

**M-Way tree  
&**

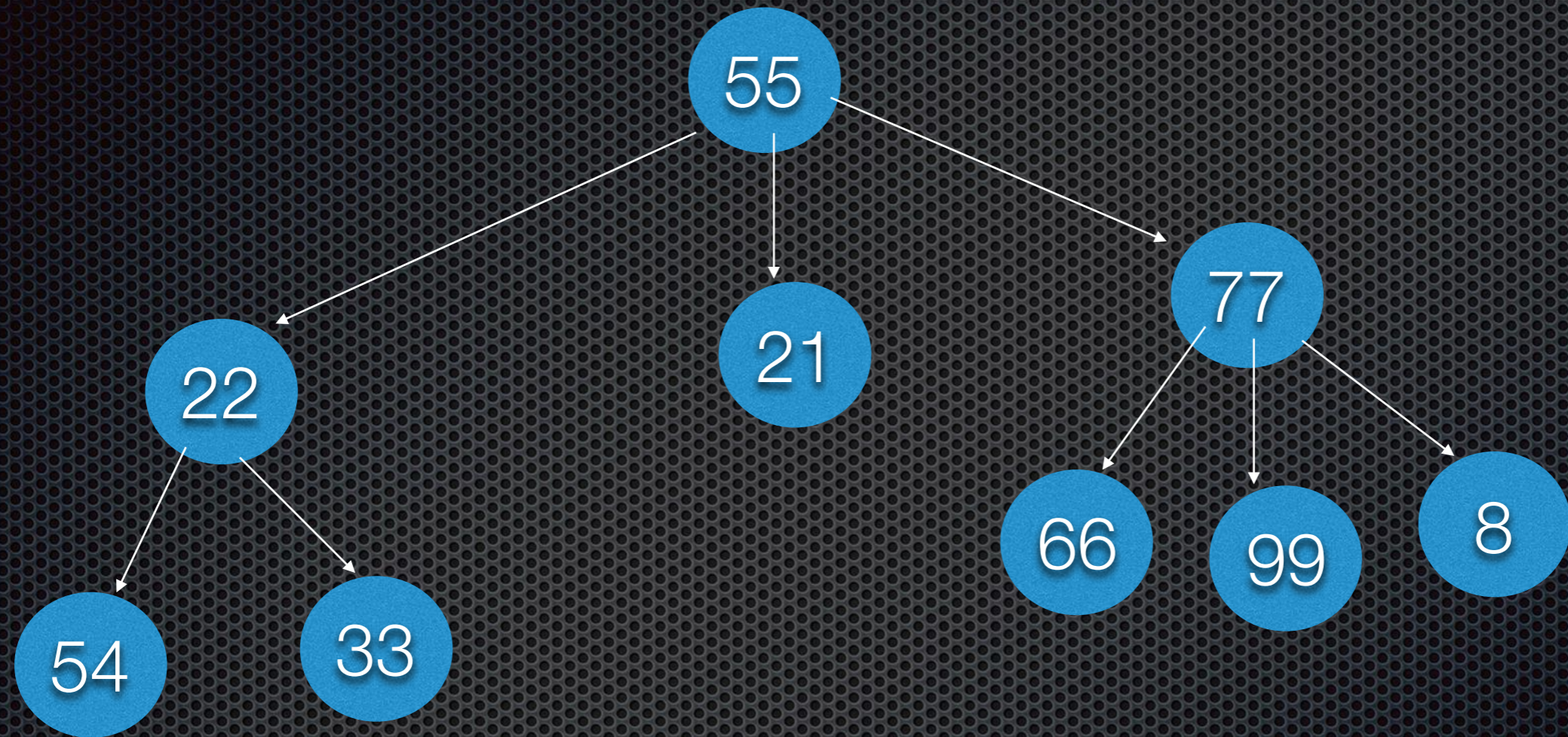
**M-WAY Search Trees**

## M-Way tree

A tree with maximum of  $m$  children is known as  
M-way tree

A multiway tree is defined as a tree that can have more than two children. If a multiway tree can have maximum  $m$  children, then this tree is called as multiway tree of order  $m$  (or an  $m$ -way tree).

M=3



## M-WAY Search Trees

The **m-way** search trees are multi-way trees which are generalised versions of binary search trees where each node contains multiple elements. In an m-Way tree of order **m**, each node contains a maximum of **m – 1** elements and **m** children.

