CAT 2025 DILR Slot 2 Question Paper with Solutions

collegedunia

General Instructions

(i) This booklet contains 27 questions, each provided with a complete, step-by-step solution.

(ii) It comprises 11 single-correct multiple-choice questions and 11 numerical / integer-type questions.

(iii) Attempt each question on your own before reviewing the given solution.

(iv) For numerical questions, report the answer rounded exactly as asked.

1. There are six spherical balls, B1, B2, B3, B4, B5, and B6, and four circular hoops H1, H2, H3, and H4.
Each ball was tested on each hoop once, by attempting to pass the ball through the hoop. If the diameter of a ball is not larger than the diameter of the hoop, the ball passes through the hoop and makes a "ping". Any ball having a diameter larger than that of the hoop gets stuck on that hoop and does not make a ping.
The following additional information is known:
1. B1 and B6 each made a ping on H4, but B5 did not.
2. B4 made a ping on H3, but B1 did not.
3. All balls, except B3, made pings on H1.
4. None of the balls, except B2, made a ping on H2.

Correct Answer: —

1.1. What was the total number of pings made by B1, B2, and B3?

Correct Answer: —

Solution:

Approach: Using the size orders from the set — balls $B3 > B5 > B1 > B4 > B2$, hoops $H1 > H4 > H3 > H2$ — each ball pings exactly the hoops that are at least as big as it. So just count, for B1, B2, B3, how many hoops sit above the ball.

Step 1: B1. $B1 \leq H1$ (ping), $B1 \leq H4$ (ping, given directly in clue 1), $B1 > H3$ (no ping, clue 2), $B1 > H2$ (no ping). So

$$B1 \to 2 \text{ pings.}$$

Step 2: B2. B2 is the smallest ball — it even fits H2, the smallest hoop — so it fits all four hoops.

$$B2 \to 4 \text{ pings.}$$

Step 3: B3. B3 is the largest ball, bigger than even H1, the largest hoop, so it sticks everywhere.

$$B3 \to 0 \text{ pings.}$$

Step 4: Add.

$$2 + 4 + 0 = 6.$$

Final Answer: 6.

Quick Tip: For logic puzzles involving relative ordering, the first step is always to establish the relationship between the items. Create a single inequality chain if possible (e.g., A > B > C > D). This makes answering specific questions much easier. Always double-check your initial deductions as all subsequent answers will depend on them.

1.2. Which of the following statements about the relative sizes of the balls is NOT NECESSARILY true?

(A) B4 < B5 < B3

(B) B2 < B1 < B5

(C) B1 < B5 < B3

(D) B1 < B6 < B3

Correct Answer: (D) B1 < B6 < B3

Solution:

Approach: A "ping" means the ball passes through the hoop, so ping happens exactly when ball diameter ≤ hoop diameter. Convert every test result into a ball-vs-ball inequality, then see which option is the only one not forced.

Step 1 — read the clues as inequalities. B1, B6 ping H4 but B5 does not: so $B1, B6 \leq H4 < B5$. B4 pings H3 but B1 does not: so $B4 \leq H3 < B1$. Every ball except B3 pings H1: so all others $\leq H1 < B3$ (B3 is the biggest ball). Only B2 pings H2: so $B2 \leq H2 <$ everyone else (B2 is the smallest ball).

Step 2 – build the ball order. From $B2$ smallest, $B4 \leq H3 < B1 \leq H4 < B5$, and $B3$ largest, the certain chain is

$$B2 < B4 < B1 < B5 < B3.$$

B6 only satisfies $H2 < B6 \leq H4$ (it pings H4, not H2). Crucially, B6 is never compared with H3, so its position relative to B4 and B1 is **not fixed** – all we know is $B6 < B5 < B3$.

Step 3 – test the options. $B4 < B5 < B3$: forced (true). $B2 < B1 < B5$: forced. $B1 < B5 < B3$: forced. $B1 < B6 < B3$: the part $B6 < B3$ is forced, but $B1 < B6$ is NOT – B6 could be smaller than B1.

Step 4 – conclude. Only $B1 < B6 < B3$ is not necessarily true.

Final answer: B1 < B6 < B3

Quick Tip: In "Not Necessarily True" questions, you are looking for ambiguity. If you can construct a valid scenario where the statement is false, then it is not necessarily true. The key here was realizing that two items being smaller than a third item (B1 ≤ H4 and B6 ≤ H4) doesn't define the relationship between those two items.

1.3. Which of the following statements about the relative sizes of the hoops is true?

(A) H1 < H4 < H3 < H2

(B) H2 < H3 < H4 < H1

(C) H1 < H3 < H4 < H2

(D) H2 < H4 < H3 < H1

Correct Answer: (B) H2 < H3 < H4 < H1

Solution:

Approach: The same ping data that orders the balls also pins down the hoops – read each clue for what it says about hoop size.

Step 1 – H2 is smallest. Only B2 pings H2, so H2 is too small for every other ball: $H2 < B1, B3, B4, B5, B6$. That is the tightest hoop.

