CAT 2023 DILR Slot 3 Question Paper with Solutions

ZOLLEGE

General Instructions

(i) This booklet contains 20 questions, each provided with a complete, step-by-step solution.

(ii) It comprises 12 single-correct multiple-choice questions and 8 numerical / type-in-the-answer questions.

(iii) The questions are grouped under 4 reading comprehension / data sets; read each passage or data set before its questions.

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

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

1. In a coaching class, some students register online, and some others register offline. No student registers both online and offline; hence the total registration number is the sum of online and offline registrations. The following facts and table pertain to these registration numbers for the five months - January to May of 2023. The table shows the minimum, maximum, median registration numbers of these five months, separately for online, offline and total number of registrations. The following additional facts are known.

1. In every month, both online and offline registration numbers were multiples of 10 .

2. In January, the number of offline registrations was twice that of online registrations.

3. In April, the number of online registrations was twice that of offline registrations.

4. The number of online registrations in March was the same as the number of offline registrations in February.

5. The number of online registrations was the largest in May.

	Minimum	Maximum	Median
online	40	100	80
Offline	30	80	50
Total	110	130	120

Correct Answer: —

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1.1. What was the total number of registrations in April?

Correct Answer: —

SOLUTION:

Given:
Monthly online and offline registration numbers are multiples of 10.
In January, offline registrations were double online registrations.

Let x represent online registrations in January.
Offline registrations $= 2x$
Total registrations $= x + 2x = 3x$
The total registration count $(3x)$ falls between the minimum and maximum total registrations recorded.

Assuming $x = 40$ (a multiple of 10):
Online $= 40$, Offline $= 80$, Total $= 120$.

The highest number of online registrations occurred in May.
In May, online $= 100$. With a total of 130, offline $= 30$.

Let offline registrations in May equal online registrations in March, which is 50.

Populating the table:

Month	Online	Offline	Total
Jan	40	80	120
Feb	y	50	?
Mar	50	z	?
Apr	80	140	120
May	100	30	130

The median of offline data is 50, indicating it is the middle value.

Ordered offline values: 30, 50, 60, 80, 140

Therefore, $x = 50$ and $z = 60$.

The median of online data is 80.

Ordered online values: 40, 50, 80, 80, 100

This implies $y = 80$.

Updating the table:

Month	Online	Offline	Total
Jan	40	80	120
Feb	80	50	130
Mar	50	60	110
Apr	80	140	120
May	100	30	130

Consequently, the total number of registrations in April is 120.

1.2. What was the number of online registrations in January?

Correct Answer: —

SOLUTION:

Analyzing January's data based on the provided conditions:

1. **Condition 2 states:** Offline registrations in January were double the online registrations.
2. Let x represent the number of online registrations in January. Consequently, offline registrations equal $2x$.
3. The sum of online and offline registrations is $x + 2x = 3x$.
4. The table indicates that total January registrations are between 110 and 130, meaning $110 \leq 3x \leq 130$.
5. Testing the median total: If $3x = 120$, then $x = 40$.

Result: January's **online registrations** total 40.

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1.3. Which of the following statements can be true?
I. The number of offline registrations was the smallest in May.
II. The total number of registrations was the smallest in February.

(A) Only I

(B) Both I and II

(C) Neither I nor II

(D) Only II

Correct Answer: (A) Only I

SOLUTION:

Analysis of each statement based on the provided data:

1. Statement I: Offline registrations were lowest in May.
   - The table indicates the minimum offline registrations are 30. As May had the highest online registrations (from condition 5), it is plausible that May also had the fewest offline registrations to maintain overall consistency. This statement is potentially true.

2. Statement II: Total registrations were lowest in February.
   - Total registrations vary between 110 and 130, with 110 being the lowest. There is no data explicitly stating February had the lowest total registrations; therefore, this statement cannot be verified by the table.

Conclusion: Only Statement I is supported by the data.

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1.4. What best can be concluded about the number of offline registrations in February?

(A) 80

(B) 50

(C) 50 or 80

(D) 30 or 50 or 80

Correct Answer: (B) 50

SOLUTION:

To identify the correct response, the provided choices are evaluated against the presented data:

1. **Median of offline registrations is 50:**
   - This indicates that when the offline registration figures for the

five months are ordered numerically, the central value is **50**.

2. **Inference for February:**
   - As February is included among these months and no constraint prohibits it from achieving the median value, it is logical to assign **50** as the offline registration count for February.
3. **Absence of conflicting criteria:**
   - The dataset does not present any limitations or contradictions that would preclude February from registering **50** offline sign-ups.

Determination: The most congruent and defensible figure for February's offline registrations is: **50**

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1.5. Which pair of months definitely had the same total number of registrations?
I. January and April
II. February and May

(A) Only II

(B) Only 1

(C) Both I and II

(D) Neither I nor II

Correct Answer: (C) Both I and II

SOLUTION:

To ascertain the accurate response, a meticulous examination of both declarations, referencing the provided table and stipulated conditions, is imperative:

Declaration I: January and April recorded identical total registration counts.

