

Interning

String $s_1 = \underline{\text{"hello"}}$;

String $s_2 = \underline{\text{"hello"}}$;

→ Memory (reusability)
sharing (=)

String $s_3 = \underline{\text{"hello"}}$;

String $s_4 = \underline{\text{"hello world"}}$

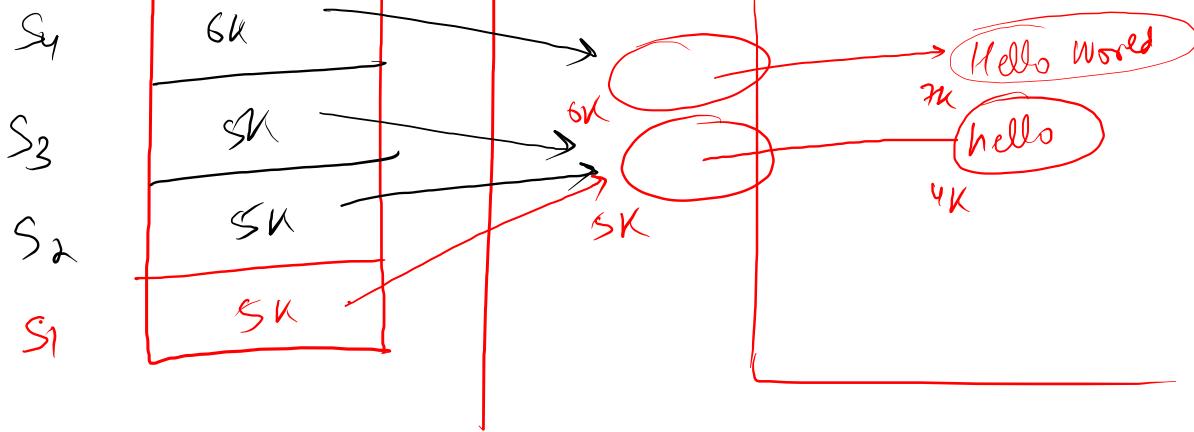
a, an, "the",
"morning",

Internality

↳ Implications

↳ Immutability

↳ Composition



String $s_1 = \underline{\text{"hello"}}$;

