AVERAGES

3

THEORY

For any group of numbers we are given, we are often interested in finding the value of the central tendency of the group of numbers. Statistics provides us with three basic measures of the central tendency for any group of numbers- These are: Mean (also referred to as Arithmetic Mean), Median and Mode. Let us take a look at the definitions for all these three measures of central tendency:

1. **Arithmetic Mean** (also referred to as Mean or Average):

$$\text{Arithmetic Mean} = \frac{\textit{Sum of the given numbers}}{\textit{Number of numbers}} = \frac{\textit{Sum}}{n}$$

This formula has three variants in which it is normally used –the first of it is what you see above. This is used obviously when you are given (or can find) the value of the sum of the numbers and also know the number of numbers. For example, consider the following statements, which you would come across regularly in this chapter: 'The sum of 8 numbers is 96'. 'A batsman has scored 1240 runs in 80 innings.' ' 40 children in a class have scored a total of 800 marks in an examination'. In each of these cases, you would use the $\text{Average} = \frac{\textit{Sum}}{n}$ formula. Thus, we would have: 1240/80 = 15.5; 800/40 = 20 as the calculated averages in the above two cases.

Consider the following statements: 'The average age of 12 students is 20 years.' 'The average reading in seven experiments is 22.1 grams.' 'A batsman has an average of 55 runs per innings in 6 innings.' In each of these cases, we will use the: $Sum = n \times average$ formula. Thus, we would have: The sum total of ages of the 12

students in the first example as 12 × 20 = 240; the sum total of the seven readings would be: 7 × 22.1 = 154.7; total runs scored by the batsman = 55 × 6 = 330.

The third variant in which form this formula is used is $n = \frac{Sum}{Average}$. This is used if we are provided information like: 'A class of students scored a total of 800 marks with an average score of 40 marks per student.' With information of this kind, we can work out the number of students in the class using 800/40 = 20.

2. **Median:** The median is the number that has the central value in the group of numbers whose central tendency we are looking for.

   Thus, for example if we have a group of numbers like 13, 22, 34, 54, 72. In this case, since 34 has the middle value for this group of numbers, the median of this group would be 34. In cases, where there are two middle values, we take the average of the two middle values to identify the value of the median.

   For example: The median of: 3, 5, 6 and 10, would be the average of 5 and 6 = 5.5.

Note: While the median is a well accepted measure of central tendency, its effectiveness is restricted to situations where the group of numbers has an evenly distributed nature. For skewed data sets, the median would not be a very good measure of central tendency. Thus, if my group of numbers is: 3, 5, 6, 88, 113. My median would be 6 and as you can yourself understand, 6 is not a good measure of central tendency here. Hence, in real life estimations one should use the median with some caution and only for appropriate situations.

3. **Mode:** This is the third measure of central tendency and is defined as the maximum occurring number in a group of numbers. For instance, if we are looking at a situation where we are taking several readings of the time-period of a pendulum –we might be interested at which is the reading that is happening most commonly. Thus, if the readings in seconds were 7, 7.1, 7.1, 7.3, 7.5, 7.1, 7.2, 6.9, 7, 6.8, 7.4; in this situation the most commonly occurring reading is 7.1 since it has occurred three times. Hence, the mode of this group would be 7.1.

   Again as you can visualise, the effectiveness of the mode as a measure of central tendency for a group of numbers is limited –and you should only use it for situations where it might be logically relevant to use the mode.

   All said and done, the arithmetic mean is the most effective measure of central tendency and hence also the most commonly and widely used one in real-life statistical situations.

Let us get our focus back on this again now:

Simple Averages versus Weighted Averages:

If you have to find the average of three numbers, say 20,30 and 70, you can find the average using sum of the numbers divided by 3. So, the average would be $\frac{20+30+70}{3} = 40$

However, consider the following situations:

(a) You go to a shop and purchase three varieties of rice 1 kg @20₹/kg, 2 kgs @30 ₹/kg and 7 kgs @70 ₹/kg. What would be the average price for a kilogram of rice you purchased?

(b) You drive your car for 1 hour @20 kmph, 2 hours @30 kmph and 7 hours @ 70 kmph. What would be your average speed?

(c) You mix three varieties of milk –water mixtures as follows: 1 litre containing 20% milk, 2 litres containing 30% milk and 7 litres containing 70% milk. What would be your percentage concentration of milk in the mixture?

(d) You make three investments that yield a different return: 1 lac with a return of 20%, 2 lacs with a return of 30% and 7 lacs with a return of 70%. What would be the average return on the total investment?

For each of these cases, the simple average calculation of $\frac{20+30+70}{3}$ would be incorrect. The reason is that in each of these cases, the correct logic to apply would be the logic of the weighted average. Let's first take a look at weighted averages:

When we have two or more groups whose individual averages are known, then to find the combined average of all the elements of all the groups, we use weighted average. Thus, if we have k groups with averages $A_1, A_2 \ldots A_k$ and having $n_1, n_2 \ldots n_k$ elements then the weighted average is given by the formula:

$$\text{Aw} = \frac{n_1 A_1 + n_2 A_2 + n_3 A_3 + \ldots + n_k A_k}{n_1 + n_2 + n_3 + \ldots + n_k}$$

Thus, for each of the above cases, the average we are looking for would be given by:

$$Average = \frac{1\times20+2\times30+7\times70}{10} = \frac{570}{10} = 57$$

Thus, for each of the above cases, the average we are looking for would be given by:

$$Average = \frac{1\times20+2\times30+7\times70}{10} = \frac{570}{10} = 57$$

An important point to note: Suppose you bought 37 kgs of rice @ 50 ₹/kg and 74 kgs of rice @ 80 ₹/kg. In such a case, the weighted average would be calculated normally as:

Average = $\frac{37\times50+74\times80}{37+74}$ = 70. However, a much simpler way to do this would be:

Average = $\frac{1\times50+2\times80}{1+2}$ = 70.

What have we done here and how is the answer the same? Well, we have replaced 37 and 74 by 1 and 2, i.e. we have replaced the weights with the ratio of the weights.

So, one should realise that in the formula for weighted averages, we have to use the ratio of the weights and not the actual weights. Always keep an eye open for this, whenever you are solving any weighted average question.

Another Meaning of Average The average [also known as *arithmetic mean* (AM)] of a set of numbers can also be defined as the number by which we can replace each and every number of the set without changing the total of the set of numbers.

Property 1: The average of 4 numbers 12, 13, 17 and 18 is:

Solution: Required average = (12 + 13 + 17 + 18)/4 = 60/4 = 15

This means that if each of the 4 numbers of the set were replaced by 15 each, there would be no change in the total.

This is an important way to look at averages. In fact, whenever you come across any situation where the average of a group of '*n*' numbers is given, you

should visualise that there are 'n' numbers, each of whose value is the average of the group. This view is a very important way to visualise averages.

This can be visualised as

$$\begin{array}{l} 12 \rightarrow +3 \rightarrow 15 \\ 13 \rightarrow +2 \rightarrow 15 \\ 17 \rightarrow -2 \rightarrow 15 \\ \underline{18 \rightarrow -3 \rightarrow 15} \\ 60 \rightarrow +0 \rightarrow 60 \end{array}$$

Property 2: In Example 1, visualise addition of a fifth number, which increases the average by 1.

$$\begin{array}{l} 15 + 1 = 16 \\ 15 + 1 = 16 \\ 15 + 1 = 16 \\ 15 + 1 = 16 \end{array}$$

The +1 appearing 4 times is due to the fifth number, which is able to maintain the average of 16 first and then 'give one' to each of the first 4.

Hence, the fifth number in this case is 20.

Property 3: The average always lies above the lowest number of the set and below the highest number of the set.

Property 4: The net deficit due to the numbers below the average always equals the net surplus due to the numbers above the average.

Property 5: *Ages and averages:* If the average age of a group of persons is x years today then after n years their average age will be $(x + n)$.

Also, n years ago their average age would have been $(x - n)$. This happens due to the fact that for a group of people, 1 year is added to each person's age every year.

WORKED-OUT PROBLEMS

Problem 3.1 The average of a batsman after 25 innings was 56 runs per innings. If after the 26th inning, his average increased by 2 runs, then what was his score in the 26th inning?

Solution *Normal process:*

Runs in 26th inning = Runs total after 26 innings − Runs total after 25 innings

$$= 26 \times 58 - 25 \times 56$$

For mental calculation use:

$$(56 + 2) \times 26 - 56 \times 25$$

$$= 2 \times 26 + (56 \times 26 - 56 \times 25)$$

$$= 52 + 56 = 108$$

Short Cut Since the average increases by 2 runs per innings it is equivalent to 2 runs being added to each score in the first 25 innings. Now, since these runs can only be added by the runs scored in the 26th inning, the score in the 26th inning must be 25 × 2 = 50 runs higher than the average after 26 innings (i.e. new average = 58).

Hence, runs scored in 26th inning = new average + old innings × change in average

$$= 58 + 25 \times 2 = 108$$

Visualise this as:

Average in first 25 innings	Average after 26 innings
56	58
56	58
56	58
...	...
...	...
25 times...	26 times...

Difference in total is two, 25 times and 58 once, that is, $58 + 25 \times 2$.

Problem 3.2 The average age of a class of 30 students and a teacher reduces by 0.5 years, if we exclude the teacher.

If the initial average is 14 years, find the age of the class teacher.

Solution *Normal process:*

Age of teacher = Total age of (students + teacher)

$$-\text{Total age of students}$$

$$= 31 \times 14 - 30 \times 13.5$$

$$= 434 - 405$$

$$= 29 \text{ years}$$

Short Cut The teacher after fulfilling the average of 14 (for the group to which he belonged) is also able to give 0.5 years to the age of each of the 30 students. Hence, he has $30 \times 0.5 \rightarrow 15$ years to give over and above maintaining his own average age of 14 years.

$$\text{Age of teacher} = 14 + 30 \times 0.5 = 29 \text{ years}$$

Note: This problem should be viewed as change of average from 13.5 to 14 when teacher is included.

Problem 3.3 The average marks of a group of 20 students on a test is reduced by 4 when the topper who scored 90 marks is replaced by a new student. How many marks did the new student have?

Solution *Normal process:*

Let initial average be x.

Then the initial total is $20x$

New average will be $(x - 4)$ and the new total will be $20(x - 4) = 20x - 80$.

The reduction of 80 is created by the replacement.

Hence, the new student has 80 marks less than the student he replaces. Hence, he must have scored 10 marks.

Short Cut The replacement has the effect of reducing the average marks for each of the 20 students by 4. Hence, the replacement must be $20 \times 4 = 80$ marks below the original.

Hence, answer = 10 marks.

Problem 3.4 The average marks of 3 students *A*, *B* and *C* is 48 marks. Another student *D* joins the group and the new average becomes 44 marks. If another student *E*, who has 3 marks more than *D*, joins the group, the average of the 4 students *B*, *C*, *D* and *E* becomes 43 marks. Find how many marks *A* got in the exam.

Solution Solve while reading. The first sentence gives you a total of 144 for *A*, *B* and *C*'s marks. *Second sentence*: When *D* joins the group, the total becomes $44 \times 4 = 176$. Hence *D* must get 32 marks.

Alternatively, you can reach this point by considering the first 2 statements together as:

D's joining the group reduces the average from 48 to 44 marks (i.e., 4 marks).