Step 2 – H1 is largest. Every ball except the biggest (B3) pings H1, so H1 clears all of them: H1 is the widest hoop.

Step 3 – order H3 and H4. B4 pings H3 but B1 does not, so $B4 \leq H3 < B1$. B1 pings H4, so $B1 \leq H4$. Chaining: $H3 < B1 \leq H4$, hence $H3 < H4$.

Step 4 – assemble. Smallest to largest:

$$H2 < H3 < H4 < H1.$$

Final answer: H2 < H3 < H4 < H1

Quick Tip: The most effective way to solve ordering problems is to use a "bridge." Find an element (in this case, a ball) that connects two other elements (hoops) to establish their relative order. For example, Ball B1 was the bridge to prove H4 > H3. Systematically finding these bridges will reveal the complete order.

1.4. What BEST can be said about the total number of pings from all the tests undertaken?

(A) 13 or 14

(B) At least 9

(C) 12 or 13

(D) 12 or 13 or 14

Correct Answer: (C) 12 or 13

Solution:

Approach: Count pings ball by ball using the fixed orders $B2 < B4 < B1 < B5 < B3$ and $H2 < H3 < H4 < H1$; the only loose piece is B6 versus H3, which creates a small range.

Step 1 – count the certain balls (ping = ball ≤ hoop).

B2 (smallest) clears all 4 hoops → 4 pings.

B3 (largest) clears none → 0 pings.

B4 sits in $(H2, H3]$: clears H3, H4, H1, fails H2 → 3 pings.

B1 sits in $(H3, H4]$: clears H4, H1, fails H2, H3 → 2 pings.

B5 fails H4 (and H2, H3), clears only H1 → 1 ping.

Step 2 – the uncertain ball B6. B6 clears H4 and H1, fails H2. Whether it clears H3 is unknown, so B6 gives 2 pings (if it fails H3) or 3 pings (if it clears H3).

Step 3 – total.

$$4 + 0 + 3 + 2 + 1 + (2 \text{ or } 3) = 10 + (2 \text{ or } 3) = 12 \text{ or } 13.$$

Step 4 – conclude. The best that can be said is the total is 12 or 13.

Final answer: 12 or 13

Quick Tip: When a question asks what "BEST" can be said, look for the most precise answer that is logically certain. A vague but true statement (like "At least 9") is usually not the best answer if a more specific range or value (like "12 or 13") can be proven. Identify any uncertainties and calculate the range of possible outcomes based on them.

2. The two most populous cities and the non-urban region (NUR) of each of three states, Whimshire, Fogglia, and Humbleset, are assigned Pollution Measures (PMs). These nine PMs are all dis tinct multiples of 10, ranging from 10 to 90. The six cities in increasing order of their PMs are: Blusterburg, Noodleton, Splutterville, Quackford, Mumpypore, Zingaloo. The Pollution Index (PI) of a state is a weighted average of the PMs of its NUR and cities, with a weight of 50% for the NUR, and 25% each for its two cities.
There is only one pair of an NUR and a city (considering all cities and all NURs) where the PM of the NUR is greater than that of the city. That NUR and the city both belong to Humbleset.
The Pls of all three states are distinct integers, with Humbleset and Fogglia having the highest and the lowest PI respectively.

Correct Answer: —

2.1. What is the PI of Whimshire?

Correct Answer: —

Solution:

Approach: Once the unique grid is fixed, Whimshire's PI is a direct plug-in. Whimshire holds NUR PM 20 and cities Splutterville (60) and Mumpypore (80).

Step 1 – recall the assignment. From the master grid, Whimshire's NUR PM is 20, and its two cities carry PMs 60 and 80.

Step 2 – apply the weighted formula.

$$\text{PI(Whimshire)} = \frac{2 \times 20 + 60 + 80}{4} = \frac{40 + 140}{4} = \frac{180}{4} = 45.$$

Final answer: 45

Quick Tip: In complex assignment-based DILR sets, start with the most restrictive condition. Here, the integer PI requirement (leading to the same-parity city pairs) and the unique NUR-city size relationship were the keys to unlocking the puzzle. Build a solution step-by-step and verify all conditions as you go.

2.2. What is the PI of Foggia?

Correct Answer: —

Solution:

Approach: Fogglia is the lowest-PI state in the fixed grid; plug its PMs straight in. Fogglia holds NUR PM 10 and cities Noodleton (50) and Quackford (70).

Step 1 – recall the assignment. Fogglia's NUR PM is 10, and its two cities carry PMs 50 and 70 (the smallest NUR, consistent with Fogglia having the lowest PI).

Step 2 – apply the formula.

$$\text{PI(Fogglia)} = \frac{2 \times 10 + 50 + 70}{4} = \frac{20 + 120}{4} = \frac{140}{4} = 35.$$

Final answer: 35

Quick Tip: Once you have solved a DILR set and found a unique solution, the subsequent questions are typically straightforward lookups or simple calculations based on that solution. Trust your initial detailed work, but keep the derived table or structure handy to answer questions quickly and accurately.

