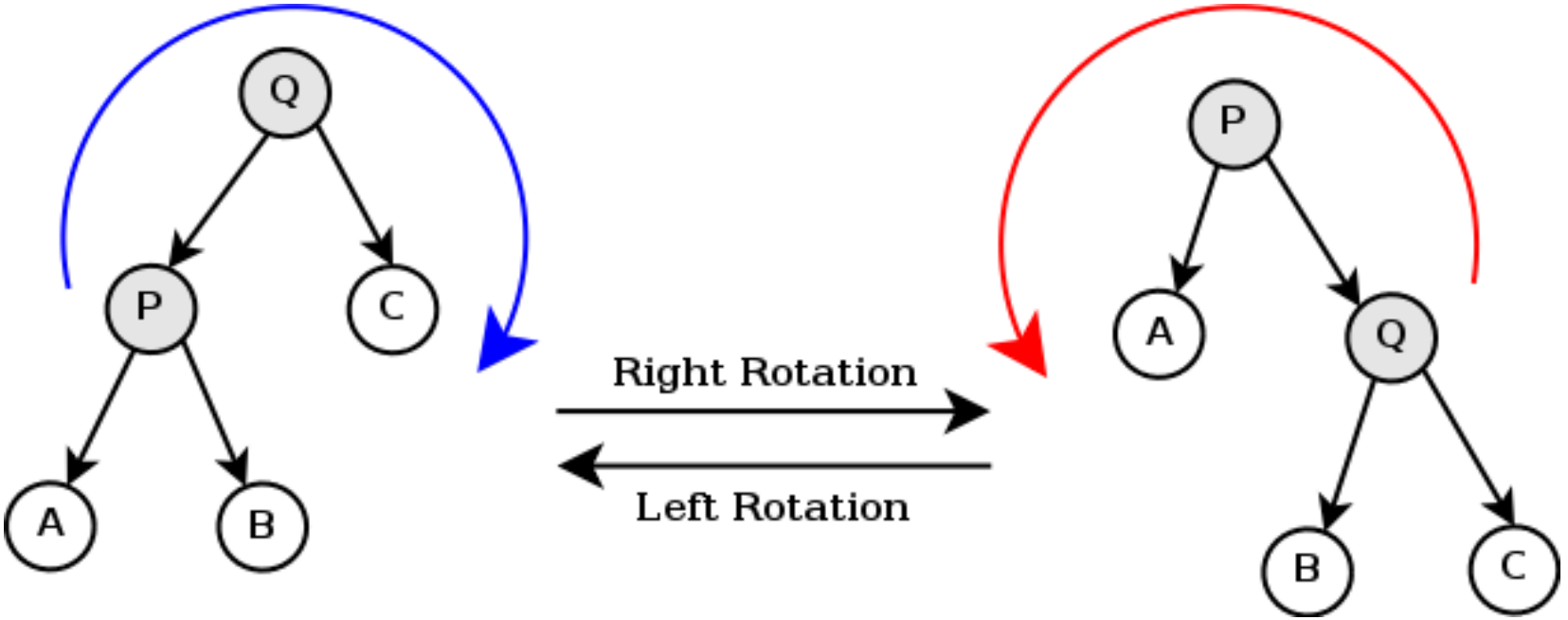
AVL Ağaçları

- Bir ikili arama ağacı eğer aşağıdaki koşulları sağlıyorsa dengeli (AVL) bir ağaçtır.
- - Yaprak ve kök olmayan her düğümüm mutlaka bir kardeşi olmalıdır.
- - Kardeşlerin yükseklikleri eşit veya en fazla 1 fark olmalıdır.

AVL Ağaçları

- Dengesiz bir ağaç hafif ya da ağır diye nitelendirilebilir. Bu nitelemeler aşağıdaki durumlara bağlıdır
- Bir düğüm sol-ağır şeklinde nitelendiriliyorsa düğümün sol çocuğunun yüksekliği sağ çocuğunun yüksekliğinden daha fazladır.
- Aynı şekilde bir düğüm sağ-ağır şeklinde nitelendiriliyorsa düğümün sağ çocuğunun yüksekliği sol çocuğunun yüksekliğinden daha fazladır.