This means that to maintain the average of 44 marks, *D* has to take 4 marks from *A*, 4 from *B* and 4 from $C \rightarrow A$ total of 12 marks. Hence, he must have got 32 marks.

From here:

The first part of the third sentence gives us information about *E* getting 3 marks more than 32. Hence, *E* gets 35 marks.

Now, it is further stated that when *A* is replaced by *E*, the average marks of the students reduces by 1 to 43.

Mathematically, this can be shown as

$A + B + C + D = 44 \times 4 = 176$ while, $B + C + D + E$

$= 43 \times 4 = 172$

Subtracting the two equations, we get $A - E = 4$ marks.

Hence, A would have obtained 39 marks.

Alternatively, you can think of this as:

The replacement of A with E results in the reduction of 1 mark from each of the 4 people who belong to the group. Hence, the difference is 4 marks. Hence, A would get 4 marks more than E i.e., A gets 39 marks.

Problem 3.5 The mean temperature of Monday to Wednesday was 27 °C and of Tuesday to Thursday was 24 °C. If the temperature on Thursday was 2/3rd of the temperature on Monday, what was the temperature onThursday?

Solution From the first sentence, we get that the total from Monday to Wednesday was 81 while from Tuesday to Thursday was 72. The difference is arising out of the replacement of Monday by Thursday.

This can be mathematically written as

$$\text{Mon} + \text{Tue} + \text{Wed} = 81 \quad (1)$$

$$\text{Tue} + \text{Wed} + \text{Thu} = 72 \quad (2)$$

Hence, $\text{Mon} - \text{Thu} = 9$

We have two unknown variables in the above equation. To solve for 2 unknowns, we need a new equation. Looking back at the problem, we get the equation:

$$\text{Thu} = (2/3) \times \text{Mon}$$

Solving the two equations we get: Thursday = 18°C.

However, in the exam, you should avoid using equation-solving as much as possible. You should, ideally, be able to reach half way through the solution during the first reading of the question, and then meet the gap through the use of options.

The answer to this problem should be obtained by the time you finish reading the question for the first time.

Thus, suppose we have the equations:

$M - T = 9$ and $T = 2M/3$ or $T/M = 2/3$ and have the options for T as

(a) 12

(b) 15

(c) 18

(d) 27

To check which of these options is the appropriate value, we need to check one by one.

Option (a) gives $T = 12$, then we have $M = 21$. But $12/21 \neq 2/3$. Hence, this is not the correct option.

Option (b) gives $T = 15$, then $M = 24$. But again $15/24 \neq 2/3$. Hence, this is not the correct option.

Option (c) gives $T = 18$, then $M = 27$. Now $18/27 = 2/3$. Hence, this is the correct option.

So we no longer need to check for option (d).

However, if we had checked for option (d) then $T = 27$, so $M = 36$. But again $27/36 \neq 2/3$. Hence, this is not the correct option.

In the above, we used 'solving-while-reading' and 'option-based' approaches.

These two approaches are very important and by combining the two, you can reach amazing speeds in solving the question.

You are advised to practice both these approaches while solving questions, which will surely improve your efficiency and speed. You will see that, with practice, you will be able to arrive at the solution to most of the LOD I problems (given later in this chapter) even as you finish reading the questions. And since it is the

LOD I level problems that appear in most examinations (like IIFT, SNAP, NMAT, CLAT, CET, BANK PO, SSC, BBA/BMS entrance etc.), you will gain a significant advantage in solving these problems.

On LOD II, LOD III and CAT-type problems, you will find that using solving-while-reading and option-based approaches together would take you through anywhere between 30 and 70% of the question by the time you finish reading the question for the first time.

This will give you a tremendous time advantage over the other students appearing in the examination.

Problem 3.6 A person covers half his journey by train at 60 kmph, half of the remainder by bus at 30 kmph and the rest by cycle at 10 kmph. Find his average speed during the entire journey.

Solution Assume the total distance to be 120 kms. Then the distances traveled by train bus and cycle are 60,30 and 30 respectively. Using the formula: Average speed = Total Distance/Total time

$$\text{we get: } \frac{120}{(1+1+3)} = \frac{120}{5} = 24 \text{ km/h.}$$

Problem 3.7 A school has only 3 classes that contain 10, 20 and 30 students, respectively. The pass percentage of these classes are 20%, 30% and 40% respectively. Find the pass percentage of the entire school.

Solution

$$\text{Using weighted average: } \frac{10\times 0.2 + 20\times 0.3 + 30\times 0.4}{10+20+30} = \frac{20}{60} = 33.33\%$$

Alternatively, we can also use solving-while-reading as

Recognise that the pass percentage would be given by

$$\frac{\text{Passed students}}{\text{Total students}}$$

As soon as you get into the second line of the question, get back to the first sentence and get the total number of passed students = 2 + 6 + 12 and you are through with the problem.

LEVEL OF DIFFICULTY (I)

1. The average age of 24 students and the principal is 15 years. When the principal's age is excluded, the average age decreases by 1 year. What is the age of the principal?

   (a) 38

   (b) 40

   (c) 39

   (d) 37

2. The average weight of 3 men A, B and C is 84 kg. Another man D joins the group and the average now becomes 80 kg. If another man E, whose weight is 3 kg more than that of D, replaces A then the average weight of B, C, D and E becomes 78 kg. The weight of A is

   (a) 70 kg

   (b) 72 kg

   (c) 79 kg

   (d) 78 kg

3. The mean temperature of Monday to Wednesday was 37 °C and of Tuesday to Thursday was 34 °C. If the temperature on Thursday was 4/5 that of Monday, the temperature on Thursday was

(a) 38 °C

(b) 36 °C

(c) 40 °C

(d) 39 °C

4. Three years ago, the average age of *A*, *B* and *C* was 27 years and that of *B* and *C* five years ago was 20 years. *A*'s present age is

   (a) 30 years

   (b) 35 years

   (c) 40 years

   (d) 48 years

5. Ajit Tendulkar has a certain average for 9 innings. In the tenth inning, he scores 100 runs thereby increasing his average by 8 runs. His new average is

   (a) 20

   (b) 24

   (c) 28

   (d) 32

6. The average of the first five multiples of 7 is

   (a) 20

   (b) 21

   (c) 28

   (d) 30

7. There are three fractions A, B and C. If $A = \frac{1}{4}$ and $B = 1/6$ and the average of A, B and C is $1/12$. What is the value of C?

   (a) $-1/2$

   (b) $-1/6$

   (c) $-1/3$

   (d) $-1/4$

8. The marks obtained by Hare Rama in Mathematics, English and Biology are respectively 93 out of 100, 78 out of 150 and 177 out of 200. Find his average score in percent.

   (a) 87.83

   (b) 86.83

   (c) 76.33

   (d) 77.33

9. The average monthly expenditure of a family was ₹2750 for the first 3 months, ₹3150 for the next three months and ₹6750 for the next three months. Find the average income of the family for the 9 months, if they save ₹650 per month.

   (a) 4866.66

   (b) 5123.33

   (c) 4666.66

   (d) 4216.66

10. The average age of a family of 6 members is 22 years. If the age of the youngest member be 7 years, what was the average age of the family at the birth of the youngest member? (Just before the brith of the youngest member)

    (a) 15

    (b) 18

    (c) 21

    (d) 12

11. The average age of 8 persons in a committee is increased by 2 years when two men aged 35 years and 45 years are substituted by two women. Find the average age of the two women.

    (a) 48

    (b) 45

    (c) 51

    (d) 42

12. The average temperature for Wednesday, Thursday and Friday was 40 °C. The average for Thursday, Friday and Saturday was 41 °C. If the temperature on Saturday was 42 °C, what was the temperature on Wednesday?

    (a) 39 °C

    (b) 44 °C

    (c) 38 °C

    (d) 41 °C

13. The speed of the train in going from Nagpur to Allahabad is 100 km/hr while when coming back from Allahabad to Nagpur, its speed is 150 km/hr. Find the average speed during the whole journey.

    (a) 125

    (b) 75

    (c) 135

    (d) 120

14. The average weight of a class of 29 students is 40 kg. If the weight of the teacher be included, the average rises by 500 gm. What is the weight of the teacher?

    (a) 40.5 kg

    (b) 50.5 kg

    (c) 45 kg

    (d) 55 kg

15. The average of 3 numbers is 17 and that of the first two is 16. Find the third number.

    (a) 15

    (b) 16

    (c) 17

    (d) 19

16. The average weight of 19 men in a ship is increased by 3.5 kg when one of the men, who weighs 79 kg, is replaced by a new man. Find the weight of the new man upto 2 decimal places.

    (a) 105.75

    (b) 107.55

    (c) 145.50

    (d) 140.50

17. The age of Shaurya and Kauravki is in the ratio 2 : 6. After 5 years, the ratio of their ages will become 6 : 8. Find the average of their ages after 10 years.

    (a) 12

    (b) 13

    (c) 17

    (d) 24

18. Find the average of the first 97 natural numbers.

    (a) 47

    (b) 37

    (c) 48

    (d) 49

19. Find the average of all prime numbers between 30 and 50.

    (a) 39.8

    (b) 38.8

    (c) 37.8

    (d) 41.8

20. If we take four numbers, the average of the first three is 16 and that of the last three is 15. If the last number is 18, the first number is

    (a) 20

    (b) 21

    (c) 23

    (d) 25

21. The average of 5 consecutive numbers is n. If the next two numbers are also included, the average will.

    (a) increase by 1

    (b) remain the same

    (c) increase by 1.4

    (d) increase by 2

22. The average of 50 numbers is 38. If two numbers, 45 and 55 are discarded, the average of the remaining numbers is

    (a) 36.5

(b) 37

(c) 37.6

(d) 37.5

23. The average of ten numbers is 7. If each number is multiplied by 12, then the average of the new set of numbers is

(a) 7

(b) 19

(c) 82

(d) 84

24. In a family of eight males and a few ladies, the average monthly consumption of grain per head is 10.8 kg. If the average monthly consumption per head be 15 kg in the case of males and 6 kg in the case of females, find the number of females in the family.

(a) 8

(b) 7

(c) 9

(d) 15

25. Average marks obtained by a student in three papers is 52 and in the fourth paper, he obtains 60 marks. Find his new average.

(a) 54

(b) 52

(c) 55

(d) 53.5

26. The average earning of Shambhu Nath Pandey for the initial three months of the calendar year 2002 is ₹1200. If his average earning for the second and third month is ₹1300, find his earning in the first month.

(a) ₹900

(b) ₹1100

(c) ₹1000

(d) ₹1200

27. In a hotel where rooms are numbered from 101 to 130, each room gives an earning of ₹3000 for the first fifteen days of a month and for the latter half, ₹2000 per room. Find the average earning per room per day over the month. (Assume 30 day in a month)

(a) ₹2250

(b) ₹2500

(c) ₹2750

(d) ₹2466.66

28. The average weight of five men is decreased by 3 kg when one of them weighing 150 kg is replaced by another person. Find the weight of the new person.

(a) 165 kg

(b) 135 kg

(c) 138 kg

(d) 162 kg

29. The average age of a group of men is increased by 5 years when a person aged 18 years is replaced by a new person of aged 38 years. How many men are there in the group?

(a) 3

(b) 4

(c) 5

(d) 6

30. The average score of a cricketer in three matches is 22 runs and in two other matches, it is 17 runs. Find the average in all the five matches.

