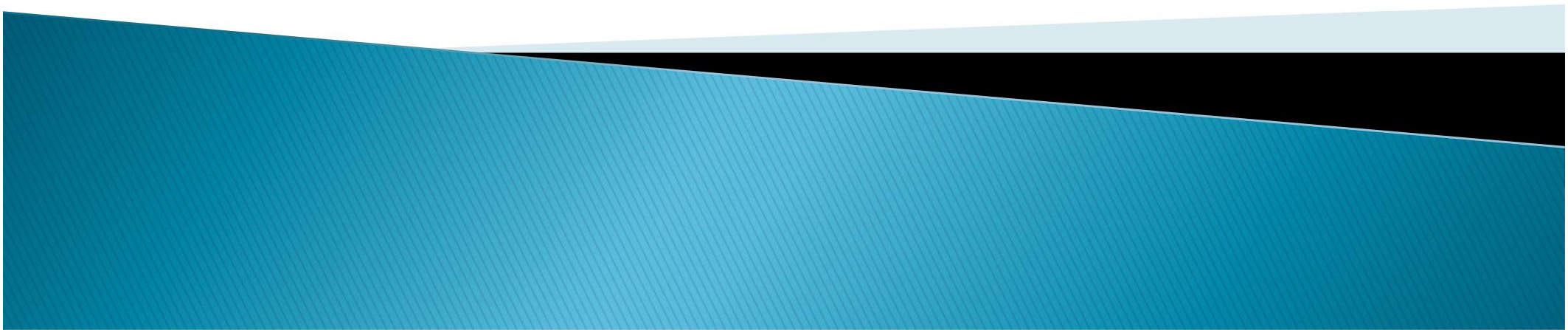
AVL TREE

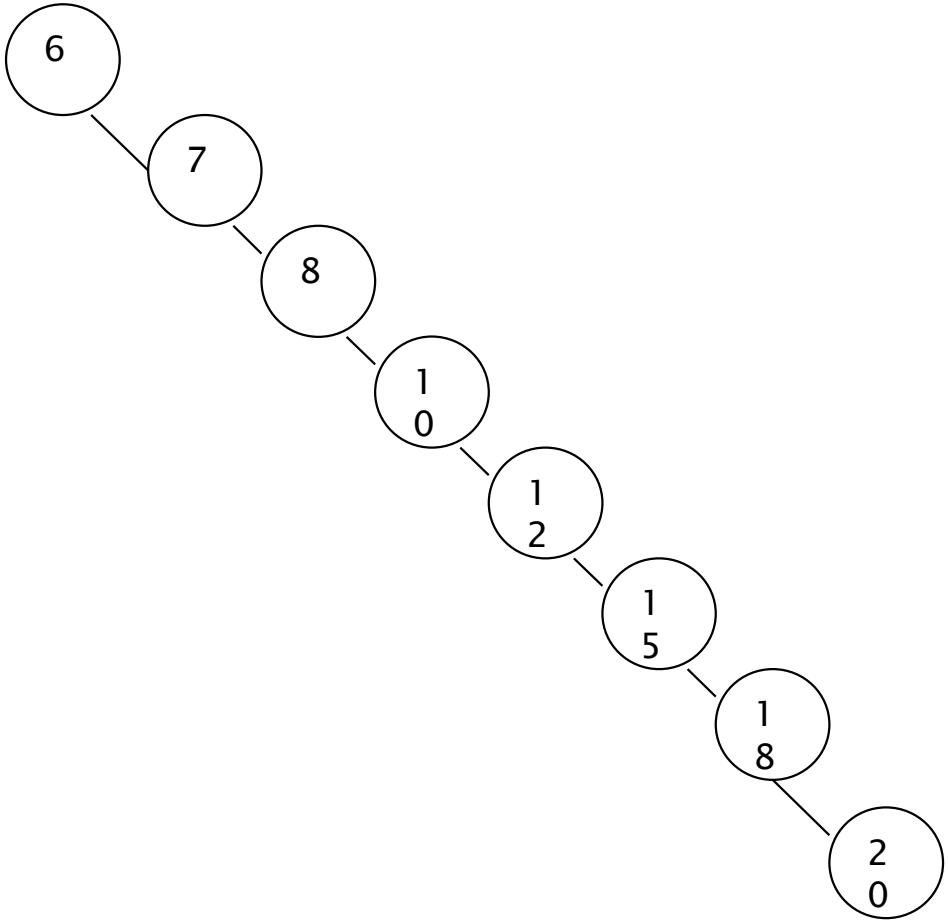


Circumstances When a Binary Tree Degenerates Into a Linked List

- If the same input is given in the sorted order as
- 6, 7, 8, 10, 12, 15, 5, 3,18, 20, you will construct a lopsided tree with only right subtrees starting from the root.

- Such a tree will be conspicuous by the absence of its left subtree from the top.

Circumstances When a Binary Tree Degenerates Into a Linked List



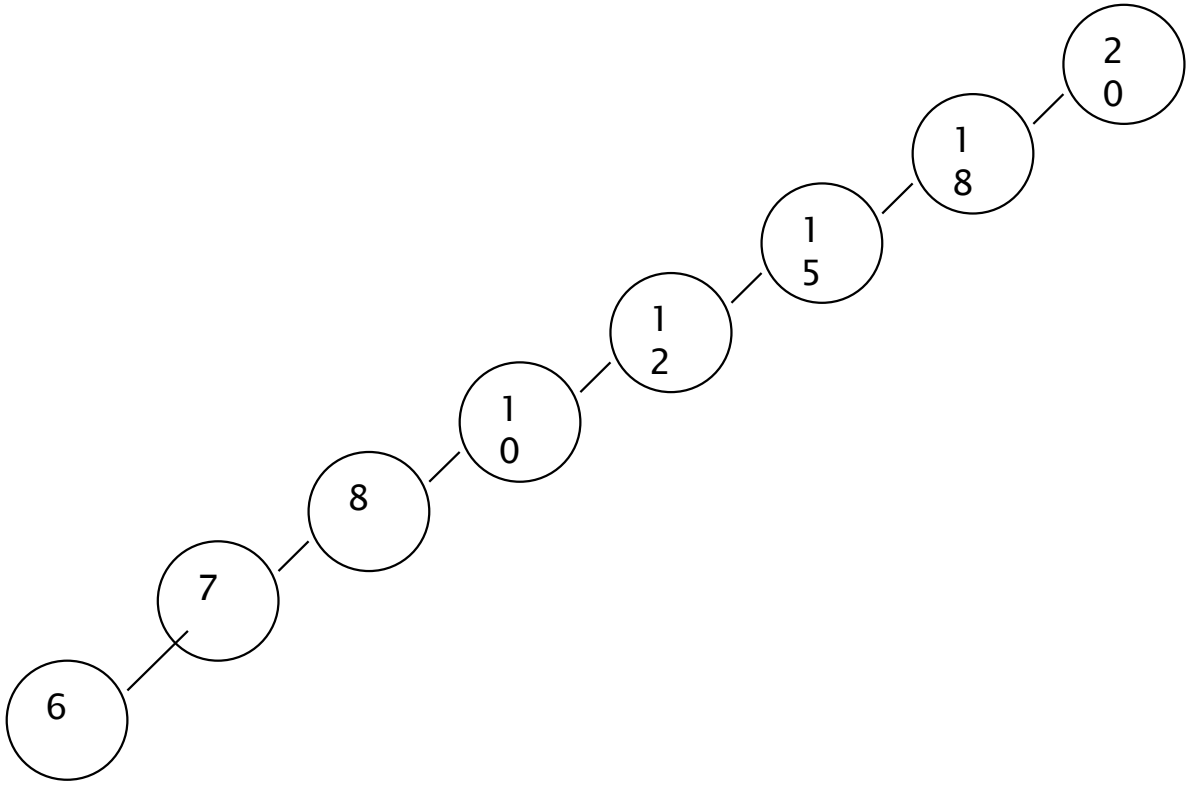
A Lopsided Binary Tree With Only Right Subtrees