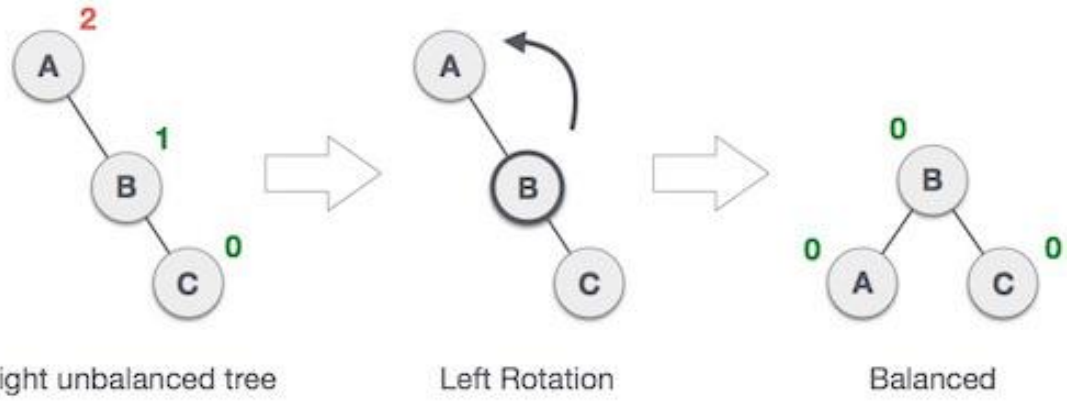
Ağaç döndürme (tree rotation)



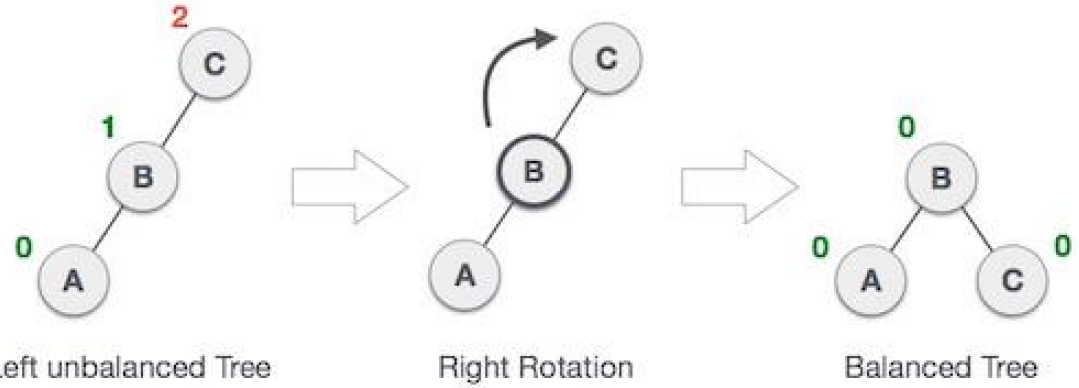
https://en.wikipedia.org/wiki/Tree_rotation

Ağaç döndürme (tree rotation)