(a) 20

(b) 19.6

(c) 21

(d) 19.5

31. The average of thirteen papers is 40. The average of the first seven papers is 42 and of the last seven papers is 35. Find the marks obtained in the seventh paper.

(a) 23

(b) 38

(c) 19

(d) 39

32. The average age of the Indian cricket team playing the Nagpur test is 30. The average age of five of the players is 27 and that of another set of five players, totally different from the first five, is 29. If it is the captain who was not included in either of these two groups, then find the age of the captain.

(a) 75

(b) 55

(c) 50

(d) 58

33. Siddhartha has earned an average of 4200 dollars for the first eleven months of the year. If he justifies his staying on in the US on the basis of his ability to earn at least 5000 dollars per month for the entire year, how much should he earn (in dollars) in the last month to achieve his required average for the whole year?

(a) $14,600

(b) $5,800

(c) $12,800

(d) $13,800

34. A bus goes to Ranchi from Patna at the rate of 60 km per hour. Another bus leaves Ranchi for Patna at the same time as the first bus at the rate of 70 km per hour. Find the average speed for the journeys of the two buses combined if it is known that the distance from Ranchi to Patna is 420 kilometers.

(a) 64.615 kmph

(b) 64.5 kmph

(c) 63.823 kmph

(d) 64.82 kmph

35. A train travels 8 km in the first quarter of an hour, 6 km in the second quarter and 40 km in the third quarter. Find the average speed of the train per hour over the entire journey.

(a) 72 km/h

(b) 18 km/h

(c) 77.33 km/h

(d) 78.5 km/h

36. The average weight of six men is 68.5 kg. If it is known that Ram and Tram weigh 60 kg each, find the average weight of the others.

(a) 72.75 kg

(b) 75 kg

(c) 78 kg

(d) 80 kg

37. The average score of a class of fourty students is 52. what will be the average score of the rest of the students if the average score of ten of the students is 61.

(a) 50

(b) 47

(c) 48

(d) 49

38. The average age of 80 students of IIM, Bangalore of the 1995 batch is 22 years. What will be the new average if we include the 20 faculty members whose average age is 37 years?

    (a) 32 years

    (b) 24 years

    (c) 25 years

    (d) 26 years

39. Out of three numbers, the first is twice the second and thrice the third. The average of the three numbers is 88. The smallest number is

    (a) 72

    (b) 36

    (c) 42

    (d) 48

40. The sum of three numbers is 98. If the ratio between the first and second is 2 : 3 and that between the second and the third is 5 : 8, then the second number is

    (a) 30
    (b) 20

    (c) 58

    (d) 48

41. The average height of 30 girls out of a class of 40 is 160 cm and that of the remaining girls is 156 cm. The average height of the whole class is

(a) 158 cm

(b) 158.5 cm

(c) 159 cm

(d) 157 cm

42. The average weight of six persons is increased by 2.5 kg when one of them whose weight is 50 kg is replaced by a new man. The weight of the new man is

(a) 65 kg

(b) 75 kg

(c) 76 kg

(d) 60 kg

43. The average age of three boys is 15 years. If their ages are in the ratio 3 : 5 : 7, the age of the youngest boy is

(a) 21 years

(b) 18 years

(c) 15 years

(d) 9 years

44. The average age of A, B, C and D five years ago was 45 years. By including X, the present average age of all the five is 49 years. The present age of X is

(a) 64 years

(b) 48 years

(c) 45 years

(d) 40 years

45. The average salary of 20 workers in an office is ₹ 1900 per month. If the manager's salary is added, the average salary becomes ₹2000 per month. What is the manager's annual salary?

(a) ₹24,000

(b) ₹25,200

(c) ₹45,600

(d) None of these

46. If a, b, c, d and e are five consecutive odd numbers, then their average is

(a) $5(a + b)$

(b) $(a\ b\ c\ d\ e)/5$

(c) $5(a + b + c + d + e)$

(d) none of these

47. The average of first five multiples of 3 is

(a) 3

(b) 9

(c) 12

(d) 15

48. The average weight of a class of 40 students is 40 kg. If the weight of the

teacher be included, the average weight increases by 500 g. The weight of the teacher is

(a) 40.5 kg

(b) 60 kg

(c) 62 kg

(d) 60.5 kg

49. In a management entrance test, a student scores 2 marks for every correct answer and loses 0.5 marks for every wrong answer. A student attempts all the 100 questions and scores 120 marks. The number of questions he answered correctly was

(a) 50

(b) 45

(c) 60

(d) 68

50. The average age of four children is 8 years, which is increased by 4 years when the age of the father is included. Find the age of the father.

(a) 32

(b) 28

(c) 16

(d) 24

51. The average of the first ten natural numbers is

(a) 5

(b) 5.5

(c) 6.5

(d) 6

52. The average of the first ten whole numbers is

(a) 4.5

(b) 5

(c) 5.5

(d) 4

53. The average of the first ten even numbers is

(a) 18

(b) 22

(c) 9

(d) 11

54. The average of the first ten odd numbers is

(a) 11

(b) 10

(c) 17

(d) 9

55. The average of the first ten prime numbers is

(a) 15.5

(b) 12.5

(c) 10

(d) 12.9

56. The average of the first ten composite numbers is

(a) 12.9

(b) 11

(c) 11.2

(d) 10

57. The average of the first ten prime numbers, which are odd, is

(a) 12.9

(b) 13.8

(c) 17

(d) 15.8

58. The average weight of a class of 30 students is 40 kg. If, however, the weight of the teacher is included, the average becomes 41 kg. The weight of the teacher is

(a) 31 kg

(b) 62 kg

(c) 71 kg

(d) 70 kg

59. Ram bought two toys for ₹5.50 each, three toys for ₹3.66 each and six toys for ₹1.833 each. The average price per toy is

(a) ₹3

(b) ₹10

(c) ₹5

(d) ₹9

60. Thirty oranges and 75 apples were purchased for ₹510. If the price per apple was ₹2, then the average price of oranges was

(a) ₹12

(b) ₹14

(c) ₹10

(d) ₹15

61. The average income of Sambhu and Ganesh is ₹3,000 and that of Arun and Vinay is ₹500. What is the average income of Sambhu, Ganesh, Arun and Vinay?

(a) ₹1750

(b) ₹1850

(c) ₹1000

(d) ₹2500

62. A batsman made an average of 40 runs in four innings, but in the fifth inning, he was out on zero. What is the average after fifth inning?

(a) 32

(b) 22

(c) 38

(d) 49

63. The average weight of 40 teachers of a school is 80 kg. If, however, the weight of the principal be included, the average decreases by 1 kg. What is the weight of the principal?

(a) 109 kg

(b) 29 kg

(c) 39 kg

(d) none of these

64. The average temperature of 1, 2 and 3 December was 24.4 °C. The average temperature of the first two days was 24 °C. The temperature on the 3 December was

(a) 20 °C

(b) 25 °C

(c) 25.2 °C

(d) none of these

65. The average age of Ram and Shyam is 20 years. Their average age 5 years hence will be

(a) 25 years

(b) 22 years

(c) 21 years

(d) 20 years

66. The average of 20 results is 30 and that of 30 more results is 20. For all the results taken together, the average is

(a) 25

(b) 50

(c) 12

(d) 24

67. The average of five consecutive natural numbers is 18. The highest of these numbers will be

(a) 24

(b) 18

(c) 20

(d) 22

68. The average of six students is 11 years. If two more students of age 14 and 16 years join, their average will become

(a) 12 years

(b) 13 years

(c) 21 years

(d) 19 years

69. The average of eight numbers is 12. If each number is increased by 2, the new average will be

(a) 12

(b) 14

(c) 13

(d) 15

70. Three years ago, the average age of a family of five members was 17 years. A baby having been born, the average of the family is the same today. What is the age of the baby?

(a) 1 year
(b) 2 years

(c) 6 months

(d) 9 months

71. Sambhu's average daily expenditure is ₹10 during May, ₹14 during June and ₹15 during July. His approximate daily expenditure for the three months is

(a) ₹13 approximately

(b) ₹12

(c) ₹12 approximately

(d) ₹10

72. A ship sails out to a mark at the rate of 15 km/h and sails back at the rate of 20 km/h. What is its average rate of sailing?

(a) 16.85 km/h

(b) 17.14 km/h

(c) 17.85 km/h

(d) 18 km/h

73. The average temperature on Monday, Tuesday and Wednesday was 41 °C and on Tuesday, Wednesday and Thursday, it was 40 °C. If on Thursday, it was exactly 39 °C, then on Monday, the temperature was

(a) 42 °C

(b) 46 °C

(c) 23 °C

(d) 26 °C

74. The average of 20 results is 30 out of which the first 10 results are having an average of 10. The average of the rest 10 results is

(a) 50

(b) 40

(c) 20

(d) 25

75. A man had seven children. When their average age was 12 years, a child aged 6 years died. The average age of the remaining six children is

(a) 6 years

(b) 13 years

(c) 17 years

(d) 15 years

76. The average income of Ram and Shyam is ₹200. The average income of Rahul and Rohit is ₹250.The average income of Ram, Shyam, Rahul and Rohit is

(a) ₹275

(b) ₹225

(c) ₹450

(d) ₹250

77. The average weight of 35 students is 35 kg. If the teacher is also included, the average weight increases to 36 kg. The weight of the teacher is

(a) 36 kg

(b) 71 kg

(c) 70 kg

(d) 45 kg

78. The average of x, y and z is 45. x is as much more than the average as y is less than the average. Find the value of z.

(a) 45

(b) 25

(c) 35

(d) 15

79. Find the average of four numbers $2\frac{3}{4}, 5\frac{1}{3}, 4\frac{1}{6}, 8\frac{1}{2}$.

(a) $5\frac{3}{16}$

(b) $3\frac{3}{16}$

(c) $16\frac{5}{3}$

(d) $3\frac{16}{5}$

80. The average salary per head of all the workers in a company is ₹95. The average salary of 15 officers is ₹525 and the average salary per head of the rest is ₹85. Find the total number of workers in the workshop.

(a) 660

(b) 580

(c) 650

(d) 460

81. The average age of eight men is increased by two years when one of them whose age is 24 years is replaced by a woman. What is the age of the woman?

(a) 35 years

(b) 28 years

(c) 32 years

(d) 40 years

82. The average monthly expenditure of Ravi was ₹1100 during the first three months, ₹2200 during the next four months and ₹4620 during the subsequent five months of the year. If the total saving during theyear was ₹2100, find Ravi's average monthly income.

(a) ₹1858

(b) ₹3108.33

(c) ₹3100

(d) None of these

83. Shyam bought two articles for ₹5.50 each, and three articles for ₹3.50 each, and three articles for ₹5.50 each and five articles for ₹1.50 each. The average price for one article is

(a) ₹3

(b) ₹3.10

(c) ₹3.50

(d) ₹2

84. In a bag, there are 150 coins of ₹1, 50 *p* and 25 *p* denominations. If the total value of coins is ₹150, then find how many rupees can be constituted by 50 *p* coins.

(a) 16

(b) 20

(c) 28

(d) None of these

LEVEL OF DIFFICULTY (II)

1. With an average speed of 40 km/h, a train reaches its destination in time. If it moves with an average speed of 35 km/h, it is late by 15 minutes. The length of the total journey is

   (a) 40 km

   (b) 70 km

   (c) 30 km

   (d) 80 km

2. In the month of July of a certain year, the average daily expenditure of an organisation was ₹68. For the first 15 days of the month, the average daily expenditure was ₹85 and for the last 17 days, ₹51. Find the amount spent by the organisation on the 15th of the month.