Circumstances When a Binary Tree Degenerates Into a Linked List

- However if you reverse the input as
- 20, 18, 15, 12, 10, 8, 7, 6, and insert them into a tree in the same sequence, you will construct a lopsided tree with only the left subtrees starting from the root.

- Such a tree will be conspicuous by the absence of its right subtree from the top.

Circumstances When a Binary Tree Degenerates Into a Linked List



A Lopsided Binary Tree With Only Left Subtrees

Introduction

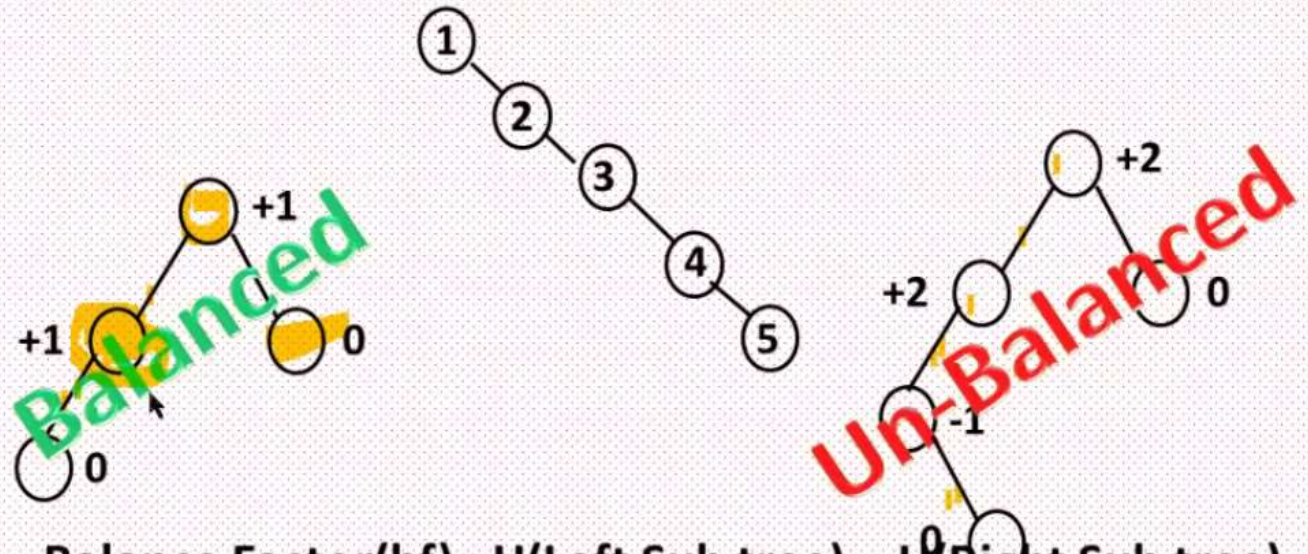
- Adelson-Velskii and Landis
- Complete binary tree is hard to build when we allow dynamic insert and remove.
  - We want a tree that has the following properties
    - Tree height = O(log(N))
    - allows dynamic insert and remove with O(log(N)) time complexity.
  - The AVL tree is one of this kind of trees.

AVL Trees

AVL (Adelson, Velski & Landis) Trees.