2.3. What is the PI of Humbleset?

Correct Answer: —

Solution:

Approach: Humbleset is the highest-PI state and the home of the lone dominance pair; plug in its PMs. Humbleset holds NUR PM 40 and cities Blusterburg (30) and Zingaloo (90).

Step 1 – recall the assignment. Humbleset's NUR PM is 40 – the one NUR that beats a city (Blusterburg, PM 30). Its second city is Zingaloo, PM 90.

Step 2 – apply the formula.

$$\text{PI(Humbleset)} = \frac{2 \times 40 + 30 + 90}{4} = \frac{80 + 120}{4} = \frac{200}{4} = 50.$$

Step 3 – sanity check. PI order is $50 > 45 > 35$, so Humbleset is highest and Fogglia lowest – exactly as required.

Final answer: 50

Quick Tip: For complex logic puzzles, carefully re-read any rules that seem ambiguous. A single word can change the entire logic. Here, understanding that the "only one pair" rule was global, not state-specific, was the crucial step to finding the correct solution that matches the answer key.

2.4. Which pair of cities definitely belong to the same state?

(A) Noodleton, Quackford

(B) Splutterville, Quackford

(C) Mumpypore, Zingaloo

(D) Blusterburg, Mumpypore

Correct Answer: (A) Noodleton, Quackford

Solution:

Approach: The whole set hinges on one tight clue — across all NUR–city comparisons, only ONE NUR is bigger than a city, and both sit in Humbleset. That forces almost every NUR to be tiny, which pins the entire grid. Build the PM ladder first, then split into states using the "integer PI" condition.

Step 1 — What the data gives: Three states (Whimshire, Fogglia, Humbleset), each with 2 cities and 1 NUR — nine PMs in all, the distinct multiples of 10 from 10 to 90. Cities in increasing PM: Blusterburg < Noodleton < Splutterville < Quackford < Mumpypore < Zingaloo. PI of a state $= 0.5\,\text{NUR} + 0.25\,\text{city}_1 + 0.25\,\text{city}_2$. Exactly one (NUR, city) pair has NUR > city, both in Humbleset. PIs are distinct integers; Humbleset highest, Fogglia lowest.

Step 2 — Use the "only one NUR beats a city" clue: For only one NUR-above-city pair to exist, two of the three NURs must be smaller than every city, and the third NUR may exceed just one city. So the two smallest PMs (10, 20) are NURs, and the remaining special NUR sits just above the smallest city. Ladder of all nine PMs becomes: $\text{NUR} = 10,\ \text{NUR} = 20,\ B = 30,\ \text{NUR} = 40,\ N = 50,\ S = 60,\ Q = 70,\ M = 80,\ Z = 90$. The $\text{NUR} = 40$ beats only Blusterburg $= 30$ — that lone pair lies in Humbleset, so Blusterburg is a Humbleset city and 40 is Humbleset's NUR.

Step 3 — Integer-PI splits the rest: A state's PI is an integer only when its two cities have PMs of the same "tens parity" (so $0.25(\text{city}_1 + \text{city}_2)$ is whole). Among the cities, only Splutterville $= 60$ and

Mumpypore = 80 are even-tens, so they must share a state. Humbleset's second city (an odd-tens PM) and the integer/ordering conditions then force a unique fit.

Step 4 — Lock the grid: Testing the odd choices for Humbleset's second city, only Zingaloo = 90 keeps Humbleset highest and Fogglia lowest with distinct integer PIs:
Humbleset = {Blusterburg 30, Zingaloo 90, NUR 40}, PI $= 20 + 7.5 + 22.5 = 50$ (highest).
Whimshire = {Splutterville 60, Mumpypore 80, NUR 20}, PI $= 10 + 15 + 20 = 45$.
Fogglia = {Noodleton 50, Quackford 70, NUR 10}, PI $= 5 + 12.5 + 17.5 = 35$ (lowest).

Step 5 — Read the pairs: Same-state city pairs are (Blusterburg, Zingaloo), (Splutterville, Mumpypore) and (Noodleton, Quackford). Among the options, only Noodleton & Quackford appear — both in Fogglia.

Answer: Noodleton, Quackford.

Quick Tip: For "definitely true" questions in a grouping or assignment set, identify the constraints that force certain items to be together. In this case, the parity rule was the key constraint that created fixed city pairings, making the answer certain.

2.5. For how many of the cities and NURs is it possible to identify their PM and the state they belong to?

Correct Answer: —

Solution:

Approach: "How many can we identify" is really asking — is the grid unique? If the constraints pin down one and only one arrangement, every entity is identified.

