

Introduction to DSA

Who am I?

Graduated from the University of Dhaka

Worked at P1, Pathao, IPVision Ltd.,
Iterato UAB, MailerLite, GymRevenue



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Co-founder

Megaminds Learning

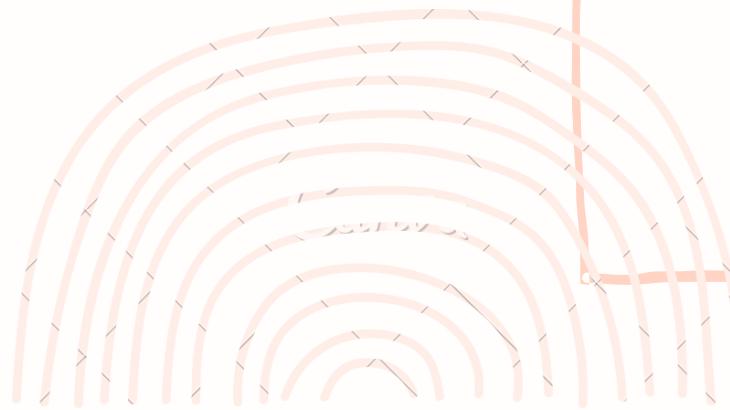
Rules for the class

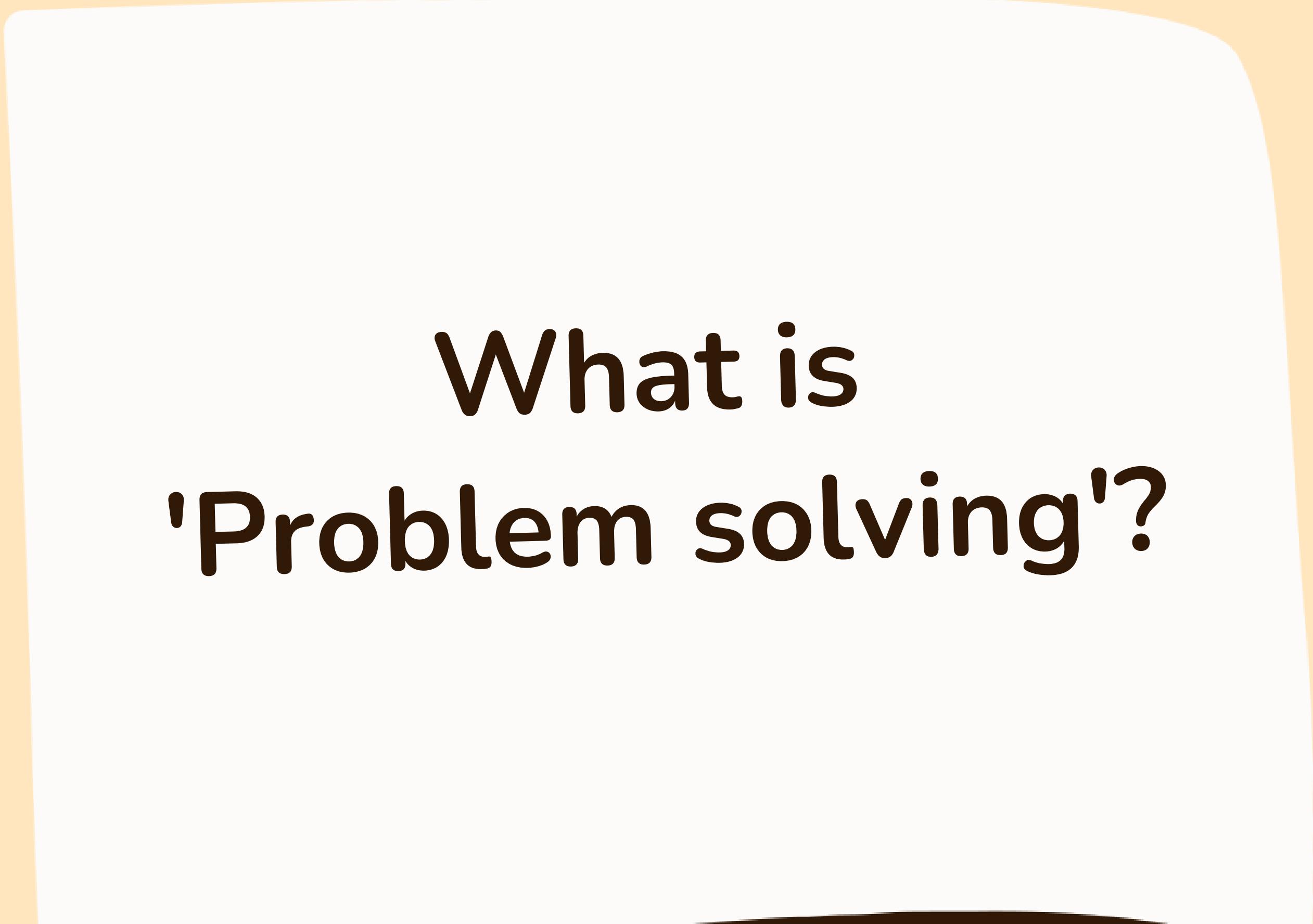
1 Take pen and paper

2 Open up your IDE

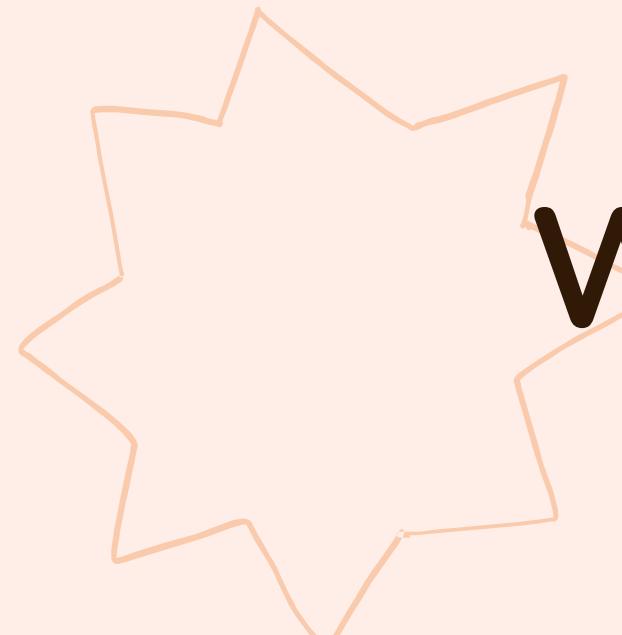
3 Close Facebook, messenger
and other distractions

4 Silent your mobile





**What is
'Problem solving'?**



Why do we need to learn problem solving?