## Property of M-way search tree

Property 1: Each node has at most **m** child nodes

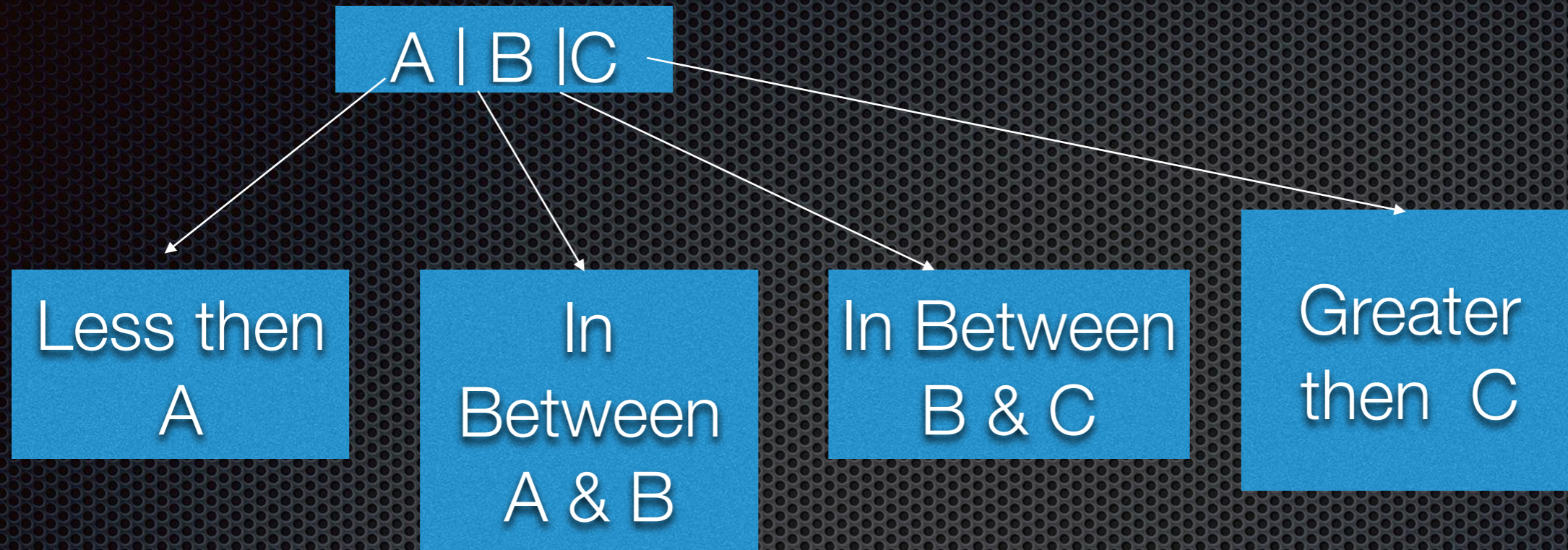
Property 2: If a node has **k** child nodes where  $k \leq m$  then the node can have only **(k-1)** keys  $k_1, k_2, \dots, k_{(k-1)}$

Property 3: Left sub tree Key value is less and right subtree value is greater than parents key value

Property 4: Each of subtree are also m-way search tree

- Property 5: All the key values in a node must be in Ascending Order.

$M=4$  (can have maximum 4 children)



# Creation of M-WAY Search Trees

10, 60, 100, 200, 40, 120, 80, 90, 70, 170, 180, 190

$m=3$  can have maximum 3 children

key =  $m-1=3-1=2$  (max no of elements)

