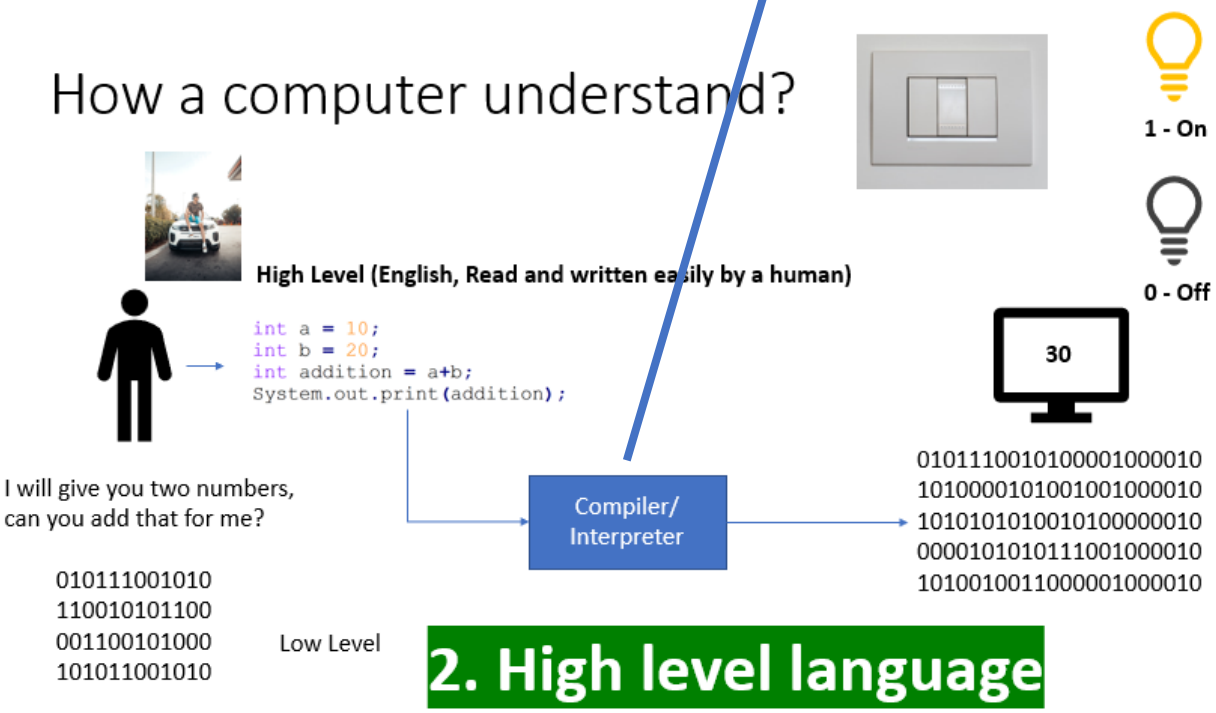
Chapter 21

Signed two's complement

How Java stores Integers internally

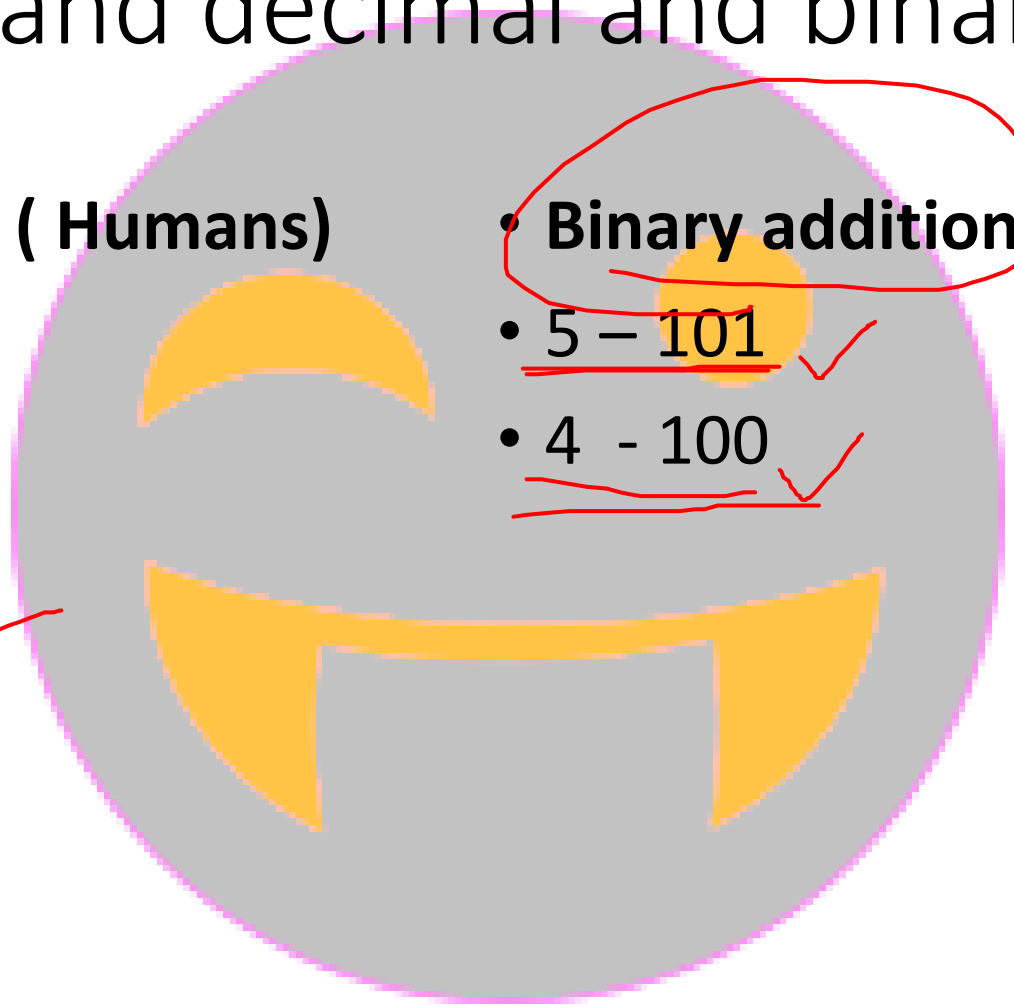
```
class VariablesDemo{
    int marks = 100;
    public static void main(String[] args){
        System.out.println("Variables Demo");
        int a, b, c, d;
        a = 10;
        b = 20;
        c = -20;
        System.out.println(a);
        System.out.println(b);
        System.out.println(c);
        d = 1000;
        System.out.println(d);
```

Signed two's complement

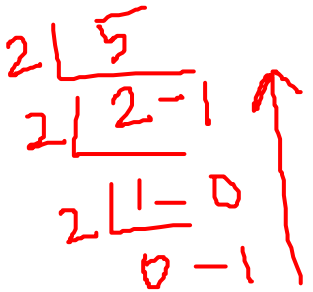


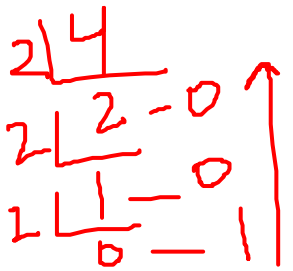
Let’s understand decimal and binary additions