1

Crack coding interviews

2

Become a better software engineer



1

You'll learn how to understand the problem and constraints better

2

You'll ask the right questions

3

You'll think before jump into coding

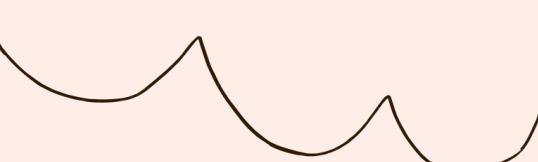
4

You will learn to face challenges and new problems

5

You'll review your solution before confirmation

How problem-solving can help you in your SE career?





Why do we need to learn so many data structures and algorithms?

1

To make better choices

2

To learn different kinds of
techniques

3

Complex problems require a
combination of different DSA
techniques

- 1 Fail to understand the problem
- 2 Not enough knowledge about the solution method or the context/pattern
- 3 Understood the problem but can't code it
- 4 Trying to shape the problem to a specific data structure or algorithm



**Why we can't solve
a problem?**



How to be good at problem solving?

1

Don't memorise the exact solution

2

Understand the concept and the pattern of the problem

3

Implement the code by yourself

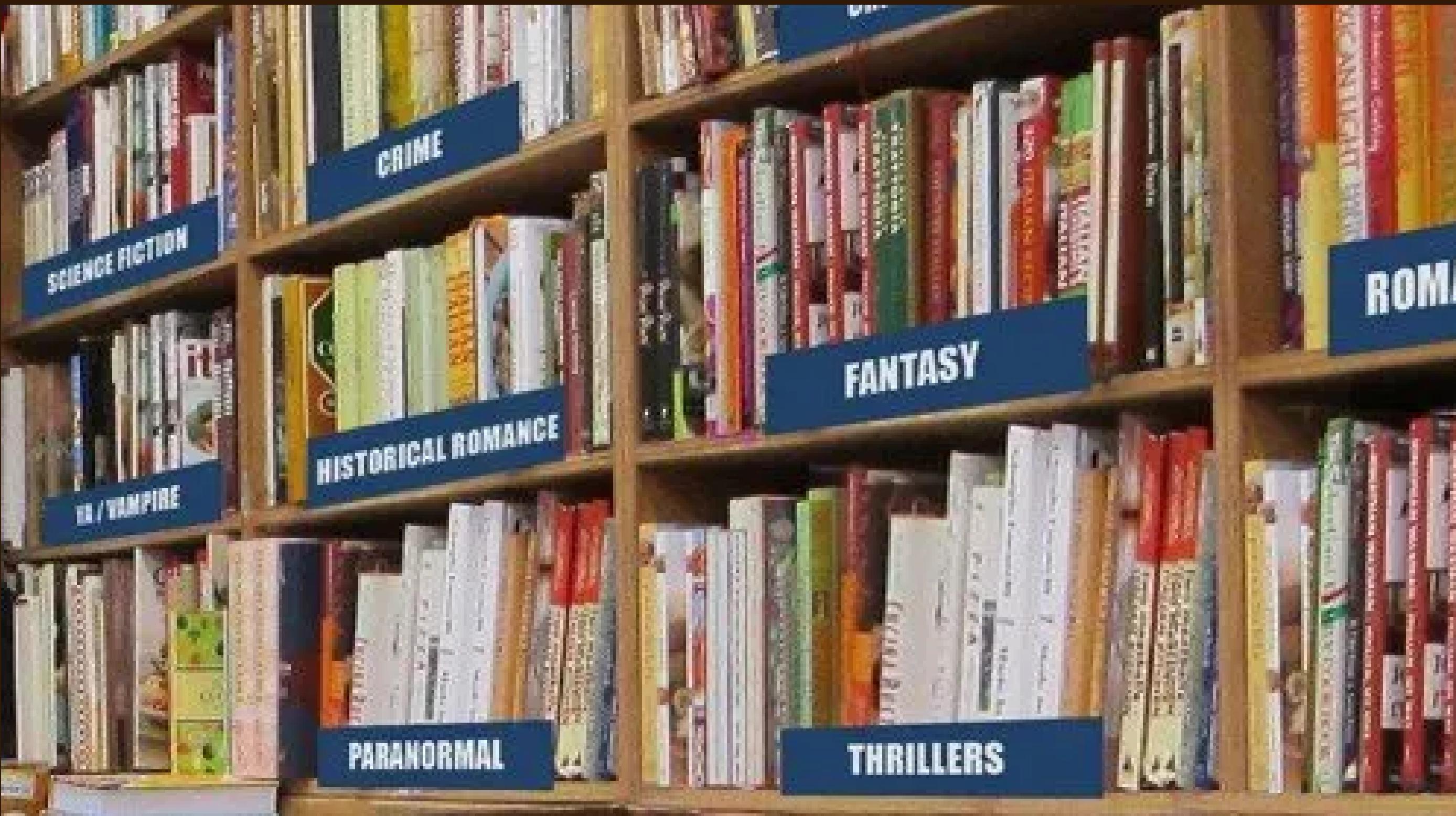
4

Be consistent, Practice regularly

**what is
'Data structure'?**

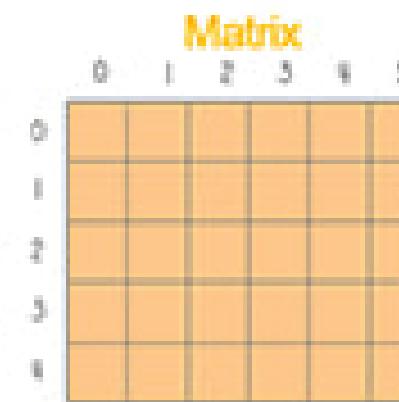
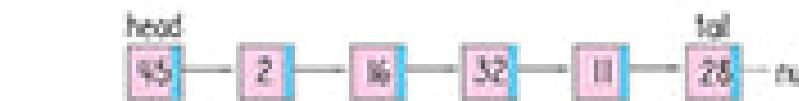




