CAT 2025 DILR SLOT 1 Question Paper with Solutions

Time Allowed :40 Minutes	**Maximum Marks :**66	**Total Questions :**22

General Instructions

Read the following instructions very carefully:

1. The total duration of the test is **40 minutes** per section.
2. Each correct answer carries **+3 marks**.
3. For multiple-choice questions (MCQs), **−1 mark** will be deducted for each wrong answer.
4. There is **no negative marking** for Type-in-the-Answer (TITA) questions.
5. Once the allotted time for a section ends, you will automatically move to the next section. You cannot go back to a previous section.
6. All answers must be entered on the computer screen using the mouse and keyboard. Rough sheets will be provided.
7. The use of calculators, mobile phones, or any other electronic device is strictly prohibited. An on-screen basic calculator will be provided.

Q1. A, B, C, D, E, and F are seated around a circular table facing the center. B sits third to the left of A. Only one person sits between C and D. E is not a neighbor of A or C. F sits immediately to the right of D. How many distinct seating arrangements satisfy all conditions?

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

Correct Answer: (A) 0

Solution:
Step 1: Understanding the Concept:
This is a circular arrangement problem with constrained positioning. We need to place 6 people (A-F) in 6 seats satisfying relative position rules. "Facing the center" implies that "Left" is clockwise and "Right" is anti-clockwise (standard mathematical orientation for right-hand rule, though in reasoning puzzles, "Left" is often clockwise movement relative to the person). Let's use the standard seating convention:

- Clockwise movement = Left.

- Anti-Clockwise movement = Right.

Step 2: Detailed Explanation:
Let the seats be numbered 1 to 6 in a clockwise direction.

1. **Place A and B:** Let A be at seat 1. "B sits third to the left of A". Left of 1 is 2, 3, 4. So, B is at seat 4. Current state: A=1, B=4. Empty: 2, 3, 5, 6.
2. **Analyze "Only one person sits between C and D":** This means C and D are separated by exactly one seat (occupied by someone else). The possible pairs of seats with one seat between them are:
   - (2, 6) - separated by seat 1 (A).
   - (3, 5) - separated by seat 4 (B).
   - Other pairs like (1,3) or (4,6) involve occupied seats A or B as endpoints, which is not allowed for C and D.

   So, the pair {C, D} must be either {2, 6} or {3, 5}.
3. **Analyze "F sits immediately to the right of D":** "Right" means moving Anti-Clockwise (decreasing seat number mod 6). Let's test both cases for {C, D}.

   Case 1: {C, D} are at seats {3, 5}.

   - **Scenario 1a: D = 3, C = 5.** Right of D (3) is seat 2. So F = 2. Remaining person E must be at seat 6. *Check E constraint:* "E is not a neighbor of A or C". E (6) is adjacent to A (1). **Constraint Violated.**
   - **Scenario 1b: D = 5, C = 3.** Right of D (5) is seat 4. But seat 4 is occupied by B. **Impossible.**

   Case 2: {C, D} are at seats {2, 6}.

   - **Scenario 2a: D = 2, C = 6.** Right of D (2) is seat 1. But seat 1 is occupied by A. **Impossible.**
   - **Scenario 2b: D = 6, C = 2.** Right of D (6) is seat 5. So F = 5. Remaining person E must be at seat 3. *Check E constraint:* "E is not a neighbor of A or C". E is at 3. Neighbors of 3 are 2 and 4. Seat 2 is occupied by C. Since E is a neighbor of C, this **Violates the Constraint**.

Step 3: Conclusion:
All possible scenarios lead to a contradiction. There are no valid arrangements.
Final Answer: 0

Quick Tip

In circular arrangements, always fix one person's position to eliminate rotational symmetry. Be very careful with "Left/Right" definitions facing the center: Right is Anti-Clockwise, Left is Clockwise.

Q2. A store sells four products — P, Q, R, and S — across four days (Mon–Thu), exactly one product per day. P is not sold on Monday or Wednesday. R is sold before Q. S is not sold on Thursday. Exactly one of P or Q is sold on Tuesday. How many valid schedules are possible?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

Correct Answer: (C) 3

Solution:
Step 1: Listing Constraints:
Days: Mon, Tue, Wed, Thu. Products: P, Q, R, S. 1. P $\neq$ Mon, Wed. (So P is Tue or Thu). 2. S $\neq$ Thu. 3. R is before Q ($R < Q$). 4. Tue = P XOR Tue = Q (Exactly one of them).
Step 2: Case Analysis based on Constraint 4:
Case 1: P is sold on Tuesday.

