

## Today's content

- Datatypes and Ranges
  - Circularity
  - Promotion and demotion of data types
- Non primitive data types
  - classes and objects
  - Arrays
  - String
- Wrapper classes
  - Function calling with non primitives
  - Immutability

# Datatypes

NP

- Primitives

- Stored in stack , - functions  
    LV

<u>integral</u>		<u>floating</u>	
• byte = 1 byte	8 bits	[ float double ]	[ char boolean ]
• short = 2	16		
• int = 4	32		
• long = 8	64		

Q • Space for N bits  
    smallest

biggest

Ex - - - - 4 bits  
          ↓  
      - 8    to    7

Positive nos [ 0000 - 0  
                  1111 - 15 ]  
Positive & Negative

Ex : 5 bits  
      - 16    to    15

$$\begin{array}{l} \text{Ex : } N = 6 \\ \underline{-32} \quad \text{to} \quad \underline{31} \\ 100000 \quad \text{to} \quad 011111 \end{array}$$

$$\Rightarrow \text{gen : } N \text{ bits } \underline{\quad} \\ -2^{N-1} \quad \text{to} \quad 2^{N-1} - 1$$

byte	8	$-2^7$	to	$2^7 - 1$	-128 to 127
short	16	$-2^{15}$	to	$2^{15} - 1$	
int	32	$-2^{31}$	to	$2^{31} - 1$	
long	64	$-2^{63}$	to	$2^{63} - 1$	

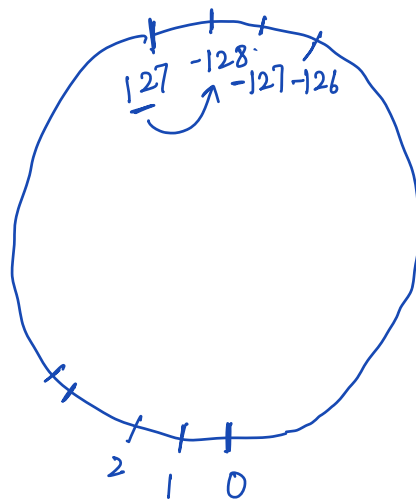
$$\begin{array}{l} N=6 \rightarrow \begin{array}{c} \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \\ 0 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \end{array} \quad - \quad \underline{\underline{[63]}} \\ \downarrow \\ \underline{000000} \quad \text{to} \quad \underline{111111} = 2^6 = \underline{\underline{64}} \end{array}$$

$$\begin{array}{r} \underline{\underline{32}} \\ -ve \\ -32 \text{ to } -1 \\ -32 \end{array} \qquad \begin{array}{r} \underline{\underline{32}} \\ +ve \\ 0-31 \\ \underline{31} \end{array}$$

byte	8	$-2^7$	to	$2^7 - 1$
short	16	$-2^{15}$	to	$2^{15} - 1$
int	32	$-2^{31}$	to	$2^{31} - 1 \Rightarrow \underline{-2 \times 10^9 \text{ to } 2 \times 10^9 - 1}$
long	64	$-2^{63}$	to	$2^{63} - 1$

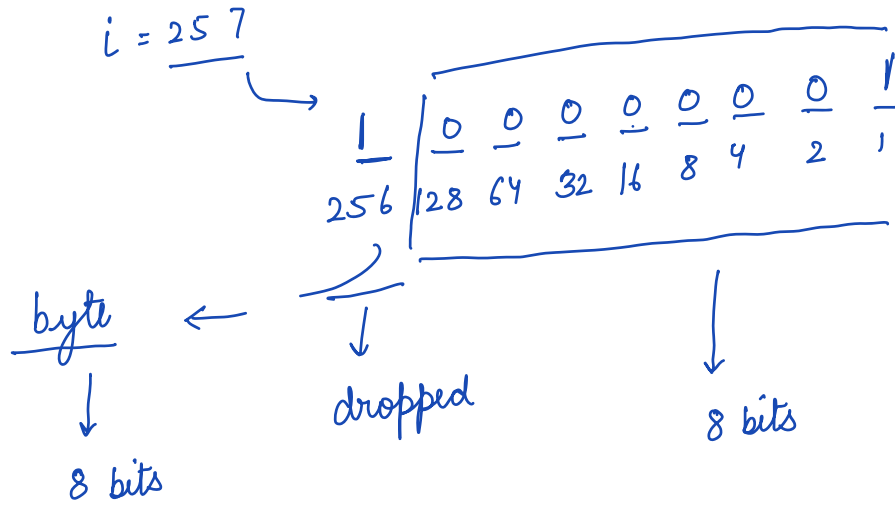
$$\begin{aligned}
 1024 &= 2^{10} \approx \underline{1000} = 10^3 \rightarrow -2^{31} \text{ to } 2^{31} - 1 \\
 &\cdot \underline{2^{10} \approx 10^3} \rightarrow -2 \times \underline{2^{10} \times 2^{10} \times 2^{10}} \text{ to } 2(2^{10} \times 2^{10} \times 2^{10}) - 1 \\
 &\rightarrow -2 \times 10^9 \text{ to } \underline{2 \times 10^9 - 1}
 \end{aligned}$$

