NEXLYTIC STUDIO

Maths for Data Careers: Free Sample Chapter

Free sample

The complete Chapter 4, Probability and counting, with worked examples, eight practice problems and full solutions.

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Welcome

What this guide is, and how to use it

This guide covers the maths behind data and analytics work, in the order most learners find easiest, from percentages to the intuition behind machine learning. Each chapter has plain-language explanations, worked examples, a formula box, common mistakes and eight practice problems with full solutions.

About the full guide

- Take the **diagnostic quiz** (30 questions) on paper. Use the Excel scorer to see which chapters need most work.
- Follow the study plan at the back of this introduction, or make your own.
- Always try problems before reading the answers. Getting one wrong and understanding why is worth more than five right by luck.

How this guide was made: the explanations are written and checked by people. Every practice problem and its answer is generated by code with random numbers, and the answers are computed rather than typed, with many cross-checked a second way. The guide is made with AI tools and checked by a person. If you find an error, please write to us and we will check and correct it. The guide gives study material and general information and does not guarantee exam, interview or job outcomes.

What is in the full guide

Chapter 1. Percentages, ratios and growth

Chapter 2. Algebra, functions and logarithms

Chapter 3. Describing data: averages and spread

Chapter 4. Probability and counting

Chapter 5. Distributions: binomial, normal, Poisson

Chapter 6. Sampling and confidence intervals

Chapter 7. Hypothesis tests and A/B testing

Chapter 8. Correlation and regression

Chapter 9. Linear algebra essentials

Chapter 10. Calculus intuition for machine learning

Diagnostic quiz, Excel scorer, glossary, formula sheet, study plan

CHAPTER 4

Probability and counting

Probability is how we talk about uncertainty: test results, risk, chance of conversion. Counting methods let you work out probabilities exactly.

The key ideas

- Probability = favourable outcomes ÷ total equally likely outcomes, a number from 0 to 1.
- P(A or B) = P(A) + P(B) − P(A and B). Subtract the overlap so it is not counted twice.
- For independent events P(A and B) = P(A) × P(B). Without replacement, the second probability changes.
- 'At least one' is easiest as 1 − P(none).
- Conditional probability P(A | B) = P(A and B) ÷ P(B). Read it as 'chance of A among cases where B happened'. P(A | B) and P(B | A) are different.
- Counting: order matters → permutations n!/(n − k)!. Order does not matter → combinations C(n, k) = n!/(k!(n − k)!).
- Bayes' rule updates a probability when you see evidence. A reliable trick is to imagine 100,000 people and count who is where.

Formulas to know

- P(A or B) = P(A) + P(B) − P(A and B)
- P(at least one) = 1 − P(none)
- P(A | B) = P(A and B) ÷ P(B)
- C(n, k) = n! ÷ (k!(n − k)!)
- P(A | B) = P(B | A)P(A) ÷ P(B)

Worked examples

EXAMPLE 4.1

Two fair six-sided dice are rolled. What is the probability that the sum is 8?

1. There are 6 × 6 = 36 equally likely outcomes
2. Outcomes with sum 8: (2,6), (3,5), (4,4), (5,3), (6,2) → 5 outcomes
3. Probability = 5/36 = 5/36

Answer: 5/36 ≈ 0.139

EXAMPLE 4.2

Each of 5 independent emails has a 25% chance of being opened. What is the probability that at least one is opened?

1. Easier to find the opposite: P(none) = (1 − 0.25)^5 = 0.237305
2. P(at least one) = 1 − 0.237305 = 0.7627

Answer: 0.7627

EXAMPLE 4.3

A team of 4 must be chosen from 11 analysts. In how many ways can this be done?

1. Order does not matter: C(11,4) = 11! ÷ (4! × 7!)
2. = 11 × 10 × 9 × 8 ÷ 24 = 330

Answer: 330

Common mistakes

- Treating P(A | B) as P(B | A). A test that is 90% accurate does not mean a positive result is 90% likely to be right.
- Forgetting the base rate when the event is rare.
- Using permutations when order does not matter.

Where you will use this: A/B testing, fraud and risk scoring, recommendation systems, and every interview that asks 'what is the chance that...'.

Practice problems: Chapter 4

Try each on paper first. Answers and worked steps are on the next page.

4.1 A bag holds 4 red and 8 blue marbles. Two are drawn one after another without replacement. What is the probability both are red?

4.2 Event A has probability 0.6 and event B has probability 0.5. They are independent. Find P(A and B) and P(A or B).

4.3 In a customer base, 40% use the app, 50% use the website, and 20% use both. What percentage use at least one, and what percentage use neither?

4.4 478 people were tracked. Saw the ad and bought: 55. Saw the ad, did not buy: 100. Did not see the ad but bought: 37. Did not see the ad, did not buy: 286. Find P(bought | saw the ad) and P(saw the ad | bought).

4.5 A fair coin is tossed 5 times. What is the probability of exactly 3 heads?

4.6 9 candidates are shortlisted for 1st, 2nd, 3rd place in a contest. In how many ways can the top 3 places be filled?

4.7 How many distinct arrangements are there of the letters in the word ANALYSIS?

4.8 In a population of accounts, 2% are truly fraudulent. A fraud rule catches 80% of real fraud, but also wrongly flags 10% of genuine accounts. One account is flagged. What is the probability it is actually fraud?

Answers: Chapter 4

Q4.1 1/11 ≈ 0.091

1. P(first red) = 4/12
2. After removing one red: P(second red) = 3/11
3. Both red = 4/12 × 3/11 = 1/11

Q4.2 P(A and B) = 0.3, P(A or B) = 0.8

1. Independent: P(A and B) = 0.6 × 0.5 = 0.3
2. P(A or B) = P(A) + P(B) − P(A and B) = 0.6 + 0.5 − 0.3 = 0.8

Q4.3 70% use at least one; 30% use neither

1. At least one = app + website − both = 40 + 50 − 20 = 70%
2. Neither = 100 − 70 = 30%
3. Subtracting 'both' avoids counting those customers twice.

Q4.4 11/31 ≈ 0.355 and 55/92 ≈ 0.598

1. People who saw the ad = 55 + 100 = 155; of them 55 bought → P(bought | saw ad) = 11/31
2. People who bought = 55 + 37 = 92; of them 55 saw the ad → P(saw ad | bought) = 55/92
3. The two conditional probabilities are different: the order of the condition matters.

Q4.5 5/16 ≈ 0.312

1. Total outcomes = 2^5 = 32
2. Ways to place 3 heads in 5 tosses = C(5,3) = 10
3. Probability = 10/32 = 5/16

Q4.6 504

1. Order matters, so use permutations: P(9,3) = 9 × 8 × 7 = 504

Q4.7 10,080

1. 8 letters in total; repeated letters: A×2, S×2
2. Arrangements = 8! ÷ (2! × 2!) = 40,320 ÷ 4 = 10,080

Q4.8 14.0%

1. Imagine 100,000 accounts. Fraud: 2,000; genuine: 98,000
2. Correctly flagged fraud = 1,600; wrongly flagged genuine = 9,800
3. P(fraud | flagged) = 1600 ÷ (1600 + 9800) = 14.0%
4. A rare event plus an imperfect test means most flags are false alarms. This is the base-rate effect.

Want the full guide?

Maths for Data Careers has ten chapters, 80 practice problems with solutions, a diagnostic quiz with an Excel scorer, a glossary and a study plan, for ₹599. Visit nexlytic-ai.netlify.app or message us on WhatsApp 7980988011.

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