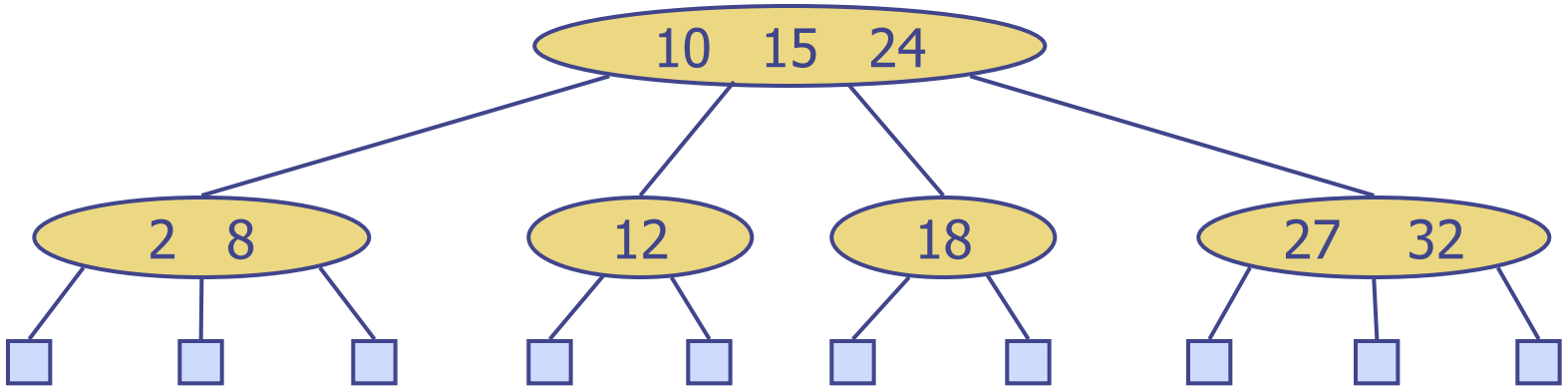
(2,4) Trees

- A (2,4) tree (also called 2-4 tree or 2-3-4 tree) is a multi-way search tree with the following properties



