1

NUMBER SYSTEMS

INTRODUCTION

The chapter of number systems is amongst the most important chapters in the whole of mathematics syllabus for the CAT examination. The students are advised to go through this chapter with utmost care, understanding each and every question type on this topic. Over the last decade, approximately 10–15 questions out of 40–50 questions asked in Mathematics have been taken from this chapter. It would be a good idea to first go through the basic definitions of all types of numbers (something I have found to be surprisingly very less known about). The student is also advised to go through the solutions of the various questions illustrated in this chapter. Besides, while solving this chapter, try to maximise your learning experience with every problem that you solve.

DEFINITIONS

Natural Numbers These are the numbers (1, 2, 3 etc.) that are used for counting. In other words, all positive integers are natural numbers.

There are infinite natural numbers and the number 1 is the least natural number.

Examples of natural numbers: 1, 2, 4, 8, 32, 23, 4321 and so on.

The following numbers are examples of numbers that are not natural: –2, –31, 2.38, 0 and so on.

Based on divisibility, there could be two types of natural numbers: *Prime and Composite*.

Prime Numbers A natural number larger than unity is a prime number if it does not have other divisors except for itself and unity.

***Note*:** Unity (i.e. 1) is not a prime number

Some Properties of Prime Numbers

- The lowest prime number is 2.
- 2 is also the only even prime number.
- The lowest odd prime number is 3.
- The remainder when a prime number $p \geq 5$ is divided by 6 is 1 or 5. However, if a number on being divided by 6 gives a remainder of 1 or 5 the number need not be prime.
- The remainder of the division of the square of a prime number $p \geq 5$ divided by 24 is 1.
- For prime numbers $p > 3$, $p^2 - 1$ is divisible by 24.
- Prime Numbers between 1 to 100 are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.
- Prime Numbers between 100 to 200 are: 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157, 163, 167, 173, 179, 181, 191, 193, 197, 199.
- If a and b are any two odd primes then $a^2 - b^2$ is composite. Also, $a^2 + b^2$ is composite.
- The remainder of the division of the square of a prime number $p \geq 5$ divided by 12 is 1.

To Check Whether a Number is Prime or Not

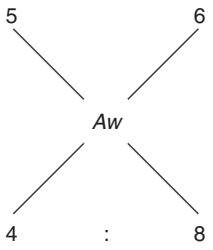
To check whether a number N is prime, adopt the following process.

(a) Take the square root of the number.
(b) Round of the square root to the next highest integer. Call this number z.

Illustration 4

4 kgs of rice at Rs. 5 per kg is mixed with 8 kg of rice at Rs. 6 per kg. Find the average price of the mixture.

Solution:



$= (6 - Aw) : (Aw - 5)$

$\Rightarrow \quad (6 - Aw)/(Aw - 5) = 4/8 \rightarrow 12 - 2\ Aw = Aw - 5$

$3\ Aw = 17$

$\therefore \quad Aw = 5.66$ Rs./kg. (Answer)

Task for student: Solve through the alligation formula approach and through the weighted average approach to get the solution. Notice, the amount of time required in doing the same.

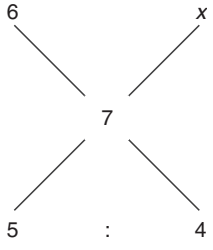
Note: The cross method becomes quite cumbersome in this case, as this method results in the formula being written. Hence, there seems to be no logic in using the cross method in this case.

Case 3: A_1, Aw, n_1 and n_2 are known; A_2 is unknown.

Illustration 5

5 kg of rice at Rs. 6 per kg is mixed with 4 kg of rice to get a mixture costing Rs. 7 per kg. Find the price of the costlier rice.

Solution: Using the cross method:



$= (x - 7) : 1$

$\therefore \quad (x - 7)/1 = 5/4 \rightarrow 4x - 28 = 5$

$\therefore \quad x =$ Rs. 8.25.

