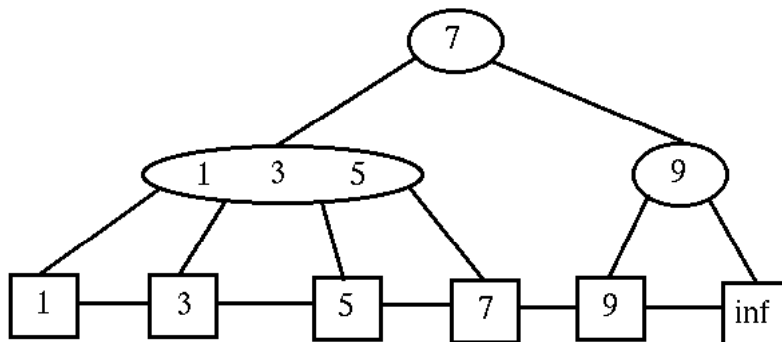

Effiziente Algorithmen und Datenstrukturen I

Aufgabe 1

Consider the following (2,4)-Tree:

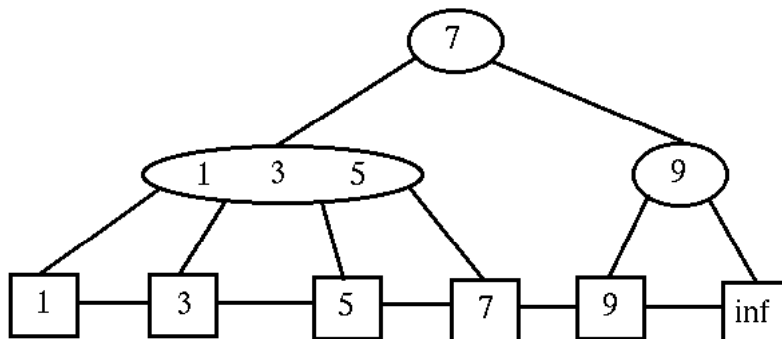


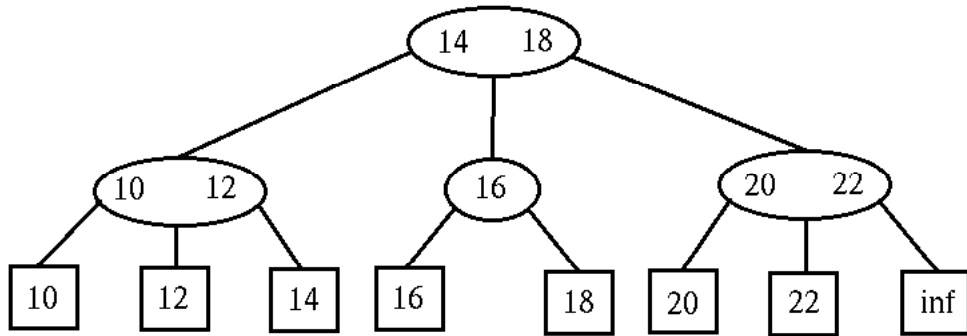
Carry out the operations in the following order and show, after each operation, what the Tree looks like (always carry out each operation on the result of the previous operation):

1. insert(4)
2. delete(3)
3. delete(1)

Aufgabe 2

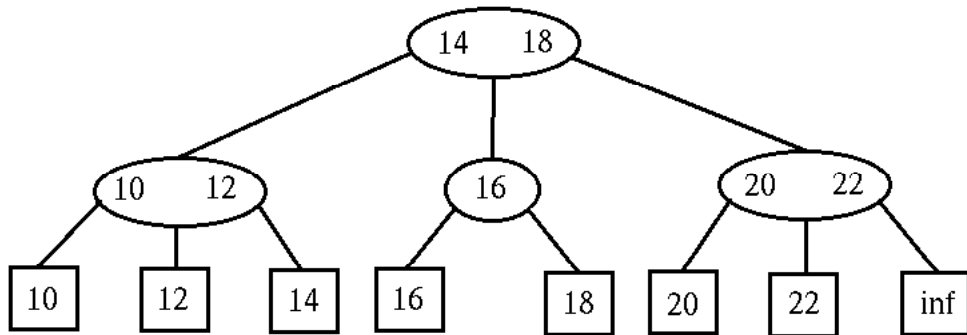
Carry out the concatenate operation on the following two (2,4)-Trees:





Aufgabe 3

Carry out the cut operation on the following (2,4)-Tree for $k = 16$:



Aufgabe 4

Theorem 3.11: *There exists a sequence of n insert and delete operations on a (2,3)-tree s.t. the total number of split and merge operations performed is $\Omega(n \log n)$.*

Please prove this theorem.