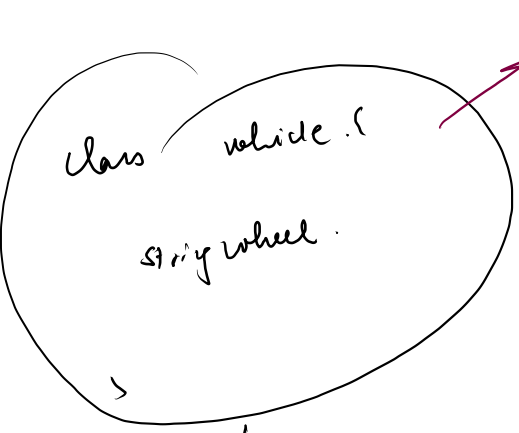
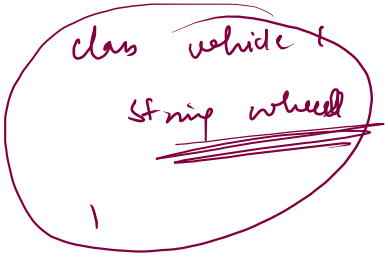
Starts @ 9:05pm

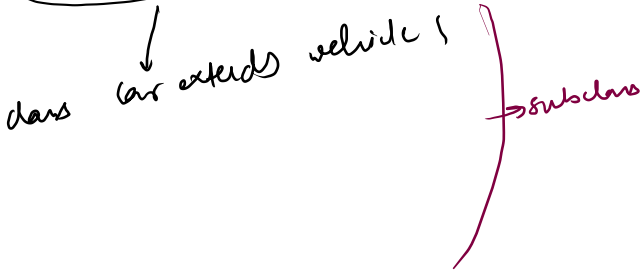
What is inheritance?



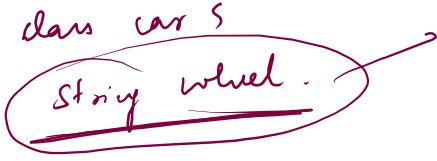
superclass

Inheritance is a feature of OOPs which allows classes inherit common properties from other classes. For example, if there is a class such as 'vehicle', other classes like 'car', 'bike', etc can inherit common properties from the vehicle class. This property helps you get rid of redundant code thereby reducing the overall size of the code.





subclass



What is polymorphism?

1. Compile-Time Poly.
   - fn. overloading → int add(int a, int b)
     int add(int a, int b, int c)
2. Runtime Time Poly.

Polymorphism refers to the ability to exist in multiple forms. Multiple definitions can be given to a single interface. For example, if you have a class named Vehicle, it can have a method named speed but you cannot define it because different vehicles have different speed. This method will be defined in the subclasses with different definitions for different vehicles.

Overridding

```
class Vehicle {
    void speed() {
    }
}

class Car extends Vehicle {
    void speed()
    {
    }
}
```

Overridding

What is encapsulation?

↳ data member and member fn.

↳ security

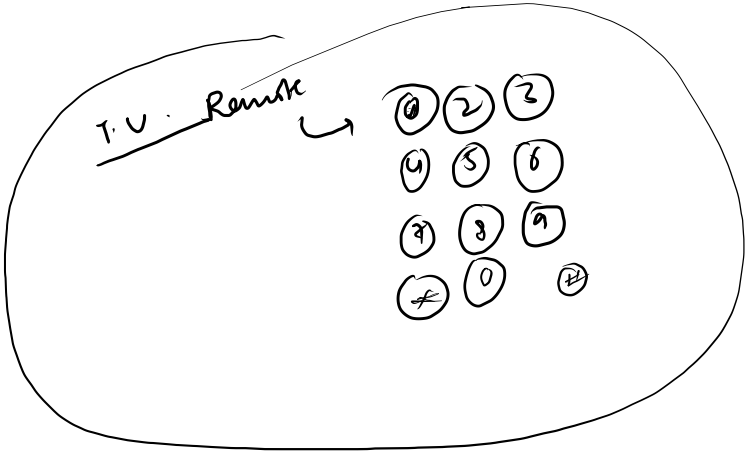
↳ getter and setter

Encapsulation refers to the binding of data member and member fn.

It can be achieved by getter & setter

Real

Encapsulation refers to binding the data and the code that works on them together in a single unit. For example, a class. Encapsulation also allows data-hiding as the data specified in one class is hidden from other classes.



What is data abstraction?

abstraction can't be 100% achieved

100% achieved

We can achieved it by abstract class and interface.