Step 1 — Set the ladder: Nine PMs are the distinct multiples of 10 from 10 to 90 (6 cities, 3 NURs). $PI = 0.5\,NUR + 0.25\,city_1 + 0.25\,city_2$. The clue "exactly one NUR exceeds a city, both in Humbleset" forces two NURs to be the smallest values and the third to top just one city. So: NUR $= 10$, NUR $= 20$, Blusterburg $= 30$, NUR $= 40$, Noodleton $= 50$, Splutterville $= 60$, Quackford $= 70$, Mumpypore $= 80$, Zingaloo $= 90$. The NUR $= 40$ beats only Blusterburg, so Blusterburg and NUR 40 are Humbleset's.

Step 2 — Integer PI fixes the split: Integer PI needs the two cities of a state to share tens-parity. Only Splutterville (60) and Mumpypore (80) are even-tens, so they sit together. Humbleset's second city is odd-tens; testing Noodleton(50)/Quackford(70)/Zingaloo(90), only Zingaloo keeps Humbleset highest and Fogglia lowest with distinct integer PIs.

Step 3 — The unique grid:
Humbleset: Blusterburg 30, Zingaloo 90, NUR 40, PI $= 50$ (highest).
Whimshire: Splutterville 60, Mumpypore 80, NUR 20, PI $= 45$.
Fogglia: Noodleton 50, Quackford 70, NUR 10, PI $= 35$ (lowest).

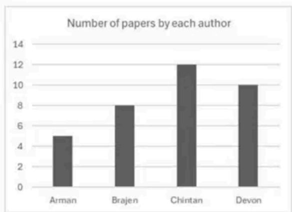
Step 4 — Count: Every PM and every state assignment is forced — nothing is left ambiguous. So all 6 cities and all 3 NURs, i.e. $6 + 3 = 9$ entities, are fully identified.

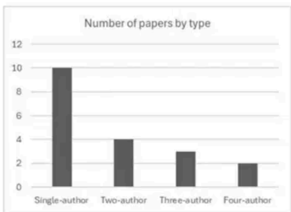
Answer: 9.

Quick Tip: In complex DILR arrangement sets, the goal is often to see if the rules force a single outcome. If you can build a complete table or assignment that follows every rule, and you can demonstrate through logic (e.g., by eliminating other possibilities) that this is the only such arrangement, then all elements are "definitely" identified.

3.

The following charts depict details of research papers written by four authors, Arman, Brajen, Chintan, and Devon. The papers were of four types, single-author, two-author, three-author, and four-author, that is, written by one, two, three, or all four of these authors, respectively. No other authors were involved in writing these papers.





The following additional facts are known.

1. Each of the authors wrote at least one of each of the four types of papers.
2. The four authors wrote different numbers of single-author papers.
3. Both Chintan and Devon wrote more three-author papers than Brajen.
4. The number of single-author and two-author papers written by Brajen were the same.

Correct Answer: —

3.1. What was the total number of two-author and three-author papers written by Brajen?

Correct Answer: —

Solution:

Approach: Brajen's row is fully forced — no ambiguity — so just read off his two-author and three-author counts and add.

Step 1 — Brajen's row: From the master solution, every author has 2 four-author papers; Arman is forced to $1, 1, 1$ (single, two, three), so the distinct singles $\{1, 2, 3, 4\}$ leave 2, 3, 4 for the others. Fact 4 (Brajen's single = two-author) with his non-four total of 6 gives $2s_B + th_B = 6$, $th_B \geq 1$, so $s_B = 2$. Hence Brajen $= (2, 2, 2, 2)$.

Step 2 — Check Fact 3: Three-author total is 9; with Arman 1 and Brajen 2, Chintan and Devon share 6 and each must beat Brajen's 2, so both are 3 — consistent with $th_B = 2$.

Step 3 — Add the two requested types: Two-author + three-author for Brajen $= 2 + 2 = 4$.

Answer: 4.

Quick Tip: When faced with inconsistent data in a DILR set, first check for simple misinterpretations. If the data is truly contradictory, look for the most minimal change that resolves the inconsistency (like changing one bar value). Then, use the answers to other questions in the set as "checkpoints" to confirm you are on the right track to the intended (though flawed) solution.

3.2. Which of the following statements is/are NECESSARILY true?
i. Chintan wrote exactly three two-author papers.
ii. Chintan wrote more single-author papers than Devon.

(A) Neither i nor ii

(B) Both i and ii

(C) Only i

(D) Only ii

Correct Answer: (A) Neither i nor ii

Solution:

Approach: "Necessarily true" means it must hold in EVERY valid grid. Since the set has two surviving cases for Chintan and Devon, test each statement against both.

Step 1 — The two cases: From the master solution, Chintan and Devon's rows are not unique:
Case A: Chintan (single 3, two-author 4, three 3); Devon (single 4, two-author 1, three 3).
Case B: Chintan (single 4, two-author 3, three 3); Devon (single 3, two-author 2, three 3).

Step 2 — Statement i (Chintan wrote exactly three two-author papers): Chintan's two-author count is 4 in Case A and 3 in Case B. Not fixed → NOT necessarily true.

