Mathematical Logic Based

PRACTICE EXERCISE

Level - 1

Direction for questions 1 to 5: Answer these questions based on the following information.

J, K, L, M and N collected stamps. They collected a total of 100. None of them collected less than 10. No two among them collected the same number.

I. J collected the same number as K and L put together.

II. L collected 3 more than the cube of an integer.

III. The number collected by J was the square of an integer.

IV. The number collected by K was either the square or the cube of an integer.

V. The number collected by M and N are in the ratio 4 : 3.

1. The number collected by J was

(a) 27. (b) 49.

(c) 36. (d) 64.

(e) 68

2. The number collected by K was

(a) 16. (b) 27.

(c) 24. (d) 36.

(e) 25.

3. The difference in the numbers collected by L and M was

(a) 3. (b) 2.

(c) 5. (d) 9.

(e) 4

4. The number/numbers collected by how many in the group was/were prime numbers?

(a) 0 (b) 1

(c) 2 (d) 3

(e) 4

5. The numbers collected by which pair among the following together add up to the cube of an integer?

(a) K and L (b) J and N

(c) M and N (d) M and L

(e) K and M

Direction for questions 6 to 9: Answer the questions based on the following information.

A, B, C, D, E, F and G are brothers. Two brothers had an argument and A said to B 'You are as old as C was when I was twice as old as D, and will be as old as E was when he was as old as C is now'. B said to A, "You may be older than F but G is as old as I was when you were as old as G is, and D will be as old as F was when F will be as old as G is".

6. Who is the eldest brother?

(a) A (b) E

(c) C (d) G

(e) Cannot be determined

7. Who is the youngest brother?

(a) B (b) D

(c) F (d) E

(e) Cannot be determined

8. Which two are probably twins?

(a) D and G (b) E and C

(c) A and B (d) A and C

(e) Cannot be determined

9. Which of the following is false?

(a) G has four elder brothers.

(b) A is older than G but younger than E.

(c) B has three elder brothers.

(d) There is a pair of twins among the brothers.

(e) E is older than A

Level - 2

Direction for questions 10 to 13: These questions are based on the following information.

Kamala has four daughters: A, B, C and D. Once the four daughters received some one rupee coins as a present from their grandfather (an ex-bank officer). Kamala opened the four parcels as the girls were at school. In the evening she told her daughters about the parcels and added," You have totally received. Rs. 20- all in Re.1 coins. None of you has received less than Rs. 2. A has got the maximum and D the least. B has got more than C "Kamala asked A who always arrived at the most logical and correct answer to look into her

own parcel only and says how many coins each of the others had receives. A looked into her parcel only and said that it was not possible to give the required answers. Kamala then said that D had received an even number of coins. With this information A gave the correct answers.

10. The number of coins received by A was

(a) 10 (b) 9
(c) 8 (d) 11
(e) 7

11. The number of coins received by B was

(a) 5 (b) 6
(c) 7 (d) 8
(e) 9

12. The number of coins received by C was

(a) 3 (b) 4
(c) 5 (d) 6
(e) 7

13. The number of coins received by D was

(a) 2 (b) 4
(c) 6 (d) 7
(e) 5

Directions for questions 14 to 18: Answer the questions on the basis of the information given below.

Each of the five friends namely Michelle, Luc, Niki, William and Sophia own exactly one distinct company among the five companies namely P, Q, R, S and T not necessarily in that particular order. The revenue of the five companies generated in a particular quarter is Rs.50 million, Rs.45 million, Rs.40 million, Rs.35 million and Rs. 30 million not necessarily in the order in which the names of the companies are mentioned.

Additional Information Given:

I. Niki does not own S.

II. The revenue generated by P is greater than the revenue generated by the company owned by Niki by Rs.5 million.

III. The revenue generated by the company owned by Michelle is greater than the revenue generated by Q by Rs. 10 million.

IV. The revenue generated by the company owned by William is greater than the revenue generated by R by Rs. 10 million.

V. Luc does not own T.

VI. The revenue generated by S is greater than the revenue generated by the company owned by Sophia by Rs. 5 million.

14. If Michelle owns P, then which of the following is the revenue generated by T?

(a) Rs.30 million (b) Rs.35 million
(c) Rs.40 million (d) Rs.25 million
(e) Rs.45 million

15. If Michelle owns R, then which of the following cannot be true?

(a) William owns P and the revenue generated by P is Rs. 50 million.
(b) The revenue generated by the company owned by Luc is Rs. 35 million.
(c) Niki owns Q.
(d) The revenue generated by the company owned by Sophia is Rs. 30 million.
(e) None of these

16. How many of the following statements can be true?

I. Michelle owns S and the revenue generated by S is Rs. 50 million.
II. Michelle owns S and the revenue generated by S is Rs. 45 million.
III. If Michelle owns S, then William owns Q.
IV. If Michelle owns P, then the revenue generated by the company owned by Luc is Rs.30 million.
V. If Michelle owns P, then Niki owns T.

(a) 2 (b) 3
(c) 4 (d) 5
(e) 1

17. What is the revenue generated by the company owned by Luc?

(a) Rs.35 million (b) Rs.40 million
(c) Rs.45 million (d) Rs.30 million
(e) Cannot be determined

18. Which company does Sophia own?

(a) Either P or Q (b) Either P or Q or R
(c) Either P or R or T (d) Either Q or R or T.
(e) Either P or Q or T

Directions for questions 19 to 23: Answer the questions on the basis of the information given below.

Sixteen consecutive natural numbers are to be filled into a 4 × 4 square matrix as shown below, such that there is one number in each box of the matrix not necessarily in any order. Few of these 16 mentioned numbers are already shown in the boxes. Remaining 12 numbers are denoted by 12 alphabets namely A, B, C, D, E, F, G, H, I, J, K and L. The numbers are filled in the boxes in such a way that the sum of the numbers in the boxes of any row, any column and any diagonal of the square matrix is the same. It is also known that D + E + I = 60.

13	A	B	16
C	D	E	F
G	H	I	J
25	K	L	28

19. How many numbers in the given matrix are numerically greater than the number denoted by C?

(a) 4 (b) 5

(c) 6 (d) 3

(e) Cannot be determined

20. Find the numerical value of (A + I) – (B + H).

(a) 2 (b) 1

(c) 0 (d) 3

(e) 4

21. If we were to construct another 4 by 4 square matrix containing 16 consecutive natural numbers having the same properties as the matrix given above, then which of the following can be the sum of the numbers in the boxes of any one row?

(a) 116 (b) 144

(c) 168 (d) 180

(e) 170

22. Find how many pairs of numbers are there in the given matrix such that both the numbers in the pair belong to either the same row or same column or same diagonal of the square matrix and the absolute difference between the numbers present in the pair is not less than 12.

(a) 7 (b) 9

(c) 10 (d) 8

(e) 6

23. Find the ratio of the numerical value of (F – G) to the numerical value of (E – J).

(a) 2 : 3 (b) 2 : 1

(c) 1 : 2 (d) 3 : 1

(e) 3 : 2

ANSWERS

1. (c) **2.** (e) **3.** (c) **4.** (b) **5.** (d) **6.** (b) **7.** (b) **8.** (c) **9.** (c) **10.** (e)

11. (b) **12.** (a) **13.** (a) **14.** (e) **15.** (c) **16.** (b) **17.** (a) **18.** (d) **19.** (a) **20.** (a)

21. (e) **22.** (b) **23.** (c)

SOLUTIONS

Level - 1

For questions 1 to 5:

$J = K + L$ and $L = x^3 + 3$.

The maximum value of x can be 2 to satisfy the condition. So, L = 11

Now, J and K can have two values. J = 25 and K = 14 or J = 36 and K = 25

But, K should be a square or a cube

$\therefore$ J = 36 and K = 25

J + K + L + M + N = 100

$\Rightarrow$ M + N = 28. Since, M and N are in the ratio 4 : 3, M = 16 and N = 12.

