# CAT Notes

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2 March 2024

# Contents

# Introduction

This is a series of notes that I am making to learn LaTeX as well as makes notes for CAT and any aptitude exam preparation. The youtube channels and resources I am using are as follows

- Rodha Youtube Channel
- Free CAT Question Bank : This contains question for each topic.

# Part I

# Number System

# Part II

# Arithmetic

# Chapter 1

# Time And Work

## 1.1 Basics

The fundamental formula is

$$\text{Work} = \text{Efficiency} * \text{Time}$$

NOTE

Efficiency is defined as the amount of work that can be done in 1 day. Mathematically, efficiency is denoted as $\eta$ (eta)

We explore the basic types of question that come under this topic. Mostly, we should try to deal with whole numbers rather than fractions however there are cases where fractions are unavoidable. Refer to the below questions

**Question 1.1** : A can complete work in 10 days and B can complete work in 15 days. Find number of days in which A and B together can complete the work

**Using fractions (not recommended)**

- Let the work be $x$ units. According to this, A does $\frac{x}{10}$ amount of work in 1 day ($\eta_A$) and B does $\frac{x}{15}$ amount of work in 1 day ($\eta_B$)
- Collectively, they will do $\frac{x}{10} + \frac{x}{15} = \frac{x}{6}$ work in 1 day ($\eta_{AB}$)
- Therefore, $x = t * \frac{x}{6} \implies t = 6$. Will take 6 days

**Using LCM (Recommended)**

- Let work be LCM(10,15) = 30. According to this, A does $\frac{30}{10} = 3$ units work in 1 day ($\eta_A$) and B does $\frac{30}{15} = 2$ units of work in 1 day ($\eta_B$)
- Collectively, they will do $3 + 2 = 5$ units of work in 1 day ($\eta_{AB}$)
- Therefore, $30 = t * 5 \implies t = 6$. Will take 6 days

**Question 1.2** : A can do work in 12 days and B can do work in 18 days. Both started the work together but A left after 2 days. In how many days can B complete the remaining work?

- Let work = LCM(12,18) = 36 units. $\eta_A = \frac{36}{12} = 3, \eta_B = \frac{36}{18} = 2$
- $\eta_{AB} = 5$

- In 2 days, they collectively do $5 * 2 = 10$ units of work. Therefore, remaining work for B is 36 - 10 = 26 units
- Time taken for B to complete remaining work = $\frac{26}{2} = 13$ days

**Question 1.3** : A can complete work in 12 days and B can complete work in 20 days. C can complete work in 40 days Find number of days in which all three can finish the work together

- Work = LCM(12,20,40) = LCM(12,LCM(20,40)) = LCM(12,40) = 120
- $\eta_A = \frac{120}{12} = 10, \eta_B = \frac{120}{20} = 6, \eta_C = \frac{120}{40} = 3$
- $\eta_{ABC} = 10 + 6 + 3 = 19$
- Time taken = $\frac{120}{19} = 6$ days (approx)

**Question 1.4** : P and Q can complete work in 15 and 21 days respectively. Q started the work and after some days, P joined. Work was finished in 14 days. Find the number of days after which P joined to work with Q

- Work = LCM(15,21) = 105
- $\eta_P = \frac{105}{15} = 7, \eta_Q = \frac{105}{21} = 5$
- Let $x$ be the days which P worked alone. Therefore, P and Q worked together for $(14 - x)$ days
- We can write the following equation

$$\begin{aligned} 105 &= 5x + 12(14 - x) \\ 105 &= -7x + 168 \\ 7x &= 168 - 105 \\ x &= \frac{63}{7} = 9 \end{aligned}$$

P joined after 9 days

# Part III

# Logical Reasoning and Data Interpretation

# Chapter 1

# Arrangements

## 1.1 Basics

Remember these points while solving the questions

- In circular arrangement, people are distributed equally and unless otherwise mentioned, face each other
- In linear arrangement unless mentioned otherwise, all are facing same direction
- Calculating "left" and "right" from the direction you are facing can be tricky. Try to visualise yourself standing and looking at that direction. This will give a better sense of right and left

## 1.2 Linear arrangement : Tricky statements

Once we know what these statements imply, we can use it to reject options and create constraints which our possible solutions must satisfy

### 1.2.1 If A and B interchange their positions then each of them gets exactly one new neighbour.

The verdict is that as long as for any two positions, there is one common neighbour before swapping, the swap is possible. For 7 people linearly arranged ,we can have the following cases

$$1, 2, 3, 4, 5, 6, 7$$

- Ends : Swapping the end positions satisfy the above condition as there is one common neighbour. Therefore, swap of (1,7)
- Adjacent elements : Any adjacement elements will have one common neighbour. Therefore, these are possible
  - (1,2)
  - (2,3)
  - (3,4)
  - (4,5)
  - (5,6)
  - (6,7)
- Gaps : With a gap of 1, there will be a common neighbour as well. Thus

- (1,3)
- (2,4)
- (3,5)
- (5,7)

### 1.2.2 Number of persons to the left of A is equal to the number of persons to right of B / Number of floors below B is equal to number of floors above C

The verdict is that if the sum of those positions is $n + 1$ where $n$ stands for number of seats / floors.

For 7 people linearly arranged, we can have the following possibilities

$$1, 2, 3, 4, 5, 6, 7$$

- (1,7)
- (2,6)
- (3,5)

For 8 people linearly arranged, we can have the following possibilities

$$1, 2, 3, 4, 5, 6, 7, 8$$

- (1,8)
- (2,7)
- (3,6)
- (4,5)

Similar situation for floors.