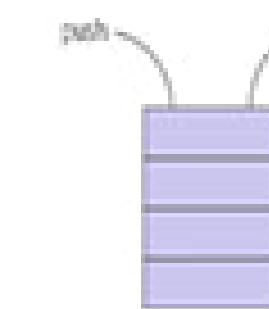




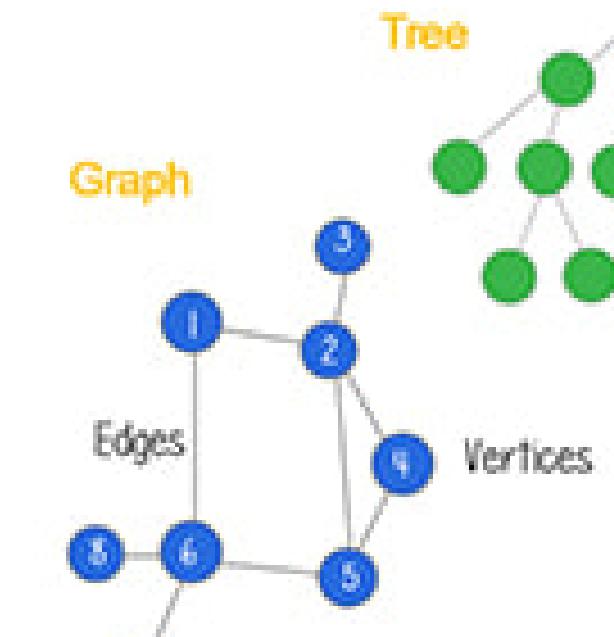
Data structures



Stack



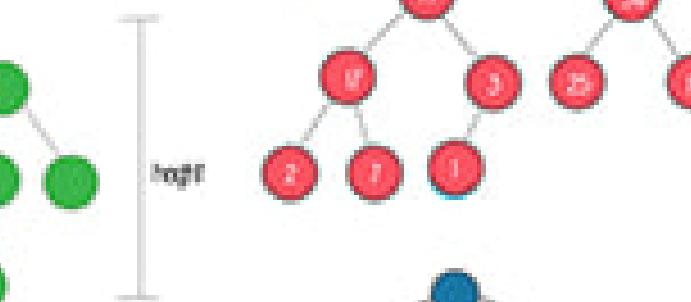
Queue



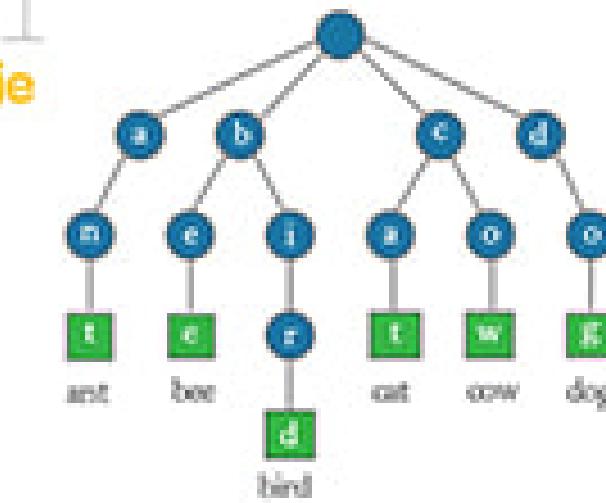
Edges
Vertices

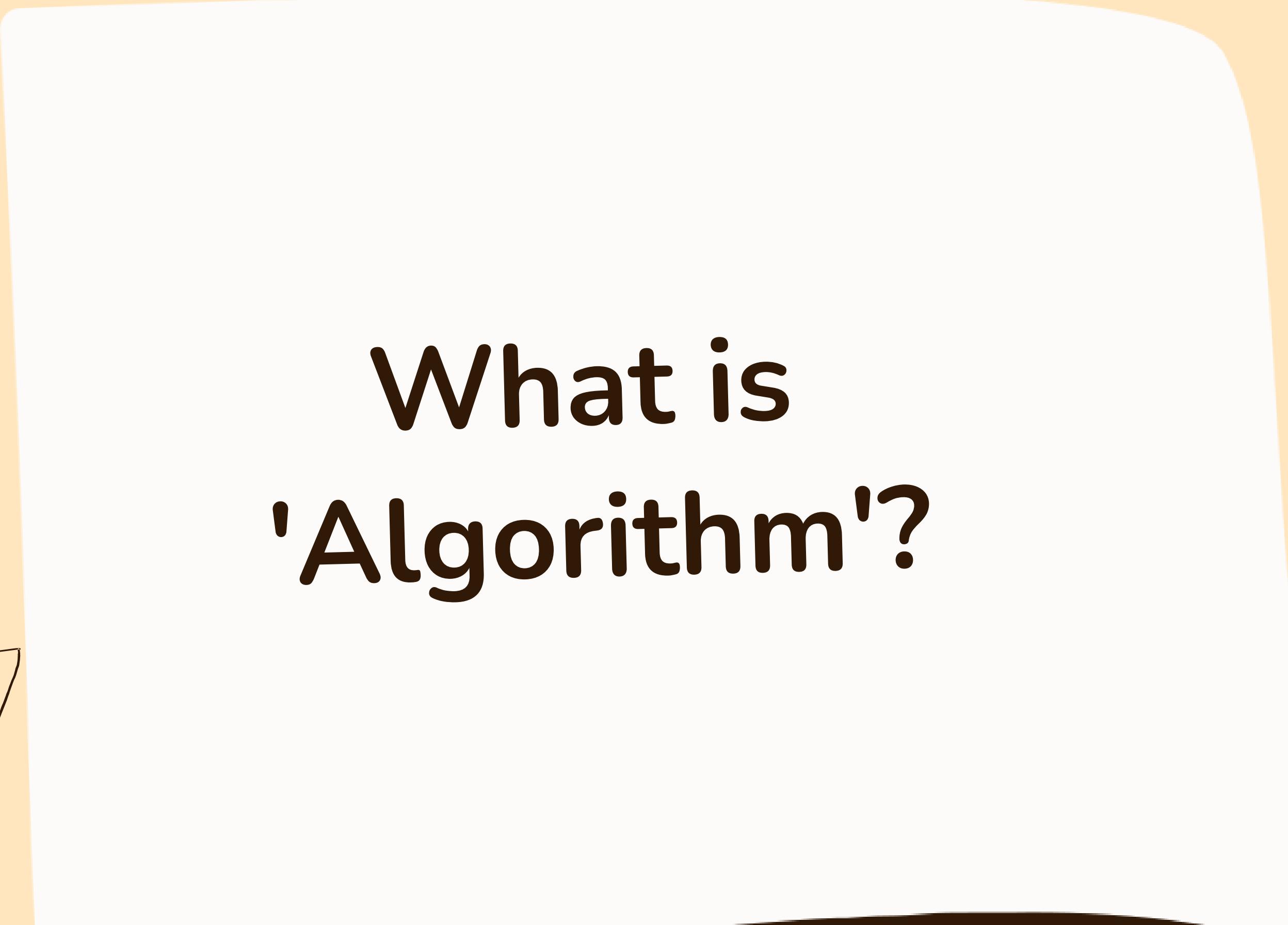


Max Heap

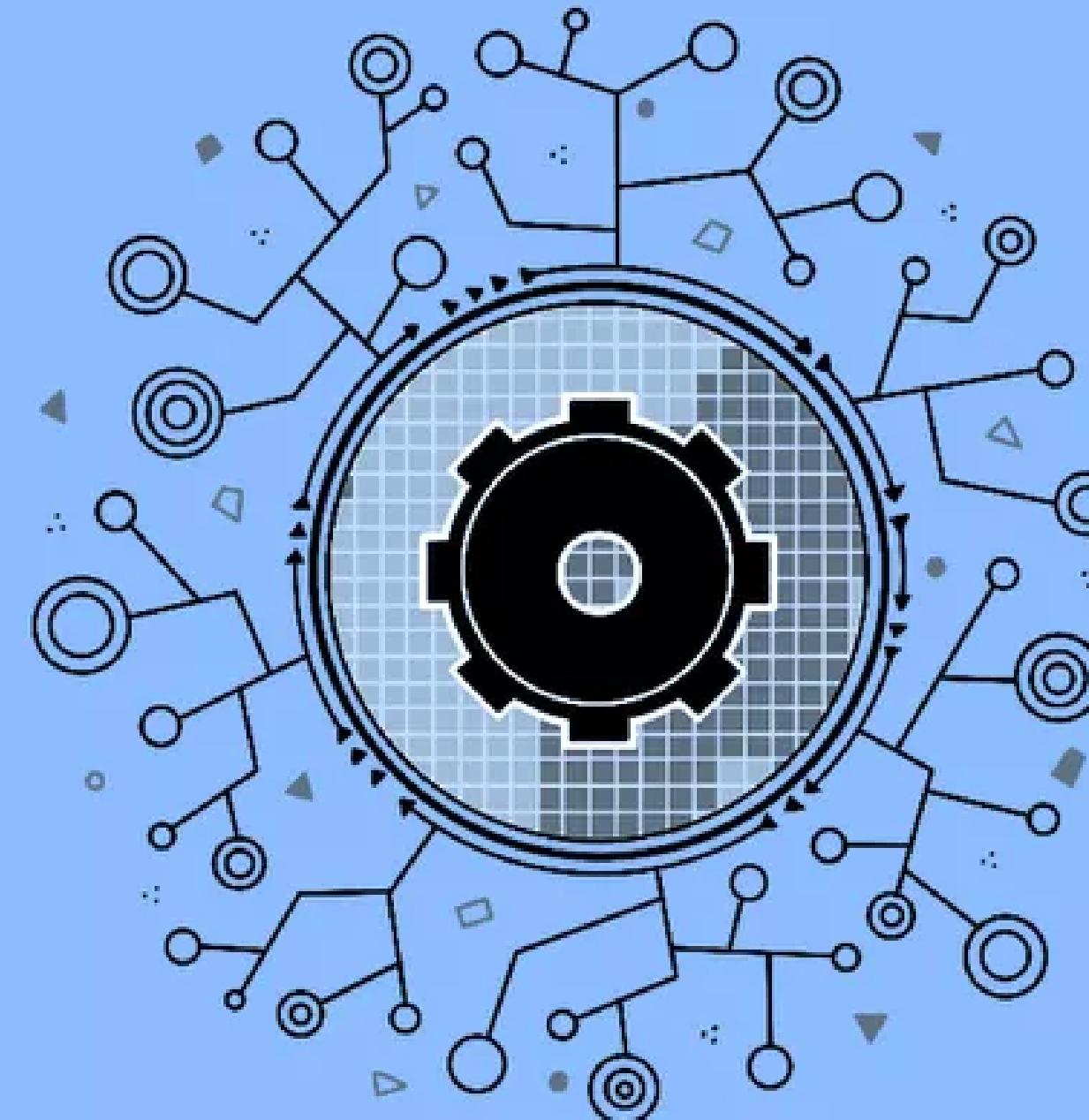


Trie





**what is
'Algorithm'?**



Algorithm

[al-gə-,ri-thəm]

A set of instructions
for solving a problem
or accomplishing a task.

Clam Bake Recipe

INGREDIENTS:

- 1 cup cold water
- 2 cups dry white wine
- 2 1/2 tbsp. Old Bay seasoning
- 1 tsp. coarse sea salt
- 4 garlic cloves, crushed
- 1 red onion, chopped
- 2 lb. potatoes, halved
- 2 lobsters
- 2 dozen Manila clams
- 4 ears fresh corn, cut into four
- chopped tarragon or parsley
- 2 sticks unsalted butter, melted
- crusty bread
- 6 lemons, cut into wedges



INSTRUCTIONS:

1. Add the water, wine, Old Bay, garlic, and salt into a huge stockpot and bring it to a boil.
2. Add the onion and potatoes into the pot first, cover it then cook on medium/high heat for 15 minutes.
3. After that, add the lobsters over the potatoes and, cover the pot and cook for 3 minutes.
4. Next, toss in the clams and corn and continue cooking for 8 to 10 minutes.
5. Remove the pot from the heat and drain.
6. Empty the contents of the pot onto a table lined with newspaper or butcher paper, then to a large platter.
7. Sprinkle everything with fresh herbs and serve with melted butter, lemon wedges, and toasted bread of your choice.

DSA = Problem solving?

Learn the 'Fundamentals'!