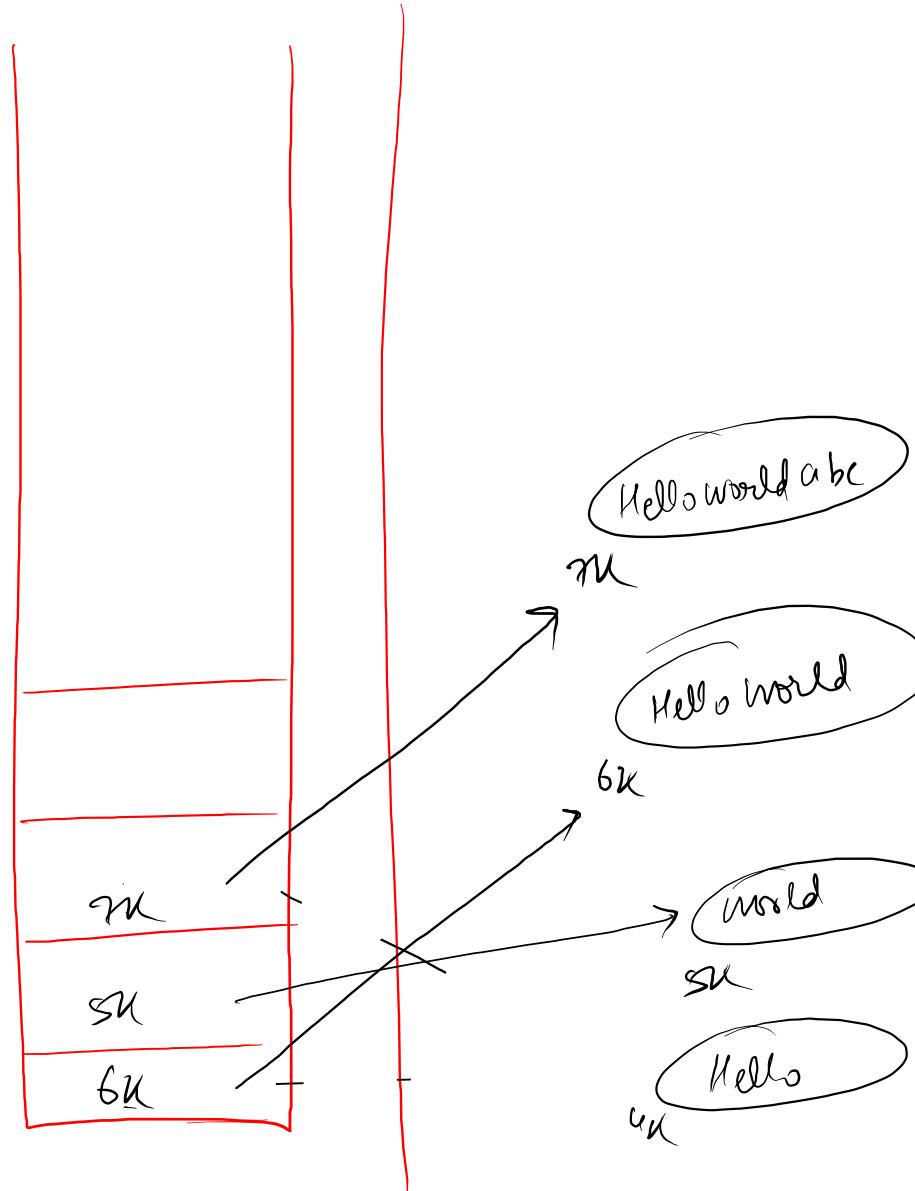
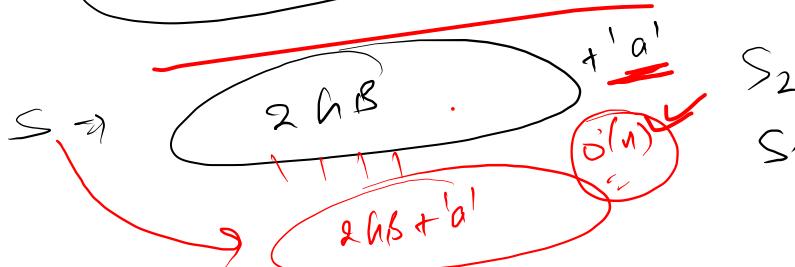
String $s_2 = \text{"world"}$

String $s_3 = \underline{s_1 + s_2}$;

$\Rightarrow s_3 = \underline{s_1 + \text{"abc"}}$;