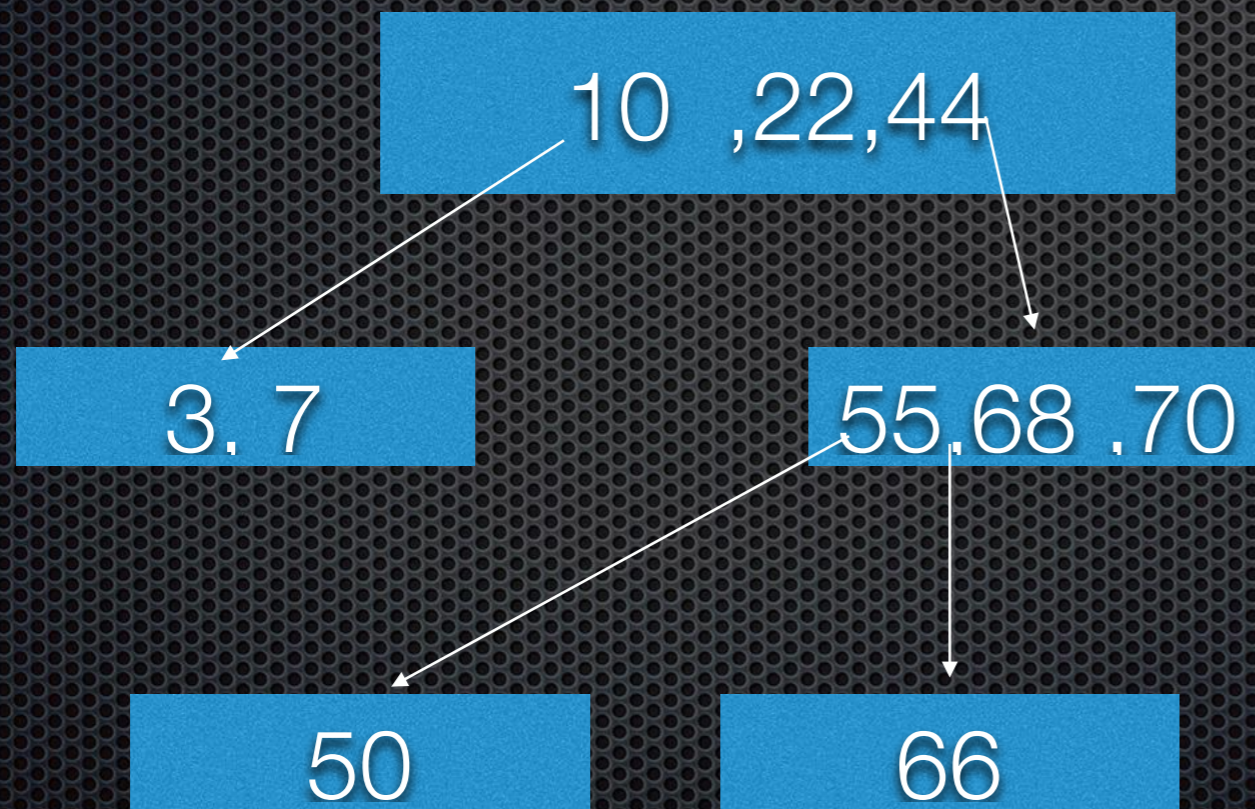
each node contains a maximum of  $m-1$  elements and  $m$  children



