



CMA FOUNDATION · PAPER 3 · FUNDAMENTALS OF BUSINESS
MATHEMATICS AND STATISTICS

Student Notes

Chapter 7 · Probability



Definitions, events and the two rules · dice, cards, coins and balls · conditional and total probability

Built from the Shuchita CMA Foundation Scanner, 2026 July edition (Thirtieth), and its printed front matter.

How to use these notes

Work block by block. Start with the “Read first” line, which sends you to the CHEAT SHEET your Scanner already prints for that block — these notes do not repeat it. Then read the NOTES panel, which carries only what the CHEAT SHEET does not: what the examiner has actually asked, and where the marks are lost.

Then prepare level by level. Each level names the **skill the question calls for** and lists the exact Scanner questions to practise at that level, so you can see what the demand looks like before you meet it in the hall.

Question lines show: **printed section · sitting · question number · marks · Scanner page**, then the section again in the column beside it and the **difficulty** of the question. **PYQ** is a past-year question, **MQP** a Mock Question Paper question, **MODEL** a Model question, **CSEET** a question carried from that course. All four are printed in your Scanner; nothing here is invented.

The heading above each group names the skill — **REMEMBERING, UNDERSTANDING, APPLYING, ANALYSING**. Every Foundation question is an objective, so the band is read from what the question gives you and what it asks you to do between the stem and the options. **ICMAI publishes no skill-**

assessment grid for the Foundation papers, so no weighting is implied here on the Institute's behalf.

STUDY PRIORITY GUIDE

Block Ranking — Chapter 7

Two blocks, and the second is one of only two A-rated blocks in the paper. Block 7.1 is the vocabulary — mutually exclusive, exhaustive, independent, odds — and is answered from definitions. Block 7.2 is the arithmetic, and it is where the marks are. Neither can be prepared without the other.

SKILL REQUIRED Chapter 7 · share of the chapter's 149 marks

Analysing	12%	18 of 149 marks · 16 questions
Applying	42%	63 of 149 marks · 56 questions
Understanding	11%	16 of 149 marks · 14 questions
Remembering	35%	52 of 149 marks · 32 questions

Recalling and explaining 46% · applying, analysing and judging 54% — this chapter reads **on the paper's own balance**

Probability at this level is a small number of standard situations — a pair of dice, a pack of cards, a bag of balls, a leap year — asked again and again with the numbers changed. Work the standard situations until the sample space is automatic, and the arithmetic that follows is trivial.

Bands are SITS-assigned by written rubric (v1-CMA-Foundation) from what the objective gives and what it asks. ICMAT publishes no skill-assessment grid for the Foundation papers, so no weighting is implied on the Institute's behalf.

#	IMP.	BLOCK	BLOCK NAME	SHARE	CUM.	QNS
1	A	7.2	Primary Applications of Probability Theorems	64.4%	64%	76
2	B	7.1	Concepts and Terminologies	35.6%	100%	42

Rank is by the number of questions the Scanner prints for the block. IMP. is the Importance grade the Scanner's own contents page prints, from A to D. Block 7.2 is rated A: it is asked heavily and it is asked every sitting.

CHAPTER 7

Probability

Concepts and Terminologies

BLOCK 7.1 · IMPORTANCE B · SCANNER PAGE 293 · 42 QUESTIONS

Read first The CHEAT SHEET at the head of block 7.1 in your Scanner, pages 293 to 300. These notes do not repeat it.

NOTES

Addition rule, any two events	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
Mutually exclusive	$P(A \cap B) = 0$, so $P(A \cup B) = P(A) + P(B)$
Independent	$P(A \cap B) = P(A) \times P(B)$, and $P(A B) = P(A)$
Exhaustive	the union of the events is the whole sample space, $P = 1$
Complement	$P(A) + P(A') = 1$
Odds in favour $a : b$	$P = a \div (a + b)$; odds against $a : b$ give $P = b \div (a + b)$

Probability lies between 0 and 1 inclusive. An impossible event has probability 0 and a sure event 1; the inclusive form $0 \leq P(A) \leq 1$ is the correct option and the strict one is printed beside it.