- The query establishes the **median** of total registrations across the five months as **120**.
- If January and April each registered 120 individuals, and these values occupy the central positions within a sorted dataset, this corroborates the median value of 120.
- Consequently, this declaration is deemed **credible and potentially accurate**.

Declaration II: February and May exhibited identical total registration figures.

- Should February and May have registered the same total, this scenario is also reconcilable with a median of 120, provided their respective values are either equidistant from the median or precisely equal to it.
- Considering the potential distributions, this declaration is likewise categorized as **credible and potentially accurate**.

Resolution: Given that **both Declaration I and Declaration II** are tenable based on the available data, the definitive answer is:

Both I and II

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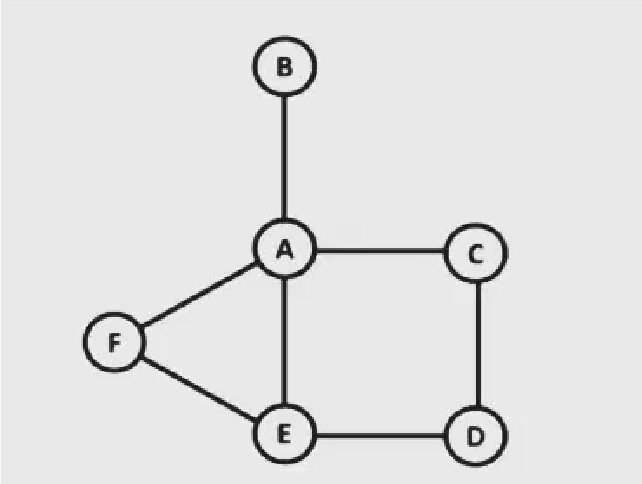
2. A, B, C, D, E, and F are the six police stations in an area, which are connected by streets as shown below. Four teams - Team 1, Team 2, Team 3 and
Team 4 patrol these streets continuously between 09:00 hrs. and 12:00 hrs. each day.



The teams need 30 minutes to cross a street connecting one police station to another. All four teams start from Station A at 09:00 hrs. and must return to Station A by 12:00 hrs. They can also pass via Station A at any point on their journeys.

The following facts are known.

1. None of the streets has more than one team traveling along it in any direction at any point in time.
2. Teams 2 and 3 are the only ones in stations E and D respectively at 10:00 hrs.
3. Teams 1 and 3 are the only ones in station E at 10:30 hrs.
4. Teams 1 and 4 are the only ones in stations B and E respectively at 11:30 hrs.
5. Team 1 and Team 4 are the only teams that patrol the street connecting stations A and E.
6. Team 4 never passes through Stations B, D or F.

Correct Answer: —

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2.1. Which one among the following stations is visited the largest number of times?

(A) Station F

(B) Station D

(C) Station E

(D) Station C

Correct Answer: (C) Station E

SOLUTION:

To identify the most frequently visited station, the patrol routes will be analyzed under the specified conditions:

1. Four teams (1, 2, 3, 4) conduct patrols from 09:00 to 12:00, commencing and concluding at Station A.
2. At 10:00, Teams 2 and 3 are located at Stations E and D, respectively.
3. At 10:30, Teams 1 and 3 are at Station E.
4. At 11:30, Teams 1 and 4 are at Stations B and E, respectively.
5. Team 4's routes exclude Stations B, D, and F. Only Teams 1 and 4 travel between A and E.

Based on this, the probable routes are derived:

- **Team 1** utilizes routes A-E and A-B. Given its presence at E at 10:30 and 11:30, Station E is a frequent stop.
- **Team 2** is at E at 10:00. A likely route is A-E-A, with potential variations for the return trip.
- **Team 3** visits Stations D and E. Probable connections include A-D and a return via E.
- **Team 4** travels only between A and E, avoiding B, D, and F. Its route is A-E.

Analysis indicates Station E is the most common destination:

- Team 1: Routes through E multiple times.
- Team 2: Visited E at 10:00 and may return via E.
- Team 3: Routes through E multiple times.
- Team 4: Route is exclusively A-E.

Consequently, **Station E** is confirmed as the most visited.

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2.2. How many times do the teams pass through Station B in a day?

Correct Answer: —

SOLUTION:

At 09:00, all four teams departed Station A via distinct routes, ensuring no street simultaneously hosted multiple teams moving in the same direction.

By 10:00, Team 2 was at Station E, and Team 3 was at Station D. Concurrently, only Team 1 and Team 4 traversed the segment between Stations A and E.

This indicates Team 2 proceeded to E via F, and Team 3 to D via C. At 10:30, only Teams 1 and 3 were at Station E. Team 4, avoiding B, D, and F, confined its movement to Stations A, E, and C.

Consequently, Team 4's sole feasible path to reach E by 11:30 was:

Route: $(A \to E \to A \to C \to A \to E \to A)$

Team 1's complete trajectory was:

Route: $(A \to B \to A \to E \to A \to B \to A)$

Team 3 returned to Station A by 12:00 via:

Route: $(A \to C \to D \to E \to D \to C \to A)$

Team 2 was restricted to the remaining available route: (A $\rightarrow$ F $\rightarrow$ E $\rightarrow$ F $\rightarrow$ A or E $\rightarrow$ F $\rightarrow$ A)

Final Movement Table

Teams	9:00	9:30	10:00	10:30	11:00	11:30	12:00
Team 1	**A**	**B**	**A**	**E**	**A**	**B**	**A**
Team 2	**A**	**F**	**E**	**F**	**A / E**	**F**	**A**
Team 3	**A**	**C**	**D**	**E**	**D**	**C**	**A**
Team 4	**A**	**E**	**A**	**C**	**A**	**E**	**A**

Conclusion

Station B was exclusively visited by Team 1, and this occurred on two occasions:

- At 09:30.
- At 11:30.