- **Decimal additions (Humans)**
- 5+4
- 9
- 52+38
- 90



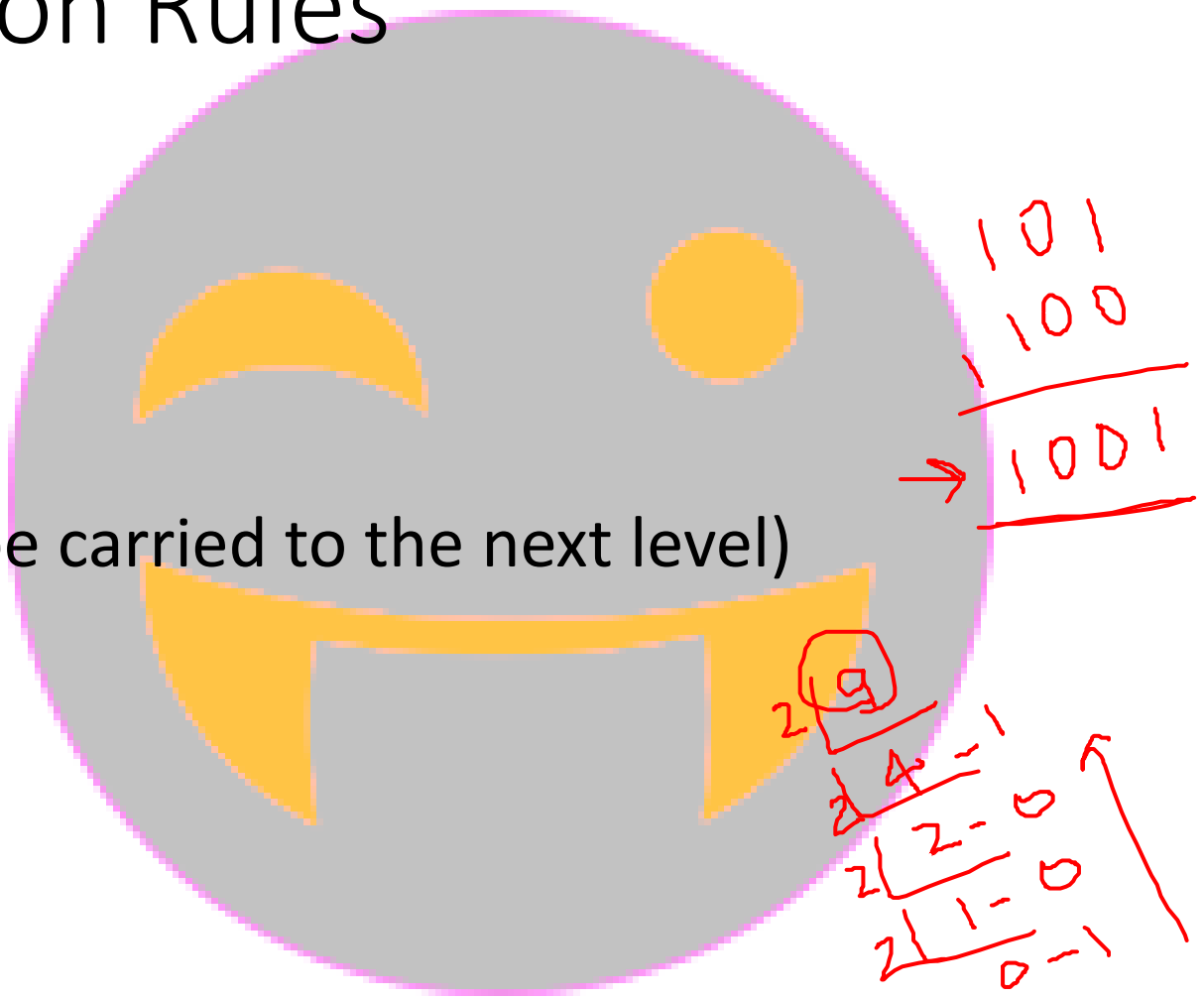
- **Binary additions**
- 5 – 101
- 4 - 100





Binary Addition Rules

- 0 + 0 = 0
- 0 + 1 = 1
- 1 + 0 = 1
- 1 + 1 = 10 (1 will be carried to the next level)



- **Binary additions**
- 5 – 101
- 4 - 100
- 9?