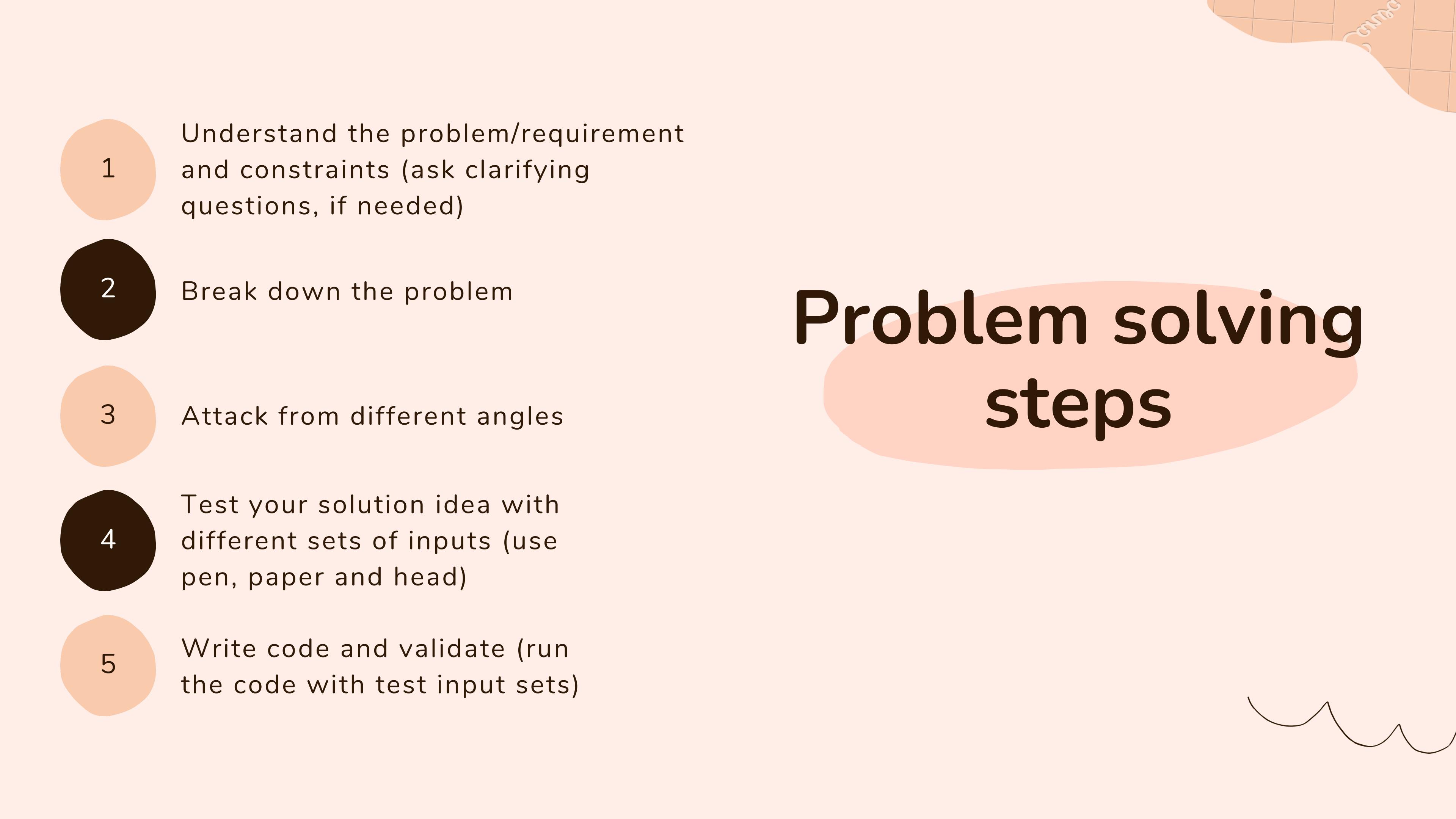
Logical
Operators

Conditional
Operators

Data types

Native Data
structures

Loops



Problem solving steps

- 1 Understand the problem/requirement and constraints (ask clarifying questions, if needed)
- 2 Break down the problem
- 3 Attack from different angles
- 4 Test your solution idea with different sets of inputs (use pen, paper and head)
- 5 Write code and validate (run the code with test input sets)

বানর এবং তেলাঙ্গ বাঁশের অংক

একটি বানর তেলাঙ্গ বাঁশ বেয়ে প্রথম মিনিটে 3 ফুট উঠে
এবং পরবর্তী মিনিটে 1.2 ফুট পিছলে নেমে যায়। এভাবে
উঠতে থাকলে N মিনিট পরে বানরটি কত উচ্চতায় থাকবে?

বানর এবং তেলাঙ্গ বাঁশের অংক

```
Height = 0;
```

```
for (minute=1; minute<=N; minute++) {  
    if (minute%2 == 1) {  
        Height += 3;  
    } else {  
        Height -= 1.2;  
    }  
}
```

Result = Height

```
Height = 0;
```

```
for (minute=1; minute<=N; minute++) {
```

```
    if (minute%2 == 1) {
```

```
        Height += 3;
```

```
    } else {
```

```
        Height -= 1.2;
```

```
}
```

```
}
```



Operation

Result = Height

Height = 0;

```
for (minute=1; minute<=N; minute++) {  
    if (minute%2 == 1) {  
        Height += 3;  
    } else {  
        Height -= 1.2;  
    }  
}
```