1. c **2.** e **3.** c **4.** b **5.** d

For questions 6 to 9:

The first statement suggests: B is now as old as C was in the past. Hence, B < C. Also, sometime in the past, A was twice as old as D. So, A > D. C will be as old as E in future. Hence, C < E.

The second statement suggests : A > F. A was as old as G in the past. Hence, A > G. D will be as old as F in future. Hence, F > D. F will be as old as G now in future. Hence, G > F. G was as old as B, when A was as old as G.

Hence, A = B.

Combining both the results, we get E > C > B = A > G > F > D (Note by A = B, it is meant that they are of similar age group, not necessarily the same).

6. b It could be figured out that E is the eldest brother.

7. b D is the youngest brother.

8. c Only A and B could probably be twins.

9. c It could be figured out that only statement (c) is false as B has only 2 elder brothers and not 3.

Level - 2

10. e A > B > C > D, thus min. D = 2, min. C = 3, min. B = 4

Thus max. A = 11

Similarly min. A = 7 $\Rightarrow$ max. B = 6

Thus, D = 2, as otherwise min. values would be 4 (D = even), 5, 6 $\Rightarrow$ A = min. 7 which add upto 22 (not possible). Thus, possible values for A are

11,10, 9, 8, 7. If A got 11 or 10, she would have been able to give answer straightway (only one possible arrangement). Also A could not have 9 or 8 as then too, she would not have been able to give the answers, as in each of the cases there are two answers with D = 2. Thus, A got 7 . Thus, B and C.

11. b **12.** a **13.** a

For questions 14 to 18:

		Companies				
		P	Q	R	S	T
Names	Michelle		X			
	Luc					X
	Niki	X			X	
	William			X		
	Sophia				X	

From (II): P – Niki = Rs.5 million.

From (III): Michelle – Q = Rs.10 million.

From (IV): William – R = Rs.10 million.

From (VI): S – Sophia = Rs.10 million.

The following table provides information about the possibilities of the revenue of the restaurant owned by different persons.

Names	Revenue (in Rs. Million)
Michelle	50 or 45 or 40
Luc	50 or 45 or 40 or 35 or 30
Niki	45 or 40 or 35 or 30
William	50 or 45 or 40
Sophia	45 or 40 or 35 or 30

The following table provides information about the possibilities of the revenue generated by different companies.

Companies	Revenue (in Rs. million)
P	50 or 45 or 40 or 35
Q	40 or 35 or 30
R	40 or 35 or 30
S	50 or 45 or 40 or 35
T	50 or 45 or 40 or 35 or 30

Case 1: Michelle owns P:

If Michelle owns P then the revenue generated by P is Rs. 50 million or Rs. 45 million or Rs. 40 million.

In the subsequent explanation wherever it is mentioned 50 or 45 or 40 or 35 or 30, it is in Rs. million.

(i) Michelle owns P and the revenue generated is Rs. 40 million.

Niki = 35, Q = 35.

Since P = 40 and Q = 35, therefore R = 35.

William = 10 + 35 = 45.

S can be either 50 or 45. If S = 45 then Sophia = 40 which is not possible as Michelle = 40.

If S = 50 then Sophia = 45 which is not possible as William = 45.

Therefore, if Michelle owns P then the revenue generated cannot be Rs. 40 million.

(ii) Michelle owns P and the revenue generated is Rs. 45 million.

Niki = 40 and Q = 35.

R could be either 30 or 40.

R = 30: William = 40, which is not possible as Niki = 40

R = 40: William = 50, which gives S = 50 and hence Sophia = 45 which is not possible as Michelle = 45

Therefore, if Michelle owns P then the revenue generated cannot be Rs. 45 million.

(iii) Michelle owns P and the revenue generated is Rs. 50 million

Niki = 45 and Q = 40.

R could be either 35 or 30. R cannot be 35 because then William will be 45 and that is not possible because Niki is already 45.

R = 30: William = 40.

S could be either 45 or 35. If S = 45 then Sophia = 40 but William is already 40.

If S = 35 then Sophia = 30, T = 45 and Luc = 35.

Hence the following table can be concluded.

As we have checked for the case when Michelle owns P, similarly if we check for the case when Michelle owns T then we find that Michelle cannot own T.

Names	Companies	Revenue (in Rs. million)
Michelle	P	50
Niki	T	45
Sophia	R	30
William	Q	40
Luc	S	35

The revenue generated by T is Rs. 45 million.

Case 2: Michelle owns R

If Michelle owns R, then the revenue generated by R has to be Rs. 40 million.

William = 50 and Q = 30.

The revenue generated by S cannot be 45 because then Sophia = 40, which is not possible.

S= 50 or 35.

S cannot be equal to 50.

S= 35, then Sophia = 30. Now P could be either 45 or 50. P cannot be 45 so P has to be 50. Niki = 45 which gives T = 45 and Luc = 35.

Therefore we get the following table

Names	Companies	Revenue (in Rs. million)
Michelle	R	40
Niki	T	45
Sophia	Q	30
William	P	50
Luc	S	35

Niki owns Q is false, as Niki owns T. Every other option is true.

Case 3: Michelle owns S.

If Michelle owns S then the only possibility is when the revenue generated by S is Rs. 50 million.

Names	Companies	Revenue (in Rs. million)
Michelle	S	50
Niki	R	30
Sophia	T	45
William	Q	40
Luc	P	35

These are the only three cases, which are possible.

14. e

15. c

16. b Statement I can be true.

Statement III can be true.

Statement V can be true.

17. a In all the three above cases we can see that the revenue generated by the company owned by Luc is Rs. 35 million.

18. d In all the three above cases we can see that Sophia could either own R or Q or T.

For questions 19 to 23:

Since 13 and 28 are the two numbers that are already filled in the boxes of the matrix, therefore the 16 consecutive natural numbers are from 13 to 28.

Sum of these 16 numbers $= \frac{16(13+28)}{2} = 8 \times 41$

Sum of the numbers in the boxes of any row or any column or any diagonal of the square matrix is $\frac{8 \times 41}{4} = 82$

Hence, A + B = 53; C + G = 44; F + J = 38; E + H = 41; D + I = 41 and K + L = 29. Therefore, (K, L) → (15, 14) or (14, 15).

Similarly, (A, B) → (26, 27) or (27, 26).

Also, E = 60 – 41 = 19 ⇒ H = 22

(C, G) → (20, 24), (24, 20), (21, 23), (23, 21)

(F, J) → (17, 21), (21, 17), (18, 20), (20, 18)

(D, I) → (17, 24), (24, 17), (18, 23), (23, 18), (20, 21), (21, 20)

In the third column, E = 19. So, B + I + L = 63

The only combination of (B, L) that satisfies without violating any condition is (26, 14).

Hence, I = 23, D = 18, K = 15, A = 27, B = 26, L = 14, H = 22 and E = 19

Now, (C, G) → (20, 24), (24, 20) and (C, F) → (21, 24), (24, 21)

Hence, C = 24, G = 20, F = 21 and J = 17.

Finally the given matrix will look like as follows:

13	27	26	16
24	18	19	21
20	22	23	17
25	15	14	28

19. a Since C = 24, therefore 4 numbers are numerically greater then C.

20. a (A + I) – (B + H) = 50 – 48 = 2.

21. e The 16 consecutive natural numbers could be from 'n' to 'n + 15', where 'n' is a natural number.

Sum of these numbers

$$= \frac{16(n+n+15)}{2} = 16n + 120.$$

Sum of the numbers in the boxes of any row

$$= \frac{16n+120}{4} = 4n + 30.$$

Only option (5), i.e. 170 gives a integer value of n.

22. b Such pairs are (13, 25), (27, 15), (26, 14), (28, 16), (28, 13), (27, 13), (26, 13), (28, 14), (28, 15).

Therefore in total there are 9 such pairs.