Task for student: Solve through the alligation formula approach and through the weighted average approach to get the solution. Notice the amount of time required in doing the same.

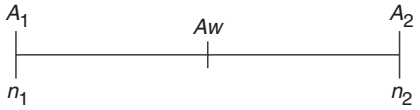
Note: The cross method becomes quite cumbersome in this case since this method results in the formula being written. Hence, there seems to be no logic in using the cross method in this case.

The above problems are quite effectively dealt by using the straight line approach, which is explained below.

The Straight Line Approach

As we have seen, the cross method becomes quite cumbersome in Case 2 and Case 3. We will now proceed to modify the cross method so that the question can be solved graphically in all the three cases.

Consider the following diagram, which results from closing the cross like a pair of scissors. Then the positions of A_1, A_2, Aw, n_1 and n_2 are as shown.



Visualise this as a fragment of the number line with points A_1, Aw and A_2 in that order from left to right. Then,

(a) n_2 is responsible for the distance between A_1 and Aw or n_2 corresponds to $Aw - A_1$

(b) n_1 is responsible for the distance between Aw and A_2. or n_1 corresponds to $A_2 - Aw$

(c) $(n_1 + n_2)$ is responsible for the distance between A_1 and A_2. or $(n_1 + n_2)$ corresponds to $A_2 - A_1$.

The processes for the 3 cases illustrated above can then be illustrated below:

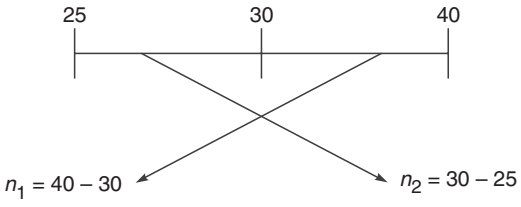
Illustration 6

On mixing two classes of students having average marks 25 and 40 respectively, the overall average obtained is 30 marks. Find

(a) the ratio in which the classes were mixed.

(b) the number of students in the first class if the second class had 30 students.

Solution:



Hence, ratio is 2 : 1, and the second class has 60 students.

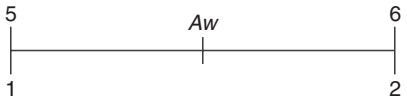
Case 2 : A_1, A_2, n_1 and n_2 are known; Aw is unknown.

Illustration 7

4 kg of rice at Rs. 5 per kg is mixed with 8 kg of rice at Rs. 6 per kg. Find the average price of the mixture.

Solution:

is the same as



Then, by unitary method:

$n_1 + n_2$ corresponds to $A_2 - A_1$
$\rightarrow 1 + 2$ corresponds to $6 - 5$

That is, 3 corresponds to 1

$\therefore$ n_2 will correspond to $\dfrac{(A_2 - A_1) \times n_2}{(n_1 + n_2)}$

In this case $(1/3) \times 2 = 0.66$.

Hence, the required answer is 5.66.

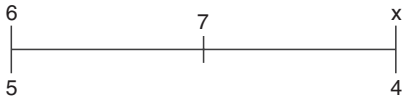
Note: In this case, the problem associated with the cross method is overcome and the solution becomes graphical.

Case 3: A_1, Aw, n_1 and n_2 are known; A_2 is unknown.

Illustration 8

5 kg of rice at Rs. 6 per kg is mixed with 4 kg of rice to get a mixture costing Rs. 7 per kg. Find the price of the costlier rice.

Using straight line method:



4 corresponds to 7 – 6 and 5 corresponds to x – 7.

The thought process should go like:

$4 \rightarrow 1$
$\therefore$ $5 \rightarrow 1.25$
Hence, $x - 7 = 1.25$
and $x = 8.25$

SOME TYPICAL SITUATIONS WHERE ALLIGATIONS CAN BE USED

Given below are typical alligation situations, which students should be able to recognize. This will help them improve upon the time required in solving questions. Although in this chapter we have illustrated problems based on alligation at level 1 only, alligation is used in more complex problems where the weighted average is an intermediate step in the solution process.