How Java stores Integers internally

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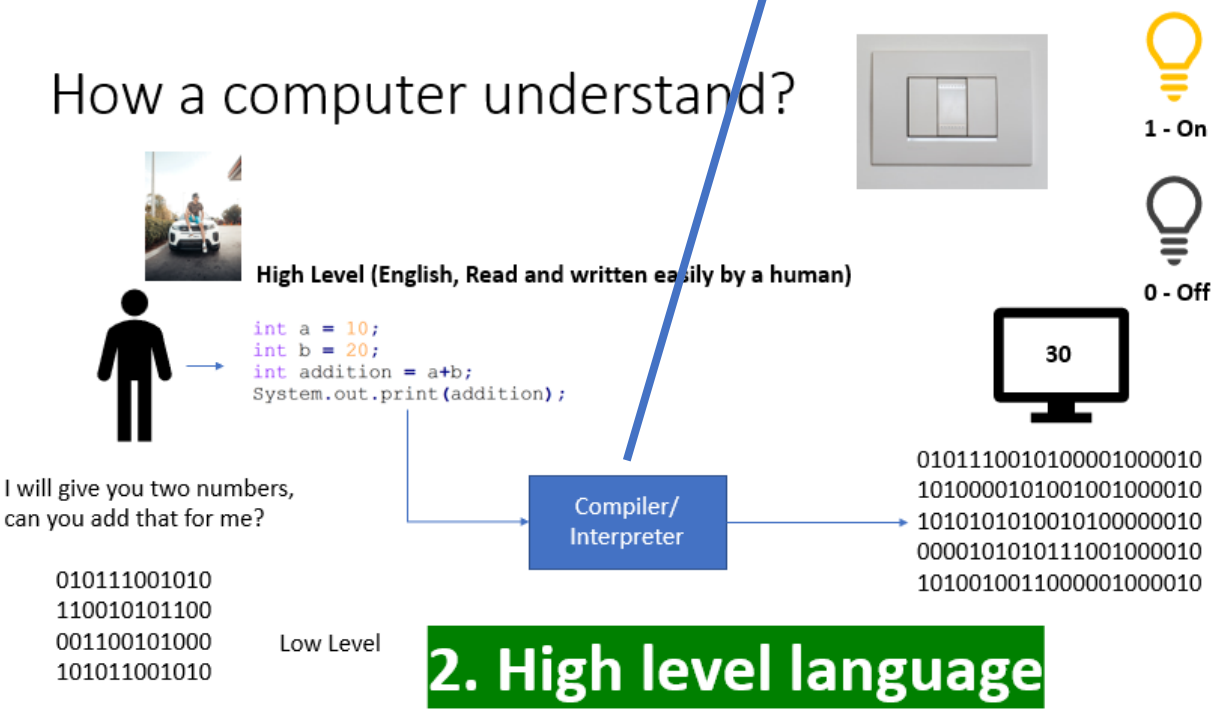
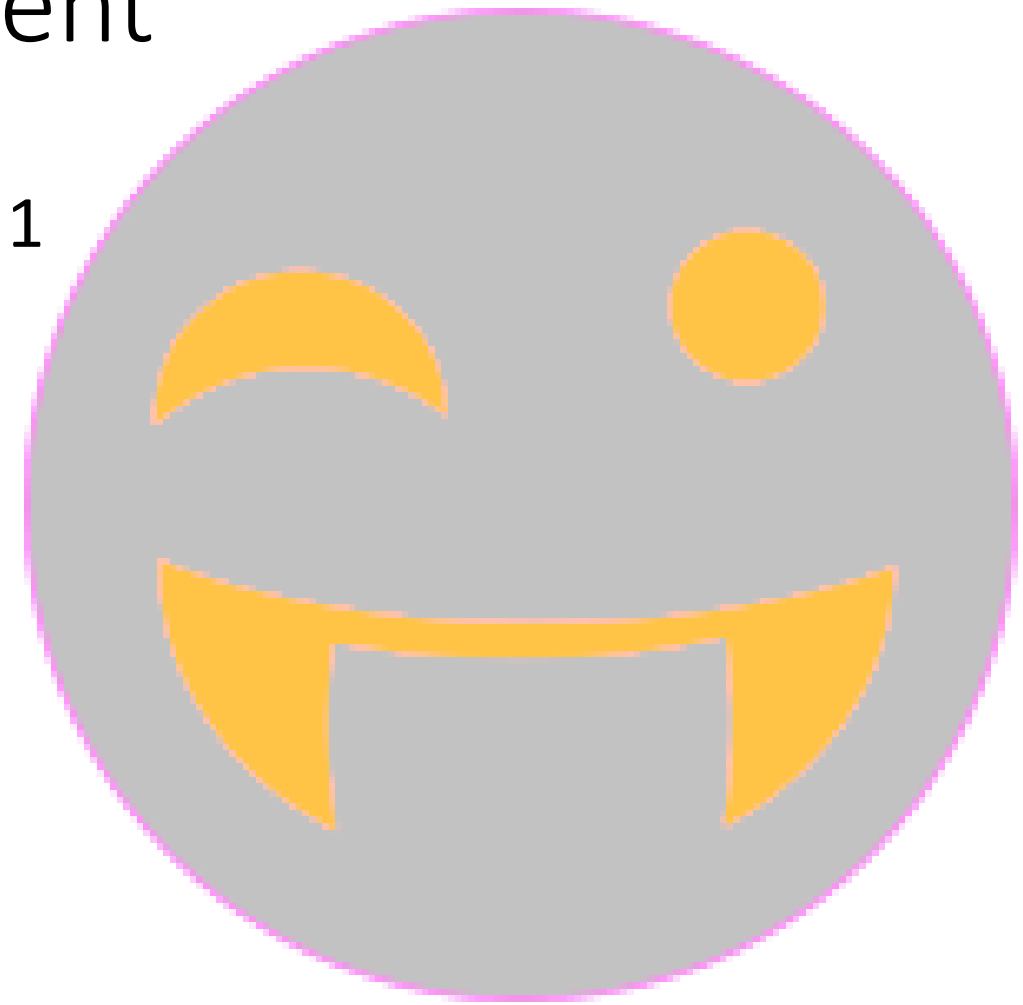
Signed two's complement