23. c F – G = 21 – 20 = 1

E – J = 19 – 17 = 2

Required ratio is 1 : 2

PREVIOUS YEARS QUESTIONS

Level - 1

1996

Directions for Questions 1 and 2: *Answer the questions based on the following information.*

In a locality, there are five small cities: A, B, C, D and E. The distances of these cities from each other are as follows.

AB = 2 km AC = 2km AD > 2 km
AE > 3 km BC = 2 km BD = 4 km
BE = 3 km CD = 2 km CE = 3 km
DE > 3 km

1. If a ration shop is to be set up within 2 km of each city, how many ration shops will be required?

(a) 2 (b) 3
(c) 4 (d) 5

2. If a ration shop is to be set up within 3 km of each city, how many ration shops will be required?

(a) 1 (b) 2
(c) 3 (d) 4

1998

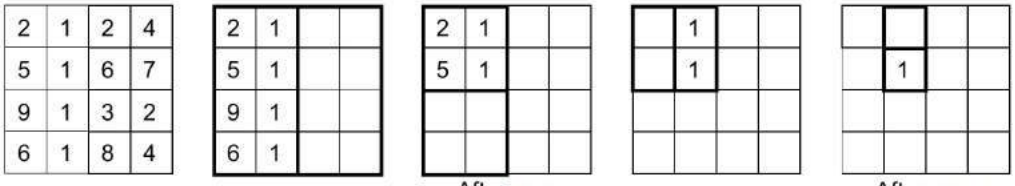
3. A, B, C, D, ..., X, Y, Z are the players who participated in a tournament. Everyone played with every other player exactly once. A win scores 2 points, a draw scores 1 point and a loss scores 0 point. None of the matches ended in a draw. No two players scored the same score. At the end of the tournament, by ranking list is published which is in accordance with the alphabetical order. Then

(a) M wins over N
(b) N wins over M
(c) M does not play with N
(d) None of these

Level - 2

1990

Directions for Questions 4 to 6 : *The following questions relate to a game to be played by you and your friend. The game consists of a 4 x 4 board (see below) where each cell contains a positive integer. You and your friend make moves alternately. A move by any of the players consists of splitting the current board configuration into two equal halves and retaining one of them. In your moves you are allowed to split the board only vertically and to decide to retain either the left or the right half. Your friend, in his/her moves, can split the board only horizontally and can retain either the lower or the upper half. After two moves by each player a single cell will remain which can no longer be split and the number in that cell will be treated as the gain (in rupees) of the person who has started the game. A sample game is shown below.*



So your gain is Re.1. With the same initial board configuration as above and assuming that you have to make the first move, answer the following questions.

4. If you choose (retain right) (retain left) in your turns, the best move sequence for your friend to reduce your gain to a minimum will be

(a) (retain upper)(retain lower)
(b) (retain lower) (retain upper)
(c) (retain upper) (retain upper)
(d) (retain lower) (retain lower)

5. If both of you select your moves intelligently then at the end of the game your gain will be

(a) Rs.4 (b) Rs.3
(c) Rs.2 (d) None of these

6. If your first move is (retain right), then whatever moves your friend may select you can always force a gain of no less than

(a) Rs.3 (b) Rs.6
(c) Rs.4 (d) None of these

1990

7. I happened to be the judge in the all India Essay Competition on Nylon Dying, organized some time back by a dyestuff firm. Mill technicians were eligible to enter the competition. My work was simplified in assessing the essays, which had to be done under five heads-Language, Coherence, Subject Matter, Machinery and Recent Developments. Marks were to be given out of a maximum of 20 under each head. There were only five entries.

The winner got 90 marks. Akhila got 13 in Coherence and Divya 10 in Machinery. Bhanu's total was less than Akhila's. Charulata has sent an entry. Ela had got as many marks as Divya. None got 20 under any head.

Who was the winner?

(a) Divya (b) Charulata

(c) Ela (d) Bhanu

2000

Directions for Questions 8 to 9: *Read each of the five problems given below and choose the best answer from among the four given choices.*

8. My bag can carry not more than ten books. I must carry at least one book each of management, mathematics, physics and fiction. Also, for every management book I carry I must carry two or more fiction books, and for every mathematics book I carry I must carry two or more physics books. I earn 4, 3, 2 and 1 points for each management, mathematics, physics and fiction book, respectively, I carry in my bag. I want to maximise the points I can earn by carrying the most appropriate combination of books in my bag. The maximum points that I can earn is

(a) 20 (b) 21

(c) 22 (d) 23

9. Eighty kilogram of store material is to be transported to a location 10 km away. Any number of couriers can be used to transport the material. The material can be packed in any number of units of 10, 20, or 40 kg. Courier charges are Rs. 10 per hour. Couriers travel at the speed of 10 km/hr if they are not carrying any load, at 5 km/hr if carrying 10 kg, at 2 km/hr if carrying 20 kg and at

1 km/hr if carrying 40 kg. A courier cannot carry more than 40 kg of load. The minimum cost at which 80 kg of store material can be transported to its destination will be

(a) Rs. 180 (b) Rs. 160

(c) Rs. 140 (d) Rs. 120

2001

10. At a village mela, the following six nautankis (plays) are scheduled as shown in the table below.

No.	Nautanki	Duration	Show Times
1	Sati Savitri	1 hr	9 a.m. and 2 p.m.
2	Joru ka Ghulam	1 hr	10.30 a.m. and 11: 30 a.m.
3	Sundar Kand	30 min	10 am and 11 a.m.
4	Veer Abhimanyu	1 hr	10 a.m. and 11a.m.
5	Reshma aur Shera	1 hr	9.30 a.m., 12 noon and 2 p.m.
6	Jhansi ki Rani	30 min	11 a.m. and 1: 30 p

You wish to see all the six nautankis. Further, you wish to ensure that you get a lunch break from 12.30 p.m. to 1.30 p.m. Which of the following ways can you do this?

(a) Sati Savitri is viewed first; Sundar Kand is viewed third, and Jhansi ki Rani is viewed last

(b) Sati Savitri is viewed last; Veer Abhimanyu is viewed third, and Reshma aur Shera is viewed first

(c) Sati Savitri is viewed first; Sundar Kand is viewed third, and Joru ka Ghulam is viewed fourth

(d) Veer Abhimanyu is viewed third; Reshma aur Shera is viewed fourth, and Jahansi ki Rani is viewed fifth

11. Mrs Ranga has three children and has difficulty remembering their ages and months of their birth. The clue below may help her remember.

- The boy, who was born in June, is 7 years old.
- One of the children is 4 years old but it was not Anshuman.
- Vaibhav is older than Suprita.
- One of the children was born in September, but it was not Vaibhav.
- Suprita's birthday is in April.
- The youngest child is only 2-year-old.

Based on the above clues, which one of the following statements is true?

(a) Vaibhav is the oldest, followed by Anshuman who was born in September, and the youngest is Suprita who was born in April

(b) Anshuman is the oldest being born in June, followed by Suprita who is 4-year-old, and the youngest is Vaibhav who is 2-year-old

(c) Vaibhav is the oldest being 7-year-old, followed by Suprita who was born in April, and the youngest is Anshuman who was born in September

(d) Suprita is the oldest who was born in April, followed by Vaibhav who was born in June, and Anshuman who was born in September

2001

12. On her walk through the park, Hamsa collected 50 coloured leaves, all either maple or oak. She sorted them by category when she got home, and found the following:

The number of red oak leaves with spots is even and positive.

The number of red oak leaves without any spot equals the number of red maple leaves without spots.

All non-red oak leaves have spots, and there are five times as many of them as there are red spotted oak leaves.

There are no spotted maple leaves that are not red.

There are exactly 6 red spotted maple leaves.

There are exactly 22 maple leaves that are neither spotted nor red.

How many oak leaves did she collect?