10,44,22,55,7,3,70,68,66,50

If  $M=4$  can have maximum 4 children

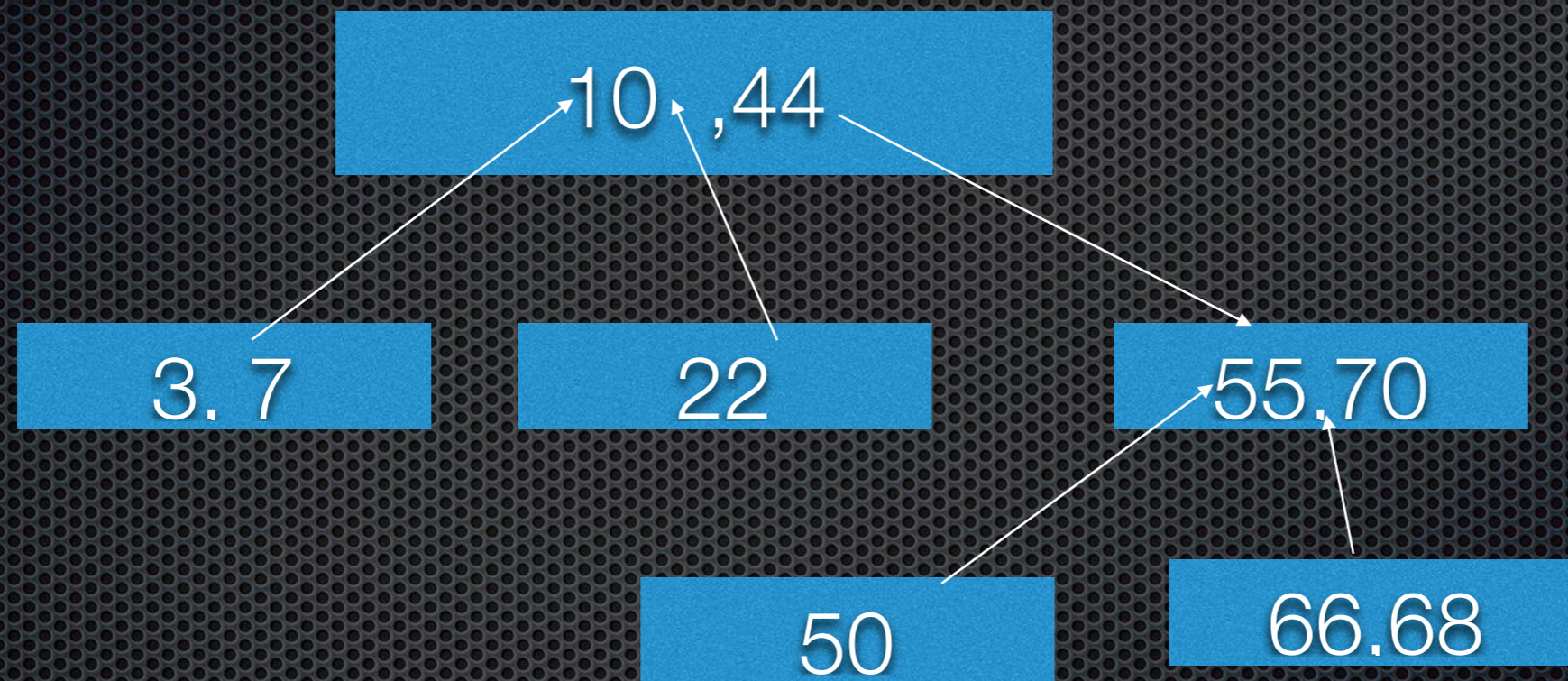
No of key= $m-1=4-1=3$  (max no of elements)