Left Rotation

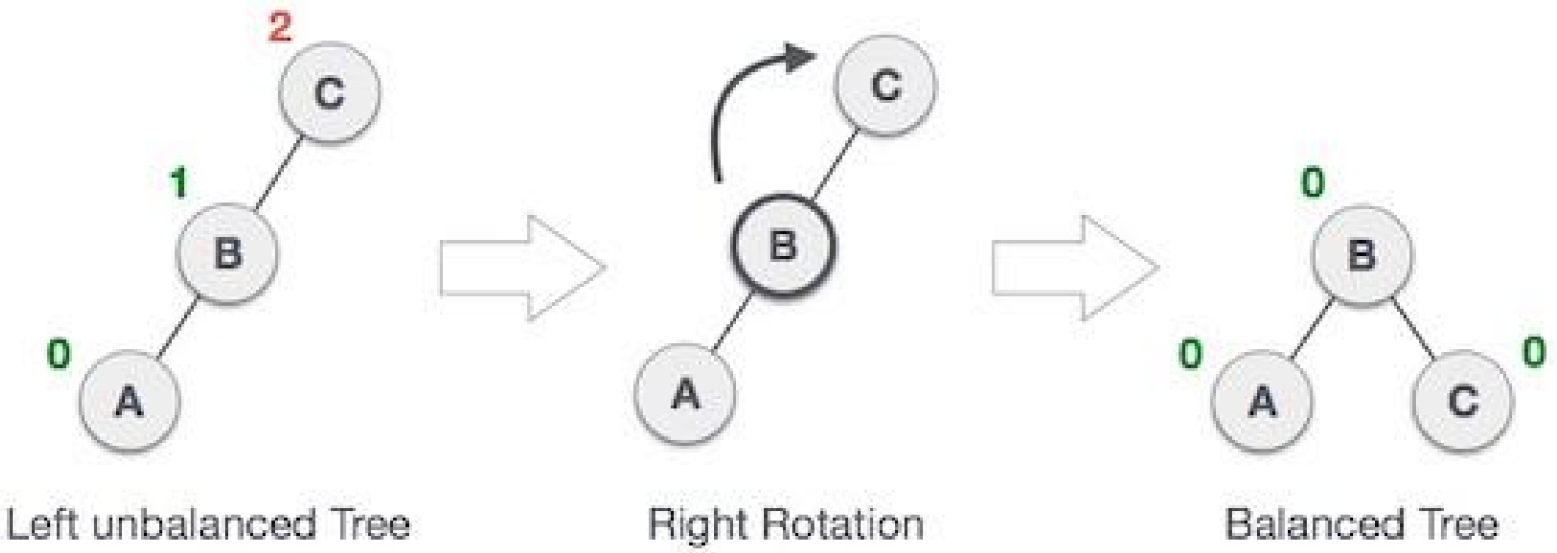


Right Rotation



Örnek: Ağaç sol-ağır