$\approx n$ operations

$+ \rightarrow O(n)$



String $s = \underline{m}$

for ($\text{int } i=1 ; i \leq 1000 ; i++$) {

$s = s + 'i'$

}



$i \Rightarrow 1000$

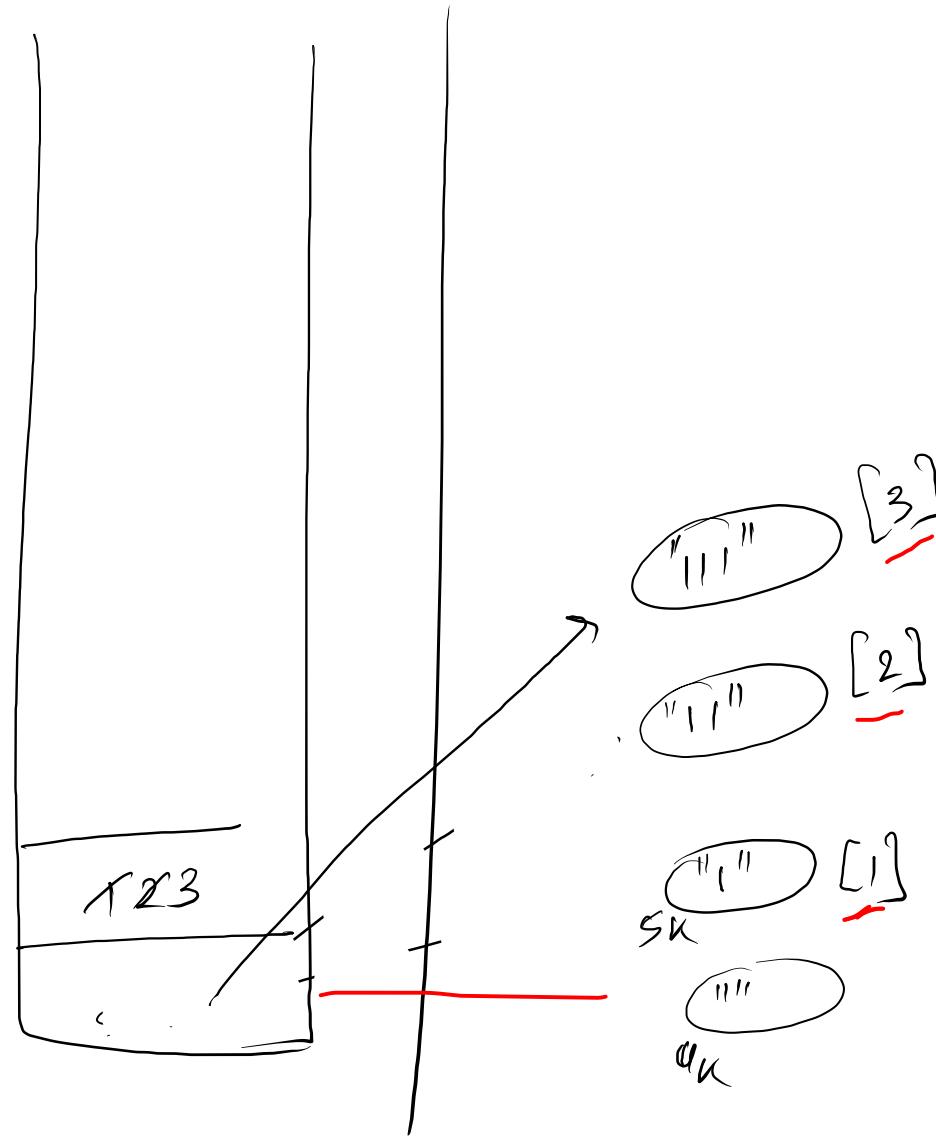
$\rightarrow 1 + 2 + 3 + \dots + 1000$

$\rightarrow 1000 (1001)$

$\rightarrow 500500$

i

s



*

String s₁ = "hello"

String s₂ = new String("hello");

String s₂ : "helbo"

s₁ == s₂ [false]

s₁ == s₃ [true]

s₁.equals(s₂) [true]

