Chapter 21

Signed two's complement



How Java stores Integers internally

```
class VariablesDemo{
                                                                        Signed two's complement
   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;
                                                       How a computer understand?
         System.out.println(a);
         System.out.println(b);
         System.out.println(c);
         d = 1000;
                                                                  High Level (English, Read and written easily by a human)
                                                                                                                  0 - Off
         System.out.println(d);
                                                                  int addition = a+b;
                                                                  System.out.print(addition);
                                                                                                      0101110010100001000010
                                                    I will give you two numbers,
                                                                                                      1010000101001001000010
                                                                                   Compiler/
                                                    can you add that for me?
                                                                                                      1010101010010100000010
                                                                                   Interpreter
                                                                                                      0000101010111001000010
                                                       010111001010
                                                                                                      1010010011000001000010
                                                       110010101100
                                                       001100101000
                                                                   Low Level
                                                                           2. High level language
                                                       101011001010
```

Let's understand decimal and binary additions

Decimal additions (Humans)

• 9

• 90

Binary additions

Binary Addition Rules

•
$$0 + 0 = 0$$

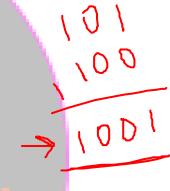
•
$$0 + 1 = 1$$

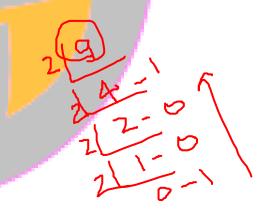
•
$$1 + 0 = 1$$

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

Binary additions

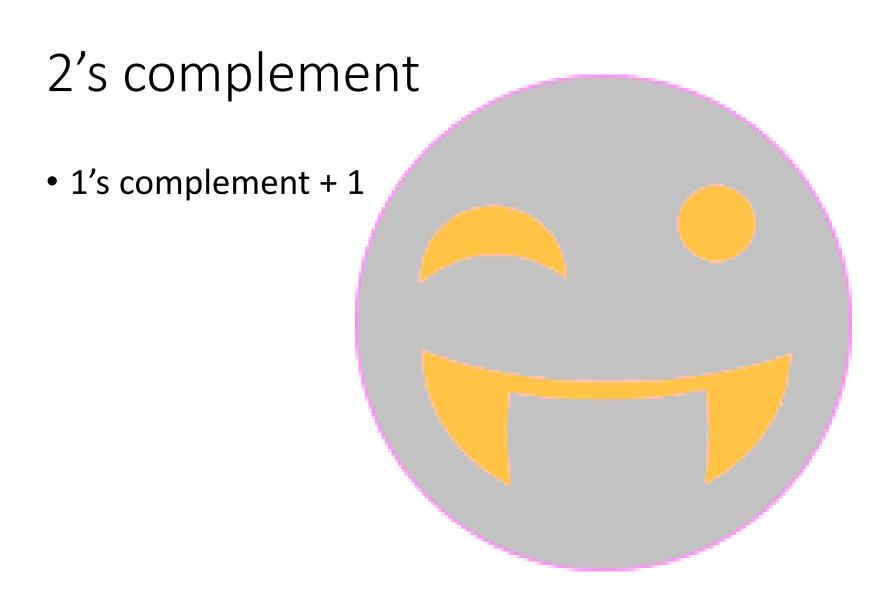
• 9?





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                                                                   Low Level
                                                                           2. High level language
                                                       101011001010
```



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

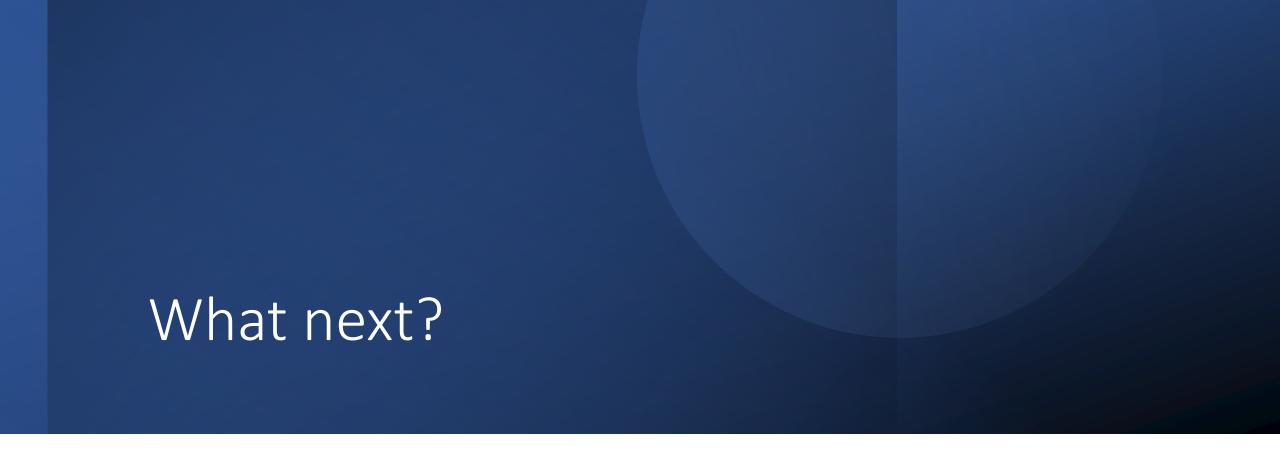
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```

Note

• Signed two's complement will only be applied to the negative integers

Useful links

• https://www3.ntu.edu.sg/home/ehchua/programming/java/DataRep resentation.html



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



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