Height of 2 child sub-tree of any node differ at most by 1

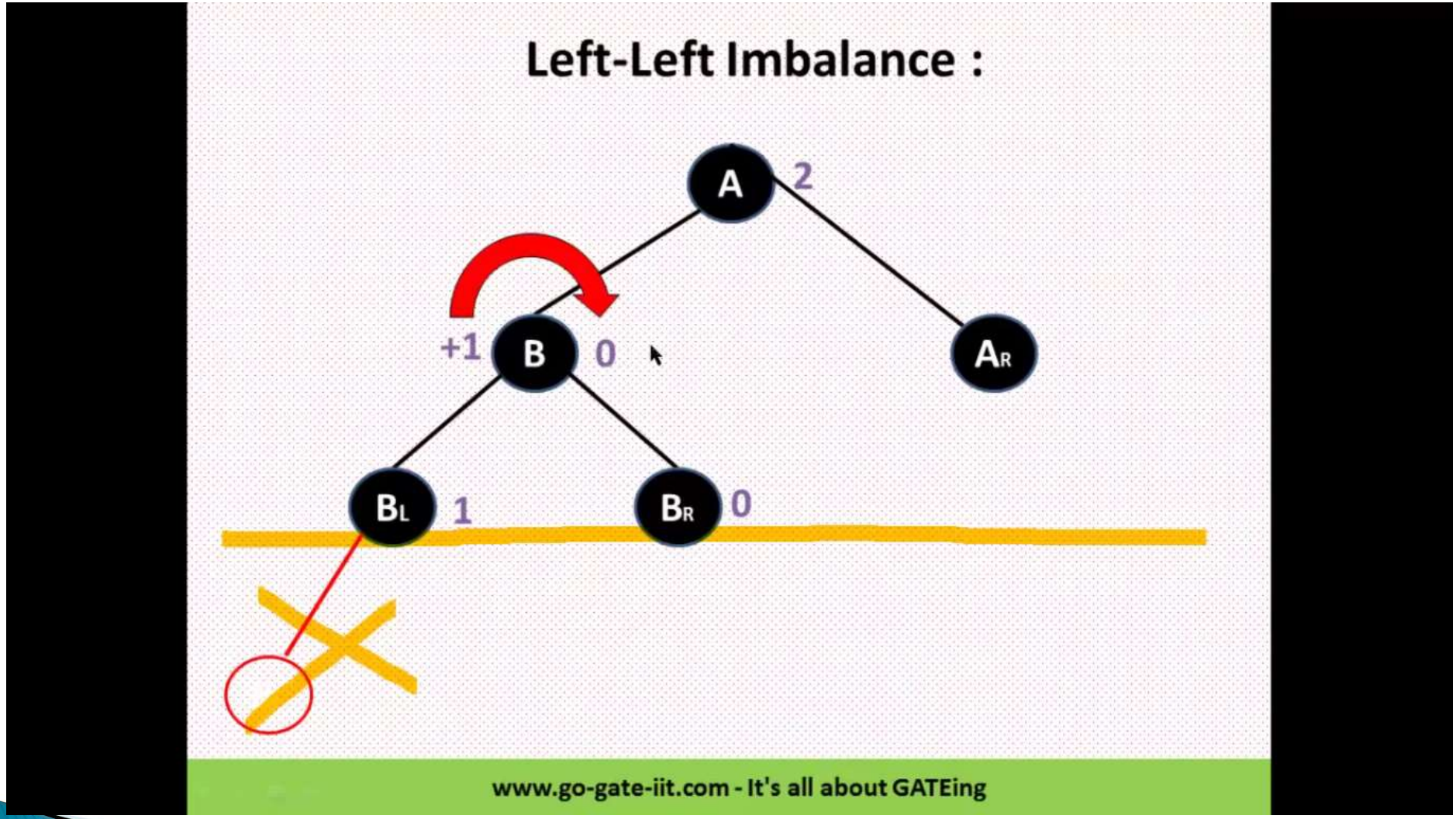
Self balancing Binary Search tree

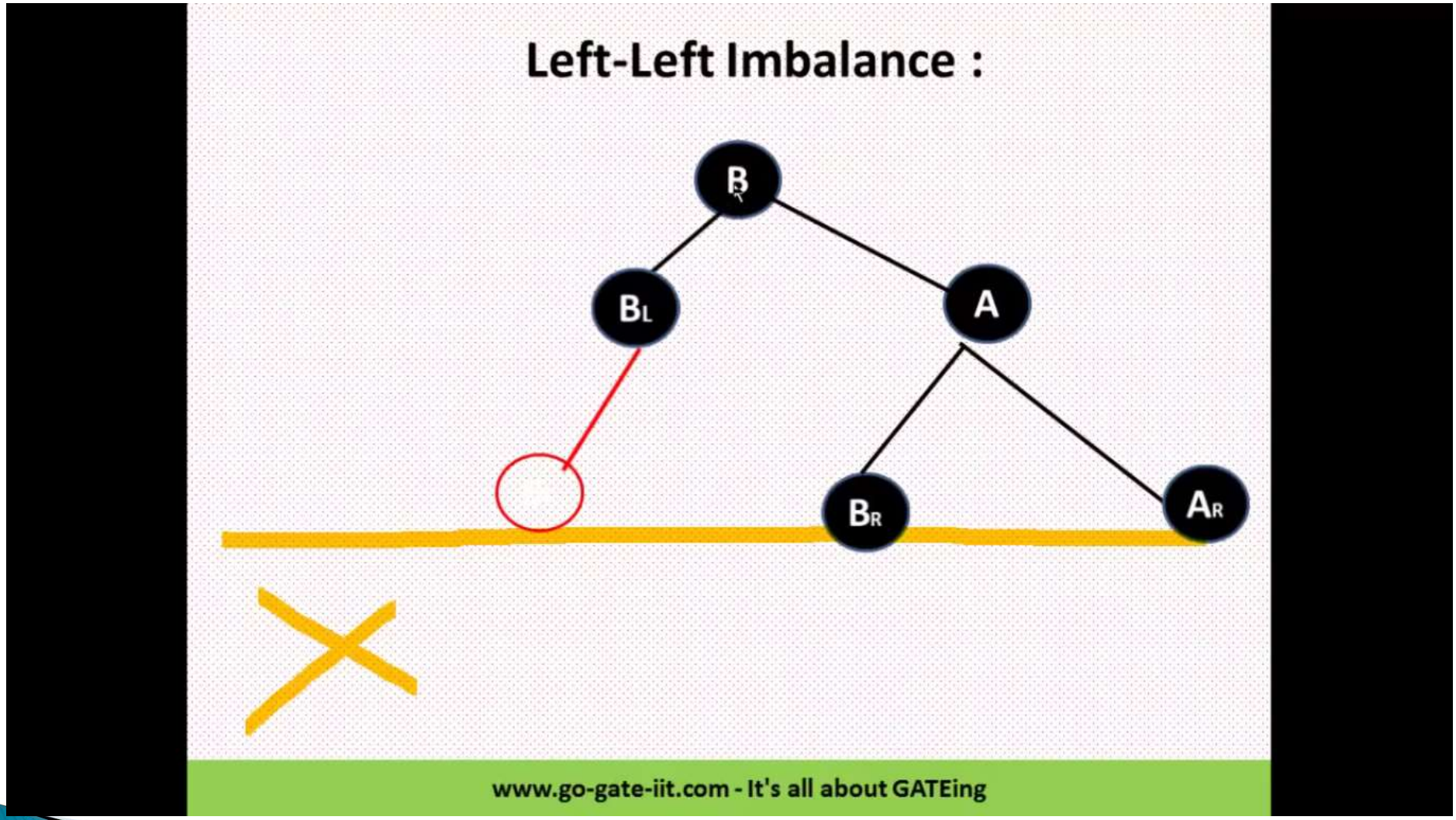


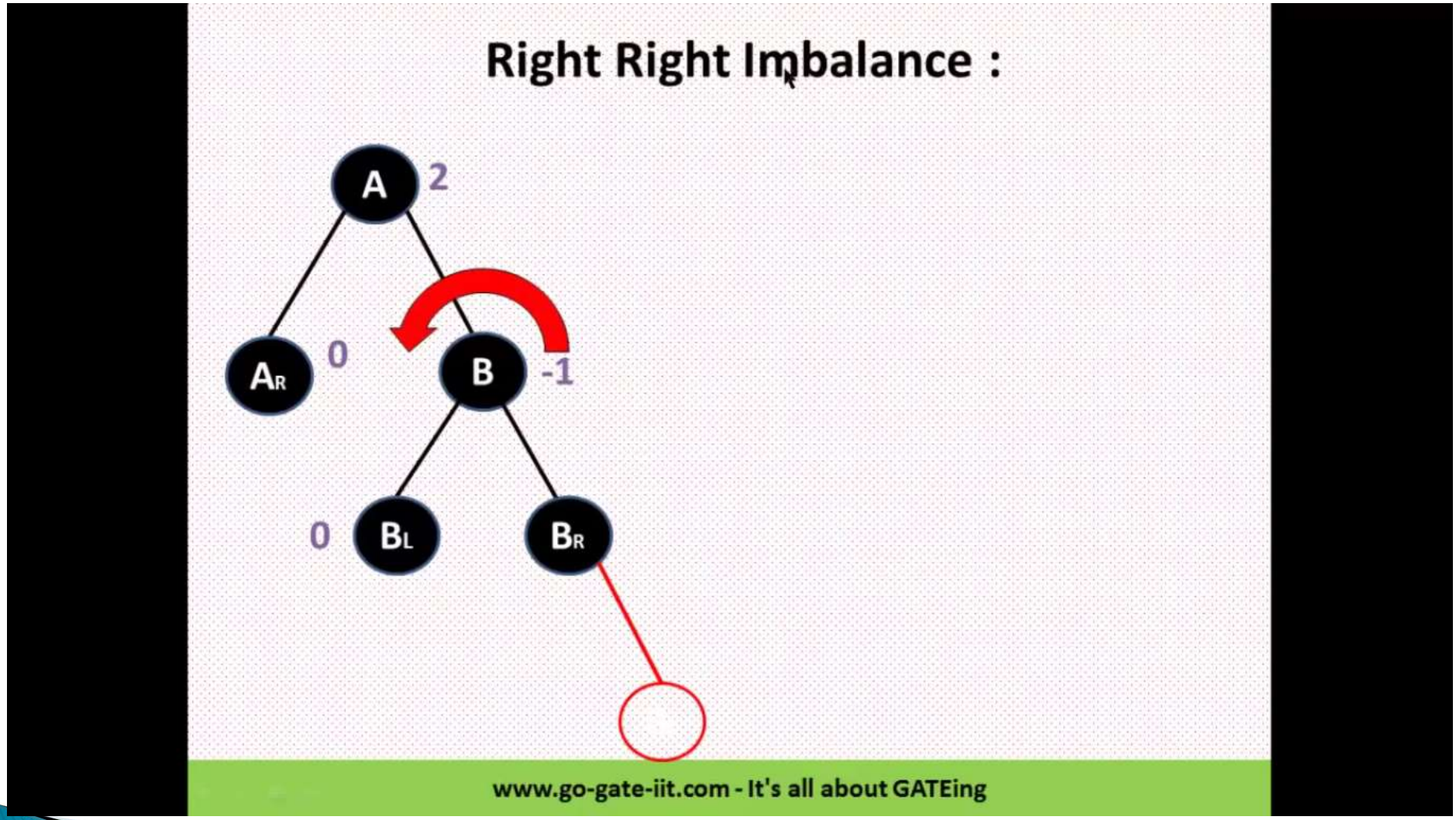
Balance Factor(bf) : H(Left Sub tree) – H(Right Sub tree)