(a) 22 (b) 17

(c) 25 (d) 18

2001

13. In a family gathering there are 2 males who are grandfathers and 4 males who are fathers. In the same gathering there are 2 females who are grandmothers and 4 females who are mothers. There is at least one grandson or a granddaughter present in this gathering. There are 2 husband-wife pairs in this group. These can either be a grandfather and a grandmother, or a father and a mother. The single grandfather (whose wife is not present) has 2 grandsons and a son present. The single grandmother (whose husband is not present) has 2 grand daughters and a daughter present. A grandfather or a grandmother present with their spouses does not have any grandson or granddaughter present.

What is the minimum number of people present in this gathering?

(a) 10 (b) 12

(c) 14 (d) 16

14. I have a total of Rs. 1,000. Item A costs Rs. 110, item B costs Rs. 90, item C costs Rs. 70, item D costs Rs. 40 and item E costs Rs. 45. For every item D that I purchase, I must also buy two of item B. For every item A, I must buy one of item C. For every item E, I must also buy two of item D and one of item B. For every item purchased I earn 1,000 points and for every rupee not spent I earn a penalty of 1,500 points. My objective is to maximise the points I earn.

What is the number of items that I must purchase to maximise my points?

(a) 13 (b) 14

(c) 15 (d) 16

15. Four friends Ashok, Bashir, Chirag and Deepak are out for shopping. Ashok has less money than three times the amount that Bashir has. Chirag has more money than Bashir. Deepak has an amount equal to the difference of amounts with Bashir and Chirag. Ashok has three times the money with Deepak. They each have to buy at least one shirt, or one shawl, or one sweater, or one jacket that are priced Rs. 200, Rs. 400, Rs. 600, and Rs. 1,000 a piece respectively. Chirag borrows Rs. 300 from Ashok and buys a jacket. Bashir buys a sweater after borrowing Rs. 100 from Ashok and is left with no money. Ashok buys three shirts. What is the costliest item that Deepak could buy with his own money?

(a) A shirt (b) A shawl

(c) A sweater (d) A jacket

2003

Directions for Questions 16 to 18: *Answer the questions on the basis of the information given below.*

Rang Barsey Paint Company (RBPC) is in the business of manufacturing paints. RBPC buys RED, YELLOW, WHITE, ORANGE, and PINK paints. ORANGE paint can be also produced by mixing RED and YELLOW paints in equal proportions. Similarly, PINK paint can also be produced by mixing equal amounts of RED and WHITE paints. Among other paints, RBPC sells CREAM paint, (formed by mixing WHITE and YELLOW in the ratio 70:30) AVOCADO paint (formed by mixing equal amounts of ORANGE and PINK paint) and WASHEDORANGE paint (formed by mixing equal amounts of ORANGE and WHITE paint). The following table provides the price at which RBPC buys paints

Color	Rs./litre
RED	20
YELLOW	25
WHITE	15
ORANGE	22
PINK	18

16. The cheapest way to manufacture AVOCADO paint would cost
    (a) Rs. 19.50 per litre.
    (b) Rs. 19.75 per litre
    (c) Rs. 20.00 per litre.
    (d) Rs. 20.25 per litre.
17. WASHEDORANGE can be manufactured by mixing
    (a) CREAM and RED in the ratio 14:10.
    (b) CREAM and RED in the ratio 3:1.
    (c) YELLOW and PINK in the ratio 1:1.
    (d) RED, YELLOW, and WHITE in the ratio 1:1:2.
18. Assume that AVOCADO, CREAM and WASHEDORANGE each sells for the same price. Which of the three is the most profitable to manufacture?
    (a) AVOCADO
    (b) CREAM
    (c) WASHEDORANGE
    (d) Sufficient data is not available.

MEMORY BASED QUESTIONS

2009

19. Five dancers Angad, Bali, Gaurav, Monica and Shonali participate in a competition called DOD. Each participant gets some points from each of the five judges A, B, C, D and E for their performance in DOD. The final score of a participant is the sum of the points received by him/her from the five judges. The winner of the competition is the dancer whose final score is the maximum among the five dancers. The following details are also known:
    - Bali gets 37 marks from judge B and Shonali gets 39 marks from judge C.
    - The final score of Gaurav is less than the final score of Shonali.
    - The winner of DOD gets a final score of 220.
    - No contestant gets more than 45 marks from any of the five judges.
    - The arithmetic mean of the final scores of Angad and Gaurav is greater than the arithmetic mean of the final scores of Monica and Shonali.

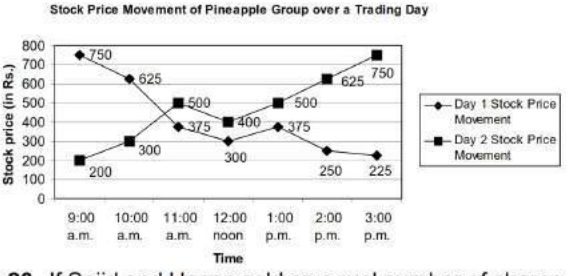
    Who is the winner of DOD?
    (a) Shonali
    (b) Monica
    (c) Angad
    (d) Cannot be determined

2010

Directions for questions 20 and 21: Answer the questions on the basis of the information given below.

Two stock traders – Hasan and Sajid – trade in the shares of Pineapple Group only. Each of them follows a different strategy for selling and buying the stocks. Sajid sells an equal number of shares at 9 a.m. and 10 a.m. and buys them back in equal numbers at 1 p.m. and 2 p.m. Hasan sells some shares at 11 a.m. and the rest at 12 noon such that the amount he gets on the two occasions is the same. He buys back the whole lot at 3 p.m. The chart given below displays the performance of Pineapple Group stock on two particular days – Day 1 and Day 2.

The profit/loss made by a trader on a particular day is the difference between the amount that he obtains by selling the shares and the amount that he spends in buying the shares. "Margin" for a day is the profit/loss expressed as a percentage of the total amount obtained by selling the shares on that day.



20. If Sajid and Hasan sold an equal number of shares on Day 1, then which of the following statements would definitely be true?
    I. Hasan made more profit than Sajid on Day 1.
    II. Hasan made less profit than Sajid on Day 1.
    III. Hasan's Margin was more than Sajid's Margin on Day 1.
    IV. Hasan's Margin was less than Sajid's Margin on Day 1.
    (a) I only
    (b) I and IV
    (c) II and IV
    (d) I and III
21. What was the ratio of Hasan's Margin to Sajid's Margin on Day 2?
    (a) 13 : 20
    (b) 11 : 20
    (c) 20 : 13
    (d) Cannot be determined

2014

Directions for questions 22 to 25 : Answer the questions on the basis of information given below.

A farmer has 60 hens in his poultry farm. Each of these 60 hens lays one egg per day. On each day out of the eggs laid, some of the eggs are found to be rotten and some of the eggs get broken. Only the eggs that are neither rotten nor broken are taken to the market for sale but due to some unavoidable reasons some eggs are not sold. The eggs that are not sold are brought back to the poultry farm.

Additional Information Given:

I. Out of the eggs that are brought back on each day, 40% are rotten and 20% are broken the next morning (and they are always integers).

II. Out of the eggs that are brought back to the poultry farm on each day, the eggs that are neither broken nor rotten are taken along with the eggs that are laid by the hens on the next day to the market for sale.

III. On any particular day the number of eggs that are not sold is less than 20% of the number of eggs that are taken to be sold out of the eggs that are laid on each day.

IV. Out of the eggs that are laid on each day, the number of eggs that are rotten is greater than 1 but less than 5 and the number of eggs that got broken is greater than 3 and less than 7.

V. Every week has five days and each week starts from day 1 and ends on day 5. Assume there are no eggs with the farmer at the beginning of day 1 of the given week.

22. Find the minimum possible aggregate number of eggs sold on day 4 and day 5.

(a) 84 (b) 83

(c) 86 (d) 85

23. If the number of eggs that got rotten and broken is maximum possible in a particular week, then find the difference between the total number of eggs that got rotten and the total number of eggs that got broken across all the five days of the week.