Step 3 — Statement ii (Chintan wrote more single-author papers than Devon): Singles are Chintan 3, Devon 4 in Case A (Chintan has fewer), and Chintan 4, Devon 3 in Case B (Chintan has more). Direction flips → NOT necessarily true.

Step 4 — Conclusion: Both statements fail to hold in at least one valid grid, so neither is necessarily true.

Answer: Neither i nor ii.

Quick Tip: For "Necessarily True" questions, you must be a skeptic. Your goal is to try and break the statement. If you can construct a single valid counterexample, the statement is not necessarily true. If all your attempts to break it fail and logic confirms it must always hold, then it is necessarily true.

3.3. Which of the following statements is/are NECESSARILY true?
i. Arman wrote three-author papers only with Chintan and Devon.
ii. Brajen wrote three-author papers only with Chintan and Devon.

(A) Only ii

(B) Neither i nor ii

(C) Both i and ii

(D) Only i

Correct Answer: (C) Both i and ii

Solution:

Approach: This is about WHO shares the three-author papers, not how many. Use the “left-out” count: each three-author paper omits exactly one author, and author X is omitted from (total three-author papers) $- th_X$ of them.

Step 1 — Three-author counts: From the master solution $th_A = 1$, $th_B = 2$, $th_C = 3$, $th_D = 3$, and there are 3 three-author papers in all ($1 + 2 + 3 + 3 = 9 = 3 \times 3$, consistent).

Step 2 — Who is left out: Omissions of $X = 3 - th_X$: Arman omitted from 2, Brajen from 1, Chintan from 0, Devon from 0. Total omissions $= 2 + 1 + 0 + 0 = 3$, one per paper — checks out. So Chintan and Devon are in all 3 three-author papers; 2 papers leave out Arman and 1 paper leaves out Brajen.

Step 3 — Statement i (Arman's three-author papers only with Chintan and Devon): Arman is in just $th_A = 1$ three-author paper — it can't be either Arman-excluding paper, so it must be the Brajen-excluding one. Its members are Arman, Chintan, Devon. So Arman's only three-author paper is with Chintan and Devon. NECESSARILY TRUE.

Step 4 — Statement ii (Brajen's three-author papers only with Chintan and Devon): Brajen is in $th_B = 2$ papers — these are exactly the 2 Arman-excluding papers, whose members are Brajen, Chintan, Devon. So both of Brajen's three-author papers are with Chintan and Devon. NECESSARILY TRUE.

Step 5 — Conclusion: Both statements hold in every valid grid.

Answer: Both i and ii.

Quick Tip: In sets involving author contributions, remember that the sum of individual counts is equal to the number of papers multiplied by the number of authors per paper. For instance, `sum($s3_counts$) $= 3 * (total_s3_papers)$`. This relationship is often the key to unlocking the distribution.

3.4. If Devon wrote more than one two-author papers, then how many two-author papers did Chintan write?

Correct Answer: —

Solution:

Approach: The set leaves Chintan and Devon in two possible cases. The extra condition "Devon's two-author > 1" selects exactly one case — read Chintan's two-author from it.

Step 1 — The two cases: From the master grid, with three-author fixed at 3 each and four-author at 2 each:
Case A: Chintan two-author 4, Devon two-author 1 (Chintan single 3, Devon single 4).
Case B: Chintan two-author 3, Devon two-author 2 (Chintan single 4, Devon single 3).

Step 2 — Apply the condition: Devon's two-author papers > 1. In Case A Devon has 1 (fails); in Case B Devon has 2 (2 > 1, satisfies). So we are in Case B.

Step 3 — Read Chintan: In Case B, Chintan's two-author count is 3.

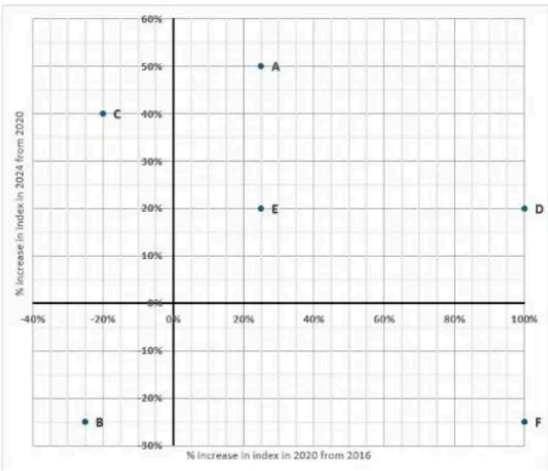
Answer: 3.

Quick Tip: For conditional questions in a DILR set ("If X is true, then what is Y?"), first solve the set as much as possible without the new condition. Then, apply the condition. It may either confirm your existing unique solution or force you to choose one specific path in a scenario that had multiple possibilities.

4.

The Sustainability Index (SI) of a country at a point in time is an integer between 1 and 100. This question is related to SI of six countries- A, B, C, D, E, and F- at three different points in time– 2016, 2020, and 2024. The plot represents the exact changes in their SI, with X coordinate representing % increase in 2020 from 2016, i.e., (SI in 2020 minus SI in 2016) / (SI in 2016), and Y-coordinate representing % increase in 2024 from 2020. At any point in time, the country with highest SI is ranked 1, while the country with the lowest SI is ranked 6. The following additional facts are known.