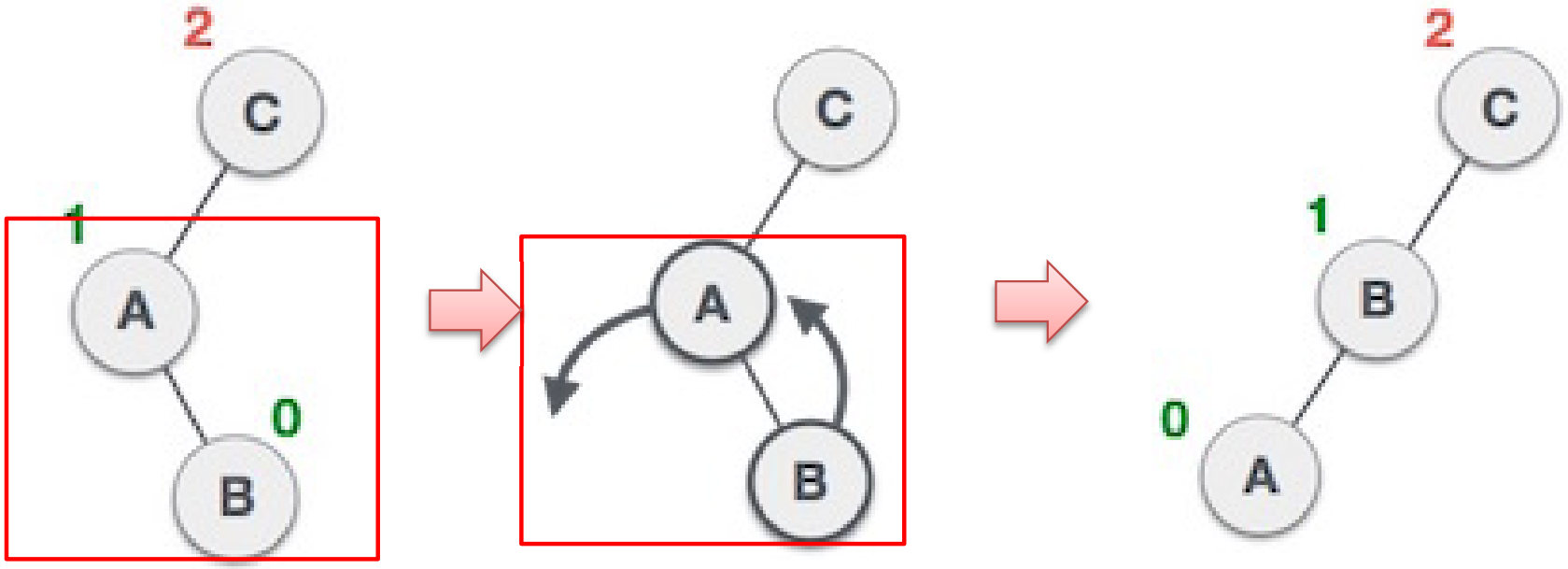
Sol alt ağaç sol ağır: Sağa tek dönüş durumu