   (a) ₹42

   (b) ₹36

   (c) ₹34

   (d) ₹52

3. In 1919, W. Rhodes, the Yorkshire cricketer, scored 891 runs for his county at an average of 34.27; in 1920, he scored 949 runs at an average of 28.75; in 1921, 1329 runs at an average of 42.87 and in 1922, 1101 runs at an average of 36.70. What was his county batting average for the four years?

(a) 36.23

(b) 37.81

(c) 35.58

(d) 28.72

4. A train travels with a speed of 20 m/s in the first 10 minutes, goes 8.5 km in the next 10 minutes, 11 km in the next 10, 8.5 km in the next 10 and 6 km in the next 10 minutes. What is the average speed of the train in kilometre per hour for the journey described?

   (a) 42 km/h

   (b) 35.8 km/h

   (c) 55.2 km/h

   (d) 46 km/h

5. One-fourth of a certain journey is covered at the rate of 25 km/h, one-third at the rate of 30 km/h and the rest at 50 km/h. Find the average speed for the whole journey.

   (a) 600/53 km/h

   (b) 1200/53 km/h

   (c) 1800/53 km/h

   (d) 1600/53 km/h

6. Typist *A* can type a sheet in 6 minutes, typist *B* in 7 minutes and typist *C* in 9 minutes. The average number of sheets typed per hour per typist for all three typists is

(a) 265/33

(b) 530/63

(c) 655/93

(d) 530/33

7. Find the average increase rate if increase in the population in the first year is 30% and that in the second year is 40%.

(a) 41

(b) 56

(c) 40

(d) 38

8. The average income of a person for the first six days is ₹29, for the next six days it is ₹24, for the next 10 days it is ₹32 and for the remaining days of the month it is ₹30. Find the average income per day.

(a) ₹31.64

(b) ₹30.64

(c) ₹29.26

(d) Cannot be determined

9. In hotel Jaysarmin, the rooms are numbered from 101 to 130 on the first floor, 221 to 260 on the second floor and 306 to 345 on the third floor. In the month of June 2012, the room occupancy was 60% on the first floor, 40% on the second floor and 75% on the third floor. If it is also known that the room charges are ₹200, ₹100 and ₹150 on each of the floors, then find the average income per room for the month of June 2012.

(a) ₹151.5

(b) ₹88.18

(c) ₹78.3

(d) ₹65.7

10. A salesman gets a bonus according to the following structure: If he sells articles worth ₹x then he gets a bonus of ₹$(x/100 - 1)$. In the month of January, his sales value was ₹100, in February it was ₹200, from March to November it was ₹300 for every month and in December it was ₹1200. Apart from this, he also receives a basic salary of ₹30 per month from his employer. Find his average income per month during the year.

    (a) ₹31.25

    (b) ₹30.34

    (c) ₹32.5

    (d) ₹34.5

11. A man covers half of his journey by train at 60 km/h, half of the remainder by bus at 30 km/h and the rest by cycle at 10 km/h. Find his average speed during the entire journey.

    (a) 36 km/h

    (b) 30 km/h

    (c) 24 km/h

    (d) 18 km/h

12. The average weight of five men is decreased by 3 kg when one of them weighing 150 kg is replaced by another person. This new person is again replaced by another person whose weight is 30 kg lower than the person he replaced. What is the overall change in the average due to this dual change?

    (a) 6 kg

    (b) 9 kg

    (c) 12 kg

    (d) 15 kg

13. Find the average weight of four containers, if it is known that the weight of the first container is 100 kg and the total of the second, third and fourth containers' weight is defined by $f(x) = x2 - 3/4\ (x2)$, where $x = 100$

    (a) 650 kg

    (b) 900 kg

    (c) 750 kg

    (d) 450 kg

14. There are five boxes in a cargo hold. The weight of the first box is 200 kg and the weight of the second box is 20% higher than the weight of the third box, whose weight is 25% higher than the first box's weight. The fourth box at 350 kg is 30% lighter than the fifth box. Find the difference in the average weight of the four heaviest boxes and the four lightest boxes.

(a) 51.5 kg

(b) 75 kg

(c) 37.5 kg

(d) 112.5 kg

15. For Question 14, find the difference in the average weight of the heaviest three and the lightest three.

    (a) 133.33 kg

    (b) 116.66 kg

    (c) 150 kg

    (d) 112.5 kg

16. A batsman makes a score of 270 runs in the 87th inning and thus, increases his average by a certain number of runs that is a whole number. Find the possible values of the new average.

    (a) 98

    (b) 184

    (c) 12

    (d) All of these

17. Nineteen persons went to a hotel for a combined dinner party. Thirteen of them spent ₹79 each on their dinner and the rest spent ₹4 more than the average expenditure of all the 19. What was the total money spent by them?

    (a) ₹1628.4

    (b) ₹1534

(c) ₹1492

(d) None of these

18. There were 42 students in a hostel. Due to the admission of 13 new students, the expenses of the mess increased by ₹31 per day while the average expenditure per head diminished by ₹3. What was the original expenditure of the mess?

(a) ₹633.23

(b) ₹583.3

(c) ₹623.3

(d) ₹632

19. The average price of three precious diamond studded platinum thrones is ₹97610498312, if their prices are in the ratio 4:7:9. The price of the cheapest is

(a) 5, 65, 66, 298.972

(b) 5, 85, 66, 29, 897.2

(c) 58, 56, 62, 889.72

(d) none of these

20. The average weight of 47 balls is 4 g. If the weight of the bag (in which the balls are kept) be included, the calculated average weight per ball increases by 0.3 g. What is the weight of the bag?

(a) 14.8 g

(b) 15.0 g

(c) 18.6 g

(d) None of these

21. The average of 71 results is 48. If the average of the first 59 results is 46 and that of the last 11 is 52. Find the 60th result.

(a) 132

(b) 122

(c) 134

(d) 128

22. A man covers 1/3rd of his journey by cycle at 50 km/h, the next 1/3 by car at 30 km/h, and the rest by walking at 7 km/h. Find his average speed during the whole journey.

(a) 14.2 km/h

(b) 15.3 km/h

(c) 18.2 km/h

(d) 12.8 km/h

23. The average age of a group of 14 persons is 27 years and 9 months. Two persons, each 42 years old, left the group. What will be the average age of the remaining persons in the group?

(a) 26.875 years
(b) 26.25 years

(c) 25.375 years

(d) 25 years

24. In an exam, the average was found to be x marks. After deducting computational error, the average marks of 94 candidates got reduced from 84 to 64. The average, thus, came down by 18.8 marks. The numbers of candidates who took the exam were

    (a) 100

    (b) 90

    (c) 110

    (d) 105

25. The average salary of the entire staff in an office is ₹3200 per month. The average salary of officers is ₹6800 and that of non-officers is ₹2000. If the number of officers is 5, then find the number of non-officers in the office?

    (a) 8

    (b) 12

    (c) 15

    (d) 5

26. A person travels three equal distances at a speed of x km/h, y km/h and z km/h respectively. What will be the average speed during the whole journey?

    (a) $xyz/(xy + yz + zx)$

    (b) $(xy + yz + zx)/xyz$

    (c) $3xyz/(xy + yz + xz)$

    (d) None of these

Directions for Questions 27 to 30: Read the following passage and answer the questions that follow.

In a family of five persons *A*, *B*, *C*, *D* and *E*, each and everyone loves one another very much. Their birthdays are in different months and on different dates. *A* remembers that his birthday is between 25th and 30th, of *B* it is between 20th and 25th, of *C* it is between 10th and 20th, of *D* it is between 5th and 10th and of *E* it is between 1st to 5th of the month. The sum of the date of birth is defined as the addition of the date and the month, for example 12th January will be written as 12/1 and will add to a sum of the date of 13. (Between 25th and 30th includes both 25 and 30).

27. What may be the maximum average of their sum of the dates of birth?

    (a) 24.6

    (b) 15.2

    (c) 28

    (d) 32

28. What may be the minimum average of their sum of the dates of births?

    (a) 24.6

    (b) 15.2

    (c) 28

    (d) 32

29. If it is known that the dates of birth of three of them are even numbers then find maximum average of their sum of the dates of birth.

    (a) 24.6

    (b) 15.2

(c) 27.6

(d) 28

30. If the date of birth of four of them are prime numbers, then find the maximum average of the sum of their dates of birth.

(a) 27.2

(b) 26.4

(c) 28

(d) None of these

31. The average age of a group of persons going for a picnic is 16.75 years. Twenty new persons with an average age of 13.25 years join the group on the spot due to which the average of the group becomes 15 years. Find the number of persons initially going for the picnic.

(a) 24

(b) 20

(c) 15

(d) 18

32. A school has only four classes that contain 10, 20, 30 and 40 students respectively. The pass percentage of these classes are 20%, 30%, 60% and 100% respectively. Find the pass percentage of the entire school.

(a) 56%

(b) 76%

(c) 34%

(d) 66%

33. Find the average of $f(x), g(x), h(x), d(x)$ at $x = 10$. $f(x)$ is equal to $x2 + 2$, $g(x) = 5x2 - 3$, $h(x) = \log x2$ and $d(x) = (4/5)x2$.

(a) 170

(b) 170.25

(c) 70.25

(d) 70

34. Find the average of $f(x) - g(x), g(x) - h(x), h(x) - d(x), d(x) - f(x)$.

(a) 0

(b) −2.25

(c) 4.5

(d) 2.25

35. $\sum_{r=1}^{n}(n+1)r$ where $r = n$.

(a) $\frac{(n-1)(n)(n+1)}{2}$

(b) $\frac{n(n+1)^2}{2}$

(c) $\frac{n(n-1)^2}{2}$

(d) $\frac{n^2}{2}$

36. The average of 'n' numbers is z. if the number x is replaced by the number $x1$, then the average becomes $z1$. Find the relation between $n, z, z1, x$ and $x1$.

(a) $\left[\frac{z^1-2}{x^1-x}=\frac{1}{n}\right]$

(b) $\left[\frac{x^1-x}{z^1}=\frac{1}{n}\right]$

(c) $\left[\frac{z-z^1}{x-x^1}=\frac{1}{n}\right]$

(d) $\left[\frac{x-x^1}{z-z^1}=\frac{1}{n}\right]$

37. The average salary of workers in Mindworkzz is ₹2,000; the average salary of faculty being ₹4,000; and the management trainees being ₹1,250. The total number of workers could be

(a) 450

(b) 300

(c) 110

(d) 500

Directions for Questions 38 to 41: Read the following and answer the questions that follows

During a cricket match, India playing against Newzealand scored in the following manner:

Partnership	*Runs scored*
1st wicket	112
2nd wicket	58
3rd wicket	72
4th wicket	92
5th wicket	46
6th wicket	23

38. Find the average runs scored by the first four batsmen.

(a) 450

(b) 300

(c) 110

(d) 500

Directions for Questions 38 to 41: Read the following and answer the questions that follows

During a cricket match, India playing against Newzealand scored in the following manner:

Partnership	*Runs scored*
1st wicket	112
2nd wicket	58
3rd wicket	72
4th wicket	92
5th wicket	46
6th wicket	23

38. Find the average runs scored by the first four batsmen.

(a) 83.5

(b) 60.5

(c) 66.8

(d) Cannot be determined

39. The maximum average runs scored by the first five batsmen could be

(a) 80.6

(b) 66.8

(c) 76

(d) cannot be determined.