•  $b = b + 1$  , circularity -128 to 127



• byte  $\textcircled{b} = \text{byte } b + 1$  int  $\rightarrow$  int

•  $5 \rightarrow \text{integer constant} \rightarrow \text{int}$



float → 4 bytes - 32 bits

double → 8 bytes - 64 bits

3.142 →  $\frac{3142}{10^3}$

$\frac{m}{e}$

3142

32 bits

IEEE 754

floating constant → double

char - 1 byte → unicode ✓

boolean - 2 byte → True false

ASCII 1 byte

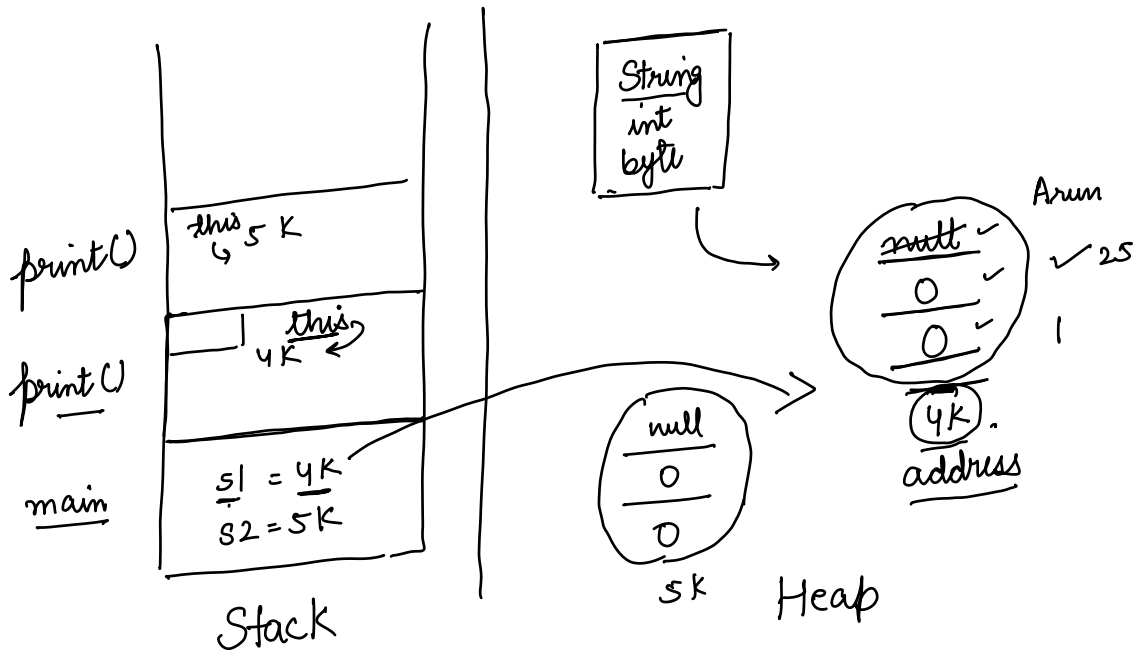
Unicode

[ ]

char → int  
↓  
1 byte

## Non primitives

- ↳ Classes & Objects
- ↳ Stack      Heap memory
- ↳ getters & setters
- ↳ C, P&P



private ✓

default ✓

public

```
class Student {  
  data memb-ers {  
    age ← private  
  }  
  methods functions {  
  }  
}
```

```
class SU {  
  s s1 = n s()}
```