Data abstraction is a very important feature of OOPs that allows displaying only the important information and hiding the implementation details. For example, while riding a bike, you know that if you raise the accelerator, the speed will increase, but you don't know how it actually happens.

abstract class A {

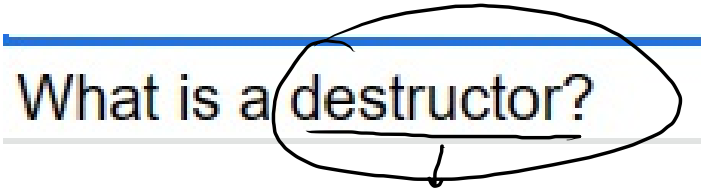
void

}

What is a constructor?

A constructor is a special type of method that has the same name as the class and is used to initialize objects of that class.

Class Object → heap occupied



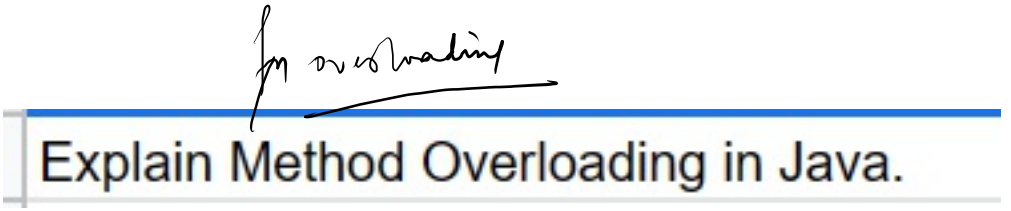
A destructor is a method that is automatically invoked when an object is destroyed. The destructor also recovers the heap space that was allocated to the destroyed object, closes the files and database connections of the object, etc.

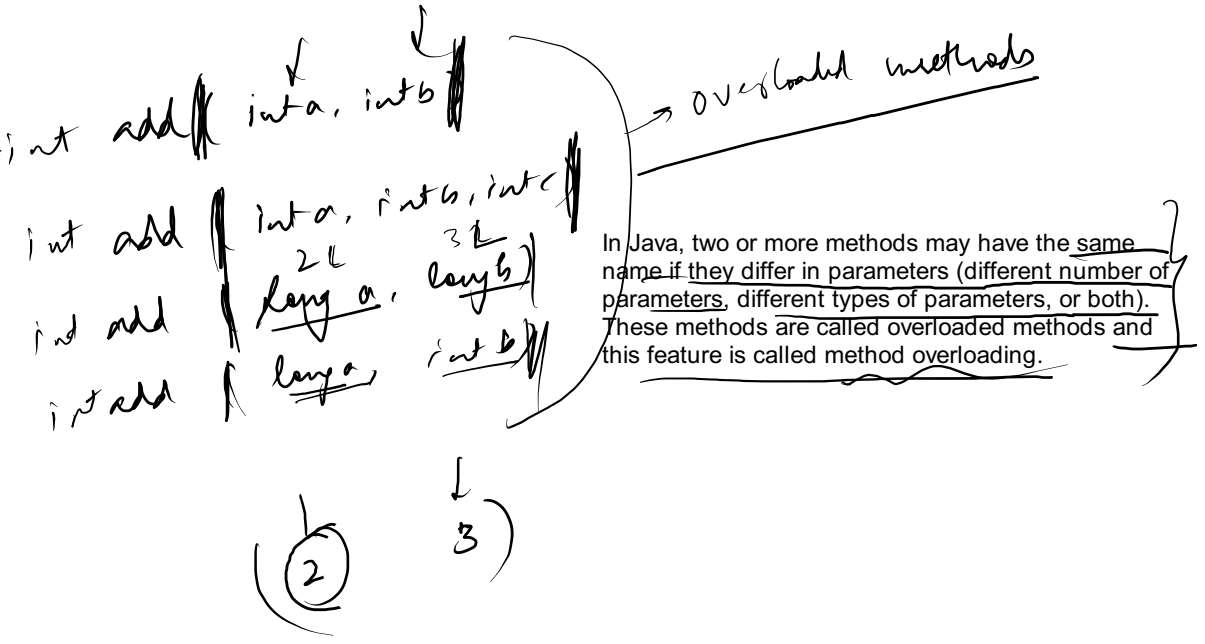
What is call by value and call by reference?

↳ stack memory reflect

↳ heap memory reflect.

Call by Value means calling a method with a parameter as value. Through this, the argument value is passed to the parameter. While Call by Reference means calling a method with a parameter as a reference. Through this, the argument reference is passed to the parameter.