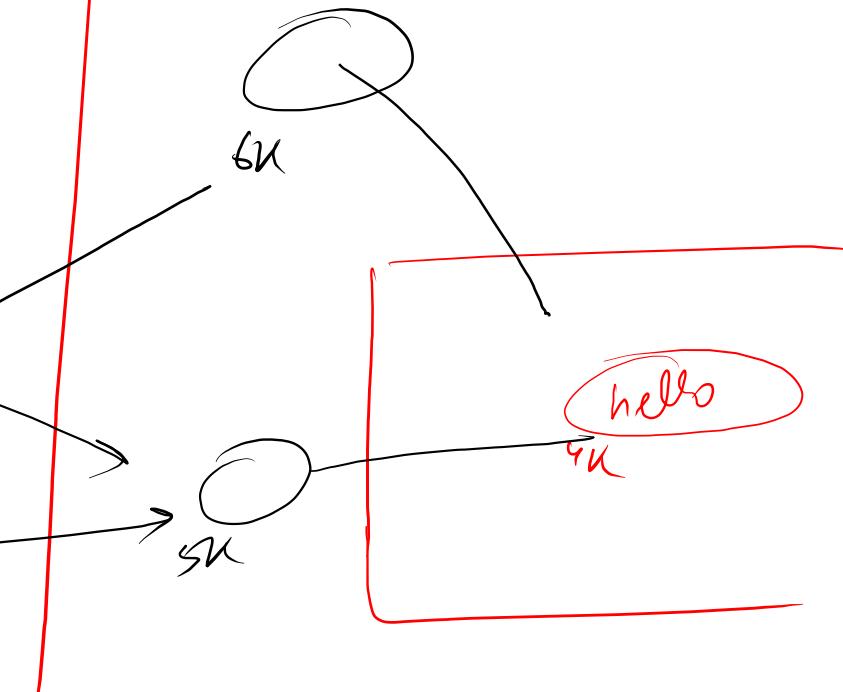
m. add.
data

s₃
s₂
s₁

String / objects

↳ compare

↳ s₁.equals(s₂)



String Builder

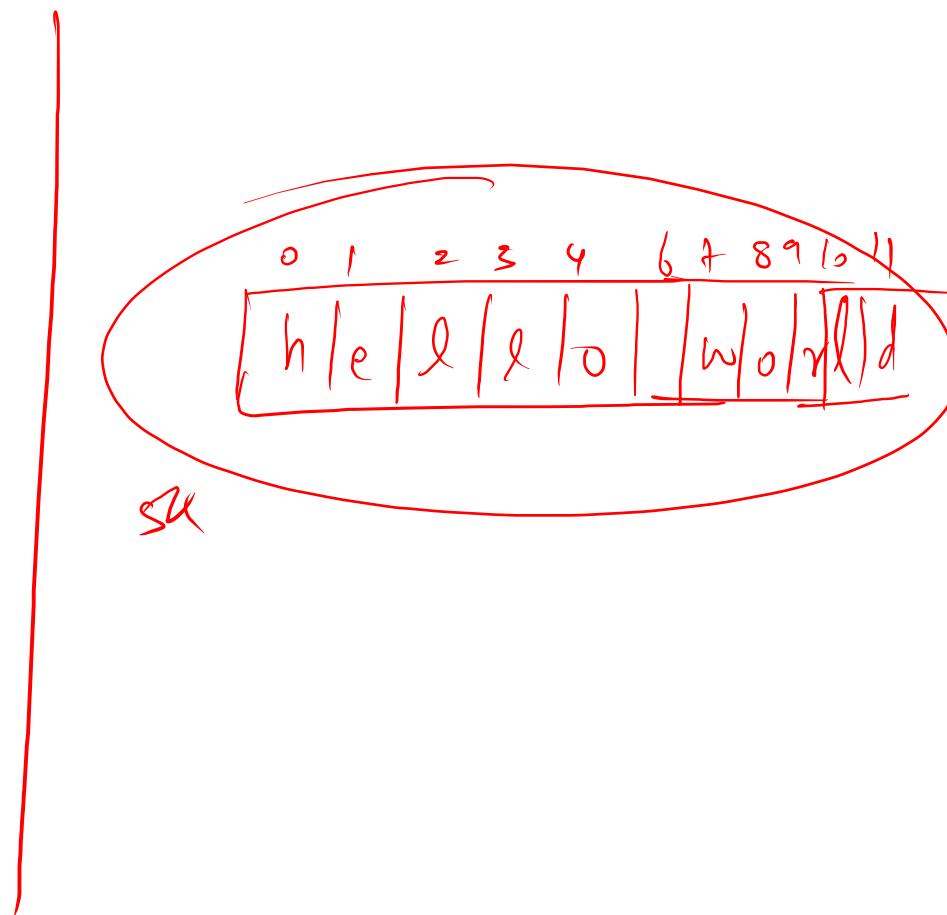
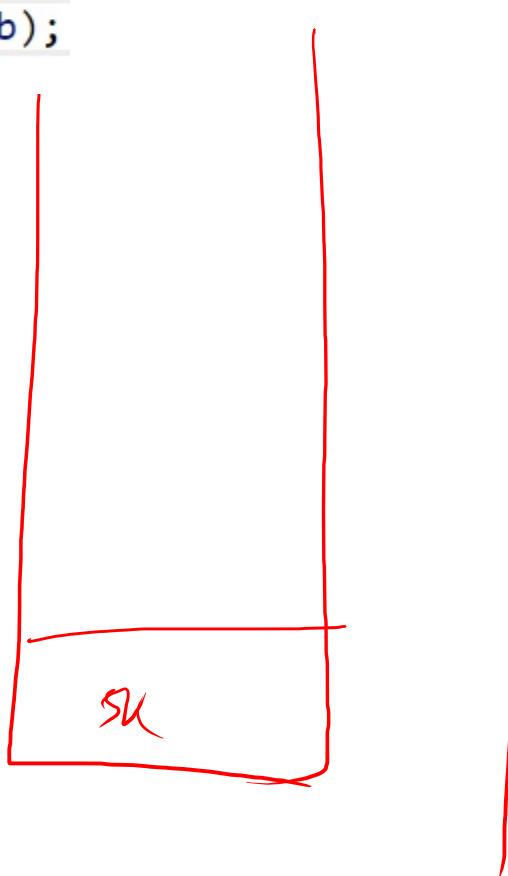
↳ Immutability