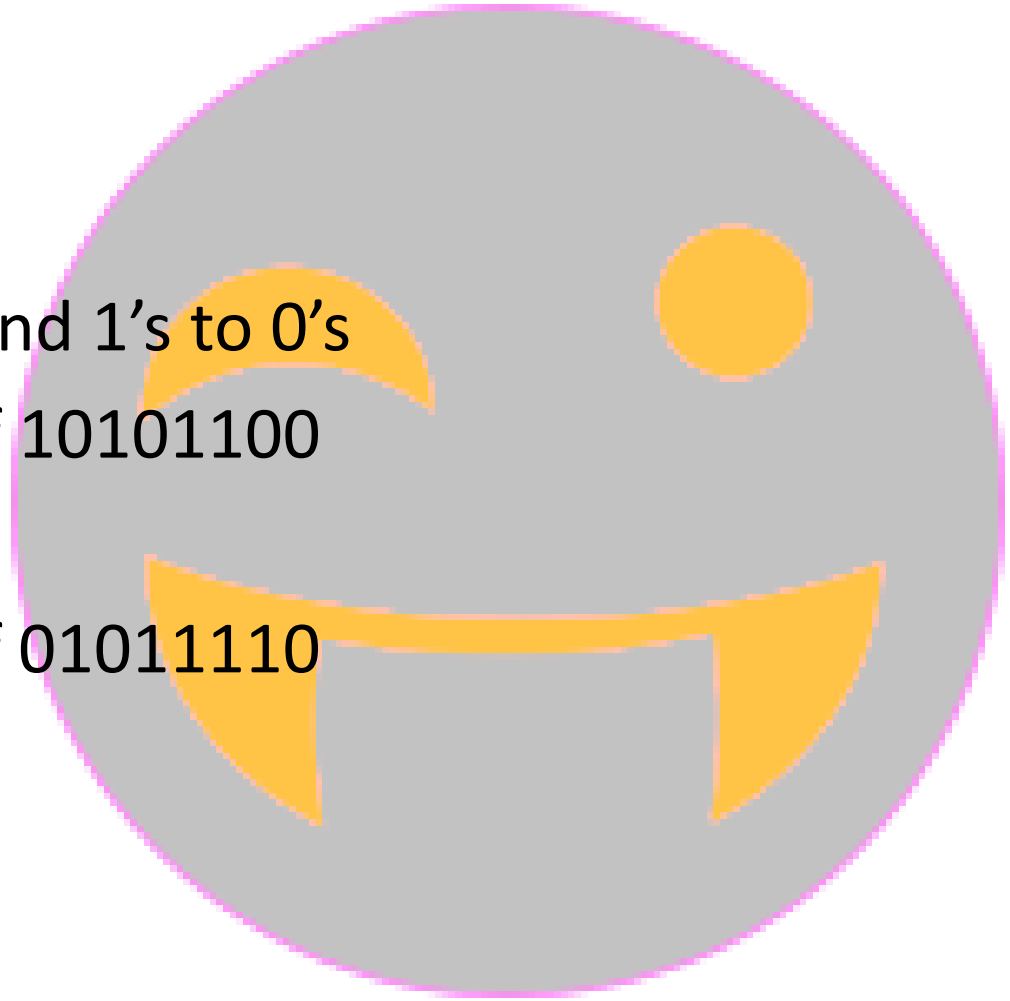
2’s complement

- 1’s complement + 1



1’s complement of a binary(10101100) number is:

- Invert bits
- Change 0’s to 1’s and 1’s to 0’s
- 1’s complement of 10101100