Explain Method Overloading in Java.


int add(int a, int b
int add(int a, int b, int c
int add(long a, long b
int add(long a, int b
overloaded methods
In Java, two or more methods may have the same name if they differ in parameters (different number of parameters, different types of parameters, or both). These methods are called overloaded methods and this feature is called method overloading.

What is method signature? What are the things it consist of?

Method signature is used by the compiler to differentiate the methods.

Method signature consist of three things.

a) Method name b) Number of arguments c) Types of arguments

add (int a, int b)

subtract (int a, int b)

add (int a, int b, int c)

add (int a, long b)

Can we declare one overloaded method as static and another one as non-static?

Yes. Overloaded methods can be either static or non static.

How do compiler differentiate overloaded methods from duplicate methods?

Duplicate methods - everything is same

Overloaded

method signature

Compiler uses method signature to check whether the method is overloaded or duplicated. Duplicate methods will have same method signatures i.e same name, same number of arguments and same types of arguments. Overloaded methods will also have same name but differ in number of arguments or else types of arguments.

Is it possible to have two methods in a class with same method signature but different return types?

No, compiler will give duplicate method error. Compiler checks only method signature for duplication not the return types. If two methods have same method signature, straight away it gives compile time error.

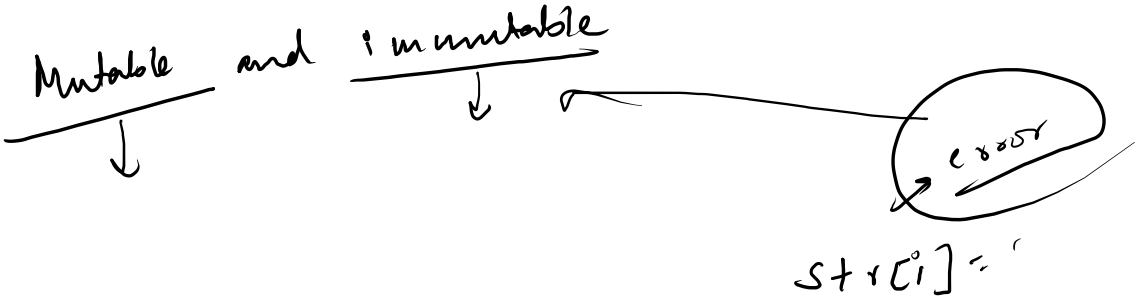
Can we overload main() method?

Yes, we can overload main() method. A class can have any number of main() methods but execution starts from public static void main(String[] args) only.

public static void main(String[] args)

What is String in Java? Is it a datatype?

The string is a final class in Java defined in java.lang package. You can assign a sequence of characters to a string variable. For example String name = "Gaurav";
No, String is not a datatype like int, char, or long. When you assign a sequence of character to String variable, you are creating a string object. Every String literal is an instance of the String class, and its value can not be changed.

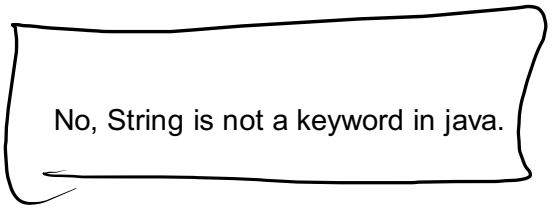


Is String immutable in java?

Yes, String class is immutable in java.
Immutable means once the object is created, its value can not be changed.

No

Is String a keyword in java ?


No, String is not a keyword in java.

How to convert String to char Array?

You can convert String to char Array using toCharArray() method.

```
char [] arr = str.toCharArray();
```

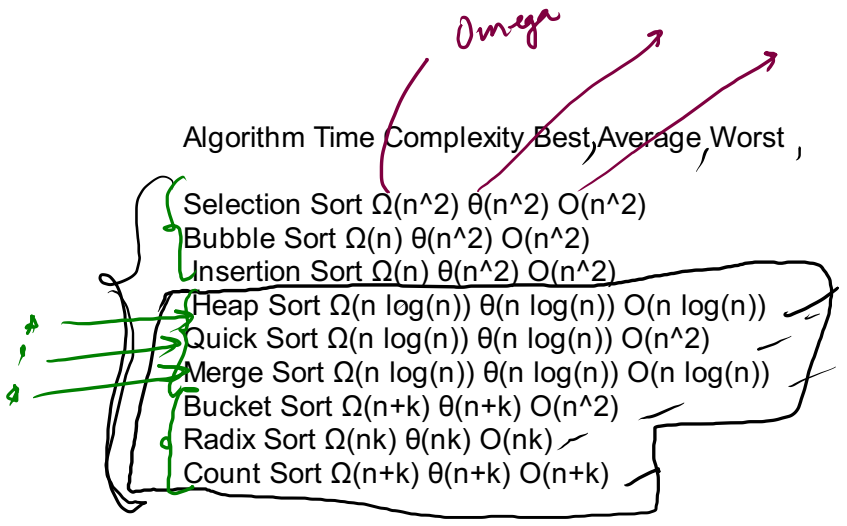
How to Split String in java?