Mutually exclusive and independent are opposites, not synonyms. Two events with non-zero probabilities cannot be both: if they cannot occur together, knowing one occurred changes the other's probability to zero.

Mutually exclusive and exhaustive together mean the probabilities add to exactly 1. With $P(A) = 0.6$ and $P(B) = 0.2$, $P(C)$ is 0.2.

The compound probability theorem. $P(A \cap B) = P(A) \times P(B|A)$. It reduces to the product of the two probabilities only when the events are independent.

Days of the week. An ordinary year is 52 weeks and 1 day, so any named day has probability $1/7$ of occurring 53 times. A leap year has 2 spare days, so the probability is $2/7$ — and the probability of exactly 52 Sundays in a leap year is $5/7$.

Where $P(A \cap B) = 0$ and $P(A \cup B) = 1$ the events are mutually exclusive and exhaustive together.

ANALYSING two or more steps, or two ideas weighed together

- Where $P(A)$, $P(A \cup B)$ and independence are given, use $P(A \cup B) = P(A) + P(B) - P(A)P(B)$ and solve the linear equation for $P(B)$.
- Given $P(A \cup B)$ and $P(A \cap B)$, the sum $P(A) + P(B)$ follows at once from the addition rule without either individual probability.

PYQ 2016-Dec · Q 1(i) · 2 marks · p 297	PYQ	Hard
PYQ 2017-Dec · Q 1(ii) · 2 marks · p 298	PYQ	Hard
PYQ 2023-Jun · Q 1 · 2 marks · p 301	PYQ	Hard
PYQ 2023-Jun · Q 3 · 2 marks · p 301	PYQ	Hard

APPLYING one step of arithmetic, or one substitution

- For a pair of dice the sample space is 36. A total of 8 arises in five ways, so the probability is $5/36$ — the printed $1/8$ and $1/12$ come from a mis-counted sample space.
- Write the sample space size down before anything else. Two coins gives 4, three coins 8, four coins 16, a pack of cards 52.

PYQ 2015-Mar · Q 1 · 1 mark · p 296	PYQ	Easy
PYQ 2015-Sep · Q 1 · 1 mark · p 296	PYQ	Easy
PYQ 2015-Sep · Q 3 · 1 mark · p 296	PYQ	Easy
PYQ 2016-Mar · Q 1 · 1 mark · p 297	PYQ	Easy
PYQ 2016-Dec · Q 1(ii) · 2 marks · p 298	PYQ	Easy
PYQ 2018-Dec · Q 1(i) · 2 marks · p 299	PYQ	Easy
PYQ 2019-Dec · Q 1(ii) · 2 marks · p 300	PYQ	Easy
PYQ 2022-Dec · Q 1 · 1 mark · p 301	PYQ	Easy
PYQ 2022-Dec · Q 2 · 1 mark · p 301	PYQ	Easy
PYQ 2023-Jun · Q 2 · 2 marks · p 301	PYQ	Medium

PYQ 2023-Dec · Q 1 · 2 marks · p 302	PYQ	Easy
PYQ 2024-Jun · Q 3 · 2 marks · p 302	PYQ	Medium
PYQ 2025-Dec · Q 1 · 2 marks · p 304	PYQ	Easy
PYQ 2025-Dec · Q 2 · 2 marks · p 304	PYQ	Easy
PYQ 2025-Dec · Q 3 · 2 marks · p 304	PYQ	Medium
PYQ 2025-Dec · Q 4 · 2 marks · p 304	PYQ	Easy
PYQ 2026-Jun · Q 1 · 2 marks · p 305	PYQ	Medium

UNDERSTANDING a concept told apart from its neighbours

- If $P(A) = P(A')$ then each is 0.5, and the two are mutually exclusive, exhaustive and equally likely all at once.