folder / package



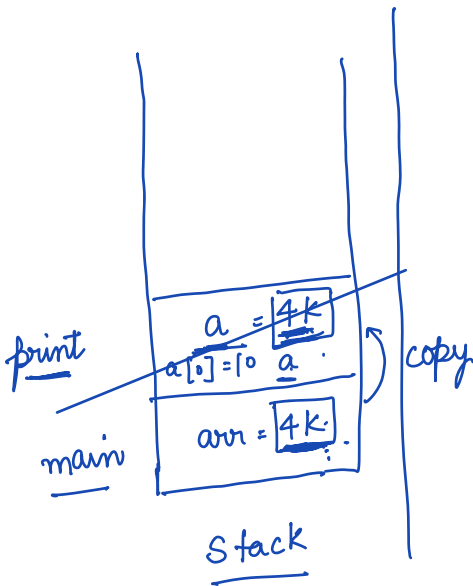
N P

Heap  
ref - stack

P

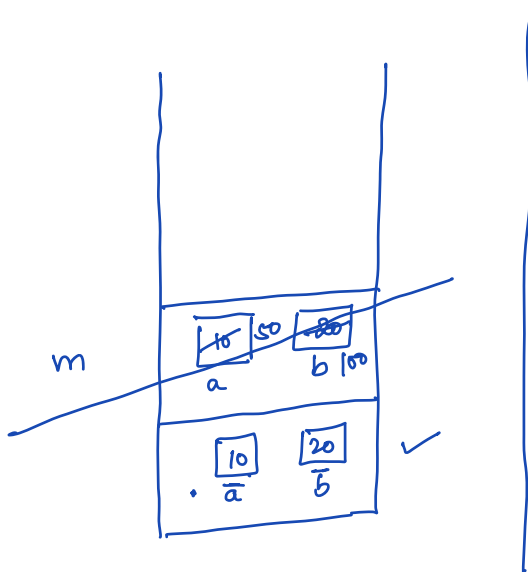
Stack

# Arrays



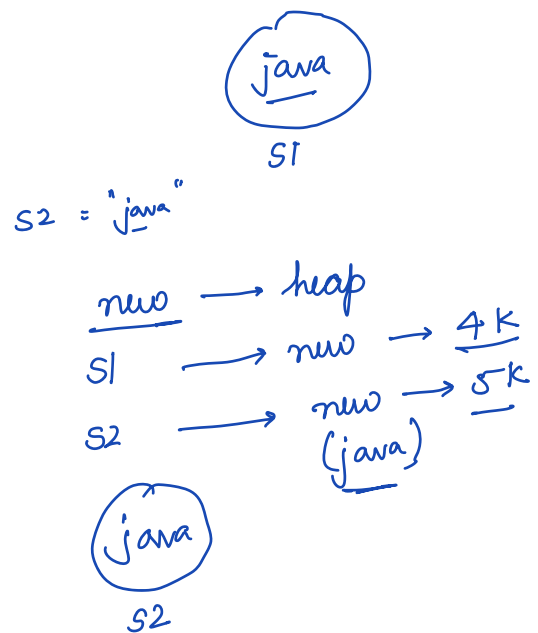
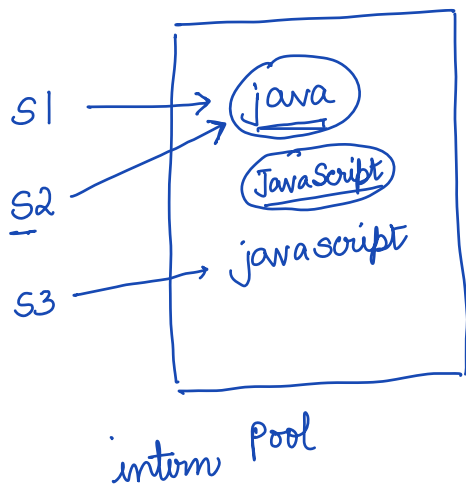
5	6	7	9	2
0	1	2	3	4
4000	4004	4008	4012	4016

call by value — Java  
copies

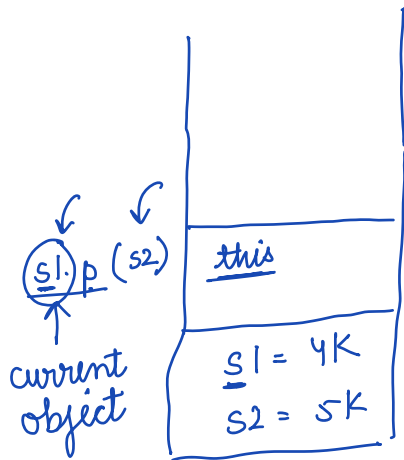
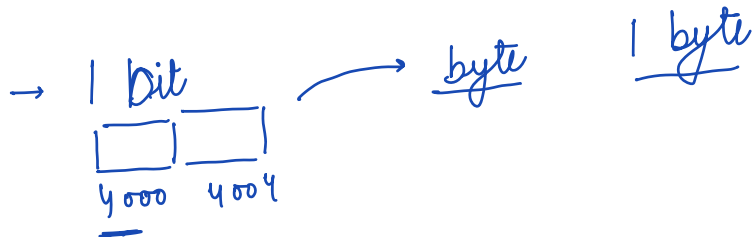
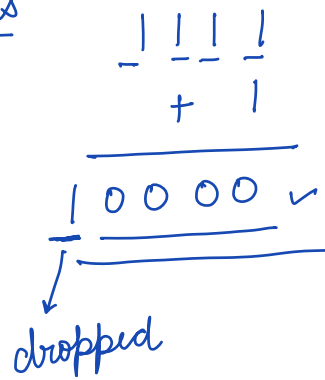




String → • immutable in nature



4 bits



Heap

long → int

int

int a, int b

$10^9$   $10^9$

$10^{18}$

long ans = (long)(a \* b)

(int) (ans %  $10^9$ )