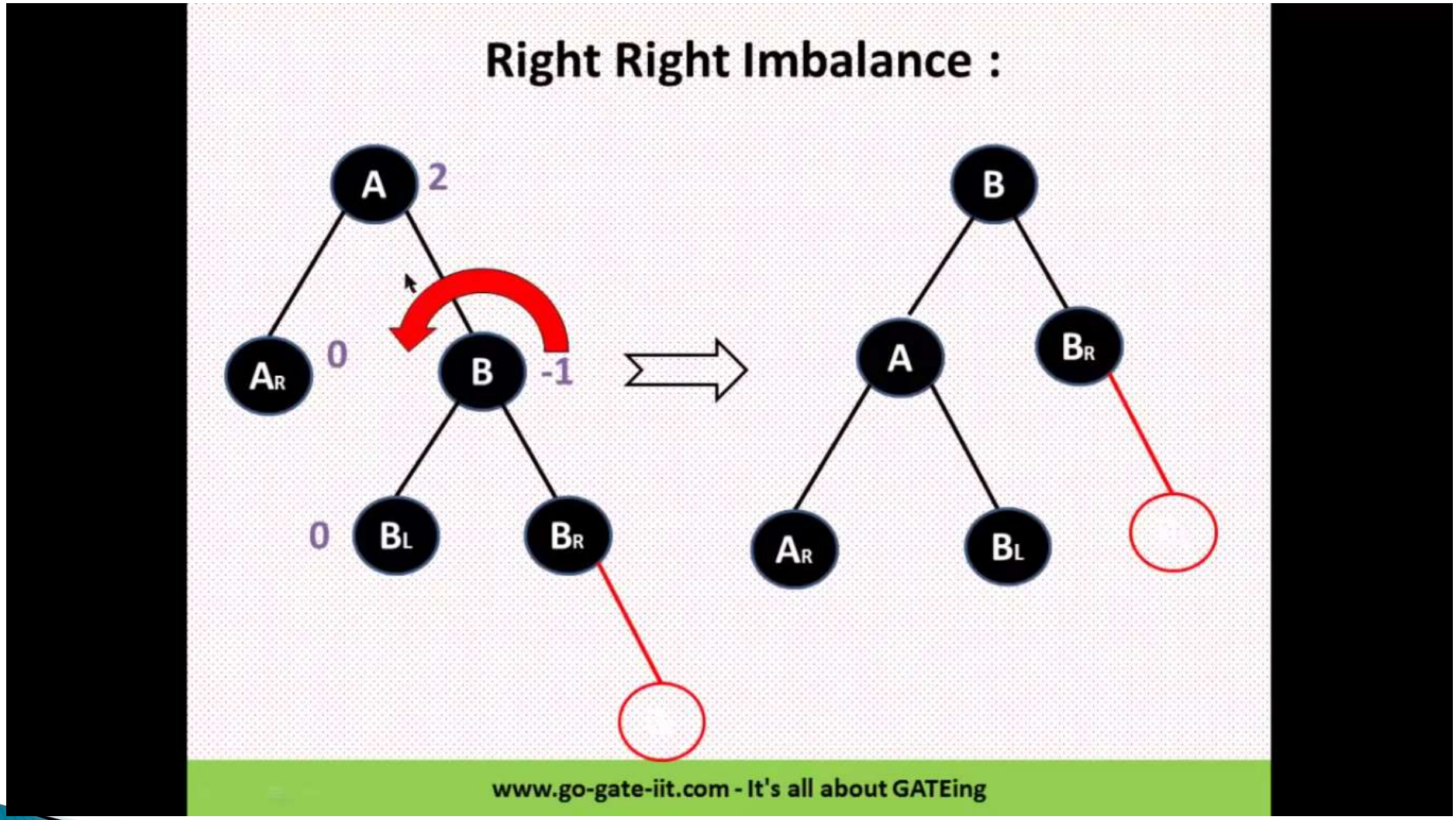
Types of imbalances

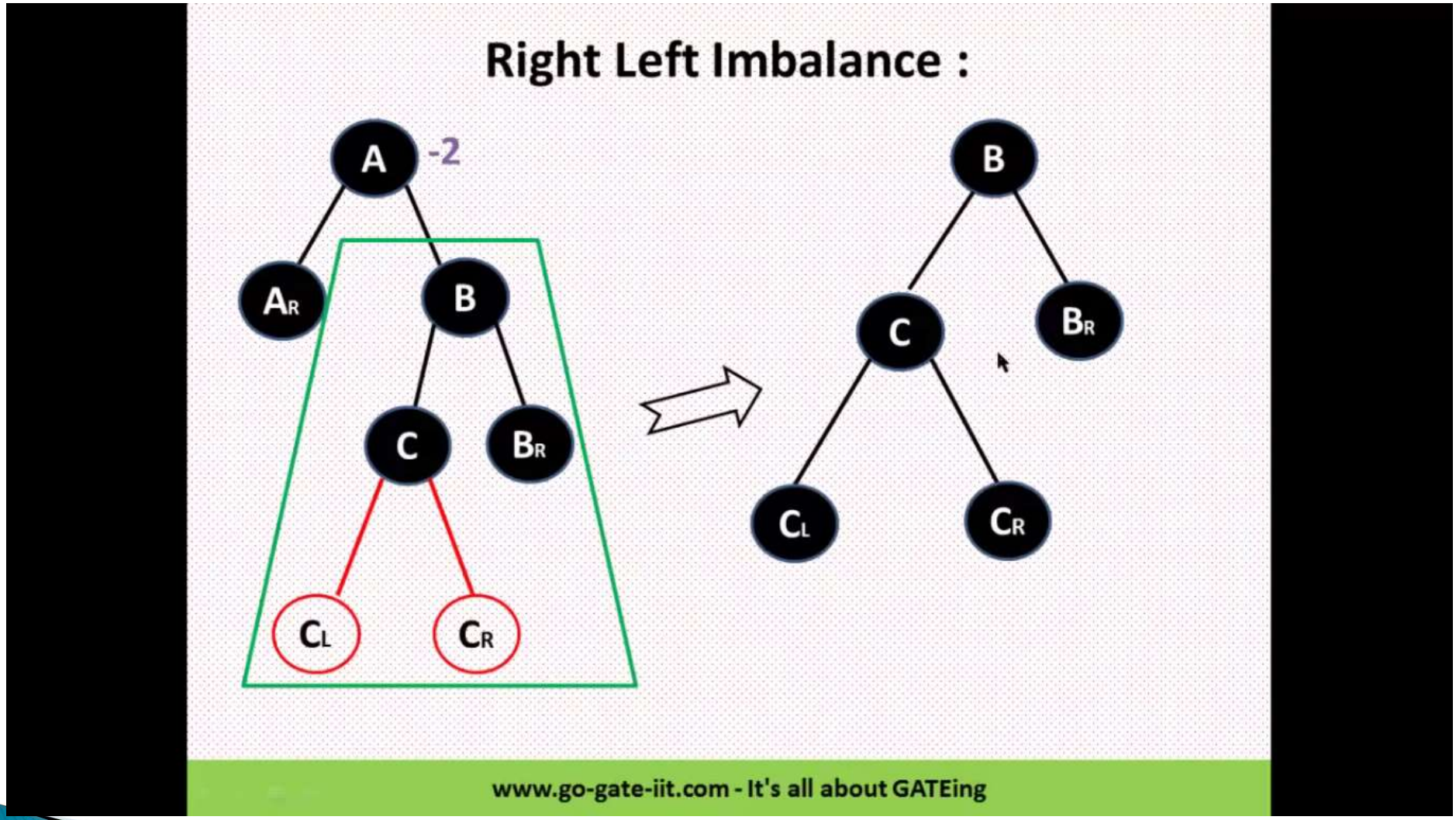
- Violation cases at node k (deepest node)
  1. An insertion into left subtree of left child of k
  2. An insertion into right subtree of right child of k
  3. An insertion into right subtree of left child of k