- 01010011
- 1’s complement of 01011110
- 10100001



Let’s see the action 

Signed two’s complement

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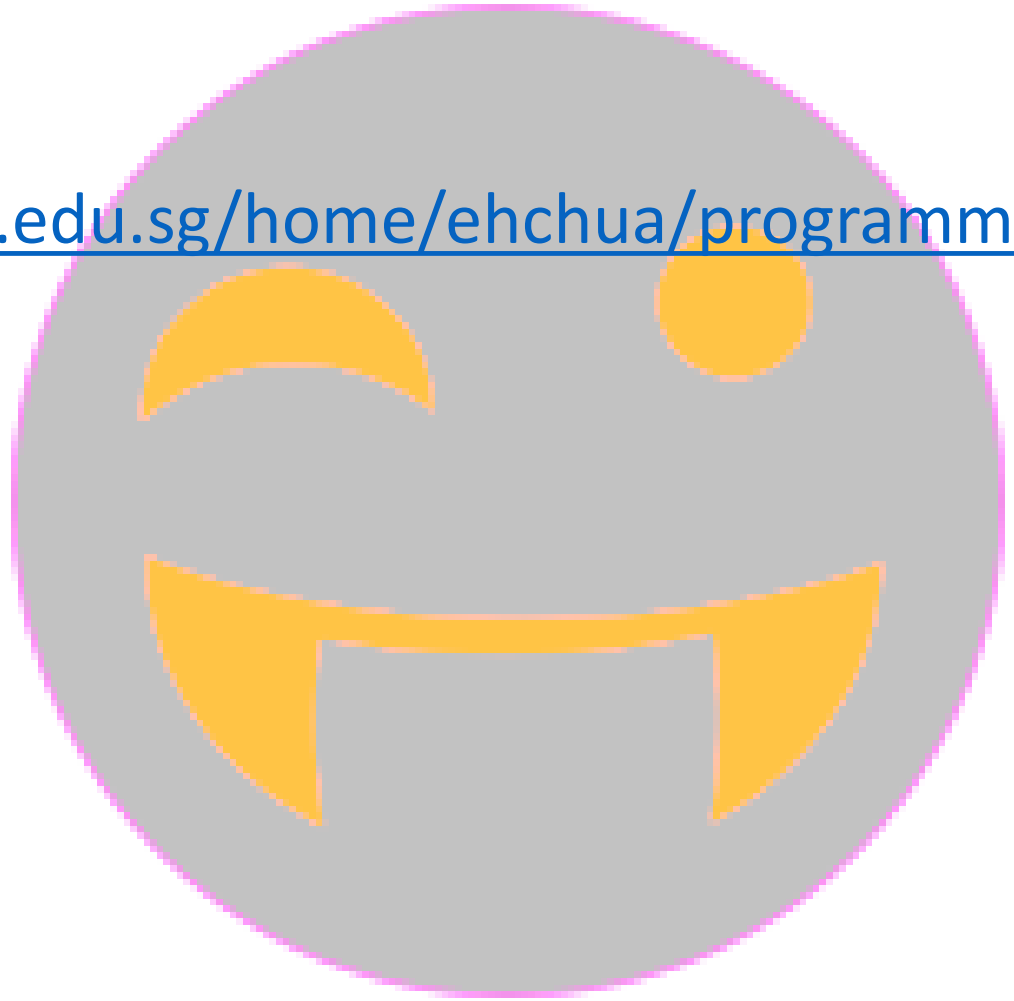
Note