You can use split() method of java.lang.String class or StringTokenizer to split a comma separated String. String split() method is easier to use and better because it expects a regular expression and returns an array of String which you can manipulate in the program code.

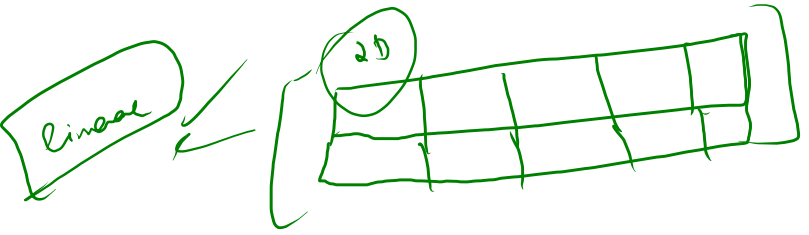
What is time complexity of an algorithm?

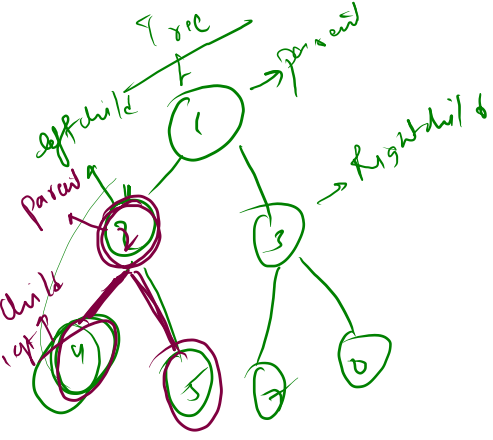
The algorithm's time complexity is a key aspect of its performance. It denotes the total time the algorithm requires to run until it completes. To estimate it, we can count the number of elementary steps that the algorithm performs from start to finish. For n*n, for instance, the algorithm only performs one step (using the mathematical operator *), while the for … n loop requires exactly n steps.

What are the most common types of sorting algorithms? What is their time complexity?


Omega
Algorithm Time Complexity Best, Average, Worst
Selection Sort Ω(n^2) θ(n^2) O(n^2)
Bubble Sort Ω(n) θ(n^2) O(n^2)
Insertion Sort Ω(n) θ(n^2) O(n^2)
Heap Sort Ω(n log(n)) θ(n log(n)) O(n log(n))
Quick Sort Ω(n log(n)) θ(n log(n)) O(n^2)
Merge Sort Ω(n log(n)) θ(n log(n)) O(n log(n))
Bucket Sort Ω(n+k) θ(n+k) O(n^2)
Radix Sort Ω(nk) θ(nk) O(nk)
Count Sort Ω(n+k) θ(n+k) O(n+k)

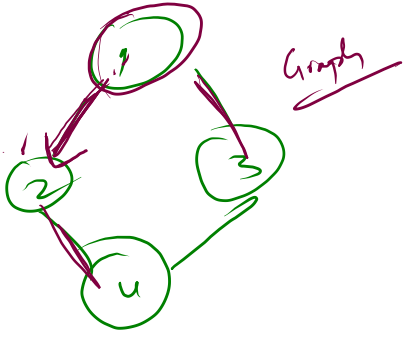
What are linear and non-linear data structures?



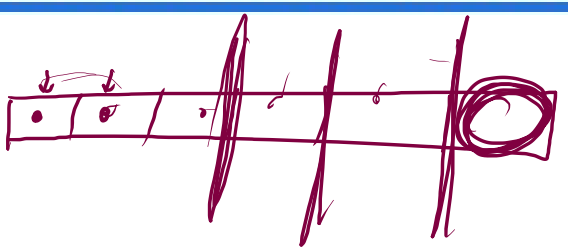


Linear structure organized the elements in a sequence/linear list. Examples of this data structures are: arrays, linked lists, queues, and stacks.

Non-linear structure, as the name suggests, allows the nodes to traverse and intertwine. Examples of this data structures are: graphs and trees.