  4. An insertion into left subtree of right child of k
  - Cases 1 and 2 equivalent
    - Single rotation to rebalance
  - Cases 3 and 4 equivalent
    - Double rotation to rebalance

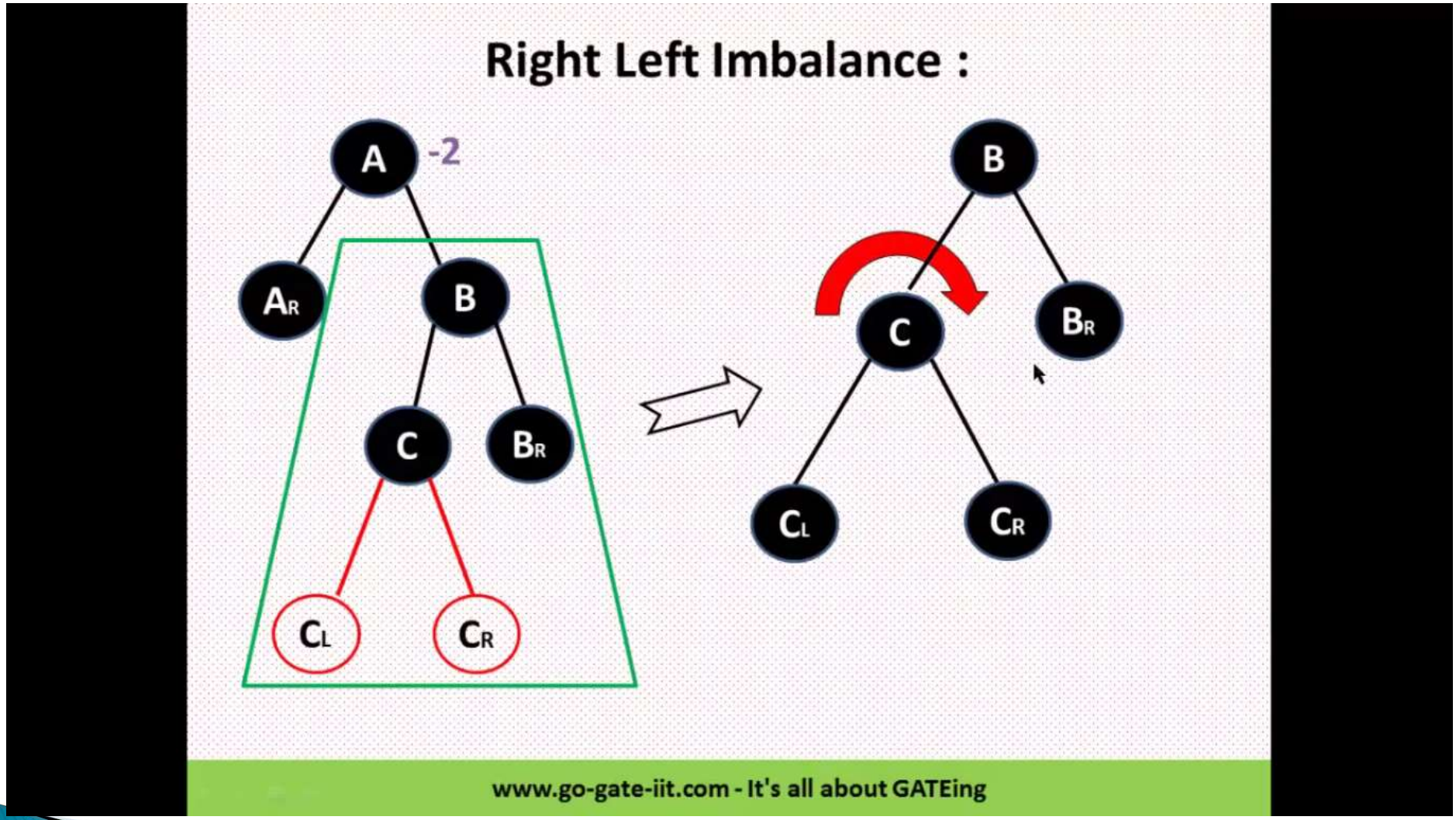

Left-Left Imbalance :
A
2
+1
B
0
AR
BL
1
BR
0
www.go-gate-iit.com - It's all about GATEing

