

# MBA Recruitment Brain Teaser Workbook

This workbook trains you to approach, structure, and solve real-world recruitment brain teasers used in consulting, finance, and tech interviews.

## Part 1. How to Practice

### Daily Routine

- **10 minutes** warm-up: one question from each category.
- **Narrate aloud** - recruiters assess *clarity and structure*, not just answers.
- **Use pen and paper** for frameworks or math breakdowns.
- **Time yourself**: aim for 90 seconds for guesstimates, 60 seconds for logic, 3–4 minutes for optimization.

### Weekly Plan

Day	Focus	Goal
Monday	Market Sizing	Build numerical intuition
Tuesday	Logic & Probability	Strengthen structured reasoning
Wednesday	Optimization	Practice multi-variable trade-offs
Thursday	Lateral Thinking	Sharpen creativity under pressure
Friday	Business Insight	Connect numbers to strategy
Weekend	Mock Interview	Combine all types with verbal narration

### Core Frameworks

#### 1. Understand the Recruiter's Intent

Brain teasers appear in **consulting, PE/VC, quant finance, and product/strategy** interviews. They test:

- Comfort with **numbers and estimation**
- **Assumption-driven thinking**
- Ability to **articulate logic clearly and calmly**
- **Commercial intuition** - how you connect math to a business reality

Example:

“How many golf balls are sold in the US each year?”

They’re not grading the number, but *how you reason and communicate*.

#### 2. Master a Repeatable Framework

Use a **business-oriented structure**:

1. **Clarify the problem**  
“Do you want US retail only or global? Annual or monthly volume?”
2. **Segment the market**  
Break into logical buckets: customers, frequency, price.



3. **Estimate with assumptions**  
Round neatly and state every step aloud.
4. **Validate with a sanity check**  
“That feels right - it’s consistent with similar niche products.”
5. **Tie back to insight**  
“So the US golf ball market is roughly \$1B, which supports 3-4 large manufacturers.”

### 3. Focus on the Three Core Teaser Families

Category	Typical Industries	Example
Market sizing & guesstimates	Consulting, tech, corp strategy	“Estimate the market for Uber in NYC.”
Logic & probability puzzles	Quant finance, data, product	“Two envelopes, one with double the money - what’s the expected value?”
Optimization & trade-offs	Ops, PM, supply chain	“Design the best route for 5 delivery trucks.”

### 4. Drill Estimation Speed and Clarity

- Practice **10-15 guesstimates** using real companies and data (number of ATMs in the US, tons of ice cream sold yearly).
- **State assumptions cleanly:** “Assume 300M people, half drink coffee, 1 cup a day...”
- Keep your math simple, round aggressively, and narrate your logic as if teaching a client.

### 5. Sharpen Your Logic Under Time Pressure

Use:

- **Brain teaser sets:** Glassdoor, PrepLounge, IGotAnOffer.
- **Data Sufficiency questions** (from GMAT/EA) to build conditional reasoning.
- **Classic puzzles** like the bridge-crossing, prisoners and lightbulb, or weighing coins - then practice summarizing the key insight in one line.

### 6. Practice Out Loud Like a Mini Case

Recruiters judge **tone, composure, and reasoning clarity**, not just math.

When practicing:

- Speak your plan first: “I’ll break this into demand and supply sides.”
- Draw quick mental or paper structures.
- Stop and recap: “So far, I have 20M potential users buying 10 times a year...”

### 7. Common Mistakes to Avoid

- Jumping straight into math without framing.
- Using over-precise numbers (kills flow).
- Forgetting the *business story* behind numbers.
- Freezing in silence - narrate even while thinking.



## Part 2. Market Sizing & Guesstimates

**Goal:** Estimate quantities, revenues, or market sizes using structured assumptions.

**Approach:**

1. Define scope (region, product, timeframe).
2. Segment population or demand.
3. Multiply frequency  $\times$  users  $\times$  price.
4. Sanity check and contextualize.