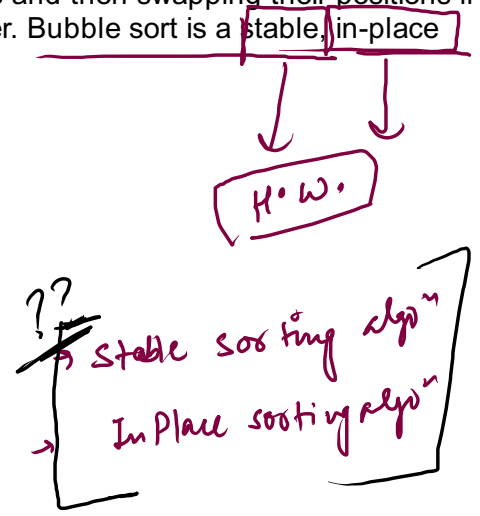
Explain how Bubble Sort works

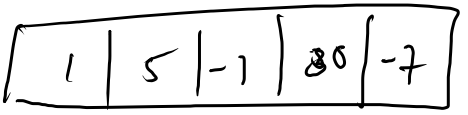


$n + n-1 + n-2 + \cdots \cdots - (1)$

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

Bubble Sort is based on the idea of repeatedly comparing pairs of adjacent elements and then swapping their positions if they are in the wrong order. Bubble sort is a stable, in-place sort algorithm.

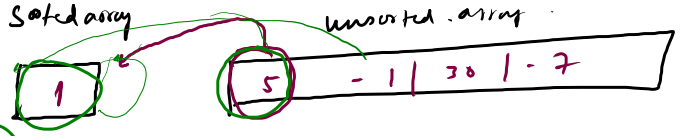


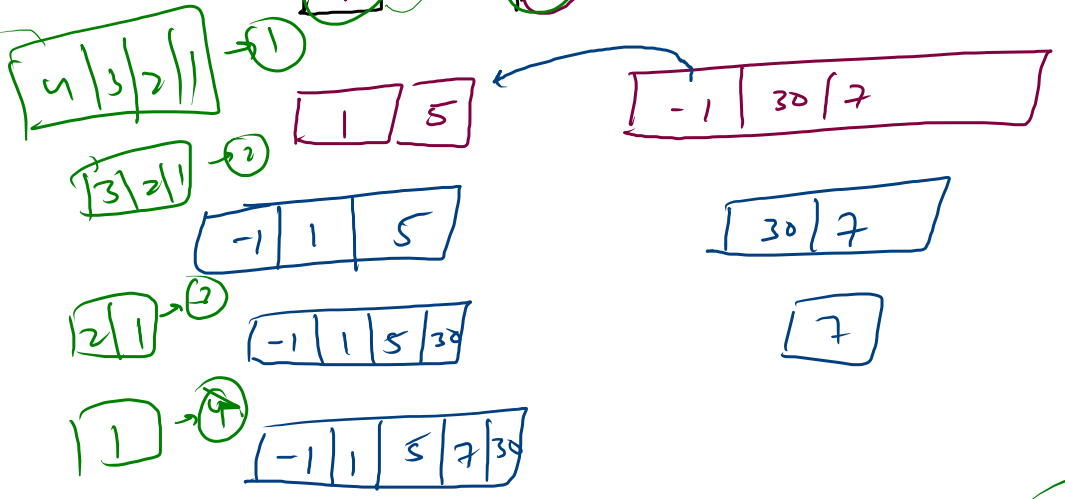


selection sort

reverse sorted

Explain how Insertion Sort works





$1 + 2 + 3 + 4 + \dots + n-1 = \frac{(n-1)(n)}{2} = n^2$

Insertion Sort is an in-place, stable, comparison-based sorting algorithm. The idea is to maintain a sub-list which is always sorted. An element which is to be 'insert'ed in this sorted sub-list, has to find its appropriate place and then it has to be inserted there. Hence the name, insertion sort.

Explain what is Binary Search

Binary search

↳ Sorted array

$x = 4$

3 > 2

while (low <= high)

low = 0

high = 4

$mid = \frac{(low + high)}{2}$ / $mid = low + \frac{(high - low)}{2}$ $\Rightarrow \frac{2low + high - low}{2} = \frac{low + high}{2}$

```
if (arr[mid] == x)
    return mid;

elseif (arr[mid] > x)
    high = mid - 1;

else  low = mid + 1;
}
```

When the list is sorted we can use the binary search (also known as half-interval search, logarithmic search, or binary chop) technique to find items on the list. Here's a step-by-step description of using binary search:

Compare Binary Search vs Linear Search

→ Sorted array

→ T.C → O(log n)

→ Searching

→ sorted / unsorted array.

→ T.C O(n)

→ Searching

Explain why complexity of Binary Search is O(log n)?