40. The minimum average runs scored by the last five batsmen to get out could be

    (a) 53.6

    (b) 44.4

    (c) 66.8

    (d) 0

41. If the fifth down batsman gets out for a duck, then find the average runs scored by the first six batsmen.

    (a) 67.1

    (b) 63.3

    (c) 48.5
    (d) Cannot be determined

42. The weight of a body as calculated by the average of seven different experiments is 53.735 g. The average of the first three experiments is 54.005 g, of the fourth is 0.004 g greater than the fifth, while the average of the sixth and seventh experiment was 0.010 g less than the average of the first three. Find the weight of the body obtained by the fourth experiment.

    (a) 49.353 g

    (b) 51.712 g

    (c) 53.072 g

    (d) 54.512 g

43. A man's average expenditure for the first four months of the year was ₹251.25. For the next five months the average monthly expenditure was ₹26.27 more than what it was during the first four months. If the person spent ₹760 in all during the remaining three months of the year, find what percentage of his annual income of ₹3000 he saved in the year.

(a) 14%

(b) −5.0866%

(c) 12.5%

(d) None of these

44. A certain number of trucks were required to transport 60 tons of steel wire from the TISCO factory in Jamshedpur. However, it was found that since each truck could take 0.5 tons of cargo less, another four trucks were needed. How many trucks were initially planned to be used?

(a) 10

(b) 15

(c) 20

(d) 25

45. One collective farm got an average harvest of 21 tons of wheat and another collective farm that had 12 acres of land less given to wheat, got 25 tons from a hectare. As a result, the second farm harvested 300 tons of wheat more than the first. How many tons of wheat did each farm harvest?

(a) 3150, 3450

(b) 3250, 3550

(c) 2150, 2450

(d) None of these

LEVEL OF DIFFICULTY (III)

Directions for Questions 1 to 8: Read the following:

There are 3 classes having 20, 25 and 30 students, respectively, having average marks in an examination as 20, 25 and 30, respectively. If the three classes are represented by A, B and C and you have the following information about the three classes, answer the questions that follow:

$A \rightarrow$ Highest score 22, Lowest score 18

$B \rightarrow$ Highest score 31, Lowest score 23

$C \rightarrow$ Highest score 33, Lowest score 26

If five students are transferred from A to B.

1. What will happen to the average score of B?

   (a) Definitely increase

   (b) Definitely decrease

   (c) Remain constant

   (d) Cannot say

2. What will happen to the average score of A?

(a) Definitely increase

(b) Definitely decrease

(c) Remain constant

(d) Cannot say

In a transfer of five students from *A* to *C*

3. What will happen to the average score of *C*?

(a) Definitely increase

(b) Definitely decrease

(c) Remain constant

(d) Cannot say

4. What will happen to the average score of *A*?

(a) Definitely increase

(b) Definitely decrease

(c) Remain constant

(d) Cannot say

In a transfer of five students from *B* to *C* (Questions 5 –6)

5. What will happen to the average score of *C*?

(a) Definitely increase

(b) Definitely decrease

(c) Remain constant

(d) Cannot say

6. Which of these can be said about the average score of *B*?

   (a) Increases if *C* decreases

   (b) Decreases if *C* increases

   (c) Increases if *C* decreases

   (d) Decreases if *C* decreases

7. In a transfer of five students from *A* to *B*, the maximum possible average achievable for group *B* is

   (a) 25

   (b) 24.5

   (c) 25.5

   (d) 24

8. For the above case, the maximum possible average achieved for group *A* will be

   (a) 20.66

   (b) 21.5

   (c) 20.75

   (d) 20.5

9. What will be the minimum possible average of Group *A* if five students are transferred from *A* to *B*?

   (a) 19.55

   (b) 21.5

(c) 19.33

(d) 20.5

10. If five students are transferred from *B* to *A*, what will be the minimum possible average of *A*?

    (a) 20.69

    (b) 21

    (c) 20.75

    (d) 20.6

11. For question 10, what will be the maximum average of *A*?

    (a) 23.2

    (b) 22.2

    (c) 18.75

    (d) 19

Directions for Questions 12 to 17: Read the following and answer the questions that follow.

If five people are transferred from *A* to *B* and another independent set of five people are transferred back from *B* to *A*, then after this operation (Assume that the set transferred from *B* to *A* contains none from the set of students that came to *B* from *A*)

12. What will happen to *B*'s average?

    (a) Increases if *A*'s average decreases

    (b) decrease always

(c) Cannot be said

(d) decreases if *A*'s average decreases

13. What can be said about *A*'s average?

    (a) Will decrease

    (b) Will always increase if *B*'s average changes

    (c) May increase or decrease

    (d) Will increase only if *B*'s average decreases

14. At the end of the two steps mentioned above (in the direction), what could be the maximum value of the average of class *B*?

    (a) 25.4

    (b) 25

    (c) 24.8

    (d) 24.6

15. For question 14, what could be the minimum value of the average of class *B*?

    (a) 22.4

    (b) 24.2

    (c) 25

    (d) 23

16. What could be the maximum possible average achieved by class *A* at the end of the operation?

    (a) 25.2

(b) 26

(c) 23.25

(d) 23.75

17. What could be the minimum possible average of class *A* at the end of the operation?

(a) 21.4

(b) 19.2

(c) 28.5

(d) 20.25

Directions for Questions 18 to 23: Read the following and answer the questions that follow.

If five people are transferred from *C* to *B*, further, five more people are transferred from *B* to *A*, then five are transferred from *A* to *B* and finally, five more are transferred from *B* to *C*.

18. What is the maximum possible average achieved by class *C*?

(a) 30.833

(b) 30

(c) 29.66

(d) 30.66

19. What is the maximum possible average of class *B*?

(a) 26

(b) 27

(c) 25

(d) 28

20. What is the maximum possible average value attained by class *A*?

(a) 22.75

(b) 23.75

(c) 23.5

(d) 24

21. The minimum possible value of the average of group *C* is

(a) 26.3

(b) 27.5

(c) 29.6

(d) 28

22. The minimum possible average of group *B* after this set of operation is

(a) 21.6

(b) 22.2

(c) 21.8

(d) 21.4

23. The minimum possible average of group *A* after the set of three operation is

(a) 20

(b) 20.3

(c) 20.4

(d) 19.8

24. Which of these will definitely not constitute an operation for getting the minimum possible average value for group *A*?

    (a) transfer of five 31s from *B* to *A*

    (b) transfer of five 26s from *C* to *B*

    (c) transfer of five 22s from *A* to *B*

    (d) transfer of five 33s from *C* to *B*

25. For getting the lowest possible value of *C*'s average, the sequence of operations could be

    (a) Transfer five 33s from *C* to *B*, five 23s from *B* to *A*, five 18s from *A* to *B*, five 18s from *B* to *C*

    (b) Transfer five 33s from *C* to *B*, 31s from *B* to *A*

    (c) Both (a) and (b)

    (d) None of these

26. If we set the highest possible average of class *C* as the primary objective and want to achieve the highest possible value for class *B* as the secondary objective, what is the maximum value of class *B*'s average that is attainable?

    (a) 27

    (b) 26

    (c) 25

(d) 24

27. For Question 26, if the secondary objective is changed to achieving the minimum possible average value of class *B*'s average, the lowest value of class *B*'s average that could be attained is

    (a) 22.6

    (b) 23

    (c) 22.2

    (d) 22

28. For question 27, what can be said about class *A*'s average?

    (a) Will be determined automatically at 22.25

    (b) Will have a maximum possible value of 22.25

    (c) Will have a minimum possible value of 22.25

    (d) Will be determined automatically at 22.5

29. A team of miners planned to mine 1800 tons of ore during a certain number of days. Due to technical difficulties in one-third of the planned number of days, the team was able to achieve an output of 20 tons of ore less than the planned output. To make up for this, the team overachieved for the rest of the days by 20 tons. The end result was that the team completed the task one day ahead of time. How many tons of ore did the team initially plan to ore per day?

    (a) 50 tons

    (b) 100 tons

(c) 150 tons

(d) 200 tons

30. According to a plan, a team of woodcutters decided to harvest 216 m^3 of wheat in several days. In the first three days, the team fulfilled the daily assignment, and then it harvested 8 m^3 of wheat over and above the plan everyday. Therefore, a day before the planned date, they had already harvested 232 m^3 of wheat. How many cubic metres of wheat a day did the team have to cut according to the plan?

(a) 12

(b) 13

(c) 24

(d) 25

31. On an average, two litres of milk and one litre of water are needed to be mixed to make 1 kg of sudha shrikhand of type *A*, and 3 litres of milk and 2 litres of water are needed to be mixed to make 1 kg of sudha shrikhand of type *B*. How many kilograms of each type of shrikhand was manufactured if it is known that 130 litres of milk and 80 litres of water were used?

(a) 20 of type *A* and 30 of type *B*

(b) 30 of type *A* and 20 of type *B*

(c) 15 of type *A* and 30 of type *B*

(d) 30 of type *A* and 15 of type *B*

32. There are 500 seats in Minerva Cinema, Mumbai, placed in similar rows. After the reconstruction of the hall, the total number of seats became 10% less. The number of rows was reduced by five but each row contained five seats more than before. How many rows and how many seats in a row were there initially in the hall?

    (a) 20 rows and 25 seats

    (b) 20 rows and 20 seats

    (c) 10 rows and 50 seats

    (d) 50 rows and 10 seats

33. One fashion house has to make 810 dresses and another one 900 dresses during the same period of time. In the first house, the order was ready three days ahead of time and in the second house, six days ahead of time. How many dresses did each fashion house make a day if the second house made 21 dresses more a day than the first?

    (a) 54 and 75

    (b) 24 and 48

    (c) 44 and 68

    (d) 4 and 25

34. A shop sold 64 kettles of two different capacities. The smaller kettle cost a rupee less than the larger one. The shop made ₹100 from the sale of large kettles and ₹36 from the sale of small ones. How many kettles of either capacity did the shop sell and what was the price of each kettle?

    (a) 20 kettles for ₹2.5 each and 14 kettles for ₹1.5 each

(b) 40 kettles for ₹4.5 each and 24 kettles for ₹2.5 each

(c) 40 kettles for ₹2.5 each and 24 kettles for ₹1.5 each

(d) Either (a) or (b)

35. An enterprise got a bonus and decided to share it in equal parts between the exemplary workers. It turned out, however, that there were three more exemplary workers than it had been assumed. In that case, each of them would have got ₹4 less. The administration had found the possibility to increase the total sum of the bonus by ₹90 and as a result each exemplary worker received ₹25. How many people received the bonus?

(a) 9

(b) 18

(c) 8

(d) 16

Directions for Questions 36 to 39: Read the following and answer the questions that follow.

In the island of Hoola Boola Moola, the inhabitants have a strange process of calculating their average incomes and expenditures. According to an old legend prevalent on that island, the average monthly income had to be calculated on the basis of 14 months in a calendar year while the average monthly expenditure was to be calculated on the basis of 9 months per year. This would lead to people having an underestimation of their savings since there would be an underestimation of the income and an overestimation of the expenditure per month.

36. If the minister for economic affairs decided to reverse the process of calculation of average income and average expenditure, what will happen to the estimated savings of a person living on Hoola Boola Moola island?