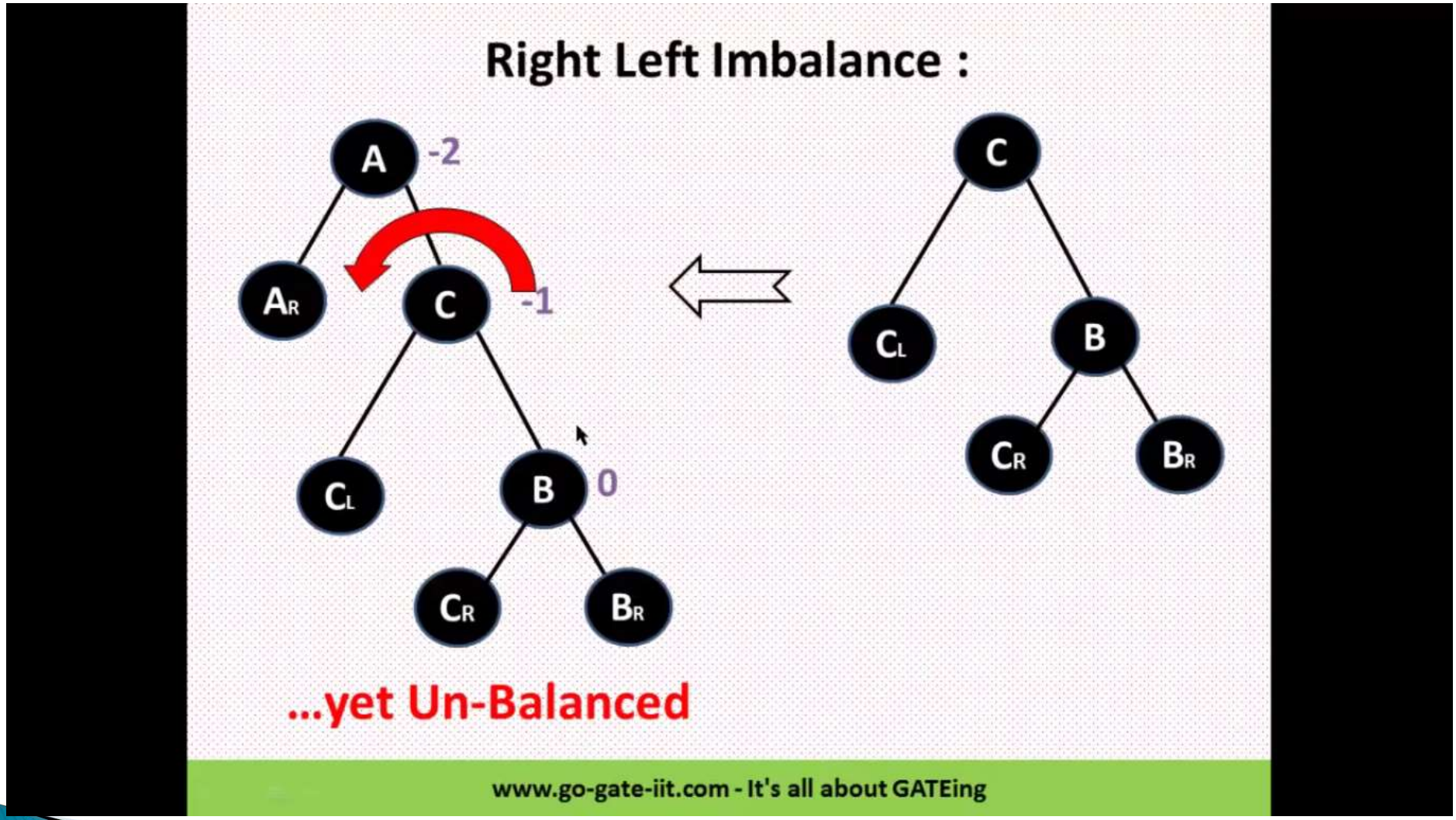

Left-Left Imbalance :
B
BL
A
BR
AR
www.go-gate-iit.com - It's all about GATEing

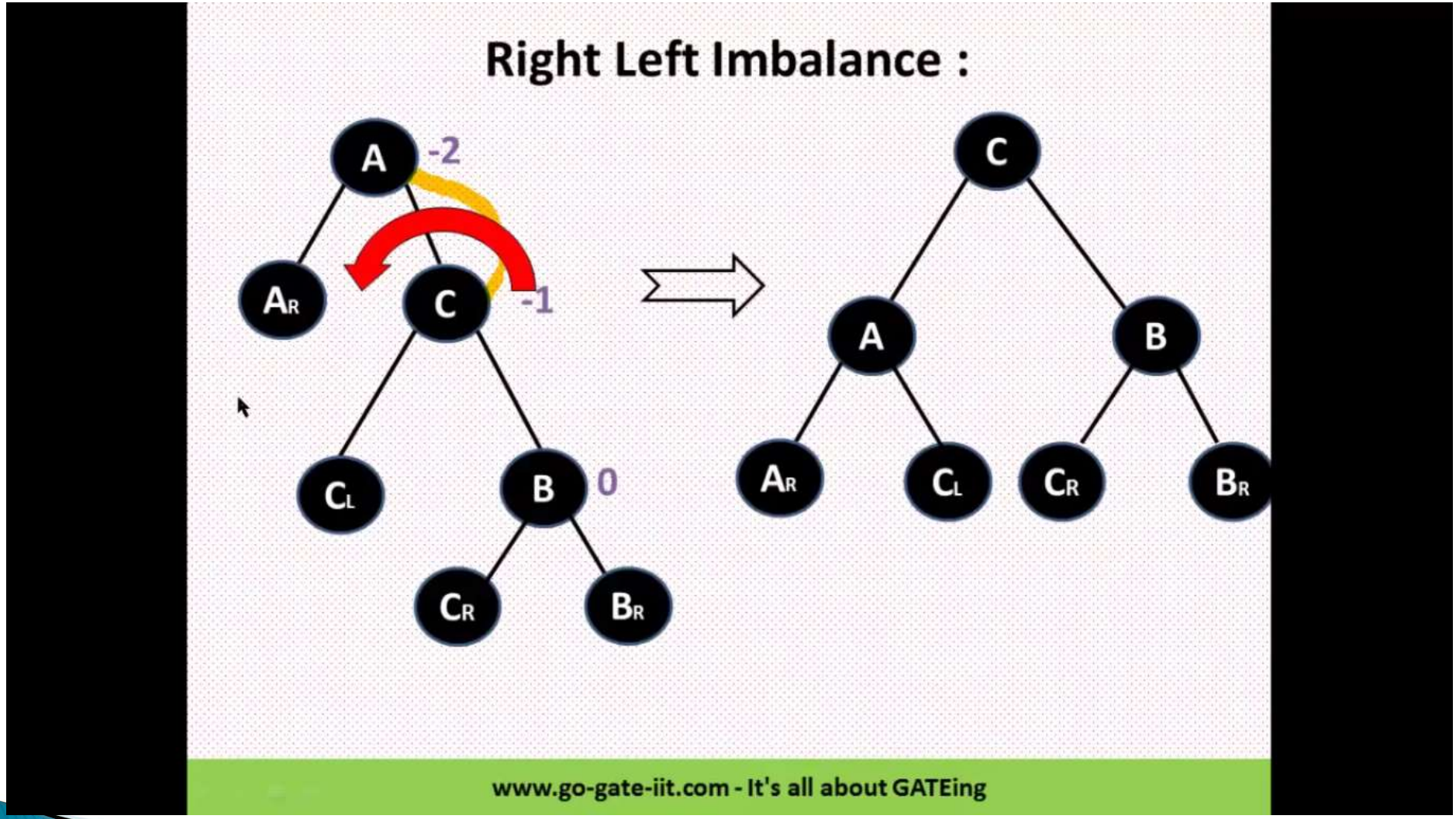

Right Right Imbalance :
A
2
AR
0
B
-1
0
BL
BR
www.go-gate-iit.com - It's all about GATEing