- Since P is on Tue, Q is NOT on Tue.
- P is set to Tue.
- Remaining Days: Mon, Wed, Thu. Remaining Products: Q, R, S.
- Constraint 2: S $\neq$ Thu. So S is Mon or Wed.
- **Subcase 1a: S = Mon.**
  - Remaining: Q, R for Wed, Thu.
  - Constraint 3: $R < Q$. So R = Wed, Q = Thu.
  - Schedule: Mon(S), Tue(P), Wed(R), Thu(Q).
  - Check constraints: P not Mon/Wed (Ok). S not Thu (Ok). One of P/Q Tue (Ok).
  - **Valid Solution 1.**
- **Subcase 1b: S = Wed.**
  - Remaining: Q, R for Mon, Thu.
  - Constraint 3: $R < Q$. So R = Mon, Q = Thu.
  - Schedule: Mon(R), Tue(P), Wed(S), Thu(Q).
  - Check constraints: All Ok.
  - **Valid Solution 2.**

Case 2: Q is sold on Tuesday.

- Since Q is on Tue, P is NOT on Tue.
- From Constraint 1: P $\neq$ Mon, Wed. Since P $\neq$ Tue, P must be Thu.
- P = Thu.
- Remaining Days: Mon, Wed. Remaining Products: R, S.

- Constraint 3: $R < Q$. Since Q is Tue, R must be Mon.
- So, R = Mon.
- Remaining Product S must be Wed.
- Schedule: Mon(R), Tue(Q), Wed(S), Thu(P).
- Check constraints: S $\neq$ Thu (Ok, it's Wed). P $\neq$ Mon/Wed (Ok).
- **Valid Solution 3.**

Step 3: Total Count:
Total valid schedules = $1 + 1 + 1 = 3$.

Quick Tip

Use the most restrictive constraint as the "pivot" for cases. Here, "Exactly one of P or Q is on Tuesday" splits the problem cleanly into two distinct scenarios.

Q3. A group of 120 students attend at least one of three workshops: Data, Logic, and Verbal. 48 attend Data, 60 attend Logic, 50 attend Verbal. 20 attend both Data & Logic, 15 attend both Logic & Verbal, 12 attend both Data & Verbal, and 8 attend all three. How many students attend exactly one workshop?

(A) 80
(B) 85
(C) 88
(D) 90
(E) 92

Correct Answer: (C) 88

Solution:
Step 1: Identify Given Values:
Total students $N(U) = 120$. $N(D) = 48$, $N(L) = 60$, $N(V) = 50$. $N(D \cap L) = 20$, $N(L \cap V) = 15$, $N(D \cap V) = 12$. $N(D \cap L \cap V) = 8$.
Step 2: Formula Approach:
The number of students attending *exactly one* workshop is given by:

$$E_1 = N(D) + N(L) + N(V) - 2[N(D \cap L) + N(L \cap V) + N(D \cap V)] + 3N(D \cap L \cap V)$$

Step 3: Calculation:
Substitute the values:

$$E_1 = 48 + 60 + 50 - 2[20 + 15 + 12] + 3[8]$$

$$E_1 = 158 - 2[47] + 24$$

$$E_1 = 158 - 94 + 24$$

$$E_1 = 64 + 24$$
$$E_1 = 88$$

Alternative (Venn Region Method):
Only all 3 = 8.
Only D&L = $20 - 8 = 12$.
Only L&V = $15 - 8 = 7$.
Only D&V = $12 - 8 = 4$.
Only D = $48 - (12 + 4 + 8) = 24$.
Only L = $60 - (12 + 7 + 8) = 33$.
Only V = $50 - (4 + 7 + 8) = 31$.
Total exactly one = $24 + 33 + 31 = 88$.

> Quick Tip
>
> Memorize the "Exactly One" formula: $\sum Single - 2\sum Double + 3\sum Triple$. It is faster than drawing and subtracting regions in a Venn diagram.

Q4. Four machines A, B, C, D produce items in a ratio. A produces 40 more than B. C produces 20% more than A. D produces half of B. If total production is 860 items, how many items did Machine C produce?

(A) 248
(B) 298
(C) 300
(D) 312
(E) 350

Correct Answer: (B) 298

Solution:
Step 1: Set up Equations:
Let B be the production of machine B.