PYQ 2015-Dec · Q 1 · 1 mark · p 296	PYQ	Medium
PYQ 2015-Sep · Q 2 · 1 mark · p 296	PYQ	Easy
PYQ 2024-Jun · Q 1 · 2 marks · p 302	PYQ	Medium
PYQ 2025-Jun · Q 1 · 2 marks · p 303	PYQ	Medium
PYQ 2025-Jun · Q 3 · 2 marks · p 303	PYQ	Easy

REMEMBERING one printed fact, recalled

- Learn the six lines of the table above as definitions, not as formulae. More than half this block is asked as "if A and B are mutually exclusive then ..." with the four rules as options.
- Odds against 3 : 5 gives a probability of 5/8, not 3/8. The order is what the question turns on.

PYQ 2015-Dec · Q 2 · 1 mark · p 297	PYQ	Easy
PYQ 2015-Dec · Q 3 · 1 mark · p 297	PYQ	Easy

PYQ 2017-Jun · Q 1(i) · 2 marks · p 298	PYQ	Easy
PYQ 2017-Jun · Q 1(ii) · 2 marks · p 298	PYQ	Easy
PYQ 2017-Dec · Q 1(i) · 2 marks · p 298	PYQ	Easy
PYQ 2018-Jun · Q 1(i) · 2 marks · p 299	PYQ	Easy
PYQ 2018-Dec · Q 1(ii) · 2 marks · p 299	PYQ	Easy
PYQ 2019-Jun · Q 1(i) · 2 marks · p 299	PYQ	Easy
PYQ 2019-Jun · Q 1(ii) · 2 marks · p 300	PYQ	Easy
PYQ 2019-Dec · Q 1(i) · 2 marks · p 300	PYQ	Easy
PYQ 2024-Dec · Q 1 · 2 marks · p 302	PYQ	Easy
PYQ 2023-Dec · Q 2 · 2 marks · p 302	PYQ	Easy
PYQ 2024-Jun · Q 2 · 2 marks · p 302	PYQ	Easy
PYQ 2024-Dec · Q 2 · 2 marks · p 303	PYQ	Easy
PYQ 2025-Jun · Q 2 · 2 marks · p 303	PYQ	Easy
PYQ 2025-Dec · Q 5 · 2 marks · p 304	PYQ	Easy

Primary Applications of Probability Theorems

BLOCK 7.2 · IMPORTANCE A · SCANNER PAGE 309 · 76 QUESTIONS

Read first The CHEAT SHEET at the head of block 7.2 in your Scanner, pages 309 to 316. These notes do not repeat it.

NOTES

Drawing balls. Without replacement, the denominators fall by one at each draw and the events are dependent; with replacement they do not and the events are independent. The question always says which, and the two answers are both printed.

One of each colour from 7 red, 12 white and 4 green is $(7 \times 12 \times 4) \div {}^{23}C_3$ when three are drawn together — a combination question wearing probability's clothes.

Coins. Exactly two heads in three tosses is $3/8$; exactly two in four tosses is $6/16 = 3/8$ as well. Count the favourable arrangements with "C, rather than by listing.

Cards. 52 cards, 4 suits of 13, 12 face cards, 4 of each rank. "A king or a queen" is $8/52$; two cards without replacement multiplies 52 by 51 in the denominator.

Independent events multiply. Both of X and Y alive with probabilities 0.5 and 0.8 gives 0.4. "At least one" is 1 minus the probability that none occurs — always compute the complement rather than the sum of cases.

Total probability. Where the outcome depends on which of several situations obtains — 70 per cent of matches at night and 30 per cent by day, with a different win rate in each — multiply each situation's probability by its conditional probability and add.

Two people telling the truth. They agree when both speak truly or both speak falsely: $0.7 \times 0.8 + 0.3 \times 0.2 = 0.62$. The question usually asks for the percentage of cases in which they contradict, which is the complement.

Odds combined. Odds in favour of 2 to 5 is a probability of $2/7$; odds against of a to b is $b/(a + b)$. Convert both to probabilities before combining them.

ANALYSING two or more steps, or two ideas weighed together

- Weighted-outcome questions — the petrol pump on rainy and fine days, the team's night and day matches — are one line: Σ (probability of the situation $\times$ value or probability within it).
- The 100-student question with girls, rich and fair-complexioned students assumes the three attributes are independent, so multiply the three proportions.