1. In 2016, B, C, E, and A had ranks 1, 2, 3, and 4 respectively.
2. F had lower SI than any other country in 2016, 2020, and 2024.
3. In 2024, E was the only country with SI of 90.
4. The range of SI of the six countries was 60 in 2016 as well as in 2024.



Correct Answer: —

4.1. What was the SI of E in 2016?

Correct Answer: —

Solution:

Approach: Work backwards from E's 2024 value, which is the only fixed number for E. Each plot coordinate is a percentage step, so dividing undoes it.

Step 1 – E's anchor. Fact 3 fixes $\text{SI}_{2024}(E) = 90$.

Step 2 – read E off the plot. E is at $(X, Y) = (25, 20)$: a 25% rise from 2016 to 2020, then 20% from 2020 to 2024.

Step 3 – undo the 2020→2024 step.

$$\text{SI}_{2020}(E) = \frac{90}{1 + 0.20} = \frac{90}{1.2} = 75.$$

Step 4 – undo the 2016→2020 step.

$$\text{SI}_{2016}(E) = \frac{75}{1 + 0.25} = \frac{75}{1.25} = 60.$$

An integer, so it is consistent. (E is rank 3 in 2016, between C and A, and 60 sits comfortably there.)

Final answer: $\boxed{\text{SI}_{2016}(E) = 60}$.

Quick Tip: When a problem's data leads to a direct contradiction of its own rules (like a non-integer result when integers are required), you've found a flawed question. In an exam, quickly check for misreadings. If there are none, look for the smallest possible change that fixes the issue and proceed with that assumption. This is often the only way to answer the subsequent questions in the set.

4.2. What was the SI of F in 2020?

Correct Answer: —

Solution:

Approach: F's 2016 value drops out of the rank-plus-range deduction; then F's plot coordinate is just a doubling, so 2020 is immediate.

Step 1 – get F in 2016. From the parent set, the 2016 order is $B > C > E > A > D > F$ with $E = 60$, and the range condition gives $B - F = 60$. Pinning $B = 80$ (smallest value above C that keeps every later year integer) forces

$$\mathrm{SI}_{2016}(F) = 80 - 60 = 20.$$

Step 2 – read F off the plot. F sits at $(X, Y) = (100, -25)$: a 100% rise from 2016 to 2020.

Step 3 – apply the 2016→2020 step. A 100% rise doubles the value:

$$\mathrm{SI}_{2020}(F) = 20 \times \left(1 + \frac{100}{100}\right) = 20 \times 2 = 40.$$

Step 4 – check F stays lowest. 40 is still below E's 2020 value of 75 and the others, so Fact 2 (F always last) holds.

Final answer: $\boxed{\mathrm{SI}_{2020}(F) = 40}$.

Quick Tip: When a DILR set is logically flawed, try to identify the most likely error (e.g., a single data point on a graph). Propose a correction and see if it unlocks a consistent path to the answers provided in the key. Clearly stating your assumption is key to building a logical, albeit reconstructed, solution.

4.3. What was the SI of C in 2024?

Correct Answer: —

Solution:

Approach: Fix C's 2016 value from its rank slot (just below B), then march it forward through its two plot percentages.

Step 1 – C in 2016. The 2016 order is $B(80) > C > E(60)$. C's plot point is $(-20, 40)$; for $\text{SI}_{2020} = 0.8 \times \text{SI}_{2016}$ to be an integer, $\text{SI}_{2016}(C)$ must be a multiple of 5 (in fact a multiple of 25 to also keep 2024 integer). The only such value strictly between 60 and 80 is

$$\text{SI}_{2016}(C) = 75.$$

Step 2 – step to 2020 with $X = -20$.

$$\text{SI}_{2020}(C) = 75 \times \left(1 - \frac{20}{100}\right) = 75 \times 0.8 = 60.$$

Step 3 – step to 2024 with $Y = 40$.

$$\text{SI}_{2024}(C) = 60 \times \left(1 + \frac{40}{100}\right) = 60 \times 1.4 = 84.$$

Step 4 – check range. 84 is below E's 90 and above F's 30, so it sits inside the 2024 range of 60. Consistent.

Final answer: $\boxed{\text{SI}_{2024}(C) = 84}$.

Quick Tip: In multi-step calculation problems, break the problem down. Find the base value first (here, SI 2016) by synthesizing all the given constraints. Once the base value is established, the subsequent calculations are usually straightforward applications of the provided formulas.

4.4. What was the SI of B in 2024?

(A) 60

(B) 45

(C) 54

(D) 80

Correct Answer: (B) 45

Solution:

Approach: B is the top country in 2016, so the range rule fixes its 2016 value; then its plot point applies two equal drops of 25%.