### Practice Questions & Outlines:

1. How many golf balls are sold in the U.S. each year?
2. Estimate the annual revenue of Uber in New York City.
3. How many cups of coffee does Starbucks sell globally per day?
4. Estimate the number of piano tuners in London.
5. How many gas stations are there in France?
6. What is the market size for Apple Watches in India?
7. Estimate total annual toothpaste consumption in the U.S.
8. How many suitcases pass through Heathrow Airport every day?
9. Estimate the number of Netflix subscribers who watch documentaries weekly.
10. What's the annual revenue potential for a premium bottled water brand in Singapore?

### Answers

1. Golf balls sold in the U.S. – golfers  $\times$  rounds per year  $\times$  balls lost per round  $\times$  price.
2. Uber NYC revenue – trips per day  $\times$  average fare  $\times$  commission  $\times$  days per year.
3. Starbucks daily cups – stores  $\times$  customers per day  $\times$  cups per customer.
4. Piano tuners London – households  $\times$  piano ownership  $\times$  tuning frequency  $\div$  tunings per tuner.
5. Gas stations France – population  $\times$  cars per capita  $\div$  cars per station.
6. Apple Watches India – target income group  $\times$  smartphone users  $\times$  conversion rate  $\times$  price.
7. Toothpaste U.S. – population  $\times$  tubes per person per year  $\times$  average price.
8. Heathrow luggage per day – flights  $\times$  passengers per flight  $\times$  avg. bags per person.
9. Netflix documentary viewers – total users  $\times$  share watching documentaries  $\times$  frequency.
10. Premium water Singapore – population  $\times$  consumption  $\times$  market share  $\times$  price.

**Practice Tip:** Focus on *reasonable logic*, not perfect accuracy.



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## Part 3. Logic & Probability Puzzles

**Goal:** Demonstrate clear reasoning and communication under uncertainty.

### Approach:

1. Identify variables.
2. State probabilities or logical rules.
3. Apply step-by-step reasoning.
4. Communicate clearly - recruiters care about process.

### Practice Questions & Reasoning Hints:

1. You flip two coins - what's the probability of exactly one head?
2. You have two children; one is a boy. What's the probability the other is also a boy?
3. A fair die is rolled twice - what's the chance the sum is 9 or more?
4. A deck has 52 cards. What's the probability of drawing two red aces in a row?
5. You pick one card at random from a deck. What's the chance it's higher than 10?
6. A jar has 3 red, 4 blue, and 5 green balls. What's the probability of not drawing green twice in a row?
7. You have 3 doors: one has a car, two have goats. You choose one, host opens another showing a goat. Switch or stay? Why?
8. How many different paths exist to move from the top-left to bottom-right of a  $3 \times 3$  grid, moving only right or down?
9. You toss a coin until you get heads. What's the expected number of tosses?
10. You're told two people in a room share a birthday. What's the minimum group size for this to be likely?

### Answers

1. Two coins  $\rightarrow$  exactly one head:  $P = 1/2$ .
2. Two children, one boy  $\rightarrow$  conditional probability  $= 1/3$ .
3. Dice sum  $\geq 9 \rightarrow$  favorable  $10/36 = 27.8\%$ .
4. Two red aces  $\rightarrow (2/52) \times (1/51) = 1/1326$ .
5. Card higher than 10  $\rightarrow 12/52 = 23\%$ .
6. No green twice  $\rightarrow 8/12 \times 7/11 = 42\%$ .
7. Monty Hall  $\rightarrow$  switching doubles win chance  $(2/3)$ .
8.  $3 \times 3$  grid paths  $\rightarrow$  combination  $(6 \text{ choose } 3) = 20$ .
9. Expected coin flips for first heads  $\rightarrow 2$ .
10. Birthday paradox  $\rightarrow \sim 23$  people.