(a) 4 (b) 2

(c) 6 (d) 8

24. What can be the maximum number of eggs (that are unbroken and not rotten) that were left unsold at the end of the fifth day?

(a) 10 (b) 50

(c) 25 (d) Cannot be determined

25. If the number of eggs sold on any day of the week is maximum possible then what is the aggregate sum of the total number of eggs sold in the entire week?

(a) 253 (b) 254

(c) 265 (d) 251

Level - 3

2000

Directions for Questions 26 and 27: *Answer the questions based on the following information.*

There are three bottles of water — A, B, C, whose capacities are 5 L, 3 L, and 2 L respectively. For transferring water from one bottle to another and to drain out the bottles, there exists a piping system. The flow through these pipes is computer-controlled. The computer that controls the flow through these pipes can be fed with three types of instructions, as explained below.

Instruction type	Explanation of the instruction
Fill (X, Y)	Fill bottle labelled X from the water in bottle labelled Y, where the remaining capacity of X is less than or equal to the amount of water in Y.
Empty (X, Y)	Empty out the water in bottle labelled X into bottle labelled Y, where the amount of water in X is less than or equal to remaining capacity of Y.
Drain (X)	Drain out all the water contained in bottle labelled X

Initially, A is full with water, and B and C are empty.

26. After executing a sequence of three instructions, bottle A contains one litre of water. The first and the third of these instructions are shown below.

First instruction: FILL (C, A)

Third instruction: FILL (C, A)

Then which of the following statements about the instructions is true?

(a) The second instruction is FILL (B, A).

(b) The second instruction is EMPTY (C, B).

(c) The second instruction transfers water from B to C.

(d) The second instruction involves using the water in bottle A.

27. Consider the same sequence of three instructions and the same initial state mentioned above. Three more instructions are added at the end of the above sequence to have A contain 4 L of water. In this total sequence of six instructions, the fourth one is DRAIN (A). This is the only DRAIN instruction in

the entire sequence. At the end of the execution of the above sequence, how much water is contained in C?

(a) 1 L (b) 2 L

(c) 0 (d) None of these

2006

Directions for Questions 28 to 32: *Answer the questions on the basis of the information given below:*

Mathematicians are assigned a number called Erdös number (named after the famous mathematician, Paul Erdös). Only Paul Erdös himself has an Erdös number of zero. Any mathematician who has written a research paper with Erdös has an Erdös number of 1. For other mathematicians, the calculation of his/her Erdös number is illustrated below:

Suppose that a mathematician X has co-authored papers with several other mathematicians. From among them, mathematician Y has the smallest Erdös number. Let the Erdös number of Y be y. Then X has an Erdös number of y+1. Hence any mathematician with no co-authorship chain connected to Erdös has an Erdös number of infinity.

In a seven day long mini-conference organized in memory of Paul Erdös, a close group of eight mathematicians, call them A, B, C, D, E, F, G and H, discussed some research problems. At the beginning of the conference, A was the only participant who had an infinite Erdös number. Nobody had an Erdös number less than that of F.

1. On the third day of the conference F co-authored a paper jointly with A and C. This reduced the average Erdös number of the group of eight mathematicians to 3. The Erdös numbers of B, D, E, G and H remained unchanged with the writing of this paper. Further, no other co-authorship among any three members would have reduced the average Erdös number of the group of eight to as low as 3.
2. At the end of the third day, five members of this group had identical Erdös numbers while the other three had Erdös numbers distinct from each other.
3. On the fifth day, E co-authored a paper with F which reduced the group's average Erdös number by 0.5. The Erdös numbers of the remaining six were unchanged with the writing of this paper.
4. No other paper was written during the conference.

28. How many participants in the conference did not change their Erdös number during the conference?

(a) 2 (b) 3

(c) 4 (d) 5

(e) Cannot be determined

29. The person having the largest Erdös number at the end of the conference must have had Erdös number (at that time):

(a) 5 (b) 7

(c) 9 (d) 14

(e) 15

30. How many participants had the same Erdös number at the beginning of the conference?

(a) 2 (b) 3

(c) 4 (d) 5

(e) Cannot be determined

31. The Erdös number of C at the end of the conference was:

(a) 1 (b) 2

(c) 3 (d) 4

(e) 5

32. The Erdös number of E at the beginning of the conference was:

(a) 2 (b) 5

(c) 6 (d) 7

(e) 8

MEMORY BASED QUESTIONS

2015

Directions for questions 33 to 36 : Answer the questions on the basis of the information given below.

From ISBT, buses ply on 6 different routes viz. 414, 413, 427, 966, 893 and 181 at an interval of 10 min, 10 min, 12 min, 15 min, 20 min and 30 min, not necessarily in that order, to four different destinations viz. Mehrauli, Badarpur, Uttam Nagar and Azadpur. There is at least one bus for each destination. Further information is also known:

i. Two buses to the same destination cannot start at the same time.

ii. If the timings of two buses plying different routes but heading towards the same destination clash, then the bus of the route number having the shorter time interval will skip this journey.

iii. Buses on two different routes ply between ISBT and Mehrauli.

iv. The difference between the time intervals of a route to Mehrauli and Uttam Nagar is equal to the difference between the time intervals of the two routes to Uttam Nagar.

v. Buses on a route to Mehrauli leaves after every 10 min.

vi. 414 leaves for Badarpur after every 30 min.

vii. Time intervals between two different routes heading towards the same destination cannot be equal.

viii. Buses on one of the routes to Uttam Nagar leave after every 15 min.

ix. Buses to any destination can leave from ISBT with an interval of at least one minute or an integral multiple of one minute.

33. If 427 leaves to Mehrauli after every 10 min, then in a given hour a minimum of how many buses can ply on route 427?

(a) 3 (b) 4

(c) 6 (d) 2

34. On a festival day, if frequency of all buses was increased by decreasing the time interval of all the routes by 5 min, then what can be the minimum time difference between any two buses plying to Mehrauli?

(a) 2 min (b) 5 min

(c) 1 min (d) None of these

35. Which of the following statements is necessarily TRUE?

(a) A maximum of 3 buses can depart at a given time.

(b) Maximum of 11 buses can depart for Mehrauli in 1 hour.

(c) Maximum difference between the intervals of the buses plying to Uttam Nagar and Badarpur is 10 min.

(d) The difference between the time intervals of buses plying to Uttam Nagar is an integral multiple of 5 min.

36. If condition (iii) is not there, then what can be the minimum difference between the time intervals between the buses plying to Uttam Nagar?

(a) 2 min (b) 3 min

(c) 4 min (d) 5 min.

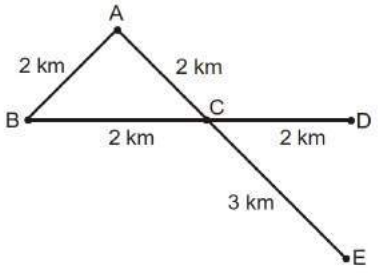
ANSWERS

1. (a)	**2.** (a)	**3.** (a)	**4.** (c)	**5.** (b)	**6.** (a)	**7.** (b)	**8.** (c)	**9.** (b)	**10.** (c)
11. (c)	**12.** (b)	**13.** (b)	**14.** (b)	**15.** (b)	**16.** (b)	**17.** (d)	**18.** (b)	**19.** (c)	**20.** (c)
21. (b)	**22.** (c)	**23.** (b)	**24.** (a)	**25.** (a)	**26.** (b)	**27.** (c)	**28.** (d)	**29.** (b)	**30.** (b)
31. (b)	**32.** (c)	**33.** (a)	**34.** (c)	**35.** (d)	**36.** (a)				

SOLUTIONS

Level - 1

For questions 1 and 2:



1. a If there is a shop at C, all A, B, C and D are within 2 km range. Another shop is needed for E. Hence, 2 shops are required.