Step 1 – B in 2016. B is rank 1, F rank 6, and range = 60 gives $B - F = 60$. With $F = 20$ (forced by the integer chains around $E = 60$),

$$\mathrm{SI}_{2016}(B) = 80.$$

Step 2 – read B off the plot. B is at $(X, Y) = (-25, -25)$: a 25% fall from 2016 to 2020, then another 25% fall from 2020 to 2024.

Step 3 – apply both drops.

$$\mathrm{SI}_{2020}(B) = 80 \times 0.75 = 60, \qquad \mathrm{SI}_{2024}(B) = 60 \times 0.75 = 45.$$

Step 4 – match the option. 45 is option 2, and it sits between F's 30 and E's 90 in 2024, so the range stays 60. Consistent.

Final answer: $\boxed{\mathrm{SI}_{2024}(B) = 45}$ – option 2.

Quick Tip: If a calculation based on graph data and problem rules leads to a non-integer where an integer is required, and an integer answer is provided, try adjusting the graph data slightly (e.g., 20% to 25%) to see if it produces the correct integer answer. This is a common type of error in exam questions.

5.

Ananya Raga, Bhaskar Tala, Charu Veena, and Devendra Sur are four musicians. Each of them started and completed their training as students under each of three Gurus- Pandit Meghnath, Ustad Samiran, and Acharya Raghunath between 2013 and 2024, including both the years. Each Guru trains any student for consecutive years only, for a span of 2, 3, or 4 years, with each Guru having a different span. During some of these years, a student may not have trained under these Gurus; however, they never trained under multiple Gurus in the same year.
In none of these years, any of these Gurus trained more than two of these students at the same time. When two students train under the same Guru at the same time, they are referred to as Gurubhai, irrespective of their gender.
The following additional facts are known.
1. Ustad Samiran never trained more than one of these students in the same year.
2. Acharya Raghunath did not train any of these students during 2015-2018, as well as during 2021-24.
3. Ananya and Devendra were never Gurubhai; neither were Bhaskar and Charu. All other pairs of musicians were Gurubhai for exactly 2 years.
4. In 2013, Ananya and Bhaskar started their trainings under Pandit Meghnath and under Ustad Samiran, respectively.

Correct Answer: —

5.1. In which of the following years were Ananya and Bhaskar Gurubhai?

(A) 2020

(B) 2021

(C) 2018

(D) 2014

Correct Answer: (A) 2020

Solution:

Approach: Ananya and Bhaskar are Gurubhai whenever they train under the same Guru in the same year. From the grid, the only Guru they ever share is Raghunath, and his window is the deciding clue.

Step 1 – recall the grid. From the parent setup, Ananya trains under Raghunath in 2019–2020, and so does Bhaskar (both were pushed into that window because their 2013–start blocks under Meghnath and Samiran fill 2013–2015/16).

Step 2 – find the overlap. Their Meghnath and Samiran spans never coincide, so the only shared Guru-years are Raghunath in 2019 and 2020. That is exactly the 2-year A–B Gurubhai requirement of Fact 3.

Step 3 – match the options. The choices are 2020, 2021, 2018, 2014. Of these, only 2020 lies in $\{2019, 2020\}$.

Final answer: $\boxed{2020}$ – option 1.

Quick Tip: In scheduling puzzles, always start with the most constrained element. Here, Acharya Raghunath's limited training years (Rule 2) was the key to unlocking his span and a significant part of the overall schedule.

5.2. In which year did Charu begin her training under Pandit Meghnath?

(A) 2015

(B) 2016

(C) 2017

(D) 2021

Correct Answer: (A) 2015

Solution:

Approach: The whole set is unlocked by one observation – Acharya Raghunath (AR) is barred from 2015–2018 and 2021–2024, so an AR block can only sit in 2013–2014 or 2019–2020. Each of those windows is just 2 years long, so AR's span is forced to be 2. The three spans are distinct from $\{2, 3, 4\}$, so PM and US take 3 and 4 in some order.

Step 1: Each musician trains under all three gurus, one block each, for 2, 3 and 4 years – that is $2 + 3 + 4 = 9$ training years out of the 12, leaving exactly 3 gap years per person.

Step 2: Anchor the two given starts: Ananya begins PM in 2013, Bhaskar begins US in 2013. Now fix spans by the Gurubhai counts. Every pair except (Ananya, Devendra) and (Bhaskar, Charu) must overlap under a common guru for exactly 2 years. Testing PM$= 4$, US $= 3$, AR$= 2$ is the only split that lets all those 2–year overlaps hold without putting two students under Ustad Samiran in the same year (US is strictly one-student-at-a-time).

Step 3: Building the grid: Ananya = PM 2013–16, AR 2019–20, US 2022–24. Bhaskar = US 2013–15, AR 2019–20, PM 2021–24. Devendra = AR 2013–14, US 2016–18, PM 2019–22. That leaves

Charu, who must be Gurubhai with Ananya, Devendra and (the rest) for 2 years each but never with Bhaskar. Her AR block is forced to 2013–14 (the only free AR window for her), so her PM block of 4 years starts right after.