**Practice Tip:** Talk through reasoning slowly; pause before final probability.



## Part 4. Optimization & Trade-Off Problems

**Goal:** Demonstrate structured thinking and business logic.

### Approach:

1. Define goal (maximize profit, minimize cost, balance quality).
2. Identify key constraints.
3. Lay out variables (capacity, cost, time).
4. Discuss trade-offs and logical prioritization.

### Example Practice Structures:

1. You manage 10 delivery trucks and 5 routes. How do you assign them for minimal cost?
2. You have one runway and 20 flights to schedule - how do you minimize delay?
3. A retailer can restock daily or weekly - how do you choose the optimal cycle?
4. You must design an elevator system for a 50-story office tower. What factors matter most?
5. You're setting up a call center - how many agents should you hire to balance service speed and cost?
6. A company has a \$1M marketing budget. How would you allocate it across online, offline, and influencer channels?
7. You're running a warehouse with variable demand. How do you optimize staff scheduling?
8. How would you determine the ideal number of cashiers for a supermarket?
9. A delivery firm must serve 100 locations in 10 hours - design a routing strategy.
10. You run a website and notice server costs rising. How would you reduce costs without hurting performance?

### Answers

1. Delivery trucks: Assign based on distance, volume, and delivery windows.
2. Runway schedule: Prioritize by turnaround time and urgency.
3. Restock frequency: Optimize cost of inventory vs. ordering.
4. Elevator design: Traffic flow, wait time, maintenance cost.
5. Call center staffing: Use arrival rate and service time → queue optimization.
6. Marketing budget: Rank channels by ROI and marginal efficiency.
7. Warehouse staffing: Apply demand patterns and shift overlap.
8. Supermarket cashiers: Balance service time vs. idle time.
9. Delivery routing: Use clustering and shortest path logic.
10. Server costs: Optimize cloud usage, caching, and redundancy.

**Practice Tip:** Always finish with a management takeaway: "*This suggests X strategy reduces cost without affecting service levels.*"



## Part 5. Lateral & Creative Thinking

**Goal:** Show mental agility, curiosity, and composure.

**Approach:** - Explain your reasoning out loud. - Don't rush - interviewers value the thought process.

### Practice Questions & Sample Angles:

1. Why are manhole covers round?
2. How many piano keys fit in a Boeing 747?
3. You have 3 light switches outside a room and 1 bulb inside - how do you find which switch controls it?
4. How would you move Mount Fuji?
5. If you could only ask one question to find the smarter of two people, what would it be?
6. How many times a day do a clock's hands overlap?
7. You have 8 balls; one is heavier. How do you find it in two weighings?
8. You walk 1 mile south, 1 mile east, and 1 mile north - and return to your start. Where are you?
9. What's heavier: a pound of feathers or a pound of gold?
10. Why are mirrors reversed left-to-right but not top-to-bottom?

### Answers

1. Manhole covers: round = no corners, easier to move, safer.
2. 747 piano keys: find volume ratio → adjust for empty space.
3. Light switches puzzle: use heat to identify bulb.
4. Move Mount Fuji: test problem-solving approach, not literal.
5. One question to find smarter person: ask meta or prediction question.
6. Clock hands overlap: every  $65\frac{5}{11}$  minutes → 22 times a day.
7. 8 balls puzzle: weigh strategically to halve search space.
8. 1 mile loop puzzle: North Pole logic.
9. Feathers vs. gold: equal in weight, different in density.
10. Mirrors reversal: reflection inverts front-back, not up-down.

**Practice Tip:** Smile and narrate your logic - creativity is measured by calm reasoning.



## Part 6. Business Insight & Decision Logic

**Goal:** Show strategic reasoning and commercial sense.

**Approach:**

1. Identify the problem category (profit, growth, product, pricing).
2. Use a consulting mini-case structure: Situation → Complication → Analysis → Recommendation.
3. Always link back to data and real-world levers.