The following situations should help the student identify alligation problems better as well as spot the way A_1, A_2, n_1 and n_2 and Aw are mentioned in a problem.

In each of the following problems the following magnitudes represent these variables:

$A_1 = 20$, $A_2 = 30$, $n_1 = 40$, $n_2 = 60$

Each of these problems will yield an answer of 26 as the value of Aw.

1. A man buys 40 kg of rice at Rs. 20/kg and 60 kg of rice at Rs. 30 kg. Find his average price. (26/kg)
2. Pradeep mixes two mixtures of milk and water. He mixes 40 litres of the first containing 20% water and 60 litres of the second containing 30% water. Find the percentage of water in the final mixture. (26%)
3. Two classes are combined to form a larger class. The first class having 40 students scored an average of 20 marks on a test while the second having 60 students scored an average of 30 marks on the same test. What was the average score of the combined class on the test. (26 marks)
4. A trader earns a profit of 20% on 40% of his goods sold, while he earns a profit of 30% on 60% of his

Hence, the net percentage change between the values of the two products is 34.81%. This process will be much faster than any other process of calculating the percentage change (provided you have developed your skill at calculating percentage values through percentage rule)

The process is found useful for calculating the net percentage change in a product $x \times y$ when both x and y change.

Use of Percentage Change Graphic for Product Constancy/Inverse Proportionality

This usage requires just a minor adjustment in the process.

The situation for this usage will be when the percentage change in one part of the product is provided and we have to find the corresponding percentage change in the other part of the product so as to maintain the value of the overall product.

This is best illustrated through an example:

$$100 \xrightarrow[= +22]{\text{Increase by 22\% on 100}}$$

$$122 \xrightarrow[\text{decrease needed to get back to 100} = -22]{} 100$$

Decrease required to keep product constant = (–22/122) = –18.03 % approx (calculated by percentage rule)

Effect of a Change in Both Numerator and Denominator on the Ratio There can be two broad cases:

Case 1: Both numerator and denominator have the same effect in terms of ratio change.

(A) Numerator increases and denominator decreases resulting in an increase in the ratio.

(B) Numerator decreases and denominator increases resulting in a decrease in the ratio.

In both the above situations the numerator and the denominator work hand in hand and have the same directional effect on the ratio. In this case, it is not difficult to understand the direction that the ratio will take in terms of its change in value.

Case 2: Numerator and denominator have the opposite effects on the value of the ratio:

(A) Numerator and denominator both increase.

(B) Numerator and denominator both decrease.

In both these cases the net effect on the value of the ratio will depend upon the relative effects of the numerator and the denominator. If the numerator dominates the change, the ratio will change in the direction of the numerator.

However, the magnitude of the change will depend on both the numerator and the denominator's change.

***A)* Numerator and its effect on the ratio:** The numerator, as we know, has a direct effect on the magnitude of change in the ratio. This direct relationship holds true not only for the direction but also for the magnitude of the percentage change in the ratio vis a vis the percentage change in the numerator.

That is, a 20% increase in the numerator increases the ratio by 20% while a 10% decrease in the numerator reduces the ratio by 10%. In general, we can say that an $x\%$ increase/decrease in the numerator increases/decreases the ratio by $x\%$.

***B)* Denominator and its effect on the ratio:** A little concentrated thought will give you a clear picture of the direction of effect the denominator's change has on the ratio. It can be stated as:

(a) A decrease in the denominator increases the ratio.

(b) An increase in the denominator reduces the ratio.

These being obvious, we can further couple this with the Table 4.1 given above to understand the magnitude of the percentage change in the ratio due to a percentage change in the denominator.