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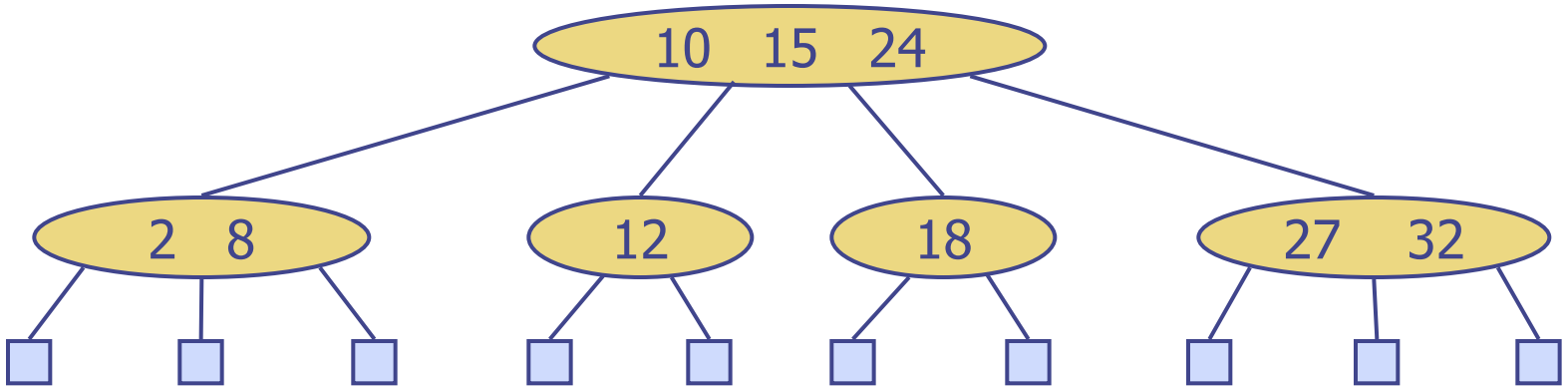
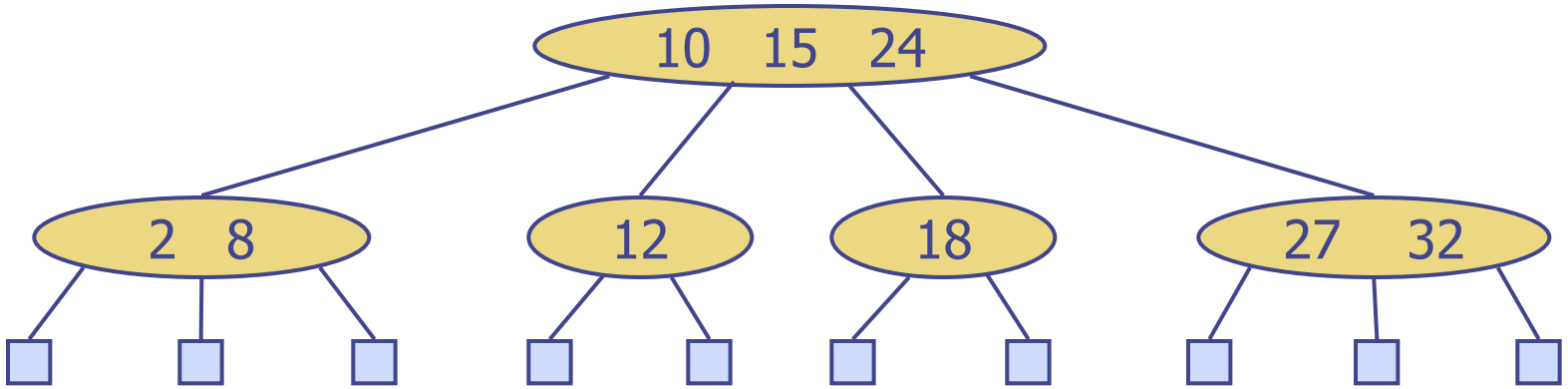
  - Node-Size Property: every internal node has 2, 3, or 4 children