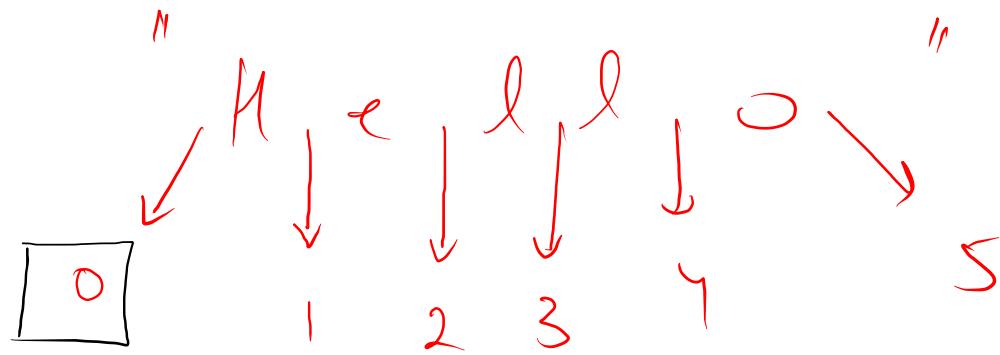
```
StringBuilder sb = new StringBuilder("hello");  
System.out.println(sb);
```

SubString ✓
charAt ✓

```
sb.append(" world");  
System.out.println(sb);
```

sb





String

Problem

Updation = difficult

Advantage

memory sharing

String Builder

no memory sharing

Updation easy

String →

String Builder

$$(abc) \Rightarrow 3 \cdot 2 \cdot 1 \rightarrow \binom{6}{\underline{\underline{=}}}$$

$$\begin{cases} abc \\ \equiv \\ bac \\ \equiv \\ cab \\ \equiv \\ acb \\ \equiv \\ bca \\ \equiv \\ cba \end{cases}$$