2. a If there is a shop at C; all A, B, D and E are within 3 km range. Hence, 1 shop is required.

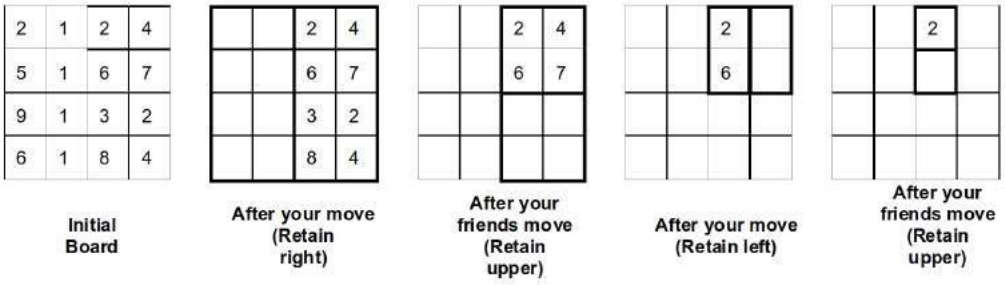
3. a It can be seen that each of the 26 players played 25 matches. Since none of the matches ended in a draw, the scores for each of the players has to be even (since a win gives 2 points). So the highest score possible for a player would be 50 and the lowest would be 0. Since all 26 of them had different scores varying between 0 and 50, the scores should indeed be all the even numbers between 0 and 50. And since the ranks obtained by players are in alphabetical order, it can be concluded that A scored 50, B scored 48, C scored 46 and so on and Z scored 0. Now the only way A can score 50 is, if he wins all his matches, i.e. he defeats all other players. Now B has scored 48. So he has lost only one of his matches, which incidentally is against A. He must have defeated all other players. Similarly, C has scored 46 matches. So he must have lost two matches, (i.e. to A and B) and defeated all other players. So we conclude that a player whose name appears alphabetically higher up in the order has defeated all the players whose name appear alphabetically lower down.

Hence, M should win over N.

Level - 2

For question 4 to 6:

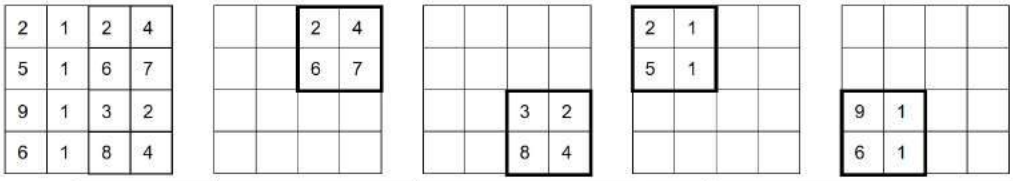
4. c



Since you choose to retain right and then left in your next move, the cells that would hence be retained contain 2,6,3,8. (look at the second grid) Hence, to reduce your gain to minimum, your friend has to retain 2 at the end. So his strategy has to be retain upper and retain upper.

5. b If both of you select the moves intelligently, you would both go for maximising your earnings.

In your first move you have to select either left or right and your friend has to then select either upper or lower. Hence the possibilities could be :



You Move	Your Friend Moves	Integers left for your 2nd move	Minimum gain ensured
(Retain Right)	(Retain Upper)	2, 4, 6, 7	4 (after you move retain right)
	(Retain Lower)	3, 2, 8, 4	3 (after you move retain left)
(Retain Left)	(Retain Upper)	2, 1, 5, 1	2 (after you move retain left)
	(Retain Lower)	9, 1, 6, 1	6 (after you move retain left)

So, if you move (retain right) you ensure a minimum gain of Rs.3 and if you move (retain left) you ensure a minimum gain of Rs.2. Hence if both of you play intelligently, you would first move retain right and ensure a minimum win of Rs.3, irrespective of what your friend moves.

6. a If your first move is (retain right) then the grid will look the same as in Q82. Your friend may hence choose either (retain upper), which will leave you to choose from 2,4,6,7 or he may choose (retain lower), which will leave you to choose from 3,2,8,4. In case he takes the former move, you can then move (retain right) and hence force a minimum gain of 4. But in case he chooses the latter move, you can then move (retain move) and force a minimum gain of 3. In either case you can force a minimum gain of Rs.3

7. b As Bhanu's total was less than Akila's, Bhanu cannot be the winner. As Ela's and Divya's marks are the same, none of them could be winners. The winner could hence be either Bhanu or Charulata. Now, Akhila got 13 in Coherence. Even if she gets 19 in all of the remaining (as no one got 20 in any 1 head), her total would only be 89. But the winner's total is 90. So Charulata is the winner.

8. c The ratio of points for carrying books of various subjects is:

Management : Mathematics : Physics : Fiction = 4 : 3 : 2 : 1

Since the points are to be maximized, the number of books that Ramesh should carry in descending order is management, mathematics, physics and fiction.

The ratio which Ramesh has to maintain is:

Management : Fiction < 1 : 2,

Mathematics : Physics < 1 : 2.

This means that a combination of management and fiction books in the ratio of 1 : 2 will give 6 points while a combination of mathematics and physics books in the ratio of 1 : 2 will give 7 points, hence, Ramesh should carry the following combination of books to maximize the points; management 1, mathematics 2, physics 5 and fiction 2, a total of 22 points.

9. b By trial and error, we can make different combinations and find the cost. Like 20 kg × 2 + 10 kg × 4, the cost would be Rs.180. The minimum cost comes in the case of 10 kg × 8, i.e. Rs.160.

10. c Sati-Savitri starts at the earliest.

So we view it first.

(1) Sati-Savitri — 9.00 a.m. to 10.00 a.m.

(2) Veer Abhimanu — 10.00 a.m. to 11.00 a.m.

(3) Jhansi Ki Rani/Sundar Kand — 11.00 a.m. to 11.30 a.m.

(4) Joru Ka Ghulam — 11.30 a.m. to 12.30 p.m.

Now lunch break from 12.30 p.m. to 1.30 p.m.

At 1.30 p.m. he can takes the show of only Jhansi Ki Rani so it cannot be viewed at 3rd.

(5) Jhansi Ki Rani — 1.30 p.m. to 2.00 p.m.

(6) Reshma aur Shera 2.00 p.m. to 3.00 p.m.

Hence, option (c) is best.

11. c Three children Vaibhav, Suprita and Anshuman.

Vaibhav > Suprita

↓

(Born in April)

One of children is born in September, but it is not Vaibhav, so it has to be Anshuman.

So Vaibhav is born in June and is 7-year-old. Vaibhav is 7-year-old and Anshuman is not 4-year-old.

So Suprita is 4-year-old.

Youngest child is 2-year-old and it has to be Anshuman.

Vaibhav > Suprita > Anshuman

(June, 7 years) (April, 4 years) (Sept., 2-year-old)

Hence, (c) is the answer.

12. b Let S = spotted, NS = Non-spotted

There are 50 coloured leaves and is given as red and non-red.

We make the following table. Let 2n be number of red oak leaves where n is any natural number.

Oak				Maple			
Red		Non-red		Red		Non-red	
S	NS	S	NS	S	NS	S	NS
2n	x	10n	0	6	x	0	22

Now we have 2n + x + 10n + 6 + x + 22 = 50

$\Rightarrow$ 12n + 2x = 22

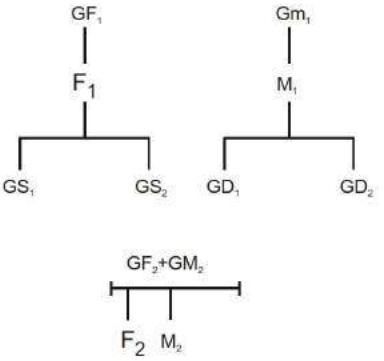
It is possible for only n = 1, x = 5

($\because$ n is not greater than 1)

Hence, number of oak leaves = 2 × 1 + 5 + 10 × 1

= 17

13. b



Thus, we have 2 grandfathers: GF_1, GF_2

4 fathers: GF_1, GF_2, F_1 and F_2

2 grandmothers: GM_1, GM_2

4 mothers: GM_1, GM_2, M_1 and M_2

Hence, minimum number will be 12.