    (a) It will increase

    (b) It will decrease

    (c) It will remain constant

    (d) Will depend on the value

37. If it is known that Mr. Magoo Hoola Boola estimates his savings at 10 Moolahs and if it is further known that his actual expenditure is 288 Moolahs in an year (Moolahs, for those who are not aware, is the official currency of Hoola Boola Moola), then what will happen to his estimated savings if he suddenly calculates on the basis of a 12 month calendar year?

    (a) Will increase by 5

    (b) Will increase by 15

    (c) Will increase by 10

    (d) Will triple

38. Mr. Boogie Woogie comes back from the USA to Hoola Boola Moola and convinces his community comprising 546 families to start calculating the average income and average expenditure on the basis of 12 months per calendar year. Now if it is known that the average estimated income on the island is (according to the old system) 87 Moolahs per month, then

what will be the change in the average estimated savings for the island of Hoola Boola Moola (Assume that there is no other change).

(a) 251.60 Moolahs

(b) 565.5 Moolahs

(c) 625.5 Moolahs

(d) Cannot be determined

39. Mr. Boogle Woogle comes back from the USSR and convinces his community comprising 273 families to start calculating the average income on the basis of 12 months per calendar year. Now if it is known that the average estimated income in his community is (according to the old system) 87 Moolahs per month, then what will be the change in the average estimated savings for the island of Hoola Boola Moola (Assume that there is no other change).

(a) 251.60 Moolahs

(b) 282.75 Moolahs

(c) 312.75 Moolahs

(d) Cannot be determined

Directions for Questions 40 to 44: Read the following and answer the questions that follow.

The Indian cricket team has to score 360 runs on the last day of a test match in 90 overs, to win the test match. This is the target set by the opposing captain Brian Lara after he declared his innings closed at the overnight score of 411 for 7.

The Indian team coach has the following information about the batting rates (in terms of runs per over) of the different batsmen:

Assume that the run rate of a partnership is the weighted average of the individual batting rates of the batsmen involved in the partnership (on the basis of the ratio of the strike each batsman gets, i.e. the run rate of a partnership is defined as the weighted average of the run rates of the two batsmen involved weighted by the ratio of the number of balls faced by each batsman).

Since decimal fractions of runs are not possible for any batsman, assume that the estimated runs scored by a batsman in an inning (on the basis of his run rate and the number of overs faced by him) is rounded off to the next higher integer immediately above the estimated value of the runs scored during the innings.

For example, if a batsman scores at an average of 3 runs per over for 2.1666 overs, then he will be estimated to have scored $2.1666 \times 3 = 6.5$ runs in his innings, but since this is not possible, the actual number of runs scored by the batsman will be taken as 7 (the next higher integer above 6.5).

Runs scored per over in different batting styles

Name of Batsman	*Defensive*	*Normal*	*Aggressive*
Das	3	4	5
Dasgupta	2	3	4
Dravid	2	3	4
Tendulkar	4	6	8
Laxman	4	5	6
Sehwag	4	5	6
Ganguly	3	4	5
Kumble	2	3	4
Harbhajan	3	4	5
Srinath	3	4	5
Yohannan	2	3	4

Also, this rounding off can take place only once for one innings of a batsman.

Assume no extras unless otherwise stated.

Assume that the strike is equally shared unless otherwise stated.

40. If the first wicket pair of Das and Dasgupta bats for 22 overs and during this partnership Das has started batting normally and turned aggressive after 15 overs while Dasgupta started off defensively but shifted gears to bat normally after batting for 20 overs, find the expected score after 22 overs.

    (a) 65

    (b) 71

    (c) 82

    (d) 58

41. Of the first-wicket partnership between Das and Dasgupta as per the previous question, the ratio of the number of runs scored by Das to those scored by Dasgupta is

    (a) 46 : 25

    (b) 96 : 46

    (c) 41 : 32

    (d) Cannot be determined

42. The latest time by which Tendulkar can come to bat and still win the game, assuming that the run rate at the time of his walking the wicket is into 2.5 runs per over, is (assuming he shares strike equally with his partner and that he gets the maximum possible support at the other end from his batting partner and both play till the last ball)

(a) After 50 overs

(b) After 55 overs

(c) After 60 overs

(d) Cannot be determined

43. For question 42, where Tendulkar batted aggressively and assuming that it is the Tendulkar –Laxman pair that wins the game for India (after Tendulkar walks into bat with the current run rate at 2.5 per over, and at the latest possible time for him to win the game with maximum possible support from the opposite end), what will be Tendulkar's score for the innings (assume equal strike)?

(a) 105

(b) 120

(c) 135

(d) None of these

44. For questions 42 and 43, if it was Laxman who batted with Tendulkar for his entire innings, then how many runs would Laxman score in the innings?

(a) 105

(b) 75

(c) 90

(d) Cannot be determined

Directions for Questions 45 to 49: Read the following and answer the questions that follow (with reference to the data provided in the table for questions 40 to 44).

If Sachin Tendulkar walks into bat after the fall of the fifth wicket and has to share partnerships with Ganguly, Kumble, Harbhajan, Srinath and Yohannan, who have batted normally, defensively, defensively, defensively and defensively, respectively while Tendulkar has batted normally, aggressively, aggressively, aggressively and aggressively, respectively in each of the five partnerships that lasted for 12, 10, 8, 5 and 10 overs, respectively, sharing strike equally with Ganguly and keeping two-thirds of the strike in his other four partnerships, then answer the following questions:

45. How many runs did Sachin score during his innings?

    (a) 128

    (b) 212

    (c) 176

    (d) None of these

46. The highest partnership that Tendulkar shared in was worth

    (a) 60

    (b) 61

    (c) 62

    (d) 58

47. The above partnership was shared with

    (a) Ganguly

    (b) Yohannan

(c) Kumble

(d) All three

48. If India proceeded to win the match based on the runs scored by these last five partnerships (assuming the last wicket pair remained unbeaten), what could be the maximum score at which Tendulkar could have come into bat?

(a) 103 for 5

(b) 97 for 5

(c) 100 for 5

(d) 104 for 5

49. For Question 48, what could be the minimum score at which Tendulkar could have come to bat?

(a) 103 for 5

(b) 97 for 5

(c) 104 for 5

(d) 98 for 5

ANSWER KEY

Level of Difficulty (I)

1. (c)
2. (c)
3. (b)

4. (c)
5. (c)
6. (b)
7. (b)
8. (d)
9. (a)
10. (b)
11. (a)
12. (a)
13. (d)
14. (d)
15. (d)
16. (c)
17. (a)
18. (d)
19. (a)
20. (b)
21. (a)
22. (d)
23. (d)
24. (b)
25. (a)
26. (c)
27. (b)
28. (b)
29. (b)
30. (a)

31. (c)
32. (c)
33. (d)
34. (a)
35. (a)
36. (a)
37. (d)
38. (c)
39. (d)
40. (a)
41. (c)
42. (a)
43. (d)
44. (c)
45. (d)
46. (d)
47. (b)
48. (d)
49. (d)
50. (b)
51. (b)
52. (a)
53. (d)
54. (b)
55. (d)

56. (c)
57. (d)
58. (c)
59. (a)
60. (a)
61. (a)
62. (a)
63. (c)
64. (c)
65. (a)
66. (d)
67. (c)
68. (a)
69. (b)
70. (b)
71. (a)
72. (b)
73. (a)
74. (a)
75. (b)
76. (b)
77. (b)
78. (a)
79. (a)
80. (a)

81. (d)
82. (b)
83. (c)
84. (d)

Level of Difficulty (II)

1. (b)
2. (c)
3. (c)
4. (c)
5. (c)
6. (b)
7. (a)
8. (d)
9. (a)
10. (c)
11. (c)
12. (b)
13. (a)
14. (b)
15. (a)
16. (d)
17. (d)
18. (a)
19. (d)
20. (d)

21. (b)
22. (b)
23. (c)
24. (a)
25. (c)
26. (c)
27. (c)
28. (b)
29. (d)
30. (a)
31. (b)
32. (d)
33. (b)
34. (a)
35. (b)
36. (c)
37. (c)
38. (d)
39. (a)
40. (d)
41. (d)
42. (c)
43. (b)
44. (c)

45. (a)

Level of Difficulty (III)

1. (b)
2. (d)
3. (b)
4. (d)
5. (d)
6. (b)
7. (b)
8. (a)
9. (c)
10. (d)
11. (b)
12. (b)
13. (b)
14. (c)
15. (a)
16. (c)
17. (d)
18. (a)
19. (b)
20. (b)
21. (b)
22. (b)
23. (a)
24. (c)
25. (a)

26. (d)
27. (c)
28. (a)
29. (b)
30. (c)
31. (a)
32. (a)
33. (a)
34. (c)
35. (b)
36. (a)
37. (b)
38. (d)
39. (b)
40. (b)
41. (b)
42. (c)
43. (b)
44. (d)
45. (b)
46. (b)
47. (b)
48. (d)
49. (b)

Solutions and Shortcuts

Level of Difficulty (I)

1. $P = 25 \times 15 - 24 \times 14 = 375 - 336 = 39$

2. D's weight $= 4 \times 80 - 3 \times 84 = 320 - 252 = 68$

   E's weight $= 68 + 3 = 71$

   Now, we know that $A + B + C + D = 4 \times 80 = 320$ and $B + C + D + E = 78 \times 4 = 312$. Hence, A's weight is 8 kg more than E 's weight. $A = 71 + 8 = 79$.

3. Monday + Tuesday + Wednesday $= 3 \times 37 = 111$;

   Tuesday + Wednesday + Thursday $= 3 \times 34 = 102$. Thus, Monday − Thursday = 9 and

   Thursday = 4 × Monday/5 → Thursday = 36 and Monday = 45.

4. Today's total age of A, B and $C = 30 \times 3 = 90$.

   Today's total age for B and $C = 25 \times 2 = 50$.

   C 's age $= 90 - 50 = 40$.

5. $9x + 100 = 10(x + 8) \rightarrow x = 20$ (average after 9 innings). Hence, new average $= 20 + 8 = 28$.

6. $7 \times 3 = 21$

7. $1/4 + 1/6 + C = 3 \times 1/12 \rightarrow C = -1/6$

8. His total score is 93 + 78 + 177 = 348 out of 450. % score = 77.33

9. Average income over 9 months = [3 × (2750 + 650) + 3 × (3150 + 650) + 3 × (6750+650)]/9

$= [3 \times 3400 + 3 \times 3800 + 3 \times 7400]/9 = 4866.66$

10. Today's total age = $6 \times 22 = 132$ years. Total age of the family excluding the youngest member (for the remaining 5 people) = $132 - 7 = 125$. Average age of the other 5 people in the family = 25 years.

    7 years ago their average age = $25 - 7 = 18$ years.

11. If the average age of 8 people has gone up by 2 years, it means the total age has gone up by 16 years. Thus, the total age of the two women would be: $35 + 45 + 16 = 96$. Hence, their average age = 48.

12. $W + T + F = 120$; $T + F + S = 123 \rightarrow S - W = 3$. Hence, temperature on Wednesday = $42 - 3 = 39$.

13. The average speed can be calculated by assuming a distance of 300 km (LCM of 100 and 150). Then time taken @ 100 kmph = 3 hours and time taken @ 150kmph = 2 hours.

    Average speed = Total distance/total time = $600/5 = 120$ kmph.