$T(n) = T(n/2) + K$

$T(n/2) = T(n/4) + K$

$\vdots$

$T(1) = 1 + K$

} x times

$T(n) = xK$

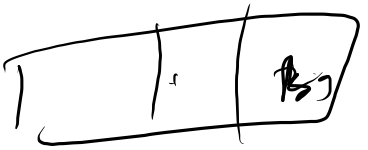
$T(n) = K \log_2^n$

$O(\log_2^n)$

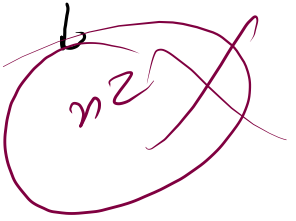
$T(n) = T\left(\frac{n}{2^k}\right) = T(1)$

$\frac{n}{2^k} = 1 \Rightarrow n = 2^k$

$\log_2^n = k$



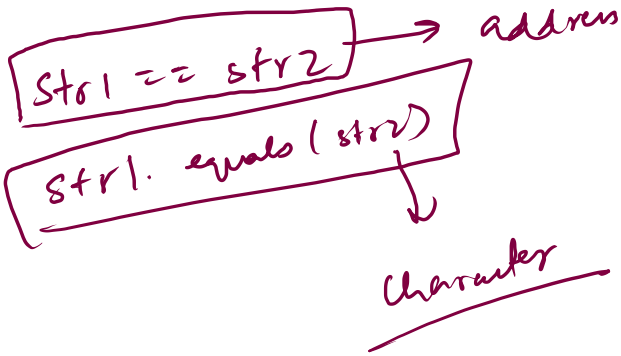
What are advantages and disadvantages of Bubble Sort?



Advantages: Simple to understand Ability to detect that the list is sorted efficiently is built into the algorithm. When the list is already sorted (best-case), the complexity of bubble sort is only O(n).

Disadvantages: It is very slow and runs in O(n2) time in worst as well as average case. Because of that Bubble sort does not deal well with a large set of data. For example Bubble sort is three times slower than Quicksort even for n = 100

How do you compare two Strings in Java?



Use equals() method to compare two Strings.

Avoid using "==" operator. The main reason to use equals() method is that it always compare String values i.e content. == operator compares the reference in the memory. Check the difference between == and equals() method in java.

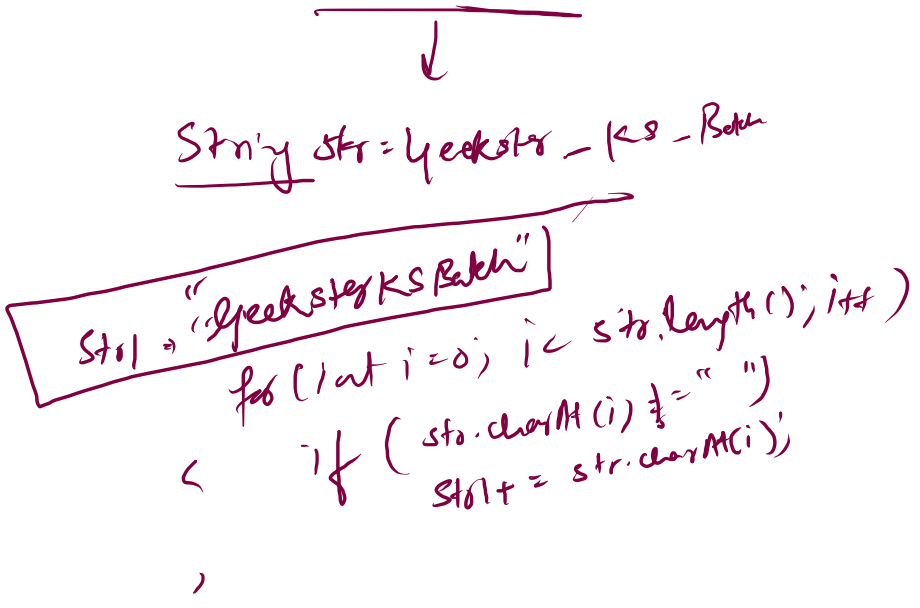
What is the use of the substring() method?

The substring() method in Java returns a ‘substring’ of the specified string.
The creation of the substring depends on the parameter passed to the substring() method.
There are two variants of the Substring method. substring(int beginIndex) substring(int beginIndex, int endIndex) In the first method, we are just giving beinIndex parameter, while in the second variant we are giving both beginIndex and endIndex. For the first variant, substring will be created from the beginIndex (inclusive) to the last character of the string. For the second variant, substring will be created from the beginIndex (inclusive) to the endIndex (exclusive).

How to check if the String is empty?