14. b We have packages as follows:

3 item (D + 2B) = Rs.40 + Rs.180 = Rs.220 ... (i)

2 item (A + C) = Rs.180 ... (ii)

4 item (E + 2D + B) = 45 + 50 + 90 = Rs.215 ... (iii)

The combinations of purchase possible are:

Case 1: 220 × 4 = Rs.880

Points: 12 × 1000 – 120 × 1500 = – 1,68,000

Case 2: 180 × 5 = Rs.900

Points: 10 × 1000 – 100 × 1500 = – 1,40,000

Case 3: 215 × 4 = Rs.860

Points:16 × 1000 – 140 × 1500 = – 1,94,000

Case 4: 2(220 + 180) + 180 = Rs.980

Points: 12 × 1000 – 20 × 1500 = – 18,000

Case 5: 2(220 + 215) = Rs.890

Points : 14 × 1000 – 110 × 1500 = – 1,51,000

Case 6: 2(215 + 180) + 180 = Rs.970

Points :14 × 1000 – 30 × 1500 = – 31,000

By seeing the above figure, we see that we maximize the point in last case when purchase is 14 item for Rs.970.

15. b Bashir < Chirag.

Now Chirag borrows Rs. 300 and Bashir Rs. 100 from Ashok. Ashok buys 3 shirt so he must have at least Rs. 1,000.

Bashir is left with no money after buying a sweater and he had to borrow Rs.100 from Ashok which means he had Rs. 500 with him.

Ashok must have less than Rs. 1,500 and he has three times the money with Deepak.

So Deepak cannot have Rs. 300 because Ashok must have Rs.1,000. Again, Deepak cannot have Rs. 500 because Ashok should have less than Rs.1,500.

So Deepak has Rs. 400 for which he can purchase the shawl which is the costliest.

16. b AVOCADO paint is mixture of ORANGE and PINK in equal quantities.

If ORANGE is made using RED and YELLOW, then the cost of ORANGE would be $\frac{20+25}{2} = 22.5$ which is greater than the cost of the ORANGE.

If we make PINK by RED and WHITE, the cost of PINK would be $\frac{20+15}{2} = 17.5$ which is less than the cost of the PINK paint.

Hence, the cost of the AVOCADO is $\frac{22+17.5}{2} = 19.75$

17. d Mixing equal amounts of ORANGE and WHITE can make WASHEDORANGE, ORANGE can be made by mixing equal amounts of RED and YELLOW. So the ratio of RED, YELLOW and WHITE is 1 : 1 : 2

18. b If cost of AVOCADO paint is Rs.19.75

The cost of the CREAM is $\frac{7\times15+3\times75}{10} = \text{Rs. } 18$

And cost of WASHEDORANGE is Rs.18.50

So CREAM is the most profitable.

19. c It's given that the winner gets a final score of 220 and no participants gets more than 45 marks from any of the judges.

Bali cannot be the winner because even if he gets 45 marks from each of the judges A, C, D and E, he would be able to reach a final score of 217 only.

Shonali cannot be the winner because even if she gets 45 marks from each of the judges A, B, D and E, she would be able to reach a final score of 219 only.

Gaurav cannot be the winner as his final score is less than that of Shonali.

Let the final scores of Angad, Gaurav, Monica and Shonali be 'a', 'g', 'm' and 's' respectively.

Therefore, as per the given condition $\frac{a+g}{2} > \frac{m+s}{2}$.

Since 's' is greater than 'g', 'a' would be greater than 'm'. So Angad is the winner.

20. c Let the number of shares sold by Sajid and Hasan on Day 1 be 36x each.

Investment made by Sajid

= 375 × 18x + 250 × 18x = Rs. 11,250x.

Profit made by Sajid

= 750 × 18x + 625 × 18x – 375 × 18x – 250 × 18x

= Rs. 13,500x.

Sajid's Margin on Day 1 ≈ 54.5%.

Investment made by Hasan

= 225 × 36x = Rs. 8,100x.

Profit made by Hasan

= 375 × 16x + 300 × 20x – 225 × 36x

= Rs. 3,900x.

Hasan's Margin on Day 1 = 32.5%.

21. b **For Hasan:**

As the share price at 11:00 a.m. and 12:00 noon was Rs. 500 and Rs. 400 respectively, the number of shares sold by Hasan at 11:00 a.m. and 12:00 noon must be in the ratio 4 : 5 respectively. Let the number of shares sold by Hasan at 11:00 a.m. and 12:00 noon be 4x and 5x respectively.

Total sales amount = 500 × 4x + 400 × 5x

= Rs. 4,000x

Total investment in purchase

= 750 × 9x = Rs. 6,750x

$\text{Margin (loss)} = \frac{6750-4000}{4000} = 68.75\%$

For Sajid:

Let the total number of shares sold by Sajid at 9 a.m. and 10 a.m. be 2y.

Total sales amount

= 200 × y + 300 × y = Rs. 500y

Total investment in purchase = 500 × y + 625y

= Rs. 1,125y

$\text{Margin (loss)} = \frac{1125-500}{500} = 125\%$

Required ratio = 68.75 : 125 = 11 : 20

For questions 22 to 25 :

Number of eggs laid on each day

= Number of hens in the poultry farm

= 60.

Out of the eggs laid on each day, the number of eggs that got rotten is either 2 or 3 or 4.

Out of the eggs laid on each day, the number of eggs that got broken is either 4 or 5 or 6.

Maximum possible number of eggs taken to the market for sale on day 1

$= 60 - (2 + 4) = 54.$

Minimum possible number of eggs taken to the market for sale on day 1

$= 60 - (4 + 6) = 50.$

The minimum number of eggs that are left unsold each day must be 5, as the number of eggs that are rotten and broken among them needs to be an integer. It can be at max 10, since number of egg left unsold on any day is less than 20% of the number of eggs laid on each day, i.e. 20% of 60 = 12.

So, the number of eggs that are sold on day 1 ranges from (50 – 10 = 40) to (54 – 5 = 49), (both inclusive).

On the next day again 60 eggs are laid, so from the above logic the range of number of eggs sold should again come out to be from 42 to 49 (both inclusive), but there are eggs that remain unsold at the end of the previous day.

Minimum possible number of eggs that are left over from the previous day and are taken along with the eggs laid on a day to the market for sale

$= 5 - (40\% \text{ of } 5) - (2\% \text{ of } 5) = 2.$

Maximum possible number of eggs that are left over from the previous day and are taken along with the eggs laid on a day to the market for sale

$= 10 - (40\% \text{ of } 10) - (20\% \text{ of } 10) = 4.$

So, the range of number of eggs that are sold on day 2 varies from (40 + 2 = 42) to (49 + 4 = 53) (both inclusive) and this holds true for day 3, day 4 and day 5 also.

	Eggs Laid	Rotten	Broken	Sold	Unsold
Day 1	60	2 - 4	4 - 6	40 - 49	5 or 10
Day 2	60	2 - 4	4 - 6	42 - 53	5 or 10
Day 3	60	2 - 4	4 - 6	42 - 53	5 or 10
Day 4	60	2 - 4	4 - 6	42 - 53	5 or 10
Day 5	60	2 - 4	4 - 6	42 - 53	5 or 10

22. c The minimum possible number of eggs that were sold on day 4 can be 42.

42 eggs are sold in the scenorio when 10 eggs are left unsold.