$$a \begin{array}{c} \swarrow \\ b - c \end{array}$$

$$a \begin{array}{c} \swarrow \\ c - b \end{array}$$

$$b \begin{array}{c} \swarrow \\ a - c \end{array}$$

$$c \begin{array}{c} \swarrow \\ a - c \end{array}$$

$$c \begin{array}{c} \swarrow \\ a - b \end{array}$$

$$b \begin{array}{c} \swarrow \\ a - b \end{array}$$

$$\begin{array}{c} \begin{array}{c} 3 | 0 \\ 2 | 0-0 \\ 1 | 0-0 \\ \hline 0-0 \end{array} & \begin{array}{c} a b c \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-1 \\ \hline 0-1 \end{array} & \begin{array}{c} 3 | 1 \\ 2 | 0-1 \\ 1 | 0-0 \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{a} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} \\ \hline \begin{array}{c} abc \\ \equiv \\ \hline 0-0 \end{array} & \begin{array}{c} a b c \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-1 \\ \hline 0-0 \end{array} & \begin{array}{c} b a c \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{a} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} \end{array}$$

$$\begin{array}{c} \begin{array}{c} 3 | 4 \\ 2 | 1 \\ 1 | 0 \\ \hline 0-0 \end{array} & \begin{array}{c} a b c \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} & \begin{array}{c} 3 | 5 \\ 2 | 1-2 \\ 1 | 0 \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} \\ \hline \begin{array}{c} abc \\ \equiv \\ b c a \\ \hline 0-0 \end{array} & \begin{array}{c} a b c \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-1 \\ \hline 0-0 \end{array} & \begin{array}{c} c b a \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} \end{array}$$

$$\begin{array}{c} \begin{array}{c} 3 | 2 \\ 2 | 0 \\ 1 | 0 \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} & \begin{array}{c} 3 | 3 \\ 2 | 1 \\ 1 | 0 \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} \\ \hline \begin{array}{c} c a b \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-1 \\ \hline 0-0 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} & \begin{array}{c} abc \\ \cancel{b} \cancel{c} \\ \downarrow \\ 0-2 \\ \hline 0-1 \end{array} \end{array}$$

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```

public static int fact(int n){
    int ans = 1;
    for(int i = 1; i <= n ; i++){
        ans = ans * i;
    }

    return ans;
}

public static void solution(String str){
    int count = fact(str.length());

    for(int num = 0 ; num < count ; num++){
        StringBuilder sb = new StringBuilder(str);
        int len = str.length();
        int tNum = num;

        while(len > 0){
            int rem = tNum % len;
            tNum = tNum / len;

            System.out.print(sb.charAt(rem));
            sb.deleteCharAt(rem);
            len--;
        }
        System.out.println();
    }
}