14. Teacher's weight = $40.5 \times 30 - 40 \times 29 = 1215 - 1160 = 55$.

15. $3 \times 17 - 2 \times 16 = 51 - 32 = 19$.

16. The weight of the new man would be 19×3.5 kg more than the weight of the man he replaces. New man's weight = $79 + 19 \times 3.5 = 145.5$ kg.

17. Let their current ages be x and $3x$ (ratio of 2:6). Then their ages after 5 years would be $x + 5$ and $3x + 5$. Now it is given that $(x + 5)/(3x + 5) = 3/4$ $\rightarrow x = 1$ and hence their current ages are 1 years and 3 years respectively. After 10 years, their average age would be 12 years.

18. The average would be given by the average of the first and last numbers (since the series 1, 2, 3, 4...97 is an arithmetic progression).

    Hence, the average = (1 + 97)/2 = 49

19. We need the average of the numbers: 31, 37, 41, 43 and 47

    Average = Total/number of numbers → 199/5 = 39.8

20. Let the numbers be a, b, c and d respectively. $a + b + c = 16 \times 3 = 48$ and $b + c + d = 15 \times 3 = 45$.

    Also, since $d = 18$, we have $b + c = 45 - 18 = 27$. Hence, $a = 48 - (b + c) \rightarrow a = 21$.

21. If the numbers are $a + 1$, $a + 2$, $a + 3$, $a + 4$ and $a + 5$, the average would be $a + 3$. If we take 7 numbers as:

    $a + 1$, $a + 2$, $a + 3$, $a + 4$, $a + 5$, $a + 6$ and $a + 7$, their average would be $a + 4$. Hence, the average increases by 1.

22. Total of 48 numbers = $50 \times 38 - 45 - 55 = 1800$. Average of 48 numbers = 1800/48 = 37.5.

23. When we multiply each number by 12, the average would also get multiplied by 12. Hence, the new average = $7 \times 12 = 84$.

24. Let the number of ladies be n. Then we have $8 \times 15 + n \times 6 = (8 + n) \times (10.8) \rightarrow 120 + 6n = 86.4 + 10.8n \rightarrow 4.8n = 33.6 \rightarrow n = 7$.

25. $(3 \times 52 + 60)/4 = 216/4 = 54$

26. $1200 \times 3 - 1300 \times 2 = 1000$

27. $(2000 \times 15 + 3000 \times 15)/30 = (2000 + 3000)/2 = 2500$

28. The decrease in weight would be 15 kg (5 people's average weight drops by 3 kg). Hence, the new person's weight = $150 \times 15 = 135$.

29. When a person aged 18 years is replaced by a person aged 38 years, the total age of the group goes up by 20 years. Since this leads to an increase in the average by 5 years, it means that there are $20/5 = 4$ persons in the group.

30. $(22 \times 3 + 17 \times 2)/5 = 100/5 = 20$

31. Let the number of marks in the 7th paper be M. Then the total of the first seven papers = 7×42 while the total of the last 7 (i.e. 7th to 13th papers) would be 7×35.

    Total of 1st 7 + total of 7th to 13th = total of all 13 + marks in the 7th paper →

    $7 \times 42 + 7 \times 35 = 13 \times 40 + M$

    $539 = 520 + M \rightarrow M = 19$

    (**Note:** We write this equation, since marks in the seventh paper is counted in both the first 7 and the last 7)

32. Let the captain's age be C . Then: $11 \times 30 = 27 \times 5 + 29 \times 5 + C \rightarrow 330 = 135 + 145 + C \rightarrow C = 50$.

33. His earning in the 12th month should be: $5000 \times 12 - 4200 \times 11 = 60000 - 46200 = 13800$.

34. Assume total distance to be 420 kms each.

Then the answer would be got by total distance/total time = 840/13 = 64.615.

35. In three quarters of an hour, the train has traveled 54 km. Thus, in a full hour the train would have traveled 1/3rd more (as it gets 1/3rd time more). Thus, the speed of the train = 54 + 1 × 54/3 = 54 + 18 = 72.

36. Total weight of all 6 = 68.5 × 6. Total weight of Ram and Tram = 60 × 2 =120. Average weight of the 4 people excluding Ram and Tram = (68.5 × 6 − 120)/4 = 72.75 kg.

37. $10 \times 61 + 30 \times A = 40 \times 52 \rightarrow A = (2080 - 610)/30 = 1470/30 = 49$

38. (80 × 22 + 20 × 37)/100 = 2500/100 = 25

39. If we take the first number as 6n, the second number would be $3n$ and the third would be $2n$. Sum of the three numbers = $6n + 3n + 2n = 11n = 88 \times 3 \rightarrow n = 24$. The smallest number would be $2n = 48$.

40. The ratio between the first, second and third would be: 10:15:24. Since their total is 98, the numbers would be 20, 30 and 48 respectively. The second number is 30.

41. (30 × 160 + 10 × 156)/40 = 159. (note this question can also be solved using the alligation method explained in the next chapter.)

42. The total weight of the six people goes up by 15 kg (when the average for 6 persons goes up by 2.5 kg). Thus, the new person must be 15 kg more than the person who he replaces. Hence, the new person's weight = 50 + 15 = 65 kg.

43. Total age = 3 × 15 = 45. Individual ages being in the ratio 3:5:7, their ages would be 9, 15 and 21 years respectively. The youngest boy would be 9

years.

44. $50 \times 4 + X = 49 \times 5 \rightarrow X = 45$

45. $(20 \times 1900 + M) = 21 \times 2000 \rightarrow M = 4000$. Hence, the salary is ₹4000 per month which also means₹48,000 per year.

46. Five consecutive odd numbers would always be in an arithmetic progression and their average would be the middle number. The average would be 'c' in this case.

47. The average of 3, 6, 9, 12 and 15 would be 9.

48. $40 \times 40 + T = 41 \times 40.5 \rightarrow T = 1660.5 - 1600 = 60.5$ kg.

49. If the number of questions correct is N, then the number of wrong answers is $100 - N$. Using this we get:

    $N \times 2 - (100 - N) \times 0.5 = 120 \rightarrow 2.5\,N = 170 \rightarrow N = 68$

50. Required age of the father will be given by the equation: $5 \times 12 = 4 \times 8 + F \rightarrow F = 28$.

51. Required average = $(1 + 2 + 3 + \ldots + 10)/10 = 55/10 = 5.5$. Alternately you could use the formula for sum of the first n natural numbers as $n(n + 1)/2$ with n as 10. Then average = Sum/10 = $10 \times 11/2 \times 10 = 5.5$

52. Required average = $(0 + 1 + 2 + \ldots + 9)/10 = 45/10 = 4.5$

53. Required average = $(2 + 4 + 6 + 8 + 10 + 12 + 14 + 16 + 18 + 20)/10 = 110/10 = 11$. Alternately you could use the formula for sum of the first n even natural numbers as $n(n + 1)$ with n as 10. Then average = Sum/10 = $10 \times 11/10 = 11$.

54. The sum of the first n odd numbers = n^2. In this case, $n = 10 \rightarrow$ Sum = 10^2 = 100. Required average = 100/10 = 10.

55. Required average = (2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29)/10 = 129/10 = 12.9

56. Required average = (4 + 6 + 8 + 9 + 10 + 12 + 14 + 15 + 16 + 18)/10 = 112/10 = 11.2

57. Required average = (3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 + 31)/10 = 158/10 = 15.8

58. Teacher's weight = 31 × 41 − 30 × 40 = 1271 − 1200 = 71

59. Required average = (2 × 5.5 + 3 × 3.666 + 6 × 1.8333)/11 = (11 + 11 + 11)/11 = 3

60. $30 \times P + 75 \times 2 = 510 \rightarrow P = (510 - 150)/30 = 12$

61. Required average = (2 × 3000 + 2 × 500)/4 = 7000/4 = 1750

62. Required average = Total runs/ total innings = (40 × 4 + 0)/5= 160/5 = 32

63. Principal's weight = 41 × 79 − 40 × 80 = 3239 − 3200 = 39.

64. Temperature on 3rd December = 24.4 × 3 − 24 × 2 = 73.2 − 48 = 25.2

65. Average age 5 years; hence would be 5 years more than the current average age. Hence, 20 + 5 = 25.

66. Required average = (20 × 30 + 30 × 20)/50 = 1200/50 = 24

67. The numbers would form an AP with common difference 1 and the middle term (also the 3rd term) as 18. Thus, the numbers would be 16, 17, 18, 19 and 20. The highest of these numbers would be 20.

68. Required average = $(6 \times 11 + 14 + 16)/8 = 96/8 = 12$

69. The new average would also go up by 2. Hence, $12 + 2 = 14$.

70. Total age 3 years ago for 5 people = $17 \times 5 = 85$. Today, the family's total age = $17 \times 6 = 102$. The age of the 5 older people would be $85 + 3 \times 5 = 100$. Hence, the baby's age is 2 years.

71. Required average = $(10 \times 31 + 14 \times 30 + 15 \times 31)/92 = (310 + 420 + 465)/92 = 12.98$ (which is closest to 13.

72. Assume a distance of 60 km. In such a case, the Required average = Total distance/Total time = $(60 + 60)/(4 + 3) = 120/7 = 17.14$

73. (Mon + Tue + wed) = $41 \times 3 = 123$ (Tue + Wed + Thu) = $40 \times 3 = 120$

    Mon − Thu = $123 - 120 = 3$. Since Thursday's temperature is given as 39, Monday's temperature would be $39 + 3 = 42$.

74. Required average = $(30 \times 20 - 10 \times 10)/10 = 500/10 = 50$

75. Total age of 7 children = $12 \times 7 = 84$ years. When the 6 year old child dies, the total age of the remaining 6 children would be $84 - 6 = 78$. Required average = $78/6 = 13$ years.

76. Required average = $(2 \times 200 + 2 \times 250)/4 = 900/4 = 225$

77. Teacher's weight = $36 \times 36 - 35 \times 35 = 1296 - 1225 = 71$ kg.

78. The statement 'x is as much more than the average as y is less than the average signifies that the numbers x, y, z form an arithmetic progression with z as the middle term. z's value would then be equal to the average of the three numbers. This average is given as 45. Hence, the correct answer is $z = 45$.

79. The sum of the given 4 numbers is 20.75. The required average = 20.75/4. Option (a) is correct.

80. Let the number of non-officer workers in the company be W. Then we will have the following equation: $(15 \times 525 + W \times 85) = (15 + W) \times 95 \rightarrow 10W = 15 \times 430 \rightarrow W = 645$. Thus, the total number of workers in the company would be 645 + 15 = 660.

81. The woman's age would be 8 × 2 = 16 years more than the age of the man she replaces. Age of the woman = 24 + 2 × 8 = 40 years.

82. Required average income = (Total expenditure + total savings]/12

    = [(1100 × 3 + 2200 × 4 + 4620 × 5) + 2100]/12 = 37300/12 = 3108.333

83. Required average = (2 × 5.5 + 3 × 3.5 + 3 × 5.5 + 5 × 1.5)/13 = 45.5/13 = 3.5

84. For 150 coins to be of a value of ₹150, using only 25 paise, 50 paise and ₹1 coins, we cannot have any coins lower than the value of ₹1. Thus, the number of 50 paise coins would be 0. Option

    (d) is correct.