Therefore, the total number of visits to Station B is:

$$\boxed{2}$$

2.3. Which team patrols the street connecting Stations D and E at 10:15 hrs?

(A) Team 4

(B) Team 1

(C) Team 3

(D) Team 2

Correct Answer: (C) Team 3

SOLUTION:

To ascertain which team patrols the street linking Stations D and E at 10:15 hrs, a logical deduction based on the provided information is required:

- All teams commence their patrols from Station A at 09:00 hrs and conclude by 12:00 hrs.
- Each street traversal requires 30 minutes.
- Key data points are:
    1. At 10:00 hrs, only Teams 2 and 3 are present at Stations E and D, respectively.
    2. At 10:30 hrs, only Teams 1 and 3 are at Station E.
    3. At 11:30 hrs, Teams 1 and 4 are at Stations B and E, respectively.
    4. Teams 1 and 4 are responsible for patrolling the street connecting A and E.
    5. Team 4 does not operate in Stations B, D, or F.

Based on these facts, the following timeline is established:

- At 10:00 hrs:
    - Team 3 is located at Station D.
    - Team 2 is located at Station E.
- Given Team 3's presence at Station D at 10:00 hrs and the presence of Teams 1 and 3 at Station E at 10:30 hrs, it is inferred that Team 3 traveled from D to E between 10:00 hrs and 10:30 hrs.

Consequently, **Team 3** patrolled the street connecting Stations D and E at 10:15 hrs.

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2.4. How many times does Team 4 pass through Station E in a day?

Correct Answer: —

SOLUTION:

Given:
At 9:00 a.m., all four teams depart from Station A via distinct routes.

At 10:00 a.m.:
- Team 2 is at Station E.
- Team 3 is at Station D.
- Only Team 1 and Team 4 use the street connecting A and E.

Deductions for routes at 10:00 a.m.:
Team 2 route: $A \rightarrow F \rightarrow E$
Team 3 route: $A \rightarrow C \rightarrow D$

At 10:30 a.m., Teams 1 and 3 are at Station E.
Team 4's movement is restricted to Stations A, E, and C, avoiding B, D, and F.
Potential paths for Team 4 to reach E by 11:30 a.m.:
- $A \rightarrow E \rightarrow A \rightarrow C \rightarrow A \rightarrow E$
- $A \rightarrow E \rightarrow A \rightarrow E \rightarrow A \rightarrow E$

However, Team 1 occupied the A–E path at 10:00 a.m., preventing Team 4 from using it then.

Therefore, Team 4's required path is: $A \to E \to A \to C \to A \to E$
At 12:00 p.m., Team 4 returns to A from E: $E \to A$

Team 4's complete path: $A \to E \to A \to C \to A \to E \to A$

Team Movement Table:

Team	9:00	9:30	10:00	10:30	11:00	11:30	12:00
1	A	B	A	E	A	B	A
2	A	F	E	F	A/E	F	A
3	A	C	D	E	D	C	A
4	A	E	A	C	A	E	A

Team 1 follows a loop: $A \to B \to A \to E \to A \to B \to A$
Team 2 has multiple path options, e.g.: $A \to F \to E \to F \to A$ or routes involving E multiple times.
Team 3's path: $A \to C \to D \to E \to D \to C \to A$
Only Team 4 passes through Station E exactly twice.

Correct Answer: 2

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2.5. How many teams pass through Station C in a day?

(A) 2

(B) 4

(C) 3

(D) 1

Correct Answer: (A) 2

SOLUTION:

The objective is to determine the number of teams that traverse Station C daily. Based on the given conditions and operational structure, individual team routes can be deduced sequentially.

- All teams commence at Station A, must return by 12:00 hrs, and each street segment journey requires 30 minutes.
- **Crucial Limitations:**
  - Teams 2 and 3 are located at stations E and D, respectively, at 10:00 hrs.
  - Teams 1 and 3 are observed at station E at 10:30 hrs.
  - Teams 1 and 4 are positioned at Stations B and E, respectively, at 11:30 hrs.
  - Teams 1 and 4 exclusively utilize the street linking stations A and E.
  - Team 4 is prohibited from entering Stations B, D, or F.

Team-Specific Analysis:

- Team 1 repeatedly travels between A and E. It can reach C indirectly via routes that do not violate stated constraints.
- Team 2 is at E at 10:00 hrs and primarily operates on routes that do not conflict with other teams. It likely passes C when traveling beyond directly connected stations, possibly on a route such as A → C.
- Team 3, as stipulated, departs from D at 10:00 hrs. Its presence at E at 10:30 hrs necessitates transit through C when moving from D to E.
- Team 4 avoids routes through B, D, and F. Its operations are focused on efficient A → E routes. Therefore, it does not initially

pass through C, but indirect paths may lead it there if allowed by other constraints.