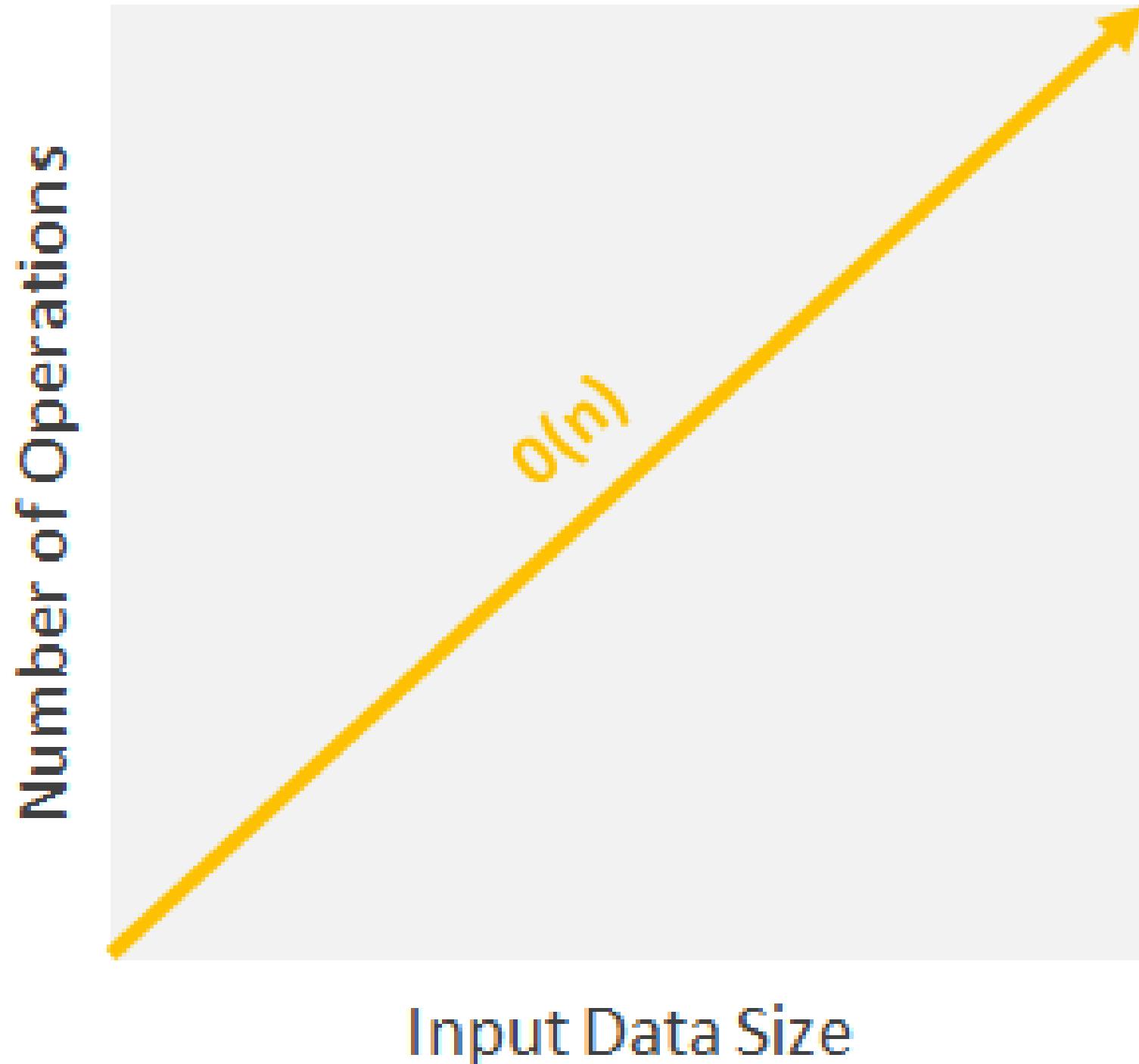
Result = Height

Complexity
 $O(n)$

Height = 0;

```
for (minute=1; minute<=N; minute++) {  
    if (minute%2 == 1) {  
        Height += 3;  
    } else {  
        Height -= 1.2;  
    }  
}
```

Result = Height



What is N?

Find the length of the given string!

MISCELLANEOUS

Find the length of the given string!

MISCELLANEOUS

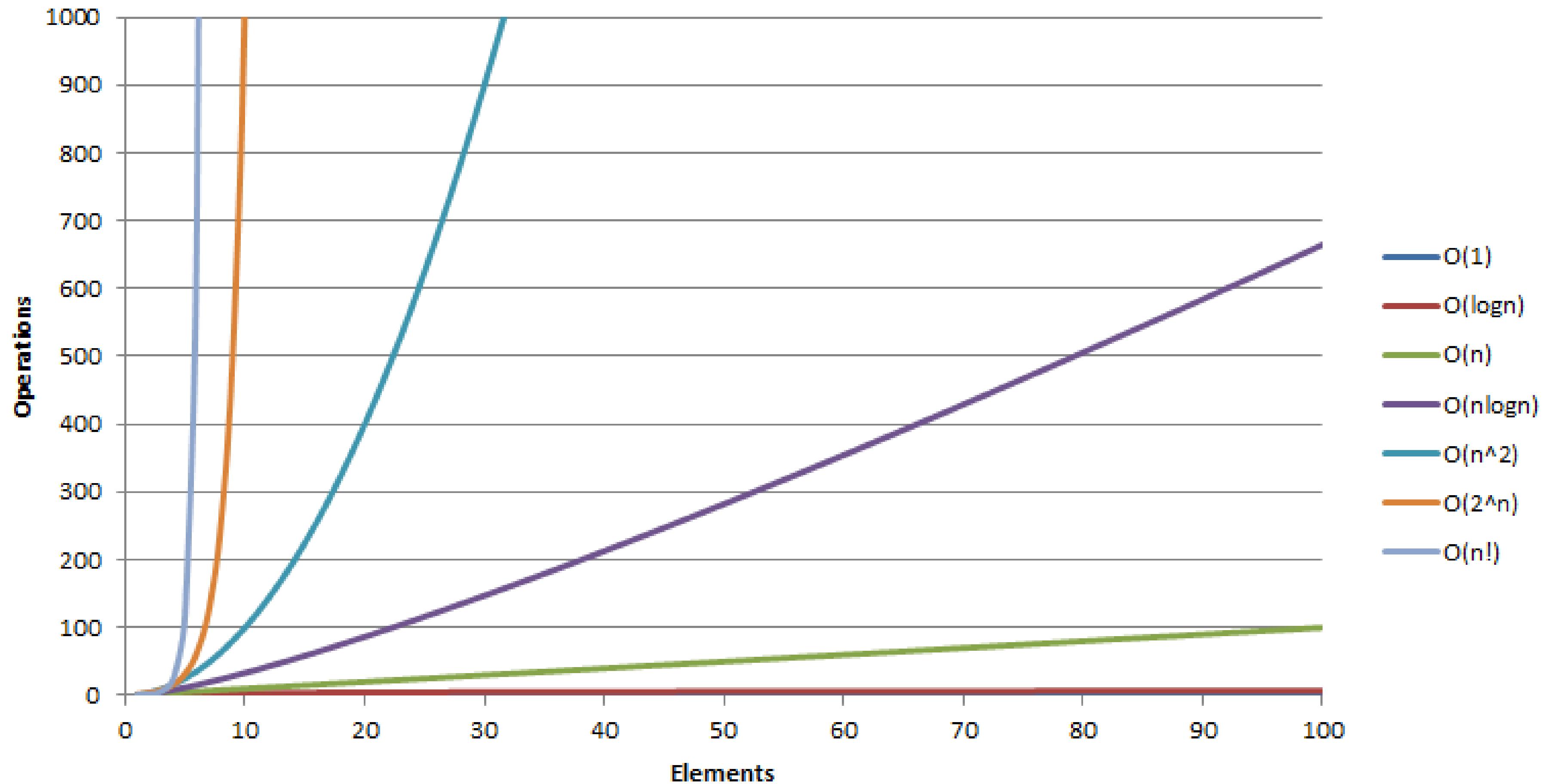
N = Length of the string

```
for (i=1; i<=10; i++) {  
    // Some operations  
}
```

Complexity
 $O(1)$

```
for (i=1; i<=10; i++) {  
    // Some operations  
}
```

Big-O Complexity



বানর এবং তেলাঙ্গ বাঁশের অংক

একটি বানর তেলাঙ্গ বাঁশ বেয়ে প্রথম মিনিটে \times ফুট উঠে
এবং পরবর্তী মিনিটে \vee ফুট পিছলে নেমে যায়। এভাবে উঠতে
থাকলে N মিনিট পরে বানরটি কত উচ্চতায় থাকবে?