**Practice Questions & Key Frameworks:**

1. A company's profits fall even though sales rise. What could cause it?
2. Two products have the same revenue but different margins - which should you prioritize?
3. A coffee chain wants to expand to airports - what factors do you analyze?
4. A city bans plastic straws - how does it impact beverage companies?
5. Should Netflix invest more in original content or licensing?
6. A grocery delivery startup has low retention. What data would you look at first?
7. How would you price a new smartwatch with unique health features?
8. Airline ticket sales drop - how do you diagnose the issue?
9. A fashion retailer wants to go global. How do you decide which country first?
10. If Amazon started a bank, what would its biggest advantage and risk be?

**Answers**

1. Profit falls, sales rise: cost structure, pricing, mix, competition.
2. Margin comparison: prioritize higher contribution, lower CAC.
3. Airport expansion: demand, partnerships, capacity.
4. Plastic straw ban: costs, branding, alternatives.
5. Netflix content mix: ROI of originals vs. licenses.
6. Low retention: funnel metrics (onboarding, satisfaction, pricing).
7. Smartwatch pricing: willingness to pay, cost-plus, competitor pricing.
8. Airline ticket drop: demand, macro, operations, brand.
9. Retailer global expansion: PESTLE, entry barriers, culture.
10. Amazon bank: advantages (trust, reach), risks (regulation).

**Practice Tip:** Speak like a mini consultant - *“Here's what I'd analyze and why it matters.”*



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## Part 7. Popular brain problems teaser with solutions

1. Light switches and one bulb

**Recruiter:** Outside a room you see three switches labeled A, B, C. Inside the room is a single bulb. You can enter the room once. How do you determine which switch controls the bulb?

**Solution:** Turn on A for one minute, then turn A off and turn on B. Enter the room. If the bulb is on it is B. If off and warm it is A. If off and cold it is C.

2. Bee between two trains

**Recruiter:** Two trains start 100 miles apart, each going 50 mph toward the other. A bee flies between them at 75 mph until they collide. How far does the bee fly?

**Solution:** Collision time is  $100 \div (50 + 50) = 1$  hour. Distance =  $75 \times 1 = 75$  miles.

3. Two cards both aces

**Recruiter:** You draw two cards without replacement. Probability both are aces?

**Solution:**  $(4/52) \times (3/51) = 12/2652 \approx 0.00453 \approx 0.45\%$ .

4. December double sales

**Recruiter:** A firm sells x each month except December which is 2x. What fraction of annual sales is December?

**Solution:** Annual =  $11x + 2x = 13x$ . December share =  $2x/13x = 2/13 \approx 15.38\%$ .

5. Heavier ball among 8 in 2 weighings

**Recruiter:** Eight identical balls, one heavier. Two weighings on a balance scale. Find the heavy one.

**Solution:** Weigh 3 vs 3. If equal, heavy in the remaining 2 then weigh 1 vs 1. If not equal, take the heavier 3 and weigh 1 vs 1 with one aside. If equal, the aside is heavy. If not, heavier on scale is heavy.

6. Times like 1:11

**Recruiter:** In 24-hour time, how many times show repeated digits like 1:11 or 22:22?

**Solution:** Valid: 1:11, 2:22, 3:33, 4:44, 5:55, 11:11, 22:22. Total 7.

7. Price up 25%, down 20%

**Recruiter:** Price rises 25% one day then falls 20% the next. Net change?

**Solution:** Start 100 → 125 → 100. Net 0%.

8. Two dice sum at least 9

**Recruiter:** Roll two fair dice. Probability the sum is 9 or more?

**Solution:** Counts: 9 (4), 10 (3), 11 (2), 12 (1) →  $10/36 = 27.78\%$ .

9. Hats and parity strategy

**Recruiter:** 100 people wear red or blue hats. In line, each sees hats behind. Starting from the front, each must guess their own color. Strategy to maximize correct guesses and expected correct count?



**Solution:** First encodes parity of red as “red” or “blue.” Everyone after compares seen parity to decode their own color. Expected 99 correct plus a 50% chance for the first.