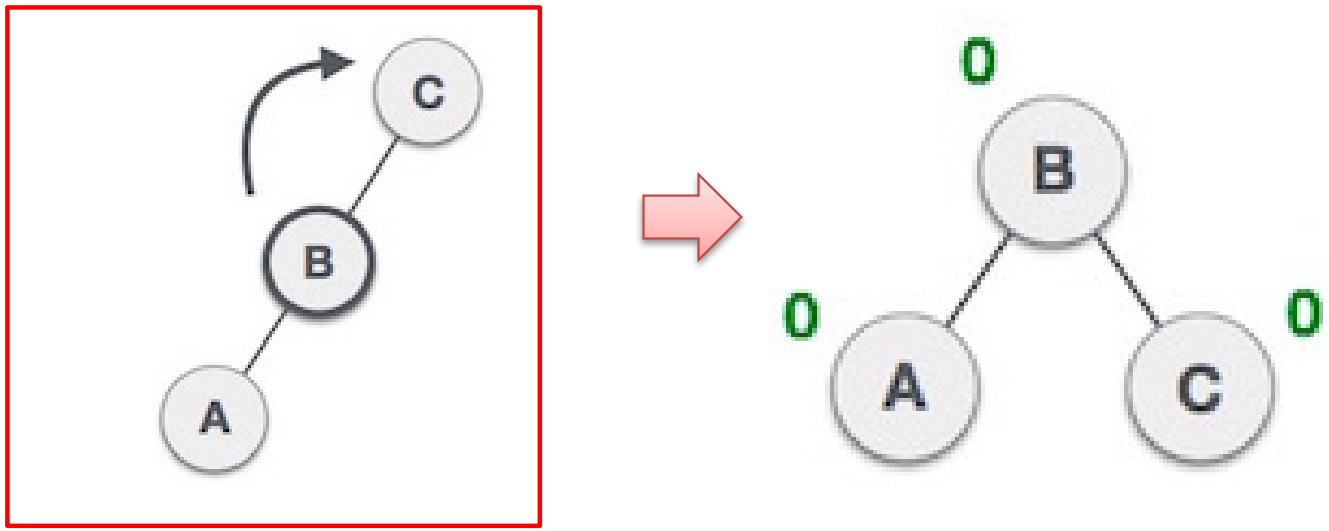


https://www.tutorialspoint.com/data_structures_algorithms/avl_tree_algorithm.htm

Örnek: Ağaç sol-ağır

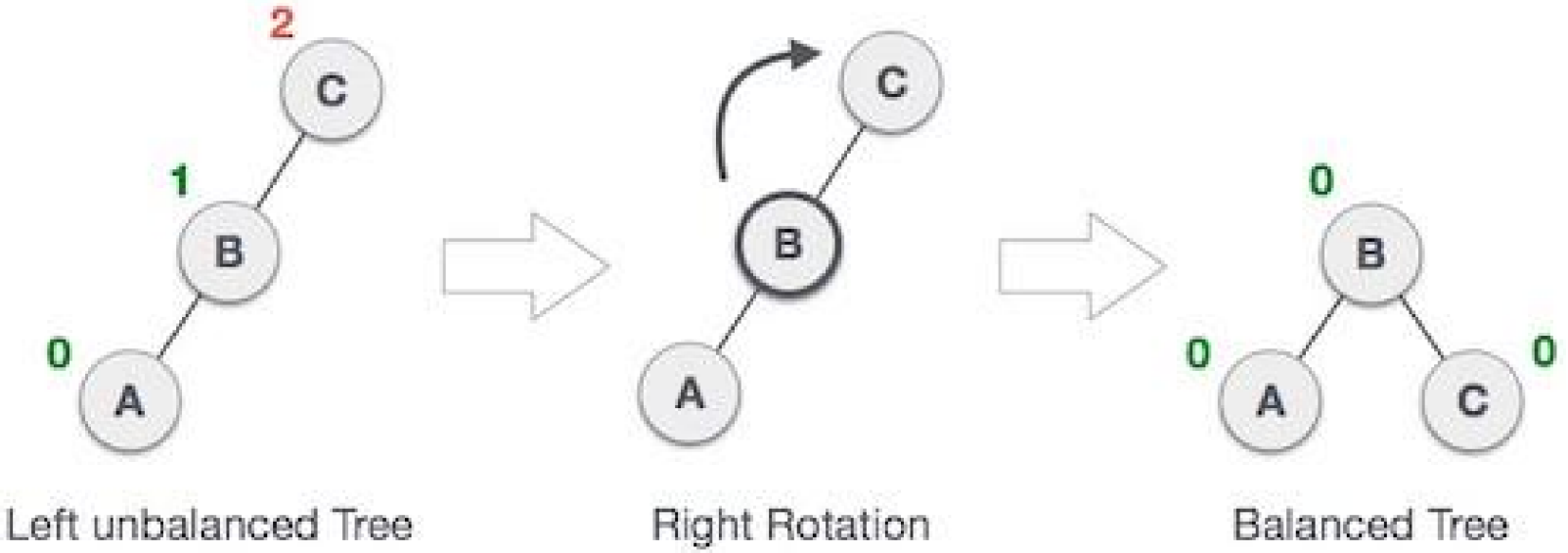
Sol alt ağaç sağ ağır: Sola –sağa dönüş (çift dönüş) durumu