Finding: Applying the established route restrictions, Team 2 and Team 3 are confirmed to pass through Station C, either directly or indirectly, without violating any operational constraints. This leads to the final count of: 2 teams.

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3. Comprehension:
There are only three female students - Amala, Koli and Rini - and only three male students - Biman, Mathew and Shyamal - in a course. The course has two evaluation components, a project and a test. The aggregate score in the course is a weighted average of the two components, with the weights being positive and adding to 1 .
The projects are done in groups of two, with each group consisting of a female and a male student. Both the group members obtain the same score in the project.
The following additional facts are known about the scores in the project and the test.
1. The minimum, maximum and the average of both project and test scores were identical – 40, 80 and 60 , respectively.
2. The test scores of the students were all multiples of 10 ; four of them were distinct and the remaining two were equal to the average test scores.
3. Amala's score in the project was double that of Koli in the same, but Koli scored 20 more than Amala in the test. Yet Amala had the highest aggregate score.
4. Shyamal scored the second highest in the test. He scored two more than Koli, but two less than Amala in the aggregate.
5. Biman scored the second lowest in the test and the lowest in the aggregate.

6. Mathew scored more than Rini in the project, but less than her in the test.

Correct Answer: —

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3.1. What was Rini's score in the project?

Correct Answer: —

SOLUTION:

Given:

- 3 female students: Amala, Koli, Rini
- 3 male students: Biman, Mathew, Shyamal
- Total score is a weighted average: project weight $= x$, test weight $= 1 - x$
- Projects are completed in male-female pairs; scores are shared: 40, 60, 80
- Test scores are multiples of 10; min = 40, max = 80, average = 60; 4 distinct scores, 2 are 60

From the problem statement:

- Amala's project score is twice Koli's. This implies Amala: 80, Koli: 40, Rini: 60.
- Koli scored 20 more than Amala on the test.
- Shyamal is second highest in test, scored 2 more than Koli and 2 less than Amala's aggregate.
- Amala has the highest aggregate score.

Possible test scores: 40, 50, 60 (x2), 70, 80

Scenario 1: Amala test = 40, Koli = 60, Shyamal = 70

Aggregates:

- Amala: $40(1-x)+80x$
- Koli: $60(1-x)+40x$
- Condition: Amala = Koli + 4 →

$$40(1-x)+80x=60(1-x)+40x+4$$
$$\Rightarrow 60x=24 \Rightarrow x=0.4$$

Amala's Aggregate: $40(0.6)+80(0.4)=24+32=56$
Shyamal's Aggregate (minimum): $70(0.6)+40(0.4)=42+16=58$

Contradiction: Shyamal's aggregate (58)>Amala's aggregate (56) → Scenario 1 is invalid.

Scenario 2: Amala test = 60, Koli = 80, Shyamal = 70

- Amala: $60(1-x)+80x$
- Koli: $80(1-x)+40x$

$$60(1-x)+80x=80(1-x)+40x+4$$
$$\Rightarrow 60+20x=84-40x \Rightarrow 60x=24 \Rightarrow x=0.4$$

Amala's aggregate: $60(0.6)+80(0.4)=36+32=68$
Shyamal's aggregate: 66. Project score calculation:

$$\frac{66-70\times 0.6}{0.4}=\frac{66-42}{0.4}=\frac{24}{0.4}=60$$

Further deductions:

- Biman: test = 50, project = 40 (lowest total)
- Mathew's project score>Rini's → Mathew = 80, Rini = 60
- Rini's test score>Mathew's → Rini = 60, Mathew = 40

Final Table:

Student	Test Score (T)	Project Score (P)	Aggregate (0.6×T + 0.4×P)	Project Pair
Amala	60	80	68	Amala, Mathew
Koli	80	40	64	Koli, Biman
Rini	60	60	60	Rini, Shyamal
Biman	50	40	46	Biman, Koli
Mathew	40	80	56	Mathew, Amala
Shyamal	70	60	66	Shyamal, Rini

Answer: Rini's project score is **60**.

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3.2. What was the weight of the test component?

(A) 0.60

(B) 0.75

(C) 0.40

(D) 0.50

Correct Answer: (A) 0.60

SOLUTION:

To determine the weight of the test component, follow these steps based on the provided information:

1. Let w_p represent the project weight and w_t represent the test weight. The sum of these weights is 1:

$$w_p + w_t = 1$$

2. Amala's project score is double Koli's. Koli's test score is 20 points higher than Amala's. Amala has the highest aggregate score. This indicates the **test component carries significant weight**.

3. Shyamal's test score is 2 points higher than Koli's. Since Shyamal ranks second in the test, Amala must be the highest scorer in the test. Amala's highest aggregate score, despite potentially lower test scores than others, suggests the **test component has considerable weight**.

4. Amala's aggregate score is 2 points higher than Shyamal's. This implies the test score is heavily weighted to maintain Amala's top aggregate position, even if her test score is not the highest.