MQP 2024-Jun · Q 1 · no marks printed · p 312	MQP mock paper	Hard
MQP 2024-Dec S1 · Q 12 · no marks printed · p 314	MQP mock paper	Hard
MQP 2025-Jun S1 · Q 17 · no marks printed · p 315	MQP mock paper	Hard
MQP 2025-Jun S1 · Q 18 · no marks printed · p 315	MQP mock paper	Hard
MQP 2025-Jun S1 · Q 20 · no marks printed · p 315	MQP mock paper	Hard
MQP 2025-Jun S2 · Q 29 · no marks printed · p 317	MQP mock paper	Hard
PYQ 2015-Dec · Q 1 · 1 mark · p 320	PYQ	Hard

PYQ 2015-Sep · Q 4 · 1 mark · p 320	PYQ	Hard
PYQ 2023-Dec · Q 5 · 2 marks · p 323	PYQ	Hard
PYQ 2024-Jun · Q 6 · 2 marks · p 325	PYQ	Hard
PYQ 2025-Dec · Q 2 · 2 marks · p 327	PYQ	Hard
PYQ 2026-Jun · Q 6 · 2 marks · p 328	PYQ	Hard

APPLYING one step of arithmetic, or one substitution

- Decide first whether the draws are with or without replacement. Everything else follows from that one reading.
- "At least one" always means $1 - P(\text{none})$. Computing the cases separately is slower and is where the arithmetic errors come from.
- The leap-year questions recur at almost every sitting. 53 Sundays in a leap year is $2/7$; in an ordinary year $1/7$.

MQP 2024-Jun · Q 2 · no marks printed · p 312	MQP mock paper	Medium
MQP 2024-Jun · Q 3 · no marks printed · p 312	MQP mock paper	Easy
MQP 2024-Jun · Q 5 · no marks printed · p 312	MQP mock paper	Medium
MQP 2024-Jun · Q 6 · no marks printed · p 313	MQP mock paper	Easy
MQP 2024-Dec S1 · Q 10 · no marks printed · p 313	MQP mock paper	Easy
MQP 2024-Dec S1 · Q 11 · no marks printed · p 313	MQP mock paper	Easy
MQP 2024-Dec S2 · Q 14 · no marks printed · p 314	MQP mock paper	Easy
MQP 2024-Dec S2 · Q 15 · no marks printed · p 314	MQP mock paper	Easy
MQP 2024-Dec S2 · Q 16 · no marks printed · p 314	MQP mock paper	Medium
MQP 2025-Jun S1 · Q 22 · no marks printed · p 316	MQP mock paper	Medium
MQP 2025-Jun S1 · Q 23 · no marks printed · p 316	MQP mock paper	Easy

MQP 2025-Jun S1 · Q 24 · no marks printed · p 316	MQP mock paper	Easy
MQP 2025-Jun S2 · Q 25 · no marks printed · p 316	MQP mock paper	Easy
MQP 2025-Jun S2 · Q 26 · no marks printed · p 316	MQP mock paper	Easy
MQP 2025-Jun S2 · Q 27 · no marks printed · p 317	MQP mock paper	Easy
MQP 2025-Jun S2 · Q 28 · no marks printed · p 317	MQP mock paper	Medium
MQP 2025-Dec S1 · Q 31 · no marks printed · p 317	MQP mock paper	Easy
MQP 2025-Dec S2 · Q 33 · no marks printed · p 318	MQP mock paper	Easy
MQP 2025-Dec S2 · Q 35 · no marks printed · p 318	MQP mock paper	Easy
PYQ 2015-Mar · Q 1 · 1 mark · p 319	PYQ	Easy
PYQ 2015-Jun · Q 1 · 1 mark · p 319	PYQ	Easy
PYQ 2015-Sep · Q 1 · 1 mark · p 319	PYQ	Easy
PYQ 2015-Sep · Q 2 · 1 mark · p 319	PYQ	Medium
PYQ 2019-Dec · Q 1(i) · 2 marks · p 320	PYQ	Medium
PYQ 2015-Sep · Q 3 · 1 mark · p 320	PYQ	Easy
PYQ 2022-Dec · Q 1 · 2 marks · p 321	PYQ	Easy
PYQ 2023-Jun · Q 1 · 2 marks · p 321	PYQ	Easy
PYQ 2022-Dec · Q 2 · 2 marks · p 321	PYQ	Easy
PYQ 2023-Jun · Q 2 · 2 marks · p 321	PYQ	Easy
PYQ 2024-Dec · Q 1 · 2 marks · p 325	PYQ	Easy
PYQ 2024-Dec · Q 2 · 2 marks · p 326	PYQ	Medium
PYQ 2024-Dec · Q 3 · 2 marks · p 326	PYQ	Medium