Java String class has a special method to check if the string is empty or not. isEmpty() method internally checks if the length of the string is zero. If it is zero, that means the string is empty, and the isEmpty() method will return true. If the length of the string is not zero, then the isEmpty() method will return false.

Write a java program to remove all the white-spaces in the String.



Memory Mapping

↳ String Buffer

str = str1 + str2

Write different ways for String concatenation in java?

→ String Buffer

→ + operator

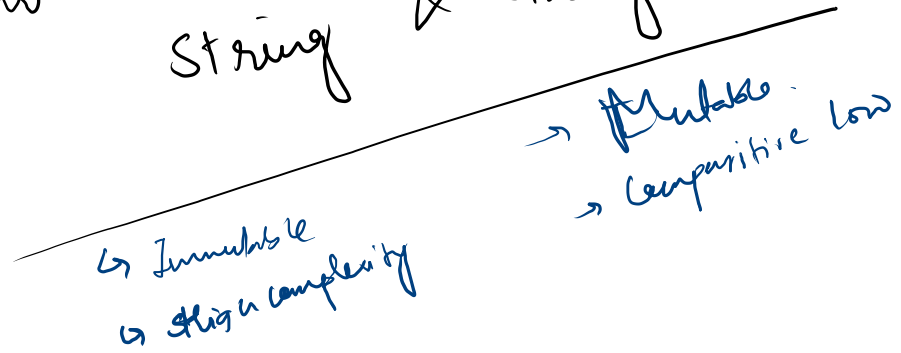
→ StringBuilder.str

str.append (str1)
str.append (str2)

→ str1.concat (str2)

→ str.join ( )

Diff^n b/w String & String Builder



What is an exception? And What is exception handling?

Exceptions provide a pattern to the error and transfer the error to the exception handler to resolve it.
The state of the program is saved as soon as an exception is raised. Exception handling in Object-Oriented Programming is a very important concept that is used to manage errors. An exception handler allows errors to be thrown and caught and implements a centralized mechanism to resolve them.

What is a try/ catch block?

try {

risky code ;

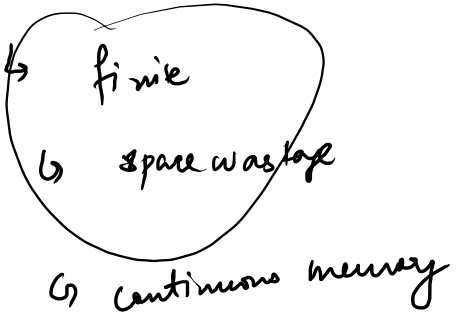
}

catch (

}

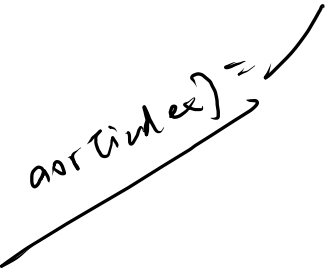
A try/ catch block is used to handle exceptions. The try block defines a set of statements that may lead to an error. The catch block basically catches the exception.

What are the drawbacks of the arrays in java?



The main drawback of the arrays is that arrays are of fixed size. You can't change the size of the array once you create it. Therefore, you must know how many elements you want in an array before creating it. You can't insert or delete the elements once you create an array. Only you can do is change the value of the elements.

Mention some advantages and disadvantages of Arrays.



Advantages: Multiple elements of Array can be sorted at the same time. Using the index, we can access any element in O(1) time.

Disadvantages: You need to specify how many elements you're going to store in your array ahead of time and We can not increase or decrease the size of the Array after creation. You have to shift the other elements to fill in or close gaps, which takes worst-case O(n) time.

As we know that Arrays are objects so why cannot we write strArray.length()

We cannot write strArray.length() because length is not a method, it's a data item of an array. We can use the methods of Object like toString() and hashCode() against Array.

What is the difference between length and length () in Java?