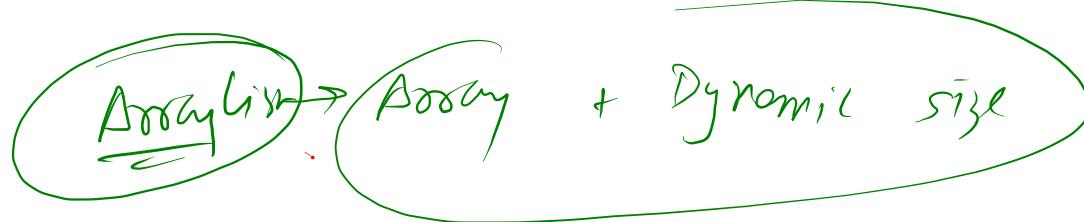
```

$str \Rightarrow abc$, Count = 6
 Num
 0
 1
 2
 3
 ✓4 bc a
 5

$sb =$ []
 len = 3, 2, 1
 $\rightarrow b\ (c\ a) \Leftarrow$
 $\cancel{rem} \rightarrow 0$

$+ Num \Rightarrow XXO$

- ① size-fixed \Rightarrow
- ② continuous memory



data Type
int \rightarrow Integer
float \rightarrow float
double \rightarrow Double
char \rightarrow Character
boolean \rightarrow Boolean
String \rightarrow String

`list.add(val) → add cost`

`list.add(idx, val) → add at index, insert val`

`size() → no. of elements`

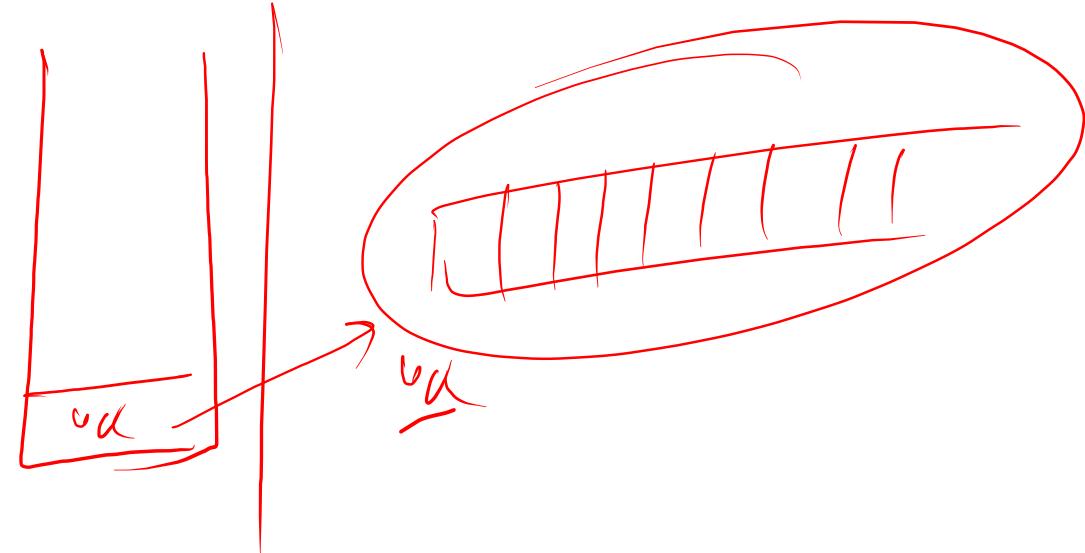
`get(idx) → returns idx val of arraylist`

`set(idx, newval) → update.`

`remove(idx) → remove`

ArrayList

ArrayList<T> al = new ArrayList<>(); al



idx=0

5	7	13	9	16	15	20
0	1	2	3	4	5	6

idx=1

7	13	9	11	15	20
0	1	2	3	4	5