10. 3L and 5L jugs to get 4L

**Recruiter:** Measure exactly 4 liters with 3L and 5L jugs.

**Solution:** Fill 5 → pour into 3 (2 left in 5). Empty 3. Pour 2 into 3. Fill 5 → top up 3 with 1 → 4 remains in 5.

11. Keep same dollar margin

**Recruiter:** Margin is 30% of price. If cost rises 10% but you keep the same dollar margin, what is the new price relative to 100?

**Solution:** Original: price 100, cost 70, margin 30. New cost = 77. Keep margin 30 → price 107.

12. Expected flips to first heads

**Recruiter:** Flip a fair coin until first heads. Expected number of flips?

**Solution:** Geometric with  $p = 1/2$  → expectation  $1/p = 2$ .

13. South, east, north loop

**Recruiter:** Walk 1 mile south, 1 east, 1 north and return to start. Where are you?

**Solution:** North Pole. Also near South Pole at latitudes where 1 mile east loops fully.

14. Vote transfer

**Recruiter:** Three candidates have 20%, 30%, 50%. If 5% of all voters switch from the leader to the runner up, who wins?

**Solution:** Leader 45, runner up 35, third 20. Leader still wins.

15. Piano tuners in Chicago

**Recruiter:** Estimate how many piano tuners work in Chicago.

**Solution:** Example: 2.7M people → about 1M households. Piano ownership 1 in 20 → 50k pianos. Tuning 1 per year. A tuner does ~960 per year.  $50k \div 960 \approx 52$  tuners. Give a range.

16. Bridge crossing 1, 2, 7, 10

**Recruiter:** Four people cross a bridge at 1, 2, 7, 10 minutes. Two cross at a time with a torch. Minimum total time?

**Solution:** 1+2 cross (2). 1 returns (+1). 7+10 cross (+10). 2 returns (+2). 1+2 cross (+2). Total 17.

17. Hourglasses 3 and 5 to time 7

**Recruiter:** You have 3-minute and 5-minute hourglasses. Measure exactly 7 minutes.

**Solution:** Start both. At 3, flip 3. At 5, flip 5. When 3 empties again, 1 minute has run on the 5 → 4 remain. When that 4 finishes, total 7.

18. Monty Hall

**Recruiter:** Car behind 1 of 3 doors. You pick a door. Host opens a goat door. Switch or



stay?

**Solution:** Switch. Win probability rises from 1/3 to 2/3.

19. Birthday paradox threshold

**Recruiter:** Minimum group size with at least a 50% chance two people share a birthday?

**Solution:** 23.

20. Dominoes on a cut chessboard

**Recruiter:** Remove two opposite corners of a chessboard. Can 31 dominoes cover the remaining 62 squares?

**Solution:** No. Opposite corners have the same color. Removal leaves color imbalance that dominoes cannot cover.

21. Two candles to time 45 minutes

**Recruiter:** Two identical candles each burn for 60 minutes but nonlinearly. How to time 45 minutes?

**Solution:** Light A at both ends and B at one end. When A burns out (30 min), light the other end of B. B finishes in 15 more minutes. Total 45.

22. Average speed trap

**Recruiter:** Out and back on a 1-mile track. Outbound average 30 mph. What inbound speed is needed to average 60 mph overall?

**Solution:** Impossible. To average 60 mph you need total time 2 minutes. Outbound at 30 mph already took 2 minutes. No time remains.

23. Rope around the Earth

**Recruiter:** A rope snug around Earth's equator is lengthened by 1 meter and lifted uniformly. How high is the gap?

**Solution:** Extra circumference  $1 = 2\pi h \rightarrow h = 1/(2\pi) \approx 0.159$  m.

24. Two eggs, 100 floors

**Recruiter:** Two identical eggs, 100 floors, find the highest safe floor in the fewest worst-case drops. Strategy and worst-case count?

**Solution:** Drop at floors 14, 27, 39, 50, 60, 69, 77, 84, 90, 95, 99, 100 using decreasing intervals. Worst case 14 drops.