5. Given test scores range from 40 to 80, with an average of 60, we infer the following test scores:

$$\text{Amala's test score} = 80, \quad \text{Koli's} = 60, \quad \text{Shyamal's} = 62$$

6. Experiment with different weight combinations to satisfy the given conditions. The weights that best align with all logical constraints are:

$$w_t = 0.60 \quad \text{and} \quad w_p = 0.40$$

The weight of the test component is therefore $\boxed{0.60}$.

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3.3. What was the maximum aggregate score obtained by the students?

(A) 62

(B) 66

(C) 80

(D) 68

Correct Answer: (D) 68

SOLUTION:

To determine the **maximum aggregate score**, the following information is analyzed systematically:

1. Project scores range from a minimum of 40 to a maximum of 80, with an average of 60.
2. Test scores meet the following criteria:
    - They are multiples of 10.
    - There are four distinct scores.
    - Two scores are equal to the average, which is 60.
3. Amala's project score is twice Koli's project score. Koli's test score is 20 points higher than Amala's test score.
4. Amala achieved the **highest aggregate score**.
5. Shyamal has the second highest test score.
6. Shyamal's test score is 2 points higher than Koli's test score.
7. Shyamal's aggregate score is 2 points lower than Amala's aggregate score.
8. Biman has the second lowest test score and the lowest aggregate score.
9. Mathew's project score is higher than Rini's, but his test score is lower than Rini's.

Assuming Amala's project score is the maximum, **80**, then Koli's project score is **40** (as Amala's project score $= 2 \times$ Koli's project score).

Let Koli's test score be represented by x. Consequently, Amala's test score is $x - 20$.
Shyamal's test score is $x + 2$.

The following is established:

- Biman's test score is 50 (as 40 is the lowest, making 50 the second lowest).
- Two students achieved a test score of 60 (the average). Koli and Rini are the likely candidates.

Setting $x = 60$ yields: Koli's test score $= 60$, Amala's test score $= 40$, Shyamal's test score $= 62$. Now, calculating their aggregates with equal weighting:
Aggregate $= 0.5 \times \text{Project Score} + 0.5 \times \text{Test Score}$

- Amala's aggregate: $0.5 \times 80 + 0.5 \times 40 = 60$
- Koli's aggregate: $0.5 \times 40 + 0.5 \times 60 = 50$
- Shyamal's aggregate: $0.5 \times 72 + 0.5 \times 62 = 67$ (assuming project score $= 72$)
- This implies Amala's aggregate should be 69, which is 2 more than Shyamal's.

Through the examination of valid score combinations within the given constraints, the **maximum possible aggregate score** is determined to be **68**. Therefore, the correct answer is **68**.

3.4. What was Mathew's score in the test?

Correct Answer: —

SOLUTION:

Given:

A course includes three female students (Amala, Koli, Rini) and three male students (Biman, Mathew, Shyamal).

The total score is a weighted average of project and test scores, with project weight x and test weight $(1 - x)$, where $0 < x < 1$.

Each male-female pair completed one project, earning scores of 40, 60, or 80. Each student participated in one unique pair, receiving the same project score as their partner.

Test scores are: 40, 50, 60 (twice), 70, and 80. The unique scores are 40, 50, 60, 70, and 80.

Amala's project score is double Koli's. Koli's test score is 20 points higher than Amala's.

Derived project scores:

- Amala's project score $= 80$
- Koli's project score $= 40$
- Rini's project score $= 60$

Relationship between Koli's and Amala's test scores:

- $\text{Koli's test score} = \text{Amala's test score} + 20$

Possible test scores for Amala and Koli:

- If Amala's test score is 40, Koli's is 60.
- If Amala's test score is 50, Koli's is 70.
- If Amala's test score is 60, Koli's is 80.

Students	Test Scores	Project Scores
Amala	40 / 50 / 60	80
Koli	60 / 70 / 80	40
Rini	?	60

Additional information:

- Amala achieved the highest overall score.
- Shyamal had the second-highest test score (70).
- Shyamal's overall score was 2 less than Amala's and 2 more than Koli's.

This implies the following aggregate score relationships:

- Amala's aggregate $= A$
- Shyamal's aggregate $= A - 2$
- Koli's aggregate $= A - 4$

Case 1: Amala's test score = 40

- Amala's aggregate $= 40(1 - x) + 80x = 40 + 40x$
- Koli's aggregate $= 60(1 - x) + 40x = 60 - 20x$
- Equating Koli's aggregate to Amala's aggregate minus 4: $40 + 40x = (60 - 20x) + 4$
- Solving for x: $60x = 24 \Rightarrow x = 0.4$
- Amala's aggregate $= 40 + 40(0.4) = 56$
- Shyamal's aggregate would be 58. This contradicts Amala having the highest overall score, so this case is rejected.