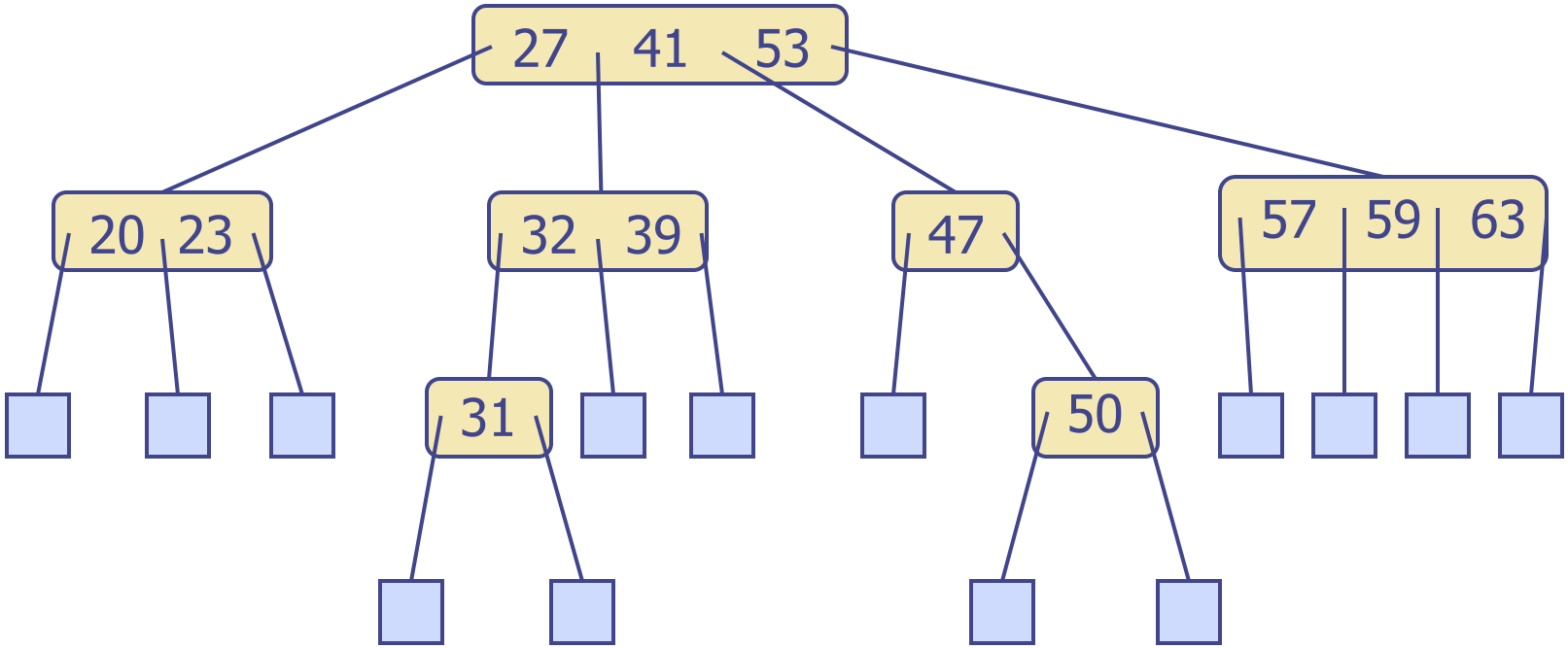


(2,4) Trees

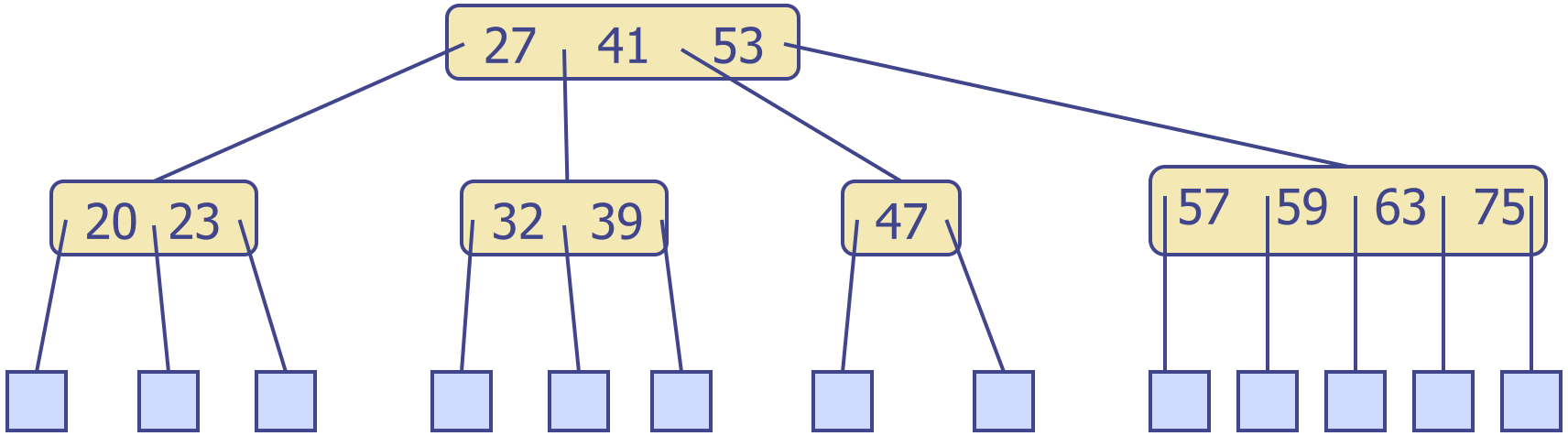
- A (2,4) tree (also called 2-4 tree or 2-3-4 tree) is a multi-way search tree with the following properties
  - Node-Size Property: every internal node has 2, 3, or 4 children
  - Depth Property: all the leaves are in the same level



(2,4) Tree?