Height = 0;

```
for (minute=1; minute<=N; minute++) {  
    if (minute%2 == 1) {  
        Height += X;  
    } else {  
        Height -= Y;  
    }  
}
```

Result = Height

Complexity
 $O(n)$

Height = 0;

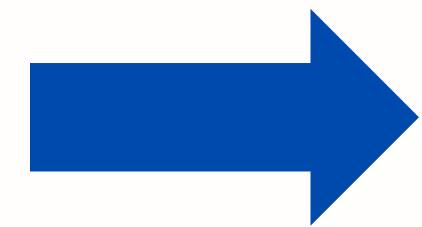
```
for (minute=1; minute<=N; minute++) {  
    if (minute%2 == 1) {  
        Height += X;  
    } else {  
        Height -= Y;  
    }  
}
```

Result = Height

Complexity
 $O(5n)$

```
for (i=1; i<=5; i++) {  
    for (j=1; j<=N; j++) {  
        // Operation  
    }  
}
```

Complexity
 $O(5n)$



Complexity
 $O(n)$

```
for (i=1; i<=5; i++) {  
    for (j=1; j<=N; j++) {  
        // Operation  
    }  
}
```

Complexity
 $O(5n)$



Complexity
 $O(n)$

```
for (i=1; i<=5; i++) {  
    for (j=1; j<=N; j++) {  
        // Operation  
    }  
}
```

Total
number of
operation
 $5n$

Algorithmic complexity

!=

Exact number of operations

Golden weighted ball problem



Iterative Solution (Naive approach)



Recursive Solution (Divide and conquer approach)



Recursive Solution (Divide and conquer better approach)

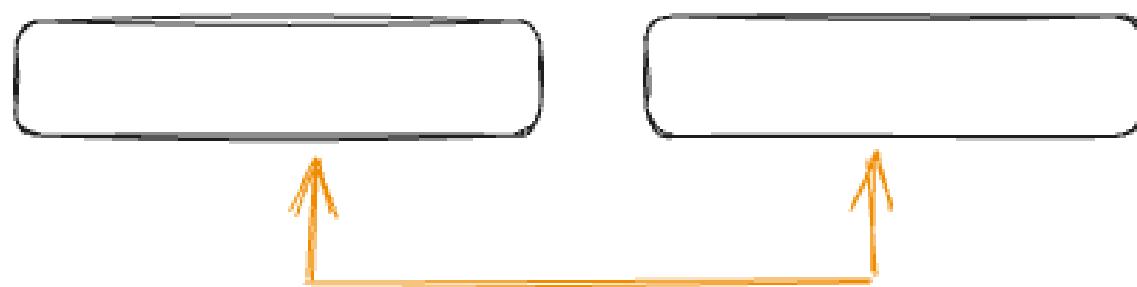


How about 100 balls?



Let's find a general solution!

Option 1 (Divide in 2 sets)



Compare these 2 sets
and eliminate 1 of them



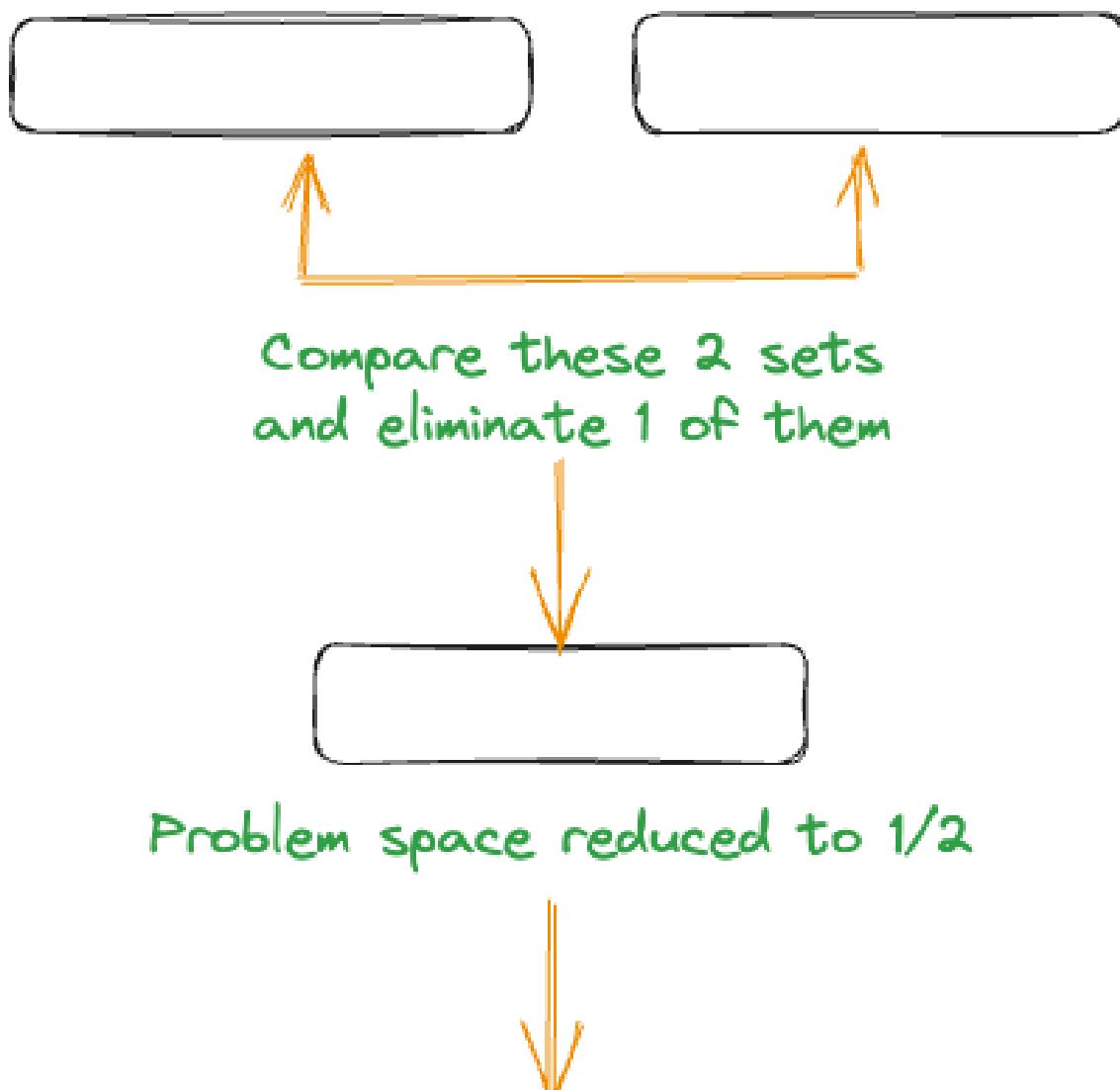
Problem space reduced to 1/2



Same approach continues
until we reach to 1 ball in each set

Let's find a general solution!