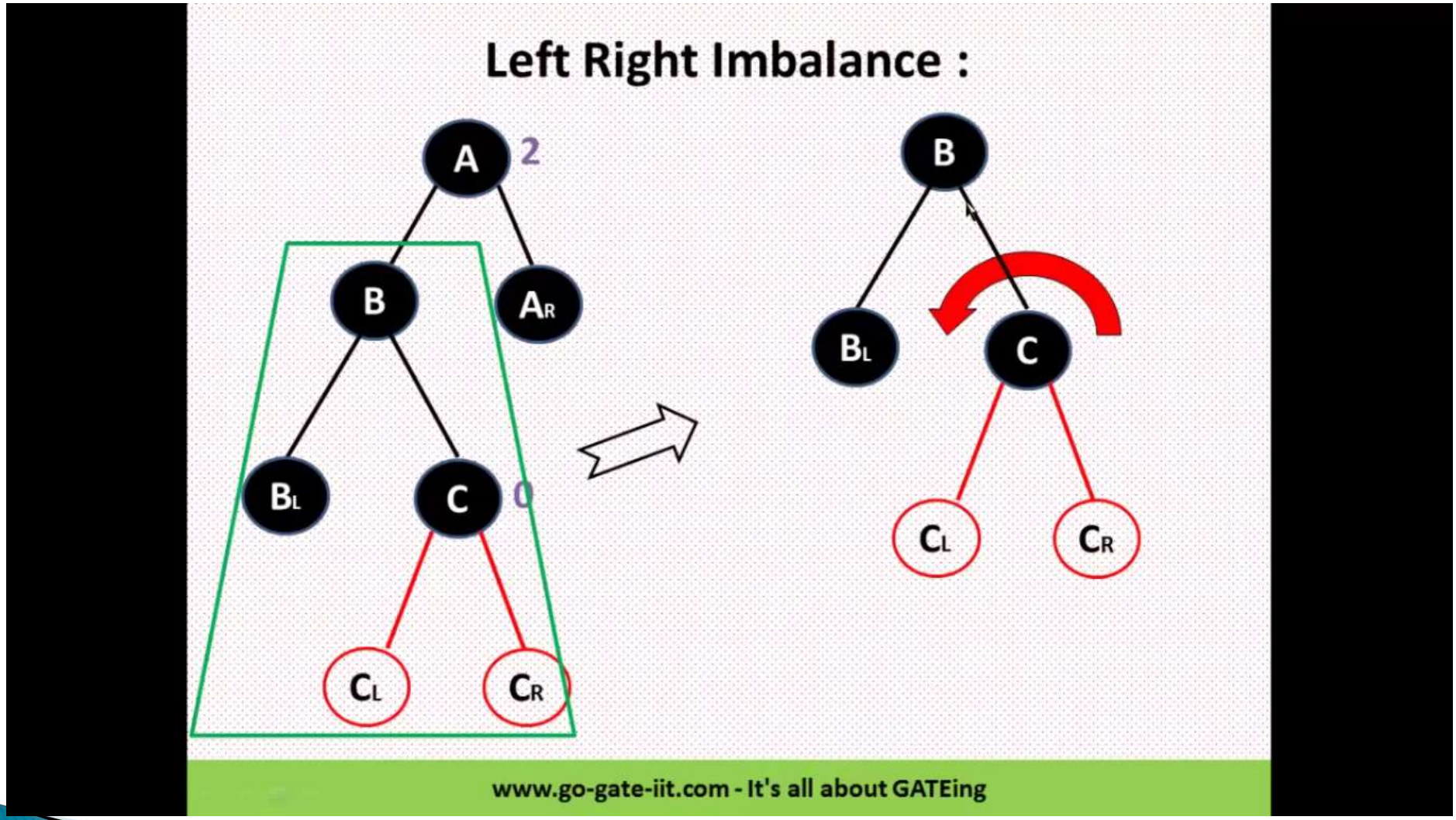

Right Right Imbalance :
A
2
A_R
0
B
-1
0
B_L
B_R
B
A
B_R
A_R
B_L
www.go-gate-iit.com - It's all about GATEing