***C)* Calculation of the combined effect:** The combined effect then that the simultaneous percentage changes in the numerator and the denominator will have on the percentage change in the ratio is easily calculated on the basis of the percentage change graphic illustrated above. The process is illustrated below:

Suppose the numerator increases by 20% and the denominator decreased by 10%. Then, the effect on the value of the ratio will be:– 20% increase due to the numerator increase and 9.09% decrease due to the denominator decrease. These values can be used on the percentage change graphic to get the net result.

FRACTION TO PERCENTAGE CONVERSION TABLE

The following percentage values appear repeatedly over the entire area where questions can be framed on the topic of percentage. Further, it would be of great help to you if you are able to recognize these values separately from values that do not appear in the table.

Again, interest for next 4 years will be equal to $7 \times 4 = 28\%$.

And interest for next 4 years (till 11 years) $-7.5 \times 4 = 30\%$

So, total interest = 18 + 28 + 30 = 76%

So, total interest earned by him = 76% of the amount

$$= \frac{(76 \times 1200)}{100} = \text{Rs. } 912$$

This calculation can be done very conveniently using the percentage rule as 75% + 1% = 900 + 12 = 912.

Problem 6.3 A sum of money doubles itself in 12 years. Find the rate percentage per annum.

(a) 12.5% (b) 8.33% (c) 10% (d) 7.51%

Solution Let principal = x, then interest = x, time = 12 years.

Using the formula, Rate = (Interest × 100)/Principal × Time

$$= (x \times 100)/(x \times 12) = 8.33\%$$

Alternatively: It is obvious that in 12 years, 100% of the amount is added as interest.

So, in 1 year = (100/12)% of the amount is added.

Hence, every year there is an addition of 8.33% (which is the rate of simple interest required).

Alternatively, you can also use the formula.

If a sum of money gets doubled in x years, then rate of interest = $(100/x)\%$.

Problem 6.4 A certain sum of money amounts to Rs. 704 in 2 years and Rs. 800 in 5 years. Find the rate percentage per annum.

(a) Rs. 580 (b) Rs. 600 (c) Rs. 660 (d) Rs. 640

Solution Let the principal be Rs. x and rate = $r\%$.

Then, difference in between the interest of 5 years and of 2 years equals to

Rs. 800 – Rs. 704 = Rs. 96

So, interest for 3 years = Rs. 96

Hence, interest/year = Rs. 96/3 = Rs. 32

So, interest for 2 years → 2 × Rs. 32 = Rs. 64

So, the principal = Rs. 704 – Rs. 64 = Rs. 640

Thought process here should be

Rs. 96 interest in 3 years → Rs. 32 interest every year.

Hence, principal = 704 – 64 = 640

Problems 6.5 A sum of money was invested at SI at a certain rate for 3 years. Had it been invested at a 4% higher rate, it would have fetched Rs. 480 more. Find the principal.

(a) Rs. 4000 (b) Rs. 4400 (c) Rs. 5000 (d) Rs. 3500

Solution Let the rate be $y\%$ and principal be Rs. x and the time be 3 years.

Then according to the question = $(x(y + 4) \times 3)/100 - (xy \times 3)/100 = 480$

$$\Rightarrow \quad xy + 4x - xy = 160 \times 100$$
$$\Rightarrow \quad x = (160 \times 100)/4 = \text{Rs. } 4000$$

Alternatively: Excess money obtained = 3 years @ 4% per annum

= 12% of whole money

So, according to the question, 12% = Rs. 480

So, 100% = Rs. 4000 (answer arrived at by using unitary method.)

Problem 6.6 A certain sum of money trebles itself in 8 years. In how many years it will be five times?

(a) 22 years (b) 16 years (c) 20 years (d) 24 years

Solution It trebles itself in 8 years, which makes interest equal to 200% of principal.

So, 200% is added in 8 years.

Hence, 400%, which makes the whole amount equal to five times of the principal, which will be added in 16 years.

Problem 6.7 If CI is charged on a certain sum for 2 years at 10% the amount becomes 605. Find the principal?