Option 1 (Divide in 2 sets)

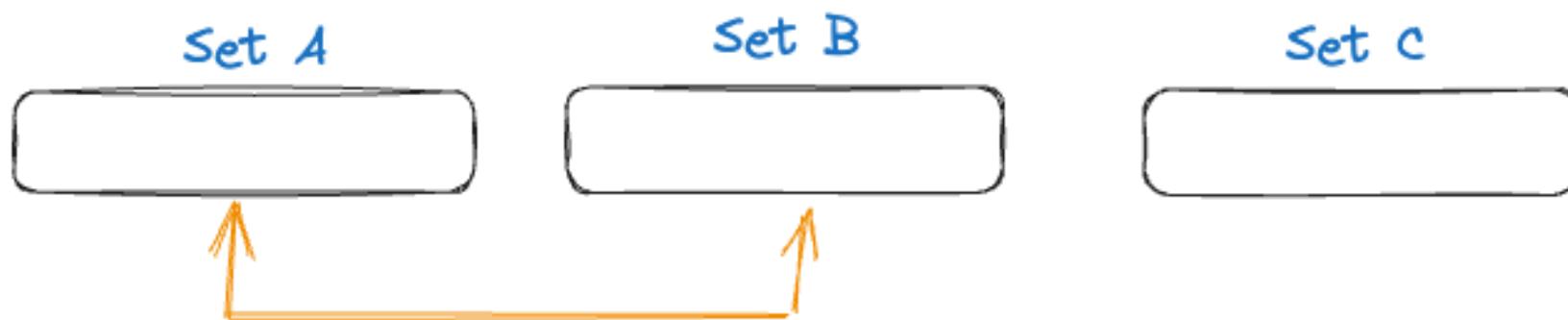


That means if there are x balls,
The total number of steps needed is:

$$\log_2 x$$

Let's find a general solution!

Option 2 (Divide in 3 sets)



Compare A and B sets:

- If A and B are equal, eliminate A and B
- If A and B are not equal, eliminate the lighter set and Set C



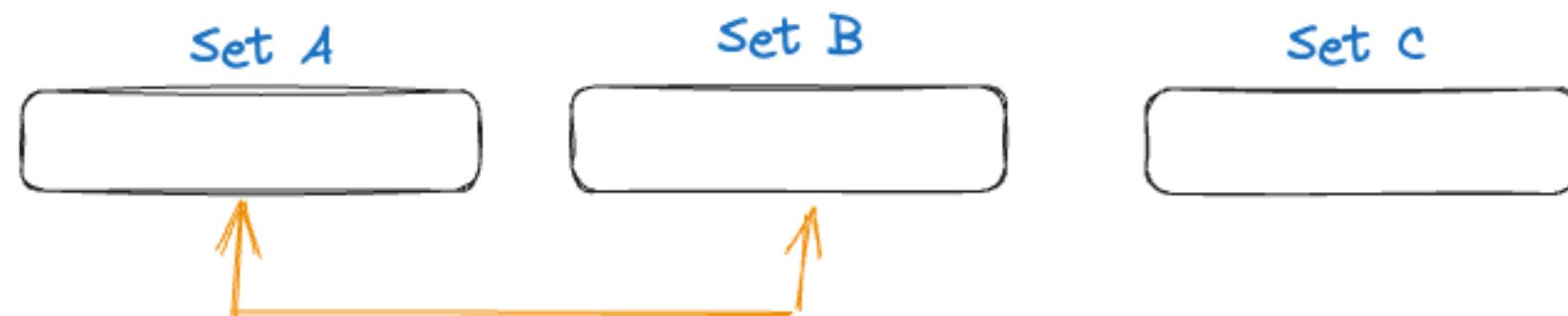
Problem space reduced to 1/3



Same approach continues
until we reach to a point we can't divide further

Let's find a general solution!

Option 2 (Divide in 3 sets)



Compare A and B sets:

- If A and B are equal, eliminate A and B
- If A and B are not equal, eliminate the lighter set and Set C



Problem space reduced to 1/3



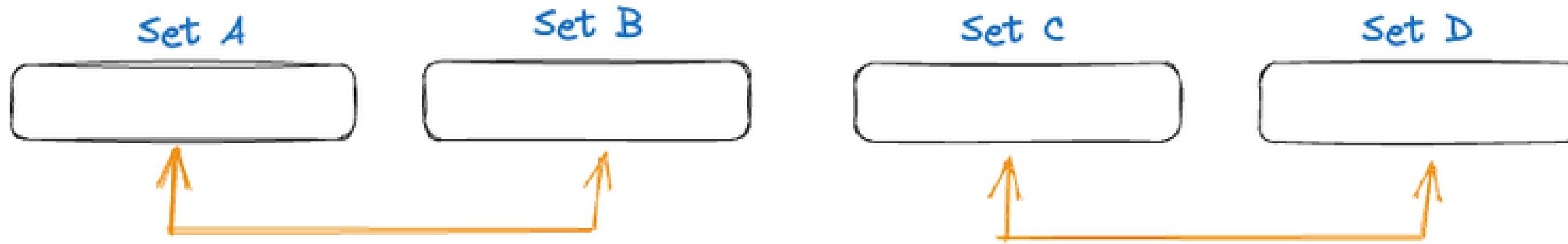
Same approach continues

until we reach to a point we can't divide further

That means if there are x balls,
The total number of steps needed is:

$$\log_3 x$$

Dividing to 4 sets will give better result?



How about 100 balls?

$$\log_3 100$$

How about 100 balls?

$$\log_3 100$$

$$= 4.19 = 5$$

Print the following pattern

N = 5

```
*  
* * *  
* * * * *  
* * * * * * *  
* * * * * * * *  
* * * * * * *  
* * * *  
*  
*
```

Print the following pattern

N = 5

```
*  
* *  
* * *  
* * * *  
* * * * *
```

Print the following pattern

N = 5

```
* * * * *
* * * *
* * *
* *
*
```

Print the following pattern

N = 5

```
*  
* * *  
* * * * *  
* * * * * * *  
* * * * * * * *
```

Common mistakes while preparing for coding interviews

- 1 Solving only easy problems to increase the number of solutions
- 2 Lack of persistence
- 3 Only solving category based problems
- 4 Solving in a lot of coding platforms
- 5 Not having a proper strategy
- 6 Memorising the solutions
- 7 Not mastering one specific language

Q/A time!

That's a wrap!

Thank you for participating!