November 3, 2023
Wintersemester 2023/2024

Universität Konstanz
Fachbereich Mathematik und Statistik

Encoding II, Algorithms and Data Structures

Exercise 1: IEE 754 Number format

a) first bit: $1 \rightarrow$ negative
following 8 bits: $10000001 = 0111\,1111_2 + 10_2 \rightarrow$ Exponent is 10_2
other bits: $10100000000000000000000 \rightarrow$ Mantissa is 1.101_2
$\implies 11000000110100000000000000000000 = -1.101_2 \times 10_2^{10_2} = -1101.1_2 = -13.5_{10}$

b) positive: first bit $= 0$
$20.5_{10} = 1\,0100.1_2 \rightarrow$ mantissa: 01001000000000000000000, exponent: $0111\,1111_2 + 100_2 = 1000\,0011_2$
$\implies 01000001101001000000000000000000$

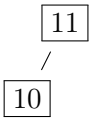
Exercise 2: ASCII

a) S $= 53_{16}$, k $= 6B_{16}$, I $= 49_{16}$: "SkI" $= 536B49_{16} = 101\,0011\,0110\,1011\,0100\,1001_2$

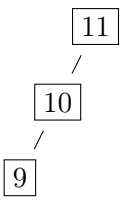
Exercise 3: Binary Search Trees

a) insert(11)
empty tree: 11 becomes root

insert(10)
$10 < 11$

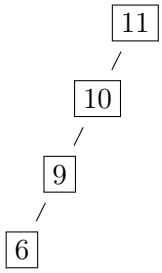


insert(9)
$9 < 11 \rightarrow 9 < 10$

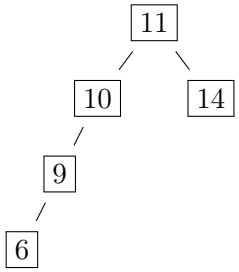


insert(6)

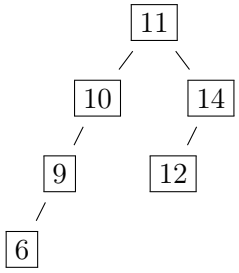
$6 < 11 \rightarrow 6 < 10 \rightarrow 6 < 9$



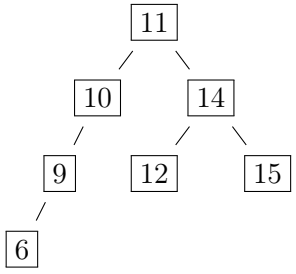
insert(14)
$14 > 11$

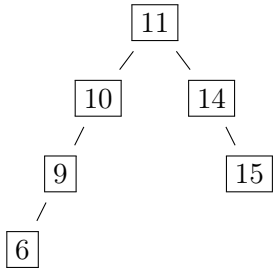


insert(12)
$12 > 11 \rightarrow 12 < 14$



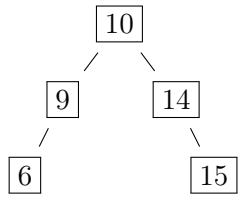
insert(15)
$15 > 11 \rightarrow 15 > 14$





remove(12) $\rightarrow$ 12 has no child:

remove(11) $\rightarrow$ 11 has two childs: replace 11 with the most right element of the left child (the 10) and remove the child, because 10 has one child on the left side move this child to the left side of the root:



Exercise 4: Hashing

a) 13???

b)

0	→ 7
1	→ 6
2	→ 5
3	→ 8
4	→ (7 collision → +7) 14
5	→ 1
6	→ 10
7	→ (5 collision → + 31) 36
8	→ 12
9	→ 3
10	→ (1 collision → + 27) 28
11	→ (8 collision → + 34) 42