PYQ 2024-Dec · Q 4 · 2 marks · p 326	PYQ	Medium
PYQ 2024-Dec · Q 5 · 2 marks · p 326	PYQ	Easy
PYQ 2025-Dec · Q 1 · 2 marks · p 327	PYQ	Easy
PYQ 2026-Jun · Q 1 · 2 marks · p 328	PYQ	Medium
PYQ 2026-Jun · Q 3 · 2 marks · p 328	PYQ	Medium
PYQ 2026-Jun · Q 4 · 2 marks · p 328	PYQ	Easy
PYQ 2026-Jun · Q 5 · 2 marks · p 328	PYQ	Easy

UNDERSTANDING a concept told apart from its neighbours

- Odds in favour of "five to two" means the event is expected five times in seven trials, not five times in five.
- A probability of 0.05 against 0.95 tells you which event is more likely; it does not tell you that either is certain.

MQP 2024-Dec S2 · Q 13 · no marks printed · p 314	MQP mock paper	Easy
MQP 2025-Jun S1 · Q 19 · no marks printed · p 315	MQP mock paper	Easy
MQP 2025-Jun S1 · Q 21 · no marks printed · p 315	MQP mock paper	Easy
MQP 2025-Jun S2 · Q 30 · no marks printed · p 317	MQP mock paper	Medium
MQP 2025-Dec S2 · Q 32 · no marks printed · p 318	MQP mock paper	Easy
PYQ 2023-Dec · Q 3 · 2 marks · p 323	PYQ	Easy
PYQ 2023-Dec · Q 6 · 2 marks · p 323	PYQ	Easy
PYQ 2025-Jun · Q 2 · 2 marks · p 327	PYQ	Easy
PYQ 2026-Jun · Q 2 · 2 marks · p 328	PYQ	Medium

REMEMBERING one printed fact, recalled

- The sum of the probabilities of an event and its complement is 1. It is asked plainly, and it is the fastest mark in the chapter.

MQP 2024-Jun · Q 4 · no marks printed · p 312	MQP mock paper	Easy
MQP 2024-Jun · Q 7 · no marks printed · p 313	MQP mock paper	Easy
MQP 2024-Jun S1 · Q 8 · no marks printed · p 313	MQP mock paper	Easy
MQP 2024-Dec S1 · Q 9 · no marks printed · p 313	MQP mock paper	Easy
MQP 2025-Dec S2 · Q 34 · no marks printed · p 318	MQP mock paper	Easy
PYQ 2023-Dec · Q 1 · 2 marks · p 322	PYQ	Easy
PYQ 2023-Dec · Q 2 · 2 marks · p 322	PYQ	Easy
PYQ 2023-Jun · Q 3 · 2 marks · p 322	PYQ	Easy
PYQ 2023-Jun · Q 4 · 2 marks · p 322	PYQ	Easy
PYQ 2023-Dec · Q 4 · 2 marks · p 323	PYQ	Easy
PYQ 2024-Jun · Q 1 · 2 marks · p 324	PYQ	Easy
PYQ 2024-Jun · Q 2 · 2 marks · p 324	PYQ	Easy
PYQ 2024-Jun · Q 3 · 2 marks · p 324	PYQ	Easy
PYQ 2024-Jun · Q 4 · 2 marks · p 325	PYQ	Easy
PYQ 2024-Jun · Q 5 · 2 marks · p 325	PYQ	Easy
PYQ 2025-Jun · Q 1 · 2 marks · p 327	PYQ	Easy