25. Mislabelled fruit jars

**Recruiter:** Three jars labeled Apples, Oranges, Mixed. All labels are wrong. You may pick one fruit from one jar. How do you fix all labels?

**Solution:** Draw from jar labeled Mixed. It must be pure. Use that fruit to deduce the other two.

26. Socks in the dark

**Recruiter:** Drawer has 10 black and 10 white socks. Minimum picks to guarantee a matching pair?

**Solution:** Three.



27. At least one ace

**Recruiter:** Draw two cards. Probability at least one ace?

**Solution:**  $1 - C(48,2)/C(52,2) = 1 - 1128/1326 = 198/1326 = 33/221 \approx 14.93\%$ .

28. Expected flips to get HH

**Recruiter:** Flip a fair coin until two consecutive heads appear. Expected number of flips?

**Solution:** 6.

29. Coupon collector with a die

**Recruiter:** Expected rolls to see all six faces of a fair die at least once?

**Solution:**  $6 \times H_6 = 6 \times (1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6) \approx 6 \times 2.45 = 14.7$ .

30. Boy born on Tuesday

**Recruiter:** I tell you I have two children and at least one is a boy born on a Tuesday. What is the probability the other child is also a boy?

**Solution:**  $13/27 \approx 48.15$  percent.

31. Cake cutting

**Recruiter:** With three straight cuts, what is the maximum number of cake pieces you can make?

**Solution:** 8. Arrange each cut to intersect the others in new places.

32. Doubling water lily

**Recruiter:** A water lily doubles its area daily and covers the lake on day 48. On which day was it half the lake?

**Solution:** Day 47.

33. Price up then down

**Recruiter:** A price increases 20 percent, then decreases 20 percent. What is the net change?

**Solution:**  $100 \rightarrow 120 \rightarrow 96$ . Net  $-4$  percent.

34. Unequal train speeds

**Recruiter:** Two trains are 120 miles apart, speeds 40 mph and 20 mph, heading toward each other. When do they meet?

**Solution:** Relative speed 60 mph. Time  $120 \div 60 = 2$  hours.

35. Pairing six loose wire ends

**Recruiter:** You have three cords, six loose ends total. Pair ends uniformly at random to make three connections. What is the probability you get three separate loops rather than one big loop?

**Solution:**  $1/3$ .

36. Ants on a stick

**Recruiter:** A stick is length 10. Ants walk at speed 1 and reverse on collision. Maximum



time until all fall off?

**Solution:** 10. Collisions are equivalent to passing through.

37. Twelve coins, one odd, heavy or light

**Recruiter:** Among 12 coins, one has different weight, unknown heavy or light. Using three weighings, can you always identify the coin and whether it is heavy or light?

**Solution:** Yes. Use a standard 4-4-4 split decision tree. First weigh 4 vs 4, branch outcomes, then design two follow-up weighings to isolate and label heavy or light.

38. Wolf, goat, cabbage

**Recruiter:** You must ferry a wolf, a goat, and a cabbage. Boat holds you plus one. The wolf eats the goat and the goat eats the cabbage if left alone. Sequence?

**Solution:** Take goat over. Return alone. Take wolf over. Bring goat back. Take cabbage over. Return alone. Take goat over.

39. Two irregular ropes

**Recruiter:** Two ropes each burn for 60 minutes at variable rates. How do you time 15 minutes?

**Solution:** Light rope A at both ends and rope B at one end. When A finishes, 30 minutes passed. Now light the other end of B. Remaining half burns in 15 minutes.

40. Clock angle

**Recruiter:** What is the angle between the hour and minute hands at 3:15?

**Solution:** Hour hand at 3 plus 15 minutes  $\rightarrow 90 + 7.5 = 97.5$  degrees. Minute hand at 90. Difference 7.5 degrees.

41. Two-coin boxes

**Recruiter:** Three boxes: GG, SS, and GS. Choose a box at random, draw one coin, it is gold. What is the probability the box is GG?

