a single draw from 3 red and 2 blue.

2.3 (Foundation) Find the probability of one red and one blue in that bag.

Exercises 2.1·2.3

2.1 (Foundation) Find the probability of two red from 3 red and 2 blue without replacement.

2.1 Without replacement, $P(RR)=\frac{3}{5} \times \frac{2}{4}=0.3$.

2.2 (Foundation) Find the probability of blue on a single draw from 3 red and 2 blue.

2.2 A single blue draw has probability $\frac{2}{(3+2)}=0.4$.

2.3 (Foundation) Find the probability of one red and one blue in that bag.

2.3 Add the two orders: $\frac{3}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{3}{4}=0.6$.

Exercises 2.4·3.1

2.4 (Higher) Find $P(A \text{ given } B)$ if $P(A \cap B) = 0.12$ and $P(B) = 0.3$.

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: Mutually exclusive events with positive probabilities must be independent.

Exercises 2.4·3.1

2.4 (Higher) Find $P(A \text{ given } B)$ if $P(A \cap B) = 0.12$ and $P(B) = 0.3$.

2.4 $P(A|B) = P(A \cap B) / P(B) = 0.12 / 0.3 = 0.4$.

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: Mutually exclusive events with positive probabilities must be independent.

3.1 False. A fair die shows 1 with probability $1/6$ and 2 with probability $1/6$. The events cannot occur together, so their joint probability is zero. Independence would require $1/36$.

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.