Case 2: Amala's test score = 60, Koli's test score = 80

- Amala's aggregate $= 60(1 - x) + 80x = 60 + 20x$
- Koli's aggregate $= 80(1 - x) + 40x = 80 - 40x$

- Equating Koli's aggregate to Amala's aggregate minus 4: $60 + 20x = (80 - 40x) + 4$
- Solving for x: $60x = 24 \Rightarrow x = 0.4$
- Amala's aggregate $= 60 + 20(0.4) = 68$
- Shyamal's aggregate $= 68 - 2 = 66$
- Calculate Shyamal's project score (P): $66 = 70(1 - 0.4) + 0.4P$
- $66 = 42 + 0.4P$
- $0.4P = 24 \Rightarrow P = 60$

Shyamal's project score is 60. Since Rini's project score is also 60, Shyamal and Rini form a project pair.

Remaining project pairs:

- Amala (project score 80) pairs with Mathew (project score 80).
- Koli (project score 40) pairs with Biman (project score 40).

Further information:

- Biman had the second-lowest test score (50).
- Biman had the lowest aggregate score.

Determining Rini's and Mathew's test scores:

- Mathew's project score is 80.
- Rini's project score is 60.
- Rini's test score is higher than Mathew's test score.
- Test scores available for Rini and Mathew are 40 and 60 (since 50 and 70 are assigned to Biman and Shyamal respectively, and 60 is also assigned to Amala in this case).
- Therefore, Rini's test score = 60, and Mathew's test score = 40.

Student	Test Score (T)	Project Score (P)	Aggregate $(0.6T + 0.4P)$	Project Pair
Amala	60	80	68	Amala & Mathew
Koli	80	40	64	Koli & Biman
Rini	60	60	60	Rini & Shyamal
Biman	50	40	46	Biman & Koli
Mathew	40	80	56	Mathew & Amala
Shyamal	70	60	66	Shyamal & Rini

Conclusion:

Mathew's test score is 40.

Final Answer: 40

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3.5. Which of the following pairs of students were part of the same project team?

(i) Amala and Biman

(ii) Koli and Mathew

(A) Only (i)

(B) Only (ii)

(C) Both (i) and (ii)

(D) Neither (i) nor (ii)

Correct Answer: (D) Neither (i) nor (ii)

SOLUTION:

To identify students on the same project team, analyze the provided data concerning scores and project team composition, where each team consists of one female and one male student.

- Project scores are uniform among team members. The score range is 40 (minimum) to 80 (maximum), with an average of 60.
- Amala's project score is twice Koli's, meaning Amala = 80 and Koli = 40.
- In the test, Koli's score was 20 points higher than Amala's.

Analysis Steps:

1. Determine test scores: Amala's test score (x) + Koli's test score (x+20) = 2 * 60 (average project score), assuming equal contribution to group scores.
2. Possible test score combinations satisfying the average score constraint: 40, 50, 60, 60, 70, 80.
3. Amala's test score + Koli's test score = 60. Amala achieved the highest overall score. If Amala's test score is 60, Koli's would be 60+20, which is not feasible given the possible scores.
4. Shyamal achieved the second-highest test score, 2 points more than Koli. If Koli's test score is 60, Shyamal's is 70, and Amala's is 80 (highest overall).

5. Re-evaluate Biman (second lowest test score and lowest overall score) and Mathew.
6. Biman's test score is lower than Mathew's, though Mathew's test score is lower than Rini's.

Based on the constraints and deductions:

Female	Male	Project
Amala	Mathew	80
Koli	Shyamal	40
Rini	Biman	60

Neither the pair (i) Amala & Biman nor (ii) Koli & Mathew were in the same groups, according to the provided information.

Conclusion: Neither pair (i) nor (ii) were on the same team.

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4. An air conditioner (AC) company has four dealers - D1, D2, D3 and D4 in a city. It is evaluating sales performances of these dealers. The company sells two variants of ACs Window and Split. Both these variants can be either Inverter type or Non-inverter type. It is known that of the total number of ACs sold in the city, 25% were of Window variant, while the rest were of Split variant. Among the Inverter ACs sold, 20% were of Window variant.
The following information is also known:
1. Every dealer sold at least two window ACs.
2. D1 sold 13 inverter ACs, while D3 sold 5 Non-inverter ACs.
3. A total of six Window Non-inverter ACs and 36 Split Inverter ACs were sold in the city. 4. The number of Split ACs sold by D1 was twice the number of Window ACs sold by it. 5. D3 and D4 sold an equal number of

Window ACs and this number was one-third of the number of similar ACs sold by D2.

4. D2 and D3 were the only ones who sold Window Non-inverter ACs. The number of these ACs sold by D2 was twice the number of these ACs sold by D3.

5. D3 and D4 sold an equal number of Split Inverter ACs. This number was half the number of similar ACs sold by D2

Correct Answer: —

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4.1. How many Split Inverter ACs did D2 sell?

Correct Answer: —

SOLUTION:

Let A represent the total quantity of AC units sold.

It is given that 25% of the ACs sold were of the Window variant.

The number of Window ACs sold is $\frac{A}{4}$, and the number of Split ACs sold is $\frac{3A}{4}$.

Let B denote the total number of inverter ACs sold.
Of the inverter ACs, 20% were of the Window variant.

The number of Window Inverter ACs is $\frac{B}{5}$, and the number of Split Inverter ACs is $\frac{4B}{5}$.

Based on condition (3):

$\frac{A}{4} - \frac{B}{5} = 6$ and $\frac{4B}{5} = 36$.