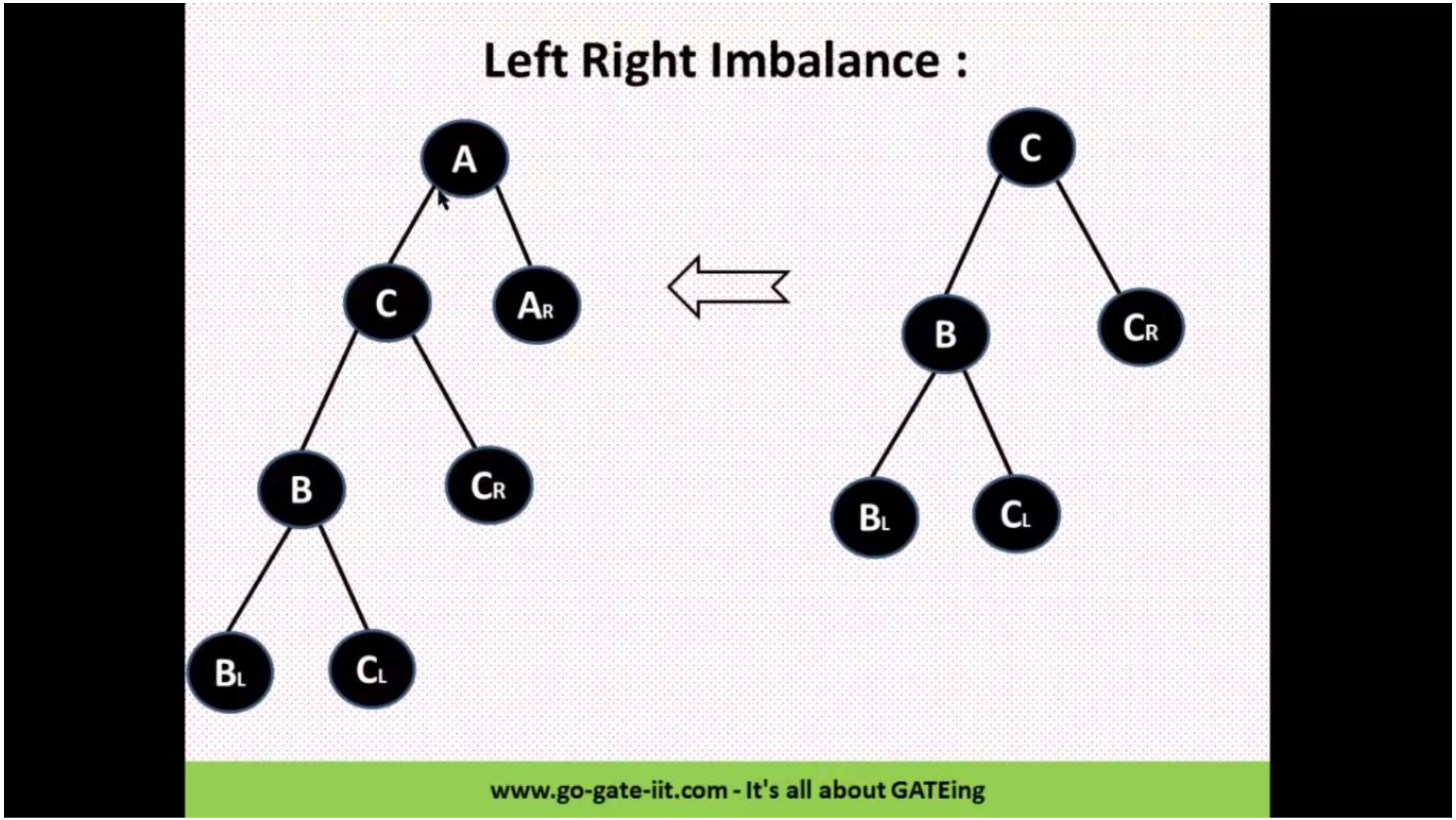

Right Left Imbalance :
A
-2
AR
B
C
BR
CL
CR
B
C
BR
CL
CR
www.go-gate-iit.com - It's all about GATEing

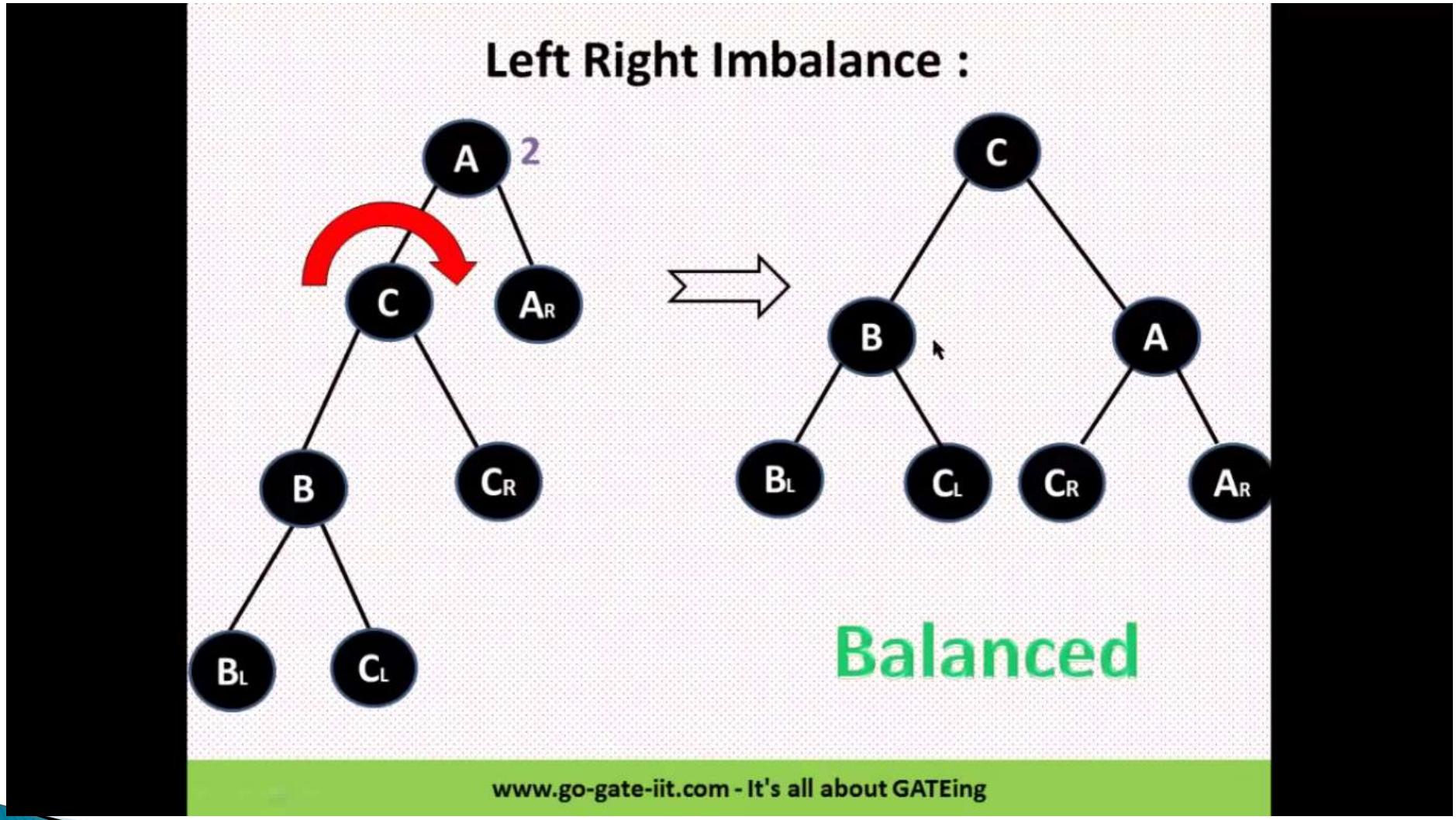

Right Left Imbalance :
A
-2
AR
B
C
BR
CL
CR
B
C
BR
CL
CR
www.go-gate-iit.com - It's all about GATEing


Right Left Imbalance :
A
-2
AR
C
-1
CL
B
0
CR
BR
C
CL
B
CR
BR
...yet Un-Balanced
www.go-gate-iit.com - It's all about GATEing


Right Left Imbalance :
A
-2
AR
C
-1
CL
B
0
CR
BR
C
A
B
AR
CL
CR
BR
www.go-gate-iit.com - It's all about GATEing


Left Right Imbalance :
A
2
B
AR
BL
C
0
CL
CR
B
BL
C
CL
CR
www.go-gate-iit.com - It's all about GATEing


Left Right Imbalance :
A
C
AR
B
CR
BL
CL
C
B
CR
BL
CL
www.go-gate-iit.com - It's all about GATEing


Left Right Imbalance :
A
2
C
AR
B
CR
BL
CL
C
B
A
BL
CL
CR
AR
Balanced
www.go-gate-iit.com - It's all about GATEing