**Solution:** 2/3 by Bayes. Gold is more likely from GG.

42. Airplane last seat

**Recruiter:** First of N passengers picks a random seat. Each later passenger sits in their own seat if free, otherwise random. Probability the last passenger sits in their own seat?

**Solution:** 1/2.

43. Weekend variant of the child problem

**Recruiter:** I have two children and at least one is a girl born on a weekend. What is the probability both are girls?

**Solution:** 6/13  $\approx$  46.15 percent.

44. Wine and water swap

**Recruiter:** You swap a spoonful of wine into water, mix, then a spoonful back into the wine. Which glass ends with more of the other liquid?

**Solution:** They contain equal amounts of the other liquid.



45. Clock overlaps

**Recruiter:** How many times do the hour and minute hands overlap in a 24-hour day?

**Solution:** 22.

46. Stairs 1 or 2 steps

**Recruiter:** You can climb an n-step staircase by taking 1 or 2 steps each move. How many distinct ways?

**Solution:** Fibonacci number  $F(n+1)$ .

47. Pattern HT

**Recruiter:** You flip a fair coin until the pattern HT appears. What is the expected number of flips?

**Solution:** 4.

48. Exactly one six

**Recruiter:** Roll two fair dice. What is the probability of exactly one six?

**Solution:**  $2 \times (1/6) \times (5/6) = 5/18 \approx 27.78$  percent.

49. Double-headed coin

**Recruiter:** You have two fair coins and one double-headed coin. Pick a coin at random and flip a head. What is the probability you picked the double-headed coin?

**Solution:** 1/2.

50. Draws to first ace without replacement

**Recruiter:** From a shuffled 52-card deck, you draw until the first ace appears. What is the expected draw position?

**Solution:**  $(N+1)/(K+1) = (52+1)/(4+1) = 53/5 = 10.6$ .

51. Random chord longer than equilateral side

**Recruiter:** Under the chord-midpoint method, what is the probability a random chord is longer than the side of the inscribed equilateral triangle?

**Solution:** 1/3.

52. Two workers

**Recruiter:** Together they finish in 6 hours. One alone takes 10 hours. How long does the other take alone?

**Solution:**  $1/6 - 1/10 = 2/30 \rightarrow$  rate  $1/15$ . So 15 hours.

53. Three points on a circle

**Recruiter:** Pick three random points on a circle. What is the probability all lie on some semicircle?

**Solution:** 3/4.

54. Two points on a stick

**Recruiter:** Choose two points uniformly on a unit segment. Probability they are within



1/3 of each other?

**Solution:** Area where  $|x - y| < 1/3$  in unit square =  $1 - 2*(2/3)^2/2 = 7/9$ .

#### 55. 100 prisoners and a lightbulb

**Recruiter:** Prisoners visit a central room with a lightbulb in unknown order. They may set a protocol beforehand. Can they guarantee eventual release?

**Solution:** Yes. Designate a counter who turns the light off a set number of times corresponding to unique “first on” signals from others. When the counter’s tally reaches 99, declare completion.

#### 56. Round table adjacency

**Recruiter:** Ten people sit at a round table uniformly at random. What is the probability two specific people sit next to each other?

**Solution:** Fix one seat. The other has 2 favorable positions out of 9. Probability 2/9.

#### 57. Piano tuners variant

**Recruiter:** Chicago has 2.7 million people, about 1 million households. Assume one piano per 20 households, one tuning per year, and 1,000 tunings per tuner per year. Estimate the number of piano tuners.

**Solution:** 50,000 tunings per year divided by 1,000  $\approx$  50 tuners.

#### 58. Medical test and false positives

**Recruiter:** A disease affects 1 % of people. A test detects it 99 % of the time if you have it, but 5 % of healthy people test positive. You test positive—what’s the chance you’re sick?

**Solution:**

Let 10 000 people test. 100 are sick  $\rightarrow$  99 true positives. 9 900 healthy  $\rightarrow$  495 false positives.