(2,4) Tree?

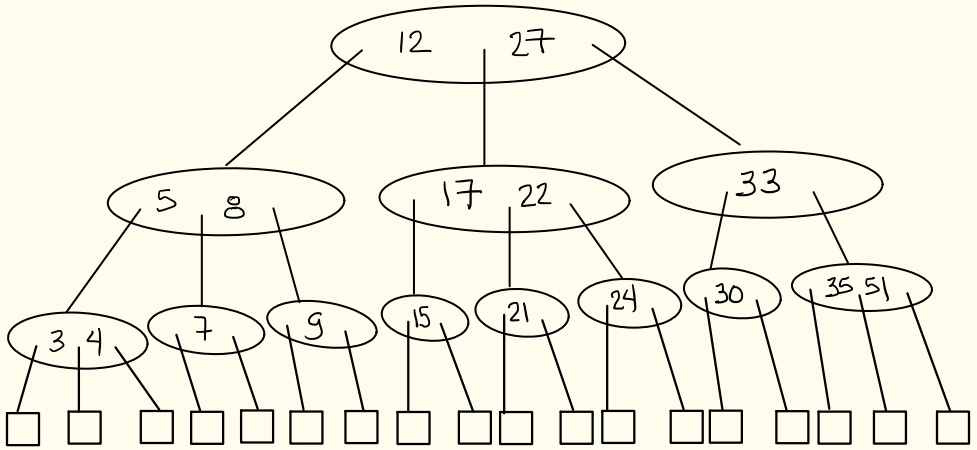


What is the Maximum Height of a (2,4) Tree?

What is the Maximum Height of a (2,4) Tree?

Build the tallest possible (2,4) tree with n keys : $k_1, k_2, \ldots, k_n$

Implementing an Ordered Dictionary with a (2,4) tree



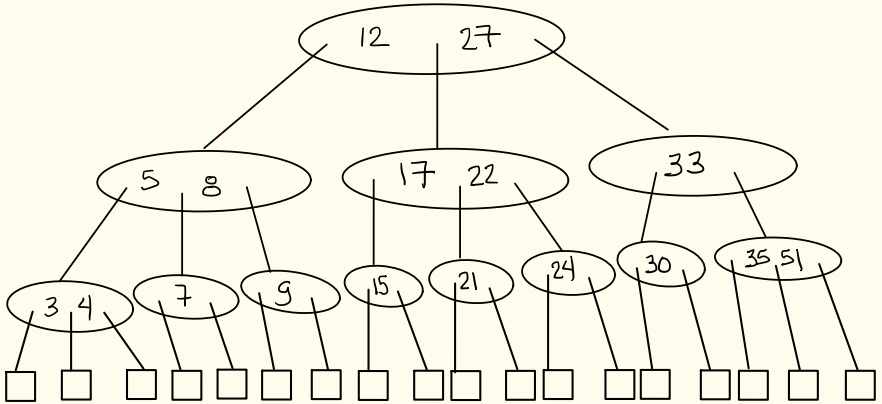
O(log n)

get(k)
smallest()
largest()
successor(k)
predecessor(k)
put(k,d)
remove(k)

Ordered Dictionary Operations on a Multiway Search Tree of Degree d

smallest	O(height)
largest	O(height)
get	O(height × log d)
successor	O(height × log d)
predecessor	O(height × log d)
put	O(d + height × log d)
remove	O(d + height × log d)

Implementing an Ordered Dictionary with a (2,4) tree



O(log n)

get(k)
smallest()
largest()
successor(k)
predecessor(k)

O(log n)

put(k,d)
remove(k)

insert 12