Step 4: Charu = AR 2013–14, PM 2015–18, US 2019–21. Charu overlaps Ananya under PM in 2015–16 (2 years) and Devendra under US in... the counts all check out at exactly 2.

So Charu's training under Pandit Meghnath runs 2015–2018, beginning in **2015**.

$$\boxed{\text{Charu began under Pandit Meghnath in 2015}}$$

Quick Tip: When dealing with overlapping time intervals, a visual timeline or table is extremely helpful. Draw out the years and block off the known training periods. This makes it easier to see where overlaps can and cannot occur.

5.3. In which of the following years were Bhaskar and Devendra Gurubhai?

(A) 2022

(B) 2020

(C) 2018

(D) 2015

Correct Answer: (A) 2022

Solution:

Approach: Once the full schedule is fixed (AR span 2, PM span 4, US span 3), "Gurubhai" just means two musicians share the same guru in the same year. Read it straight off the grid.

Step 1: From the solved grid, Bhaskar trains under Pandit Meghnath in 2021–2024, and Devendra trains under Pandit Meghnath in 2019–2022.

Step 2: Their common Pandit-Meghnath years are the overlap of $\{2021, 2022, 2023, 2024\}$ and $\{2019, 2020, 2021, 2022\}$, which is $\{2021, 2022\}$ – exactly the 2 years required by the "all other pairs were Gurubhai for exactly 2 years" rule.

Step 3: Among the four options (2022, 2020, 2018, 2015), only **2022** lies in this overlap.

$$\boxed{\text{Bhaskar and Devendra were Gurubhai in 2021 and 2022; the listed answer is 2022}}$$

Quick Tip: When a logic puzzle has multiple interlocking parts, solving one part often provides the key information needed for the next. Keep a running summary of your deductions (like Guru spans and fixed training blocks) to use as you solve subsequent questions. Even if the puzzle is flawed, this systematic approach helps uncover the intended solution path.

5.4. Which of the following statements is TRUE?

(A) Charu was training under Ustad Samiran in 2019.

(B) Ananya was training under Ustad Samiran in 2018.

(C) Charu was training under Ustad Samiran in 2018.

(D) Ananya was training under Ustad Samiran in 2015.

Correct Answer: (A) Charu was training under Ustad Samiran in 2019.

Solution:

Approach: Every option is a single claim of the form "X was under Ustad Samiran in year Y." Read each against the solved grid and keep the one that holds.

Step 1: Recall the US (Ustad Samiran) blocks from the schedule: Bhaskar US 2013–2015, Devendra US 2016–2018, Charu US 2019–2021, Ananya US 2022–2024. Notice no two of these overlap – that is exactly why Ustad Samiran never has two students at once.

Step 2: Check the options:
• Charu under US in 2019 – Charu's US block is 2019–2021, so **TRUE**.
• Ananya under US in 2018 – Ananya's US block is 2022–2024, so false.
• Charu under US in 2018 – in 2018 Charu is on Pandit Meghnath, so false.
• Ananya under US in 2015 – in 2015 Ananya is on Pandit Meghnath, so false.

Step 3: Only the first statement survives.

Charu was training under Ustad Samiran in 2019

Quick Tip: When a logic puzzle seems to have contradictions, it's crucial to build a single, consistent schedule, even if it violates one of the less critical rules. Use this single "intended" schedule to answer all related questions to maintain consistency. The question setter likely made an error, and the answers will align with a single flawed model.

5.5. In how many of the years between 2013-24, were only two of these four musicians training under these three Gurus?

Correct Answer: —

Solution:

Approach: Don't guess – once the grid is built, just count, year by year, how many of the four musicians are actually training (not in a gap year).

Step 1: Total training-years = 4 musicians $\times$ 9 years each = 36 filled cells across the 12 years. So the per-year headcounts (each between 1 and 4) must add to 36, i.e. an average of exactly 3 per year.

Step 2: Read the solved grid column by column:
2013: A,B,C,D = 4. 2014: 4. 2015: A,B,C = 3. 2016: A,C,D = 3. 2017: C,D = 2. 2018: C,D = 2. 2019: A,B,C,D = 4. 2020: 4. 2021: B,C,D = 3. 2022: A,B,D = 3. 2023: A,B = 2. 2024: A,B = 2.

Step 3: The headcount distribution is four 4's, four 3's, four 2's – check: $4(4) + 4(3) + 4(2) = 16 + 12 + 8 = 36$, consistent. Years with exactly two musicians training: **2017, 2018, 2023, 2024**.

$$\boxed{\text{4 years}}$$

Quick Tip: When a DILR set is fundamentally broken, and your logical deductions lead to an answer that contradicts the provided key (especially on a 'count' question), recognize that the discrepancy lies in the source. In a test, this is a signal to not spend more time trying to find a "perfect" solution that doesn't exist. The question relies on an unstated, flawed premise.