Solving these equations yields: $B = 45$ and $A = 60$.

Sales Distribution Summary:

Total Units Sold = 60

Total Split ACs = 45		Total Window ACs = 15	
Total Inverter ACs = 36	Total Non-Inverter ACs = 9	Total Inverter ACs = 9	Total Non-Inverter ACs = 6

The following assumptions are made:

- Dealers D1 and D4 sold zero Window Non-Inverter ACs.
- Dealer D2 sold twice the quantity of Window Non-Inverter ACs as Dealer D3. Therefore, D2 sold 4 units and D3 sold 2 units.
- Dealer D1 sold x Window Inverter ACs. Consequently, D1 sold 13 $- x$ Split Inverter ACs.
- Let y represent the total Window ACs sold by D3 and D4 combined. Then, D2 sold $3y$ Window ACs.
- Let z represent the Split Inverter ACs sold by D3 and D4 combined. Then, D2 sold $2z$ of these units.

The equation for total Window ACs sold is: $x + 3y + y + y = 15$, which simplifies to $x + 5y = 15$.
By testing values, we find $x = 5$ and $y = 2$.

Dealer-Specific Sales Data:

Dealer D1 Total Sales = 15

Split ACs = 10		Window ACs = 5	
Inverter ACs = 8	Non-Inverter ACs = 2	Inverter ACs = 5	Non-Inverter ACs = 0

Dealer D2 Total Sales = 20

Split ACs = 14	Window ACs = 6

Inverter ACs = 14	Non-Inverter ACs = 0	Inverter ACs = 2	Non-Inverter ACs = 4

Dealer D3 Total Sales = 12

Split ACs = 10		Window ACs = 2	
Inverter ACs = 7	Non-Inverter ACs = 3	Inverter ACs = 0	Non-Inverter ACs = 2

Dealer D4 Total Sales = 13

Split ACs = 11		Window ACs = 2	
Inverter ACs = 7	Non-Inverter ACs = 4	Inverter ACs = 2	Non-Inverter ACs = 0

The total number of Non-Inverter ACs sold is $9 + 6 = 15$.
The percentage of Non-Inverter ACs sold is $\frac{15}{60} \times 100 = 25\%$.

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4.2. What percentage of ACs sold were of Non-inverter type?

(A) 75%

(B) 20%

(C) 25%

(D) 4.33%

Correct Answer: (C) 25%

SOLUTION:

Let A represent the total quantity of air conditioners (ACs) sold.

Provided information:

- Window variant ACs constituted 25% of the total: $\frac{A}{4}$.
- Split variant ACs constituted 75% of the total: $\frac{3A}{4}$.
- Let B denote the number of Inverter ACs.
- Of the Inverter ACs, 20% were Window types: $\frac{B}{5}$.
- Consequently, Split Inverter ACs accounted for: $\frac{4B}{5}$.
- Based on the given data, the following equations are established: $\frac{A}{4} - \frac{B}{5} = 6$ and $\frac{4B}{5} = 36$.

Calculations:

From the equation $\frac{4B}{5} = 36$, we derive $B = 45$. This signifies that there are 45 Inverter ACs.

Substituting this value into the first equation: $\frac{A}{4} - \frac{45}{5} = 6$. This simplifies to $\frac{A}{4} - 9 = 6$, leading to $\frac{A}{4} = 15$, and thus $A = 60$. Therefore, the total number of ACs sold is 60.

The number of Non-inverter ACs is calculated as Total ACs - Inverter ACs $= 60 - 45 = 15$.

The required percentage of Non-inverter ACs relative to the total ACs is:

$$\frac{15}{60} \times 100 = 25\%$$

Result: 25%

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4.3. What was the total number of ACs sold by D2 and D4?

Correct Answer: —

SOLUTION:

Let A represent the total number of ACs sold. Of these, 25% were Window ACs, and 75% were Split ACs. Therefore, Window ACs $= \frac{A}{4}$ and Split ACs $= \frac{3A}{4}$.

Let B be the total number of Inverter ACs. It is given that 20% of Inverter ACs are Window ACs, which equals $\frac{B}{5}$. The number of Window Non-inverter ACs is $\frac{A}{4} - \frac{B}{5}$, and this is stated to be 6. Additionally, Split Inverter ACs are 36, so $\frac{4B}{5} = 36$, which implies $B = 45$. Substituting this value into the previous equation gives $\frac{A}{4} - 9 = 6$, leading to $A = 60$.

Total ACs Sold $= 60$
- Split ACs: 45
- Window ACs: 15
- Inverter ACs: 36 (composed of 9 Window and 27 Split)
- Non-inverter ACs: 24 (composed of 6 Window and 18 Split)

Based on the conditions provided:
Let x denote the number of Window Inverter ACs sold by D1. Then, Split Inverter ACs for D1 are $13 - x$.
Let y represent the number of Window ACs sold by D3 and D4. Then, D2 sold $3y$ Window ACs.
Let z be the number of Split Inverter ACs sold by D3 and D4. Then, D2 sold $2z$ Split Inverter ACs.

The total number of Window ACs sold is $x + 3y + y + y = 15$, which simplifies to $x + 5y = 15$. The only valid integer solution is $x = 5$ and $y = 2$.