- $A = B + 40$
- $C = 1.2A = 1.2(B + 40)$ (Since 20% more means 120% or 1.2 times)
- $D = 0.5B$
- Total = $A + B + C + D = 860$

Step 2: Solve for B:
Substitute all terms into the total equation:

$$(B + 40) + B + [1.2(B + 40)] + 0.5B = 860$$
$$2.5B + 40 + 1.2B + 48 = 860$$
$$3.7B + 88 = 860$$

$$
\begin{aligned}
3.7B &= 772 \\
B &= \frac{772}{3.7} = \frac{7720}{37} \\
B &\approx 208.65
\end{aligned}
$$

Step 3: Calculate C:
Using the exact fraction for B to minimize error:

$$
\begin{aligned}
A = B + 40 &= \frac{7720}{37} + \frac{1480}{37} = \frac{9200}{37} \\
C = 1.2 \times A &= \frac{6}{5} \times \frac{9200}{37} \\
C &= \frac{6 \times 1840}{37} = \frac{11040}{37} \\
C &\approx 298.37
\end{aligned}
$$

Since the number of items must typically be an integer, and the closest integer is 298, we select that. (Note: The specific numbers in the problem result in a non-integer, likely due to a slight approximation in the problem statement's creation, but the mathematical derivation leads to 298).

> Quick Tip
>
> When equations result in non-integers for "items" or "people", do not panic. Check your calculation once, and if correct, pick the closest integer option.

Q5. Six people — P, Q, R, S, T, U — stand in a line. P is somewhere ahead of Q. Exactly two people stand between Q and R. S is not adjacent to P or R. T is not in the first or last position. How many distinct valid arrangements are possible?

(A) 20
(B) 22
(C) 23
(D) 24
(E) 25

Correct Answer: (C) 23

Solution:
Step 1: Constraints: 1. $P < Q$ (P is to the left of Q). 2. Q and R have 2 people between them (Patterns: $QxxR$ or $RxxQ$). 3. S is not neighbor of P or R. 4. T is not at pos 1 or 6.
Step 2: Analyze Q and R positions (Distance 3): Pairs for (Q,R) or (R,Q) with 2 gaps: (1,4), (2,5), (3,6).
Case 1: Positions {1, 4}

- **1a: Q=1, R=4.** $P < Q \implies P < 1$. Impossible.
- **1b: R=1, Q=4.** $P < 4$. P can be 2, 3 (1 is occupied).

- If $P = 2$: Occ={1,2,4}. S not adj P(2) or R(1). S cannot be 3 (adj 2,4), 2(occ), 5? Adj R(1) is 2. Adj P(2) is 1,3. S slots: 5, 6.
- $S = 5 \implies T, U \in \{3, 6\}$. T not 6 $\implies T = 3, U = 6$. (1 soln).
- $S = 6 \implies T, U \in \{3, 5\}$. T can be 3 or 5. (2 soln).
- If $P = 3$: Occ={1,3,4}. S not adj P(3) or R(1). Adj P: 2,4. Adj R: 2. S $\neq$ 2. S slots: 5, 6.
- $S = 5 \implies T, U \in \{2, 6\}$. T not 6 $\implies T = 2, U = 6$. (1 soln).
- $S = 6 \implies T, U \in \{2, 5\}$. (2 soln).

Total Case 1 = 6.

Case 2: Positions {2, 5}

- **2a: Q=2, R=5.** $P < 2 \implies P = 1$.
- Occ={1,2,5}. S not adj P(1), R(5). S $\neq$ 2, 4, 6. S must be 3.
- $S = 3$. Remaining T, U in {4,6}. T not 6 $\implies T = 4, U = 6$. (1 soln).
- **2b: R=2, Q=5.** $P \in \{1, 3, 4\}$.
- If $P = 1$: S not adj 1, 2. S $\in \{4, 6\}$. ($S = 4 \to T = 3 \to$ 1 soln; $S = 6 \to$ 2 soln). Total 3.
- If $P = 3$: S not adj 3, 2. S $\in \{6\}$. ($S = 6 \to T = 4 \to$ 1 soln). Total 1.
- If $P = 4$: S not adj 4, 2. S $\in \{6\}$. ($S = 6 \to T = 3 \to$ 1 soln). Total 1.
- **Total Case 2b = 5.**

Case 3: Positions {3, 6}

- **3a: Q=3, R=6.** $P \in \{1, 2\}$.
- If $P = 1$: S not adj 1, 6. S $\in \{4\}$. ($S = 4 \to T, U \in \{2, 5\} \to$ 2 soln).
- If $P = 2$: S not adj 2, 6. S $\in \{4\}$. ($S = 4 \to T, U \in \{1, 5\}, T \neq 1 \to$ 1 soln).
- **Total Case 3a = 3.**
- **3b: R=3, Q=6.** $P \in \{1, 2, 4, 5\}$.
- If $P = 1$: S not adj 1, 3. S $\in \{5\}$. ($T, U \in \{2, 4\} \to$ 2 soln).
- If $P = 2$: S not adj 2, 3. S $\in \{5\}$. ($T, U \in \{1, 4\}, T \neq 1 \to$ 1 soln).
- If $P = 4$: S not adj 4, 3. S $\in \{1\}$. ($T, U \in \{2, 5\} \to$ 2 soln).
- If $P = 5$: S not adj 5, 3. S $\in \{1, 2\}$. ($S = 1 \to$ 2 soln; $S = 2 \to$ 1 soln).
- **Total Case 3b = 8.**

Total: $6 + 1 + 5 + 3 + 8 = 23$.