- Signed two’s complement will only be applied to the negative integers

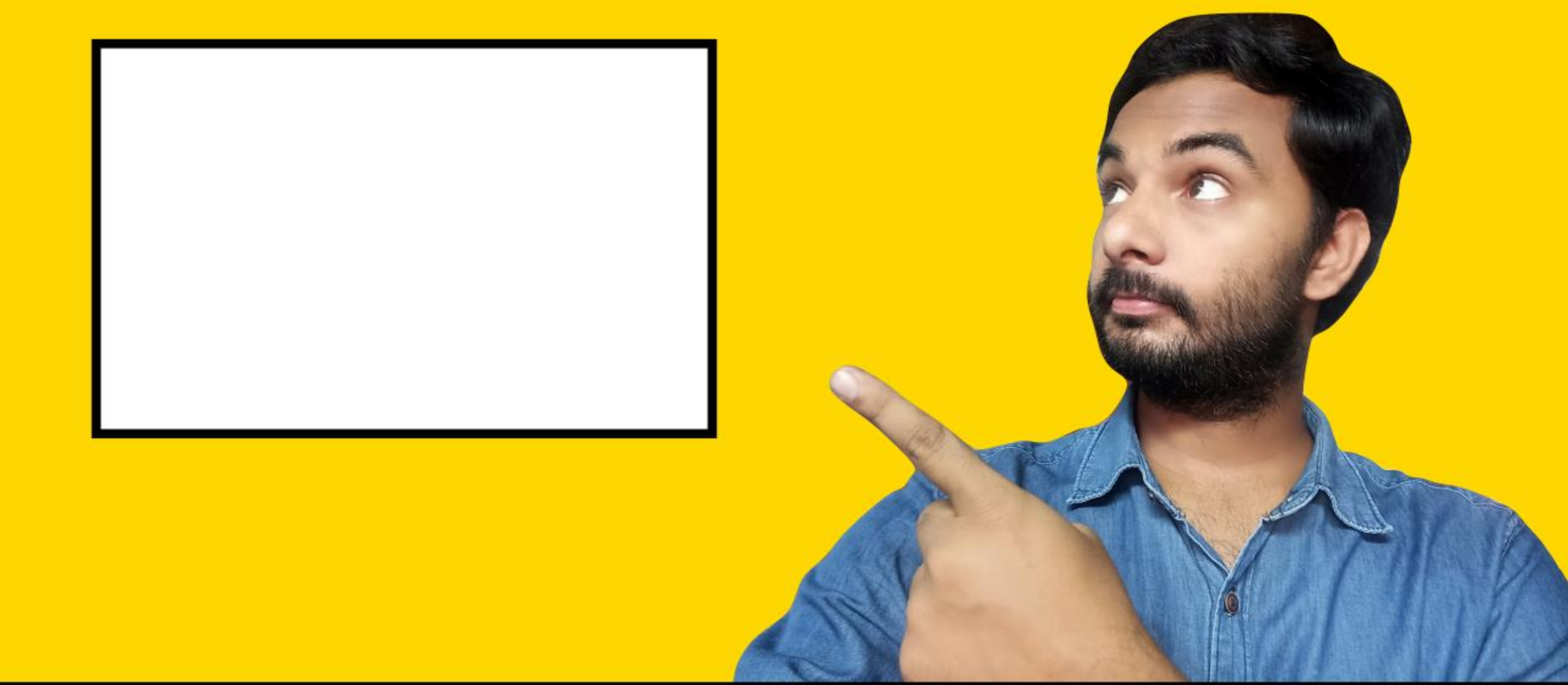
Useful links

- https://www3.ntu.edu.sg/home/ehchua/programming/java/DataRepresentation.html



What next?

Data types practical – Floating point numbers (float, double)



చిన్న బ్రేక్ చిటికలో వచ్చేస్తా