(a) Rs. 550 (b) Rs. 450 (c) Rs. 480 (d) Rs. 500

Solution Using the formula, amount = Principal $(1 + \text{rate}/100)^{\text{time}}$

$$605 = p(1 + 10/100)^2 = p(11/10)^2$$
$$p = 605(100/121) = \text{Rs. } 500$$

Alternatively: Checking the options,

Option (a) Rs. 550

First year interest = Rs. 55, which gives the total amount Rs. 605 at the end of first year. So not a valid option.

Option (b) Rs. 450

First year interest = Rs. 45

Second year interest = Rs. 45 + 10% of Rs. 45 = 49.5

Thus, the work done per man-day has to rise from 1 to 1.5, that is, by 50%. Hence, the efficiency of work has to rise by **50%.**

Problem 8.4 *A* is twice as efficient as *B*. If they complete a work in 30 days find the times required by each to complete the work individually.

Solution When we say that *A* is twice as efficient as *B*, it means that *A* takes half the time that *B* takes to complete the same work.

Thus, if we denote *A*'s 1 day's work as *A* and *B*'s one day's work as *B*, we have

$$A = 2B$$

Then, using the information in the problem, we have: 30 A + 30 B = 100% work

That is, 90 B = 100% work $\rightarrow$ B = 1.11 % (is the work done by B in 1 day) $\rightarrow$ B requires **90 days** to complete the work alone.

Since, $A = 2B \rightarrow$ we have A = 2.22 % $\rightarrow$ A requires 45 days to do the work alone.

You should be able to solve this mentally with the following thought process while reading for the first time:

$\frac{100}{30}$ = 3.33%. $\frac{3.33}{3}$ = 1.11%. Hence, work done is 1.11% per day and 2.22% per day $\rightarrow$ 90 and 45 days.

Problem 8.5 *A* is two times more efficient than *B*. If they complete a work in 30 days, then find the times required by each to complete the work individually.

Solution Interpret the first sentence as $A = 3B$ and solve according to the process of the previous problem to get the answers. (You should get *A* takes 40 days and *B* takes 120 days.)

Level of Difficulty (LOD) I

1. Raju can do 25% of a piece of work in 5 days. How many days will he take to complete the work ten times?
   (a) 150 days (b) 250 days
   (c) 200 days (d) 180 days
2. 6 men can do a piece of work in 12 days. How many men are needed to do the work in 18 days.
   (a) 3 men (b) 6 men
   (c) 4 men (d) 2 men
3. *A* can do a piece of work in 20 days and *B* can do it in 15 days. How long will they take if both work together?
   (a) $8\left(\frac{6}{7}\right)$ days (b) $8\left(\frac{4}{7}\right)$ days
   (c) $9\left(\frac{3}{7}\right)$ days (d) None of these
4. In question 3 if *C*, who can finish the same work in 25 days, joins them, then how long will they take to complete the work?
   (a) $6\left(\frac{18}{47}\right)$ days (b) 12 days
   (c) $2\left(\frac{8}{11}\right)$ days (d) $47\left(\frac{6}{18}\right)$ days
5. Nishu and Archana can do a piece of work in 10 days and Nishu alone can do it in 12 days. In how many days can Archana do it alone?
   (a) 60 days (b) 30 days
   (c) 50 days (d) 45 days
6. Baba alone can do a piece of work in 10 days. Anshu alone can do it in 15 days. If the total wages for the work is Rs. 50. How much should Baba be paid if they work together for the entire duration of the work?
   (a) Rs. 30 (b) Rs. 20
   (c) Rs. 50 (d) None of these
7. 4 men and 3 women finish a job in 6 days, and 5 men and 7 women can do the same job in 4 days. How long will 1 man and 1 woman take to do the work?
   (a) $22\left(\frac{2}{7}\right)$ days (b) $25\left(\frac{1}{2}\right)$ days
   (c) $5\left(\frac{1}{7}\right)$ days (d) $12\left(\frac{7}{22}\right)$days
8. If 8 boys and 12 women can do a piece of work in 25 days, in how many days can the work be done by 6 boys and 11 women working together?
   (a) 15 days (b) 10 days
   (c) 12 days (d) Cannot be determined
9. *A* can do a piece of work in 10 days and *B* can do the same work in 20 days. With the help of *C*, they finish the work in 5 days. How long will it take for *C* alone to finish the work?

a depth of 280 metres. How many metres of drilling was the plan for each day.