Quick Tip

Break linear arrangements into cases based on the "widest" constraint first (here, Q and R separated by 2), then filter by the others.

Q6. A delivery network allows routes from Start (S) to End (E) through intermediate hubs A, B, C. Allowed edges: $S \to A, S \to B, A \to C, A \to E, B \to C, C \to E$. A route cannot visit more than 3 nodes including S and E. How many valid routes from S to E are possible?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

Correct Answer: (A) 1

Solution:
Step 1: Map the Network:

- From S: A, B
- From A: C, E
- From B: C
- From C: E

Step 2: List all paths from S to E: 1. $S \to A \to E$ 2. $S \to A \to C \to E$ 3. $S \to B \to C \to E$
Step 3: Apply Constraints: The constraint is: "Cannot visit more than 3 nodes including S and E". This means the path length (in terms of vertices) must be ≤ 3.

- Path 1 ($S \to A \to E$): Visits S, A, E. Total 3 nodes. **Valid**.
- Path 2 ($S \to A \to C \to E$): Visits S, A, C, E. Total 4 nodes. **Invalid**.
- Path 3 ($S \to B \to C \to E$): Visits S, B, C, E. Total 4 nodes. **Invalid**.

Only 1 valid route exists.

Quick Tip

In small network problems, listing all paths is often faster than using complex graph theory. Check the node count carefully (Start + Intermediates + End).

Q7. Four players — W, X, Y, Z — play a round-robin tournament (each plays each once). A win gives 2 points, loss 0. W scores more points than X. Y wins exactly one match. Z does not lose to X. How many distinct possible point-tables exist for the four players?

(A) 2
(B) 3
(C) 4

(D) 5
(E) 6

Correct Answer: (B) 3

Solution:
Step 1: Tournament Properties:

- 4 players, Round Robin $= \binom{4}{2} = 6$ matches.
- Total points $= 6 \times 2 = 12$.
- Possible scores per player: 0, 2, 4, 6.

Step 2: Constraints: 1. $W > X$. 2. $Y = 2$ points (1 Win, 2 Losses). 3. Z beats X (Since Z does not lose to X, and there are no draws). Thus $Z \geq 2$.
Step 3: Possible Score Distributions (Sum 12, Y=2): We need sets $\{W, X, Y, Z\}$ where $Y = 2$ and $W + X + Z = 10$. Since max score is 6, valid partitions of 10 for (W, X, Z) using even numbers ≤ 6:

- Set A: {6, 4, 0}
- Set B: {6, 2, 2}
- Set C: {4, 4, 2}

Step 4: Assigning to W, X, Z satisfying Constraints:
Case 1: Scores {6, 4, 0, 2}

- $Y = 2$.
- Constraint $Z \geq 2$ (must beat X). So Z cannot be 0.
- Constraint $W > X$.
- W cannot be 0 or 2 (must accommodate 6 or 4).
- **Scenario 1:** $W = 6, Z = 4, X = 0$.
- $W > X$ (6¿0). $Z \geq 2$. Z beats X (X has 0 wins, so X lost to Z). Valid.
- Point Table: **(6, 0, 2, 4)**.

Case 2: Scores {6, 2, 2, 2}

- $Y = 2$. Remaining 6, 2, 2.
- $W > X$. So W must be 6. $X = 2, Z = 2$.
- $W = 6, X = 2, Y = 2, Z = 2$.
- Check validity: W wins 3. X, Y, Z win 1 each (Cyclic X beats Y, Y beats Z, Z beats X).
- Constraint Z beats X? In the cycle Z beats X, X beats Y... yes, this is a valid tournament graph.
- Point Table: **(6, 2, 2, 2)**.

Case 3: Scores {4, 4, 2, 2}

- $Y = 2$. Remaining 4, 4, 2.
- $W > X$.
- **Scenario 3:** $W = 4, Z = 4, X = 2$.
- $W > X$ (4¿2). $Z \geq 2$.
- Validity check: Z(4) and W(4) win 2 games. X(2) and Y(2) win 1.
- Can Z beat X? Yes. (e.g., Z beats X and W; W beats X and Y; etc.).
- Point Table: **(4, 2, 2, 4)**.

No other assignments satisfy $W > X$ and $Z \geq 2$ with the given partitions. Total distinct point tables: 3.

> Quick Tip
>
> In tournament questions, first determine the total points available (Matches × Points per match). Then list partitions of that sum satisfying the min/max score constraints.