```
for (i = 0 ; i < size ; i++) {  
    if (isPrime(list.get(i))) {  
        list.remove(i);  
    }  
}
```

Some elements
may skip
Output →

idx=6 size 2

5	7	13	9	16	15	20

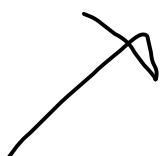
0 1 2 3 4 5 6

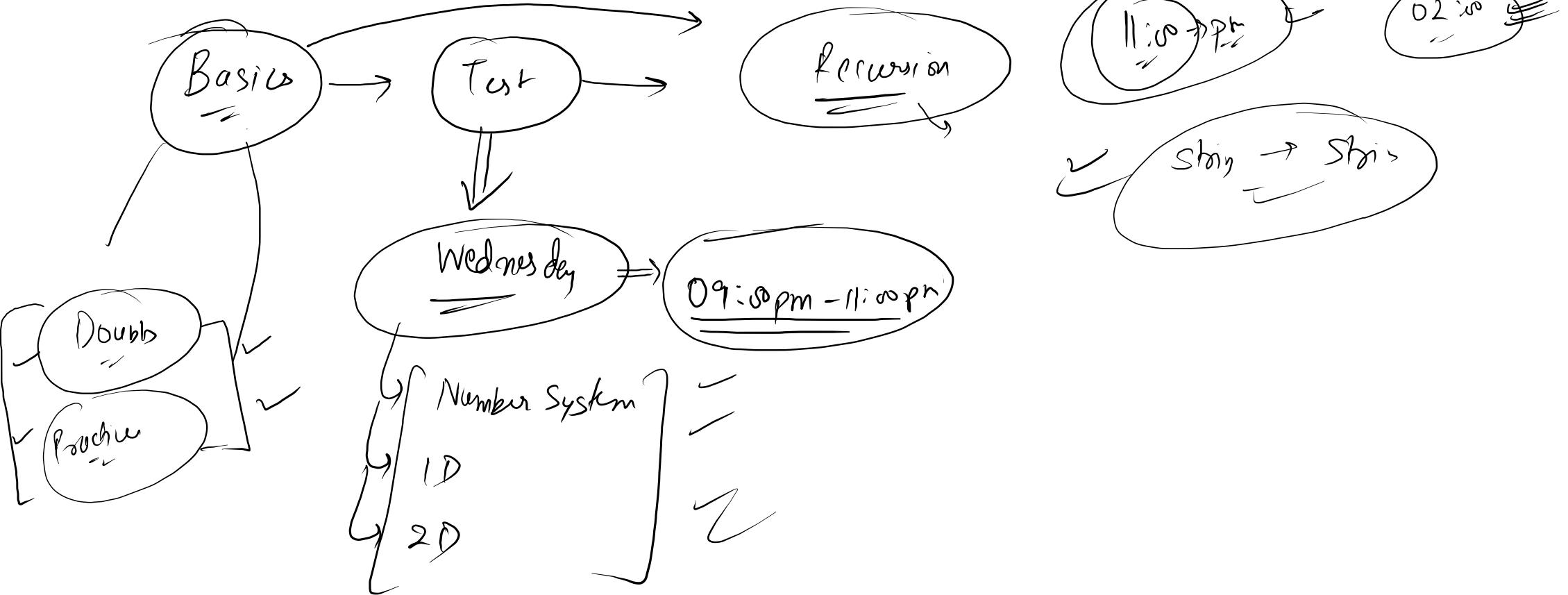
idx=1

.
5	7	9	16	15	20

0 1 2 3 4 5

Array list
remove (last)





$$a^2 = b^2 + c^2 \quad \text{GCD} \times \underline{\text{cm}} = \bar{N}_1 \times \bar{N}_2$$

(50) Reforma

$\cancel{+15}$ $\cancel{45}$

$264 \rightarrow$

$l_0 < h_i$

45, 15

$h_i - l_0 > 1$
 $(h_i > l_0 + 1)$

15 8 0

45 0 15 0

Eudicon

0
8 15 1

0
15 0 45 3

$(45 - 25 \rightarrow 20)$

8
7 8 1

45
0

$25 - 20 \rightarrow 5$

$h \leq D$

7
1 7 2

GCD

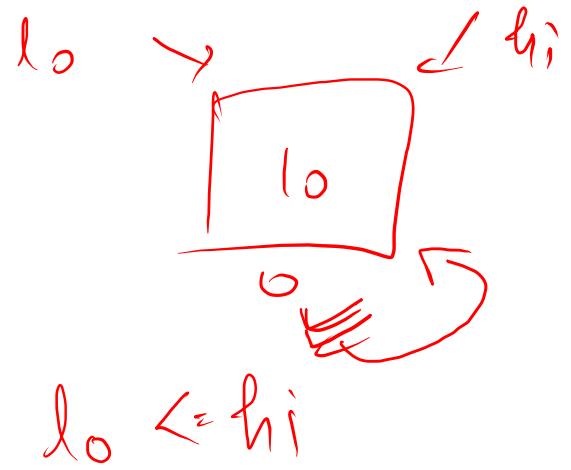
$\frac{15}{5}$

$$\boxed{lo \leq hi}$$

$$\boxed{hi - lo > 1}$$

$$o-o > 1$$

X



$$\boxed{x = lo}$$

$$\boxed{lo == hi}$$