(a) 38 metres (b) 30 metres
(c) 27 metres (d) None of these

3. A pipe can fill a tank is x hours and another can empty it in y hours. If the tank is 1/3rd full then the number of hours in which they will together fill it in is

(a) $\frac{(3xy)}{2(y-x)}$ (b) $\frac{(3xy)}{(y-x)}$

(c) $\frac{xy}{3(y-x)}$ (d) None of these

4. Dev and Tukku can do a piece of work in 45 and 40 days respectively. They began the work together, but Dev leaves after some days and Tukku finished the remaining work in 23 days. After how many days did Dev leave

(a) 7 days (b) 8 days
(c) 9 days (d) 11 days

5. A finishes 6/7th of the work in $2z$ hours, B works twice as fast and finishes the remaining work. For how long did B work?

(a) $\left(\frac{2}{3}\right)z$ (b) $\left(\frac{6}{7}\right)z$

(c) $\left(\frac{6}{49}\right)z$ (d) $\left(\frac{3}{18}\right)z$

Directions for questions 6–10: Read the following and answer the questions that follow.

A set of 10 pipes (set X) can fill 70% of a tank in 7 minutes. Another set of 5 pipes (set Y) fills 3/8 of the tank in 3 minutes. *A* third set of 8 pipes (set Z) can empty 5/10 of the tank in 10 minutes.

6. How many minutes will it take to fill the tank if all the 23 pipes are opened at the same time?

(a) 5 minutes (b) $5\frac{5}{7}$ minutes
(c) 6 minutes (d) None of these

7. If only half the pipes of set X are closed and only half the pipes of set Y are open and all other pipes are open, how long will it take to fill 49% of the tank?

(a) 16 minutes (b) 13 minutes
(c) 7 minutes (d) None of these

8. If 4 pipes are closed in set Z, and all others remain open, how long will it take to fill the tank?

(a) 5 minutes (b) 6 minutes
(c) 7 minutes (d) 7.5 minutes

9. If the tank is half full and set X and set Y are closed, how many minutes will it take for set Z to empty the tank if alternate taps of set Z are closed.

(a) 12 minutes (b) 20 minutes
(c) 40 minutes (d) 16 minutes

10. If one pipe is added for set X and set Y and set Z's capacity is increased by 20% on it's original value and all the taps are opened at 2.58 p.m., then at what time does the tank get filled? (If it is initially empty.)

(a) 3.05 p.m. (b) 3.04 p.m.
(c) 3.10 p.m. (d) 3.03 p.m.

11. Ajit can do as much work in 2 days as Baljit can do in 3 days and Baljit can do as much in 4 days as Diljit in 5 days. A piece of work takes 20 days if all work together. How long would Baljit take to do all the work by himself?

(a) 82 days (b) 44 days
(c) 66 days (d) 50 days

12. Two pipes can fill a cistern in 14 and 16 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom of the cistern, it takes 32 minutes extra for the cistern to be filled up. When the cistern is full, in what time will the leak empty it?

(a) 114 h (b) 112 h
(c) 100 h (d) 80 h

13. A tank holds 100 gallons of water. It's inlet is 7 inches in diameter and fills the tank at 5 gallons/min. The outlet of the tank is twice the diameter of the inlet. How many minutes will it take to empty the tank if the inlet is shut off, when the tank is full and the outlet is opened? (*Hint:* Rate of filling or emptying is directly proportional to the diameter)

(a) 7.14 min (b) 10.0 min
(c) 0.7 min (d) 5.0 min

14. A tank of capacity 25 litres has an inlet and an outlet tap. If both are opened simultaneously, the tank is filled in 5 minutes. But if the outlet flow rate is doubled and taps opened the tank never gets filled up. Which of the following can be outlet flow rate in liters/min?