Posterior =  $99 / (99 + 495) \approx 16.7\%$ .

**Explanation:** Bayes’ rule shows even good tests can mislead when prevalence is low.

#### 59. Forgotten PIN order

**Recruiter:** Your four-digit PIN has all different digits but you forgot the order. How many combinations must you try to guarantee success?

**Solution:**  $4! = 24$ .

**Explanation:** Every ordering of the four digits is a unique PIN.

#### 60. Random walk return

**Recruiter:** On a 1-D line you start at 0 and move +1 or -1 randomly each step. What is the probability you ever return to 0?

**Solution:** 1.

**Explanation:** In one dimension a symmetric random walk is recurrent—it always revisits the start.



### 61. Nine-ball heavier problem

**Recruiter:** Nine identical balls, one heavier. Find the heavy one in two weighings.

**Solution:** Weigh 3 vs 3. If equal → heavy in last 3 → weigh 1 vs 1. If unequal → pick heavier 3 → weigh 1 vs 1, if equal the aside ball is heavy.

**Explanation:** Divide and conquer halves the possibilities each time.

### 62. Three coins

**Recruiter:** Flip three fair coins. Probability of at least two heads?

**Solution:**  $3C2 + 3C3 = 4$  favorable / 8 total = 0.5.

**Explanation:** Only HHT, HTH, THH succeed.

### 63. Hearts before spades

**Recruiter:** Reveal a shuffled deck sequentially. What's the probability the first heart appears before the first spade?

**Solution:**  $\frac{1}{2}$ .

**Explanation:** By symmetry either suit can appear first.

### 64. Two-child problem (classic)

**Recruiter:** I have two kids; at least one is a girl. Probability both are girls?

**Solution:** 1/3.

**Explanation:** Combinations: GG, GB, BG. GG is one of three equally likely cases.

### 65. Swimmers and current

**Recruiter:** Two swimmers cross a river and return. Is total time minimized by always aiming perpendicular or by correcting for drift?

**Solution:** Perpendicular minimizes total time.

**Explanation:** Current cancels equally each way; diagonal adds unnecessary distance.

### 66. Four coin tosses at least one six

**Recruiter:** Roll a die up to 4 times; stop if you get a 6. Probability you see at least one 6?

**Solution:**  $1 - (5/6)^4 = 671/1296 \approx 51.8\%$ .

**Explanation:** Complement = no 6 in 4 tries.

### 67. Bridge crossing 1, 2, 5, 10

**Recruiter:** Four people cross in pairs with a torch. Times 1, 2, 5, 10. Minimum total?

**Solution:** 1+2 cross (2); 1 back (1); 5+10 cross (10); 2 back (2); 1+2 cross (2) → 17?

Wait check:  $2 + 1 + 10 + 2 + 2 = 17$ ? actual known optimal = 17? But classical solution gives 19 for that set, since 1 + 2 cross (2), 1 back (1), 5 + 10 (10), 2 back (2), 1 + 2 (2): total 17. Correction correct formula.

**Explanation:** Use shuttle method minimizing slow crossings.

### 68. 1-mile square walk

**Recruiter:** Move 1 south, 1 west, 1 north, 1 east. Where do you finish?



**Solution:** Back where you started—net displacement zero.

**Explanation:** Vector sum cancels.

#### 69. Middle-digit average

**Recruiter:** For three-digit numbers with distinct digits, what is the probability the middle digit equals the average of the outer two?

**Solution:** 1/9.

**Explanation:** For any outer pair differing by an even number, one valid middle exists; among all valid triples this ratio holds.

#### 70. U.S. smartphone market size

**Recruiter:** Estimate how many smartphones are sold yearly in the U.S.

**Solution:** Population 330 M  $\rightarrow$  ~270 M users (80 %). Replace every 3 years  $\rightarrow$  90 M per year. Add 10 % growth  $\rightarrow$  ~100 M.

**Explanation:** State assumptions clearly and end with a rounded, realistic estimate.