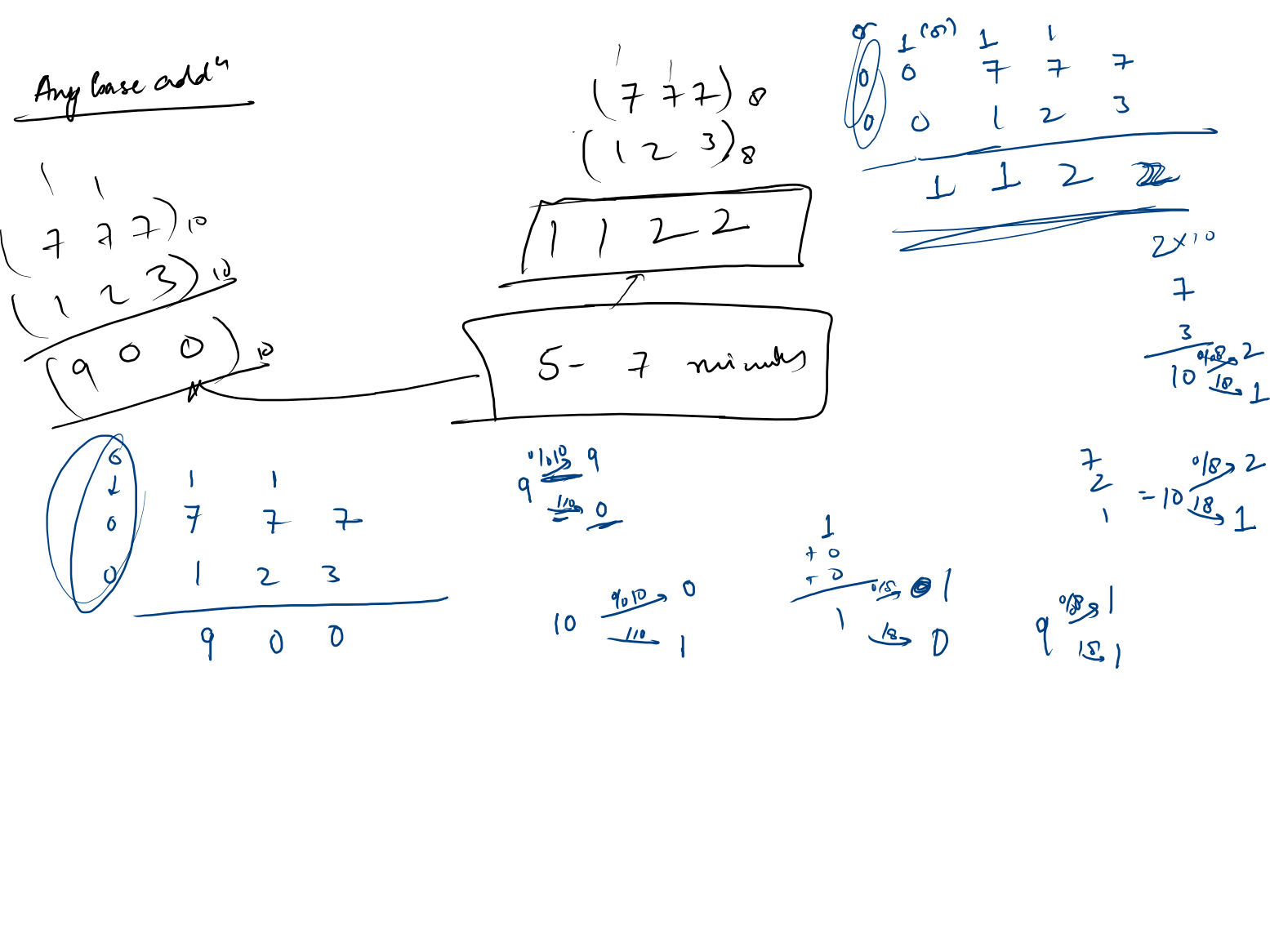
property

method

length in Java The length variable returns the length of an array i.e. a number of elements present in an array. After initializing, the length of an array cannot be changed, so the length variable can directly be used to get the length of an array. It is used only for an array.

length() in Java It is a static method of String class. The length() returns the number of characters stored in a string object. The string class uses this method as the length of a string can be modified using the various operations performed on a string object. The String class uses a char[] array internally.

Any base addn



```java
public static void main(String[] args) {
    /* Enter your code here. Read input from STDIN. Print out
    int n1=[illegible];
    int n2=[illegible];
    int b=10;

    int ans=0;
    int carry=0;
    int power=1;

    while(n1>0 || n2>0 || carry>0){
        int ld1=n1%10;
        int ld2=n2%10;

        int sum=ld1+ld2+carry;

        ans+=(power*(sum%b));
        carry=sum/b;

        n1/=10;
        n2/=10;
        power*=10;
    }

    System.out.println(ans);
}
```

ans = 0
carry = 0
power = 10000

ld1 = ~~7~~ 7
ld2 = 3 ~~2~~ 1
sum = 7+3+0 = 10 → %10 → 0, /10 → 1

ans = 0 + 1*2 = 2 = 2 + 10*2 = 22 + 1*100 = 122
carry = 1 → 0

sum = 1 → %10 → 1, /10 → 0
⇒ 7+1+1 = 9 → %10 → 1, /10 → 0
= 7+2+1 = 10 → %10 → 0, /10 → 1

ans = 122 + 1000*1 = 1122