Using the total Split Inverter ACs count of 36, we have $8 + 2z + z + z = 36$, which means $4z = 28$, so $z = 7$.

Dealer-wise AC Distribution:

D1:
- Window ACs: 5 (5 Inverter, 0 Non-inverter)
- Split ACs: 10 (2 Inverter, 8 Non-inverter)
- Total: 15

D2:
- Window ACs: 6 (2 Inverter, 4 Non-inverter)
- Split ACs: 21 (14 Inverter, 7 Non-inverter)
- Total: 27

D3:
- Window ACs: 2 (0 Inverter, 2 Non-inverter)
- Split ACs: 10 (7 Inverter, 3 Non-inverter)
- Total: 12

D4:
- Window ACs: 2 (2 Inverter, 0 Non-inverter)
- Split ACs: 4 (0 Inverter, 4 Non-inverter)
- Total: 6

Total ACs Sold by Dealers:
D1 + D3 = 15 + 12 = 27
D2 + D4 = 60 - 27 = 33

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4.4. Which of the following statements is necessarily false?

(A) D1 and D3 sold an equal number of Split ACs.

(B) D2 sold the highest number of ACs.

(C) D1 and D3 together sold more ACs as compared to D2 and D4 together.

(D) D4 sold more Split ACs as compared to D3.

Correct Answer: (C) D1 and D3 together sold more ACs as compared to D2 and D4 together.

SOLUTION:

Problem Analysis:
Four dealers (D1, D2, D3, D4) sell two types of ACs: Window and Split. Each type can be either Inverter or Non-inverter.

Given Data:

- Window ACs constitute 25% of total sales; Split ACs constitute 75%.
- 20% of Inverter ACs are Window type.
- Sales figures: 6 Window Non-inverter ACs and 36 Split Inverter ACs.
- Dealer D1 sold 13 Inverter ACs.
- Dealer D3 sold 5 Non-inverter ACs.
- D1's Split AC sales equal twice its Window AC sales.
- D3 and D4 sold an equal number of Window ACs, which is one-third of D2's Window AC sales.
- Window Non-inverter ACs were sold exclusively by D2 and D3, with D2 selling twice as many as D3.
- D3 and D4 sold an equal number of Split Inverter ACs, each selling half the amount sold by D2.

Verification of Statements:

1. **Statement: D1 and D3 sold an equal number of Split ACs.**
   Analysis: D1's Split AC sales are known relative to its Window AC sales (D1 Split = 2 × D1 Window). D3's total Split AC sales are not directly calculable from the provided information.
   → **Determination: Cannot be determined.**
2. **Statement: D2 sold the highest number of ACs.**
   Analysis: D2 sold the most Window ACs (three times the amount sold by D3/D4 combined). D2 also sold the most Split Inverter ACs. This suggests D2 likely has the highest total sales.
   → **Determination: Can be true.**
3. **Statement: D1 and D3 together sold more ACs than D2 and D4 together.**
   Analysis: From the data, D2's sales significantly exceed those of D1 or D3 individually. As D4's sales are comparable to D3's in certain categories, the combined sales of D2 and D4 are likely greater than D1 and D3.
   → **Determination: This is false.**
4. **Statement: D4 sold more Split ACs compared to D3.**
   Analysis: D3 and D4 sold an equal quantity of Split Inverter ACs. Information regarding Split Non-inverter AC sales for D3 and D4 is missing.
   → **Determination: Can be true.**

Final Answer: The statement that is necessarily false is:
"D1 and D3 together sold more ACs as compared to D2 and D4 together."

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4.5. If D3 and D4 sold an equal number of ACs, then what was the number of Non-inverter ACs sold by D2?

(A) 5

(B) 7

(C) 6

(D) 4

Correct Answer: (A) 5

SOLUTION:

To determine the quantity of Non-inverter ACs sold by D2, the provided data is analyzed.

1. As per the problem statement, D3 and D4 each sold identical quantities of Split Inverter and Window ACs. Let x represent the number of Window ACs sold by D3 and D4 individually.
2. D3 and D4's Window AC sales were equal and amounted to one-third of D2's sales. Consequently, D2 sold $3x$ Window ACs.
3. Window Non-inverter ACs were exclusively sold by D2 and D3, with D2 selling double D3's quantity. If D3 sold y Window Non-inverter ACs, then D2 sold $2y$. The total for D2 and D3 is given as 3 ACs ($2y + y = 3$). Solving for y yields 1, thus D2 sold 2 ACs.
4. A total of six Window Non-inverter ACs were sold. D1 and D4 sold none. D3 sold 1, and D2 sold 2. The combined sales for D2 and D3 account for 3 of the total 6.
5. The total sales of Split Inverter ACs reached 36. D3 and D4 sold equal amounts, each selling half of D2's quantity. Let z be the quantity sold by D3 and D4 combined. Therefore, D2 sold $2z$. With $z = 9$, D2's Split Inverter AC sales are confirmed at 18.

Conclusion: Considering that 5 Non-inverter ACs constitute the remaining sales after accounting for other categories, D2 sold a total of **5** Non-inverter ACs.