10,44,22,55,7,3,70,68,66,50

If  $M=3$

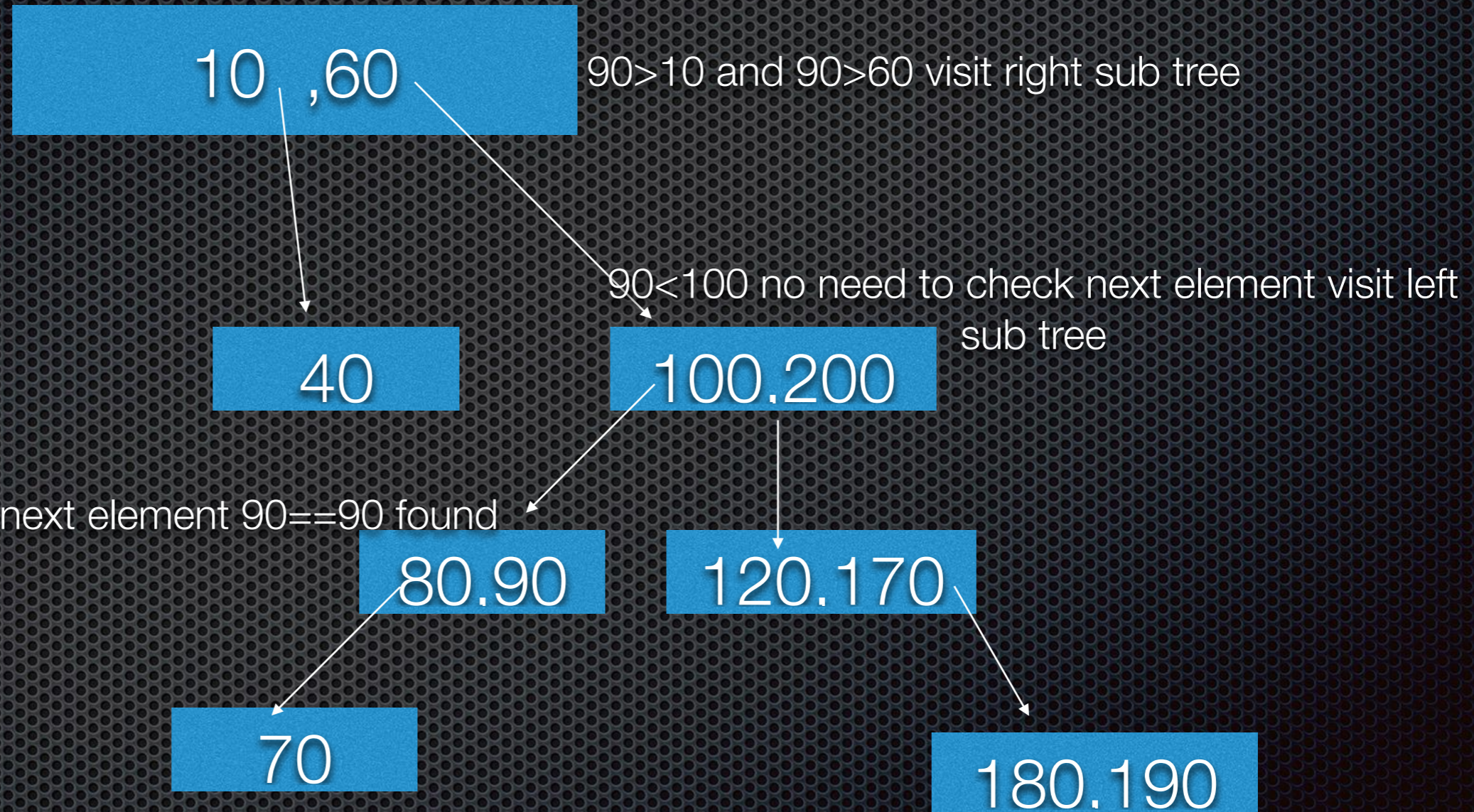
No of key= $m-1=3-1=2$





# Search

## Search 90



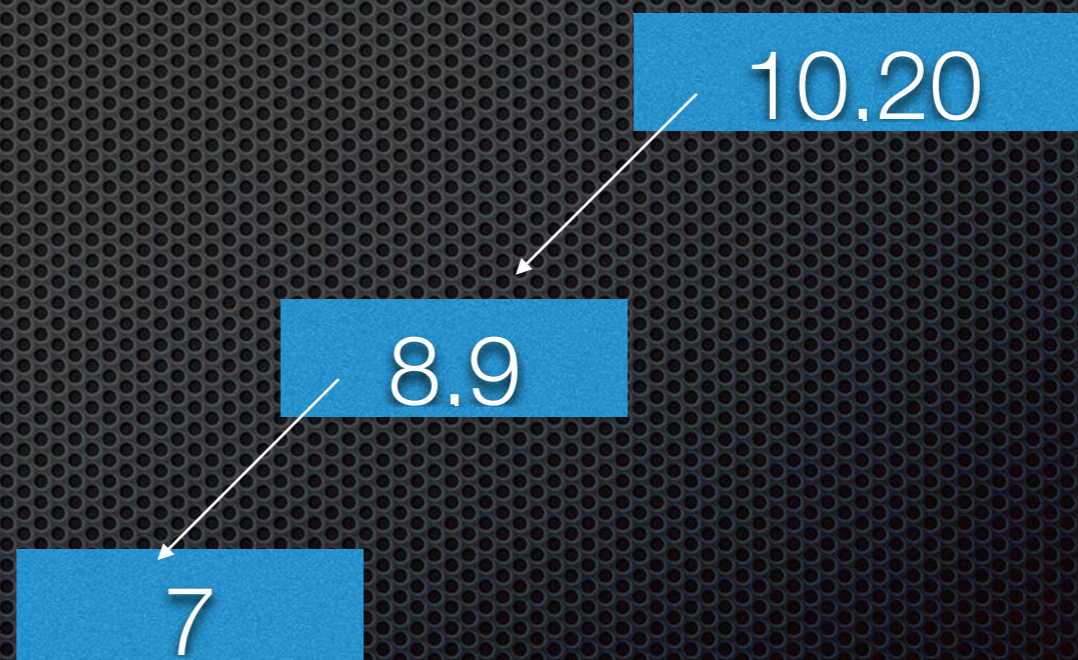
# Delete

Case 1: The key we want to delete **zero** children

Case 2: The key we want to delete has **one** child

Case 3: The key we want to delete has **two** children

Replace with successor or predecessor and remove a duplicate



M=3