So, the next day i.e. day 5, the minimum number of eggs that were sold can be calculated as

Out of the 60 eggs that were laid – maximum rotten and broken eggs can be removed which are 4 and 6 respectively. Thus, left with 50 eggs. Also, from the 10 eggs of the previous day maximum rotten and broken can be removed which are 4 and 2 respectively, thus left with 4 eggs only. So, out of the total 54 eggs, a maximum of only 10 eggs can be left unsold. Therefore, the minimum eggs that were sold on day 5 were 54 – 10 = 44.

Hence, aggregate sum of eggs is 42 + 44 = 86.

Note: Most of the students will make a mistake of considering 42 eggs for both the days but this is not possible on any two consecutive days simultaneously.

23. b Number of eggs that got rotten and broken is maximum possible.

So, assume that on each day 10 eggs remain unsold at the end of each day.

So, out of these 10 eggs that remain unsold at the end of each day, the number of eggs that get rotten and broken on the next day is 4 and 2 respectively.

The maximum number of eggs that got rotten and broken from among the eggs laid each day is 4 and 6 respectively.

So, the number of eggs that got broken across all the five days

$= 6 \times 5 + 2 \times 4 = 38.$

Number of eggs that got rotten across all the five days

$= 4 \times 5 + 4 \times 4 = 36.$

Required difference = 38 – 36 = 2.

24. a The maximum number of eggs that were left unsold at the end of the fifth day can be 10.

25. a The maximum number of eggs that were sold on day 1 can be 49, in a scenario when 5 eggs were left unsold. In this case, the maximum number of eggs that were sold on day 2 can be calculated as

60(laid on day 2) – 2 (minimum rotten out of 60) – 4 (minimum broken out of 60) + 5 (previous days unsold eggs) – 2(rotten out of 5) – 1(broken out of 5) – 5(minimum unsold) = 51

Since, on day 2 also, 5 eggs were left unsold the maximum number eggs sold on day 3 will again be 51. The same holds true for day 4 and day 5.

So, the maximum number of eggs that can be sold in the entire week can be 49 + 51 × 4 = 253.

Note: Most of the students will make a mistake of considering 53 eggs for any two consecutive days but this is not possible on any two consecutive days simultaneously.

Level - 3

26. b The initial water in bottles A, B and C are 5 L, 0 L and 0 L respectively.

First instruction. FILL (C, A) means that 2 litres is transferred from A to C (leaving 3 litres A, and C is full)

Third instruction FILL (C, A) again means some water is transferred from A to C.

After the third instruction, 1 litre of water is left in bottle A.

Option (a) is not possible because if it were executed, there would not be any water left in A for executing the third instruction of FILL(C,A).

Option (b) is possible because C is emptied out and when third instruction is followed, of the 3 litres left in A (at the end of first instruction), two litres are transferred to C leaving only 1 litre in A.

Option (c) can be eliminated because, there was no water in B.

Option (d) is not possible because had it been executed, there would not be any water left in A for executing the third instruction.

27. c The first four instructions are:

1st : FILL (C, A)

2nd : EMPTY (C, B)

3rd : FILL (C, A)

4th : DRAIN (A)

Fourth instruction drains off 1 liter from A and the quantities with A, B and C at the end of 3rd instruction is 1 L, 2 L and 2 L respectively.

Amount of water in the system after 4th instruction = 5 – 1 = 4 L

If at the end of the 6th instruction, all the 4 L are in A, then B and C will definitely be empty.

For questions 28 to 33:

As only Paul Erdös was having an Erdös number of zero, so the minimum Erdös number among A, B, C, D, E, F, G, H should be 1 or greater than one. At the end of the third day, F co-authored a paper with A and C. F had the minimum Erdös number among the 8 people. So if F's Erdös number is y, then A and C's Erdös number should change to (y + 1) after third day. As A and C decreased the average by maximum possible extent, it means C had the second-height Erdös number among all eight, as A had an Erdös number of infinity. Suppose Erdös numbers of A, B, C, D, E, F, G, H are y + 1, b, y + 1, c, d, e, y, g, h respectively at the end of third day.

$\therefore$ (y + 1 + b + y + 1 + c + d + e + y + g + h) = 24 = (3 × 8)

$\Rightarrow$ 3y + 2 + b + d + e + g + h = 24

When E co-authored with F, the average Erdös number reduced again, it means, E's Erdös number was not the same with A & C initially. As at the end of third day, 5 people had same Erdös number, they should be A, C and any 3 out of B, D, G, H. Suppose those 3 people are B, D, G. Then

(3y + 2 + y + 1 + y + 1 + y + 1 + e + h) = 24

$\Rightarrow$ 6y + h + e = 19 ...(i)

On the fifth day, E co-authored a paper with F and hence, Erdös number of E changed to (y + 1). Also the average decreased by 0.5 which means the total decreased by 4.

Hence, e - (y + 1) = 4

$\Rightarrow$ e – y = 5

Putting the value of e in equation (i), we get

6y + h + (5 + y) = 19

$\Rightarrow$ 7y + h = 14

Only possible value of y = 1 as h cannot be zero.

So after 3rd round Erdös number of A, C, E, F were 2, 2, 6, 1 respectively.

28. d Only A, C, E changed their Erdös number, rest 5 did not change their Erdös number.

29. b At the end of conference 6 people including E were having an Erdös number of 2 and F was having 1 as Erdös number. So 8th person was having an Erdös number of [20 – (2 × 6 + 1)] = 7

30. b At the end of 3rd round, 5 people were having same Erdös number. A and C changed their Erdös number after coauthoring with F. So, the other 3 will have same Erdös number in the beginning.

31. b 2

32. c After co-authoring with F, E was having Erdös number of 2, which was 4 less than initial Erdös number of E. So answer is 2 + 4 = 6.

33. a A bus to Uttam Nagar departs after every 15 min.

One of the buses to Mehrauli leaves after every 10 min.

Other bus to Mehrauli can leave after every 12 min or 20 min

Let us assume bus on route no. 427 leaves after every 10 min between 9:00 a.m & 10:00 a.m i.e. at 9:00, 9:10, 9:20, 9:30, 9:40, 9:50 and 10:00 a.m.

12 min

If timings of buses plying after 12 & 10 min clash then the bus plying after every 12 min will go.

If timings of any of the buses plying after 12 min coincides with departure time of 427 then the next bus timings will clash only after 60 min(LCM of 12 & 10)

So maximum of 1 bus timings can clash with route no. 427 in a given hour.

Hence, a minimum 7 – 1= 6 buses on route 427 can depart in an hour.

20 min

If timings of buses plying after 20 & 10 min clash then the bus plying after every 20 min will go.

If timings of any of the bus plying after 20 min coincides with departure time of 427 then the next bus timings will clash again after 20 min(LCM of 20 & 10)

If the timings of two buses clash at 9:00 AM then timings will again clash at 9:20, 9:40 and 10:00

Hence, a minimum 7 – 4 = 3 buses on route 427 can depart in an hour.

34. c If frequency of all buses increases by 5 min then new time intervals become 5, 5, 7, 10, 15 and 25 min.

So now one of the bus to Mehrauli departs after every 5 min. The Other bus can depart after every 7 min or 15 min.

The minimum time difference between buses plying after 5 and 7 min can be 1 min (GCD of 5 and 7).

35. d The difference in time intervals between a particular bus to Mehrauli and Uttam Nagar is same as the difference in time intervals between two buses plying towards Uttam Nagar.

Hence, time intervals between Buses for Mehrauli and Uttam Nagar can only be:

Mehrauli – 10 and 12 / 20

Uttam Nagar – 15 and 10 / 20

So the time interval between two different routes to Uttam Nagar is always a multiple of 5.

36. a If condition (iii) is waved off then there can be possibility of 3 buses plying to Uttam Nagar. Then 3 buses to Uttam Nagar can ply between intervals 10,12 and 15 mins or between intervals of 10,15,20 mins.

So the minimum time interval can be in the first case i.e. when 3 buses ply after an interval of 10, 12, 15 mins.

Minimum difference between time interval

= 12 – 10 = 2 minute.

■■