Level of Difficulty (II)

1. The train needs to travel 15 minutes extra @35 kmph. Hence, it is behind by 8.75 km. The rate of losing distance is 5 kmph. Hence, the train must have travelled for 8.75/5 = 1 hour 45 minutes @ 40 kmph → 70 km.

   Alternatively, you can also see that 12.5% drop in speed results in 14.28% increase in time. Hence, total time required is 105 minutes @ 40 kmph → 70 kilometres.

   Alternatively, solve through options.

2. Standard question requiring good calculation speed. Obviously, the 15th day is being double counted. Calculations can be reduced by thinking as:

   Surplus in first 15 days – deficit in last 17 days = 255 – 289 → net deficit of 34. This means that the average is reducing by 34 due to the double counting of the 15th day. This can only mean that the 15th day's expenditure is ₹68 – 34 = 34.

   (Lengthy calculations would have yielded the following calculations:

   85*15 + 51*17 – 68*31 = 34)

3. Find out the number of innings in each year. Then the answer will be given by:

   $$\frac{\text{Total runs in 4 years}}{\text{Total innings in 4 years}} = 4270/120=35.58$$

4. Find the total distance covered in each segment of 10 minutes. You will get total distance = 46 kilometres in 50 mins.

5. Assume that the distance is 120 km. Hence, 30 km is covered @ 25 kmph, 40 @ 30 kmph and so on.

   Then average speed is 120/total time

6. In three hours, the total number of sheets typed will be: 60/6 + 60/7 + 60/9 = 10 + 8.57 + 6.66.
   Hence, the number of sheets/hour is 25.23/3 = 8.41 is equivalent to 530/63.

7. 100 → 130 → 182. Hence, 82/2 = 41.

8. You do not know the number of days in the month. Hence, the question cannot be answered.

9. The number of rooms is 18 + 16 + 30 on the three floors respectively.

   Total revenues are: 18*200 + 16*100 + 30*150 = 9700 required average = 9700/110 = 88.18.

   (**Note:** Here that if you could visualise here that since the number of rooms is 110, the decimal values cannot be 0.3 or 0.7 which effectively means that options 3 and 4 are rejected.)

10. Replace x with the sales value to calculate the bonus in a month.

11. Use the same process as Q. No. 5 above.

12. The weight of the second man is 135 and that of the third is 105. Hence, net result is a drop of 45 for 5 people. Hence, 9 kg is the drop.

13. Put x = 100 to get the weight of the containers. Use these weights to find average weight as 2600/4 = 650.

14. The weight of the boxes are 1st box → 200, 3rd box → 250 kg, 2nd box → 300 kg, 4th box → 350 and 5th box → 500 kg. Hence difference between the heavier 4 and the lighter 4 is 300. Hence, difference in the averages is 75.

15. Difference between heaviest three and lightest three totals is: (350 + 500) – (250 + 200) = 400

    Difference in average weights is 400/3= 133.33.

16. Part of the runs scored in the 87th innings will go towards increasing the average of the first 86 innings to the new average and the remaining part of the runs will go towards maintaining the new average for the 87th innings. The only constraint in this problem is that there is an increase

in the average by a whole number of runs. This is possible for all three options.

17. Assume x is the average expenditure of 19 people. Then, $19x = 13 \times 79 + 6(x + 4)$. $x = 80.84$ and total expense – $19x \times 0.84 = 1536.07$

18. $42\ A + 31 = 55\ (A - 3) \rightarrow 13\ A = 196 \rightarrow A = 196/13 = 15.07$. Total expenditure original = $15.07 \times 42 = 633.23$

19. The total price of the three stones would be $97610498312 \times 3 = 292831494936$. Since, this price is divided into the three stones in the ratio of 4 : 7 : 9, the price of the cheapest one would be = $(4 \times 2928314936/20) = 58566298987.2$

20. The average weight per ball is asked. Hence, the bag does not have to be counted as the 48th item.

    The required answer would be given by $47 \times 4.3 - 47 \times 4 = 47 \times 0.3 = 14.1$ gms

21. $71 \times 48 = 59 \times 46 + x + 11 \times 52 \rightarrow x = 122$.

    Alternately, this can be solved by using the concepts of surpluses and deficits as:

    2×59 (deficit) – 4×11(surplus) + 48 (average to be maintained by the 60th number) = 118 – 44 + 48 = 122.

22. Solve through the same process as the Q. No. 5 of this chapter.

23. $(14 \times 333 - 2 \times 504)/12$ will give you the answer in months.

24. $\frac{(84-64)\times 94}{18.8}$

25. Use alligation to solve. 20———32———68. Thus, 5 corresponds to 12, hence for 36 the answer will be 15.

26. Let the equal distances be 'd' each. Then $3d/(d/x + d/y + d/z) = 3xyz/(xy + yz + zx)$.

Solutions for Questions 27 to 30:

You have to take between 25th and 30th to mean that both these dates are also included.

27. The maximum average will occur when the maximum possible values are used. Thus:

A should have been born on 30th, B on 25th, C on 20th, D on 10th and E on 5th. Further, the months of births in random order will have to be between August to December to maximise the average.
Hence, the total will be 30 + 25 + 20 + 10 + 5 + 12 + 11 + 10 + 9 + 8 = 140.
Hence average is 28.

28. The minimum average will be when we have 1 + 5 + 10 + 20 + 25 + 1 + 2 + 3 + 4 + 5 = 76. Hence, average is 15.2.

29. This does not change anything. Hence, the answer is the same as Q. 27.

30. The prime dates must be 29th, 23rd, 19th and 5th. Hence, the maximum possible average will reduce by 4/5 = 0.8. Hence, answer will be 27.2.

31. Solve using alligation. Since 15 is the mid-point of 13.25 and 16.75, the ratio is 1:1 and hence there are 20 people who were going for the picnic initially.

32. The number of pass candidates are 2 + 6 + 18 + 40 = 66 out of a total of 100. Hence, 66%.

Solutions for Questions 33 and 34:

Put $x = 10$ in the given equations and find the average of the resultant values.

35. Solve through options.

36. $nz - x + x_1 = nz_1 \rightarrow$ Simplify to get Option (c) correct.

37. By alligation the ratio is 3:8. Hence, only 110 is possible.

Solutions for Questions 38 to 41:

38. You do not know who got out when. Hence, cannot be determined.

39. Since possibilities are asked about, you will have to consider all possibilities. Assume, the sixth and seventh batsmen have scored zero. Only then will the possibility of the first five batsmen scoring the highest possible average arise. In this case, the maximum possible average for the first five batsmen could be 403/5 = 80.6.

40. Again it is possible that only the first batsman has scored runs.

41. We cannot find out the number of runs scored by the 7^{th} batsman. Hence answer is (d).

42. You can take 53 as the base to reduce your calculations. Otherwise the question will become highly calculation intensive.

43. 251.25*4 + 277.52 * 5 + 760 = 3152.6

44. Solve using options. 20 is the only possible value.

45. Check through options to solve.

Level of Difficulty (III)

1. Definitely decrease, since the highest marks in Class A is less than the lowest marks in Class B.
2. Cannot say since there is no indication of the values of the numbers which are transferred.
3. It will definitely decrease since the highest possible transfer is lower than the lowest value in C.
4. The effect on A will depend on the profile of the people who are transferred. Hence, anything can happen.
5. Cannot say since there is a possibility that the numbers transferred are such that the average can either increase, decrease or remain constant.
6. If *C* increases, then the average of *C* goes up from 30. For this to happen, it is definite that the average of *B* should drop.
7. The maximum possible average for *B* will occur if all the 5 transferees from A have 22 marks.
8. The average of Group A after the transfer in Q. 7 above is:

   (400 – 18*5)/15 = 310/15 = 20.66
9. (400 – 22*5)/15 = 19.33
10. 400 + 23*5 = 515. Average = 515/25 = 20.6
11. 400 + 31*5 = 555. Average = 555/25 = 22.2
12. Will always decrease since the net value transferred from *B* to *A* will be higher than the net value transferred from *A* to *B*.

14. The maximum possible value for B will happen when the A to B transfer has the maximum possible value and the reverse transfer has the minimum possible value.
15. For the minimum possible value of B, we will need the A to B transfer to be the lowest possible value while the B to A transfer must have the highest possible value. Thus, A to B transfer $\rightarrow 18 \times 5$ while B to A transfer will be 31×5. Hence, answer is 22.4.
16. The maximum value for A will happen in the case of Q. 15. Then the increment for group A is:

    $31 \times 5 - 18 \times 5 = 5 \times (31 - 18) = 65.$

    Thus, maximum possible value is $465/20 = 23.25$.
17. Minimum possible average will happen for the transfer we saw in Q. 14. Thus, the answer will be $405/20 = 20.25$.
18. The maximum possible value for C will be achieved when the transfer from C is of five 26's and the transfer back from B is of five 31's. Hence, difference is totals will be +25. Hence, max. average = $(900 + 25)/30 = 30.833$.

    (**Note:** Here that 900 has come by 30×30)
19. For the maximum possible value of Class B, the following set of operations will have to hold:
    Five 33's are transferred from C to B, whatever goes from B to A comes back from A to B, then five 23's are transferred from B to C. This leaves us with:

    Increase of 50 marks $\rightarrow$ average increases by 2 to 27.

20. A will attain maximum value if five 33's come to *A* from *C* through *B* and five 18's leave *A*. In such a case the net result is going to be a change of +75. Thus, the average will go up by 75/20 = 3.75 to 23.75.

Solutions for Questions 21 to 23:

Will be solved by the same pattern as the above questions.

(**Note:** For question 22, you need to realise that there are only a maximum of six 31's in group *B*.)

24. Option (c) is correct, since you need to transfer out whatever you got into *A*, in order to keep the value of *A*'s average at the minimum.

Solutions for Questions 25 to 28:

Will be solved by the same pattern as above questions.

Solutions for Questions 29 to 35:

These are standard questions using the concept of averages. Hence, analyse each and every sentence by itself and link the interpretations. If you are getting stuck, the only reason is that you have not used the information in the questions fully.

36. Monthly estimates of income is reduced as the denominator is increased from 12 to 14 at the same time the monthly estimate of expenditure is increased as the denominator is reduced from 12 to 9. Hence, the savings will be underestimated.

Solutions for Questions 37 to 39:

Use the averages formulae and common sense to answer.

Solutions for Questions 40 to 49:

The questions are commonsensical with a lot of calculations and assumptions involved. You have to solve these using all the information provided.

40. Das's score = 15*2 + 7*2.5 = 47.5 → 48

    Dasgupta's score = 20*1 + 2*1.5 = 23

41. From the above, the answer is 48:23 = 96:46.

Solutions for Questions 42 to 44:

By maximum possible support from the other end, you have to assume that he has Laxman or Sehwag batting aggressively for the entire tenure at the crease. Strike has to be shared equally.

42. Through options, after 60 overs, score would be 150. Then Tendulkar can score @ 4 runs per over (sharing the strike and batting aggressively) and get maximum support @ 3 runs per over. Thus, in 30 overs left, the target will be achieved.

43. Tendulkar's score for the innings will be 30*4 = 120.

44. We do not know when Laxman would have come into bat. Hence, this cannot be determined.

Solutions for Questions 45 to 49:

Build in each of the conditions in the problem to form a table like:

Partnership Partner Overs faced Tendulkar's score Partner's score

6th wicket Ganguly 12 6 overs × 6 6 overs × 4

7th wicket and so on

8th wicket

9th wicket

10th wicket