### 1.2.3 C is between A and B – AND – C is exactly between A and B

- **C is between A and B** : This simply implies that C is between A and B. This can be any arbitrary positiion
- **C is exactly between A and B** : This implies that C **is exactly** between A and B $\implies$ mid point. For example, if A is at 3 and B is at 7, then C will be at $\frac{7+3}{2} = 5$ position

### 1.2.4 E is 2 places away from F

This can be a little tricky. Simplest method is to assume 1-based index and count. For example

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| A | B | C | D | E | H | F |

- B is 1 place away from A (2 - 1 = 1)
- C is 2 places away from A (3 - 1 = 2)
- D is 2 places away from B (4 - 2 = 2)
- F is 2 places away from E (7 - 5 = 2)
- F is 4 places away from C (7 - 3 = 4)
- E is one place away from D (5 - 4 = 1)

## 1.3 Linear and Circular Arrangement

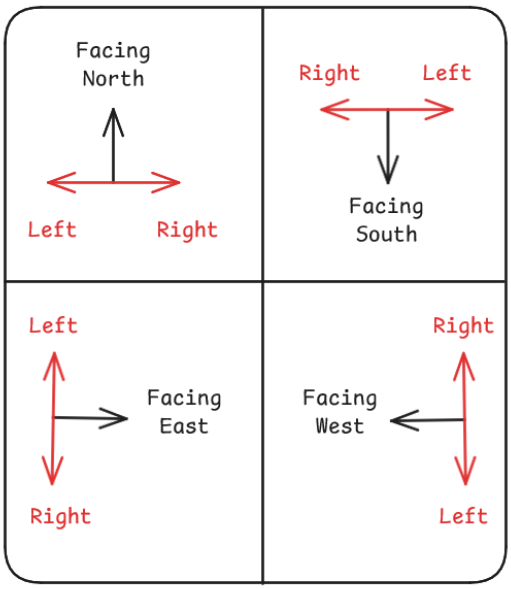
There are statements that apply to both linear and circular arrangements but their meaning is entirely different. Refer to the table below

| Statement | Linear | Circular |
|---|---|---|
| A is to left of B | A can be anywhere left to B | A is exactly left to B |
| A is immediate to left of B | A is exactly left to B | A is exactly left to B |
| C is to right of D | C can be anywhere right to D | C is exactly right to D |
| C is immediate right of D | C is exactly right to D | C is exactly right to D |
| C is between A and B | C can be anywhere between A and B | C is exactly between A and B |
| C is exactly between A and B | C is exactly between A and B | C is exactly between A and B |

In circular arrangement, "right" is ambiguous as we are in a "circle". Therefore, it is assumed that "right" is "immediate right".

## 1.4 Problem Solving Tips

- While solving questions with linear arrangement and less number of parameters, try dealing with two conditions at one time. The second condition becomes a constraint which limits choices
- While solving questions of linear arrangement with multiple parameters, read the question once and do the following
  - Create a table where you can store "direct" information that is, things that are explicitly stated in question
  - Create short notes of relations and indirect information. Instead of re reading the question again, we will simply focus on these conditions. When these conditions are created, we can see the one or two things that other things depend on
- When dealing with direction, visually make a diagram of what is left and right



NOTE

For questions, it is way too much of an effort to create them in latex. I have to see what I can do to do this efficiently later (maybe for next year CAT's attempt)

# Part IV

# Formulae

# Chapter 1

# Quant Formulae and Tips

## 1.1 Subtracting two numbers

There are some scenarios where we need to count the difference between two numbers. The difference of two numbers $b$ and $a$ where $b \geq a$ by default "excludes" $a$. For example, if we want to know the count of numbers which are in between 2 and 7 where we do not count 2 and count 7, it would be $7 - 2 = 5$. The numbers being $[3, 4, 5, 6, 7]$

However, if we want to find the count of numbers which are between 2 and 7 where both 2 and 7 are counted, it would be $7 - 2 + 1 = 6$. The numbers being $[2, 3, 4, 5, 6, 7]$

## 1.2 Random Properties of Numbers

1. Odd + Odd = Even
2. Even + Even = Even
3. Odd + Even = Odd
4. Odd * Odd = Odd
5. Odd * Even = Even
6. Even * Even = Even

## 1.3 Algebra

### 1.3.1 Factor formulae

1. $a^3 + b^3 = (a + b)\ (a^2 - ab + b^2)$
2. $a^3 - b^3 = (a - b)\ (a^2 + ab + b^2)$
3. $a^2 - b^2 = (a - b)\ (a + b)$
4. $a^2 + b^2$ cannot be factorised

Based on above, there exists a few patterns

- $a^n + b^n$

1. If $n$ is odd, then divisible by $(a+b)$
2. If $n$ is even, anything cannot be concluded

- $a^n - b^n$
  1. If $n$ is odd, then divisible by $(a-b)$
  2. If $n$ is even, then divisible by $(a+b)$ and $(a-b)$

## 1.4 Properties of exponents

1. $a^m * b^n = a^{m+n}$
2. $\frac{a^m}{b^n} = a^{m-n}$
3. $a^0 = 1$
4. $a^{-m} = \frac{1}{a^m}$
5. $(a^m)^n = a^{mn}$
6. $(ab)^m = a^m * b^m$
7. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

## 1.5 Some important numbers and their prime factorization

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1. $1001 = 13 * 11 * 7$
2. $1003 = 17 * 59$
3. $1007 = 19 * 53$
4. $10001 = 137 * 73$

## 1.6 Miscellaneous / Uncategorized

1. $2^0 + 2^1 + \ldots 2^n = 2^{n+1} - 1$
2. $3^0 + 3^1 + \ldots 3^n = \frac{3^{n+1} - 1}{2}$

# Part V

# Thank you