(a) 2 (b) 6 (c) 4 (d) 3

15. X takes 4 days to complete one-third of a job, Y takes 3 days to complete one-sixth of the same work and Z takes 5 days to complete half the job. If all of them work together for 3 days and X and Z quit, how long will it take for Y to complete the remaining work done.

needed to fill the tank than to discharge it. Determine the delivery of the pump discharging the tank.

(a) 40 m^3/min (b) 50 m^3/min
(c) 60 m^3/min (d) 80 m^3/min

27. Two pipes *A* and *B* can fill up a half full tank in 1.2 hours. The tank was initially empty. Pipe *B* was kept open for half the time required by pipe *A* to fill the tank by itself. Then, pipe *A* was kept open for as much time as was required by pipe *B* to fill up 1/3 of the tank by itself. It was then found that the tank was 5/6 full. The least time in which any of the pipes can fill the tank fully is

(a) 4.8 hours (b) 4 hours
(c) 3.6 hours (d) 6 hours

28. A tank of 425 litres capacity has been filled with water through two pipes, the first pipe having been opened five hours longer than the second. If the first pipe were open as long as the second, and the second pipe was open as long as the first pipe was open, then the first pipe would deliver half the amount of water delivered by the second pipe; if the two pipes were open simultaneously, the tank would be filled up in 17 hours. How long was the second pipe open?

(a) 10 hours (b) 12 hours
(c) 15 hours (d) 18 hours

29. Two men and a woman are entrusted with a task. The second man needs three hours more to cope with the job than the second man and the woman would need working together. The first man, working alone, would need as much time as the second man and the woman working together. The first man, working alone, would spend eight hours less than the double period of time the second man would spend working alone. How much time would the two men and the woman need to complete the task if they all worked together?

(a) 1 hour (b) 3 hours
(c) 4 hours (d) 5 hours

30. The Bubna dam has four inlets. Through the first three inlets, the dam can be filled in 12 minutes; through the second, the third and the fourth inlet, it can be filled in 15 minutes; and through the first and the fourth inlet, in 20 minutes. How much time will it take all the four inets to fill up the dam?

(a) 8 min (b) 10 min
(c) 12 min (d) None of these

Level of Difficulty (LOD) III

Directions for questions 1–10: Study the following tables and answers the questions that follow.

Darbar Toy Company has to go through the following stages for the launch of a new toy:

	Expert man-days required	*Non-expert man-days required*
1. Design and development	30	60
2. Prototype creation	15	20
3. Market survey	30	40
4. Manufacturing setup	15	30
5. Marketing and launch	15	20

The profile of the company's manpower is

Worker name	*Expert at*	*Non-Expert at*	*Refusal to work on*
A	Design and development	All others	Market survey
B	Prototype creation	All others	Market survey
C	Market survey and marketing and launch	All others	Design and development
D	Manufacturing	All others	Market survey
E	Market survey	All others	Manufacturing

1. Given this situation, the minimum number of days in which the company can launch a new toy going through all the stages is

(a) 40 days (b) 40.5 days
(c) 45 days (d) None of these

2. If *A* and *C* refuse to have anything to do with the manufacturing set up. The number of days by which the project will get delayed will be

(a) 5 days (b) 4 days
(c) 3 days (d) None of these

3. If each of the five works is equally valued at Rs.10,000, the maximum amount will be received by

(a) *A* (b) *C* (c) *D* (d) *E*

4. For question 3, the second highest amount will be received by

(a) *A* (b) *C* (c) *D* (d) *E*

5. If *C* works at 90.909% of his efficiency during marketing and launch, who will be highest paid amongst the five of them?