Örnek: Ağaç sağ-ağır

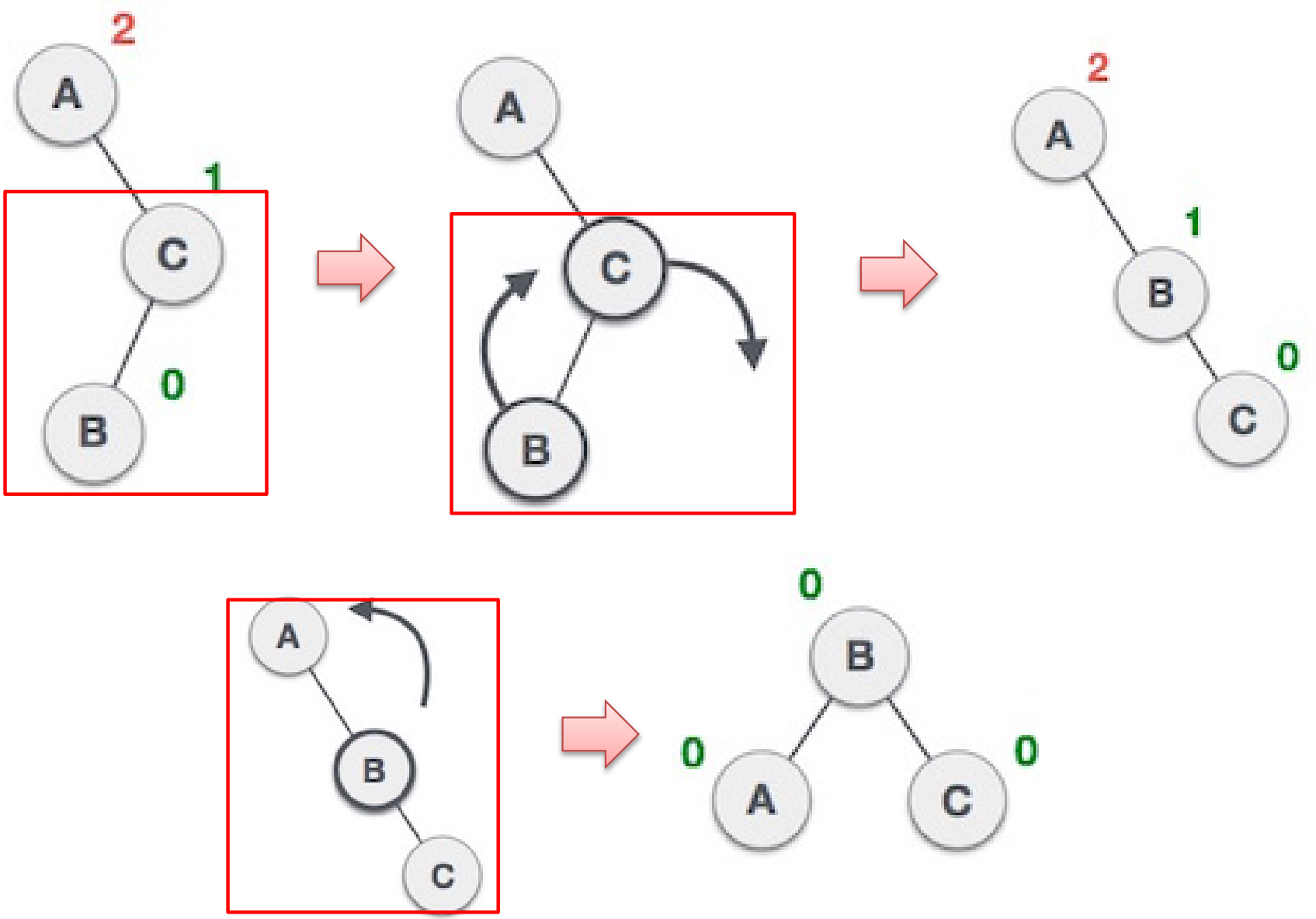
Sol alt ağaç sol ağır: Sağa tek dönüş durumu



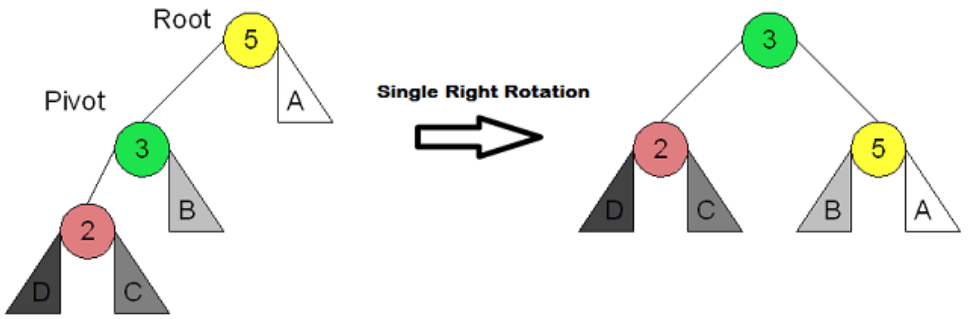
https://www.tutorialspoint.com/data_structures_algorithms/avl_tree_algorithm.htm

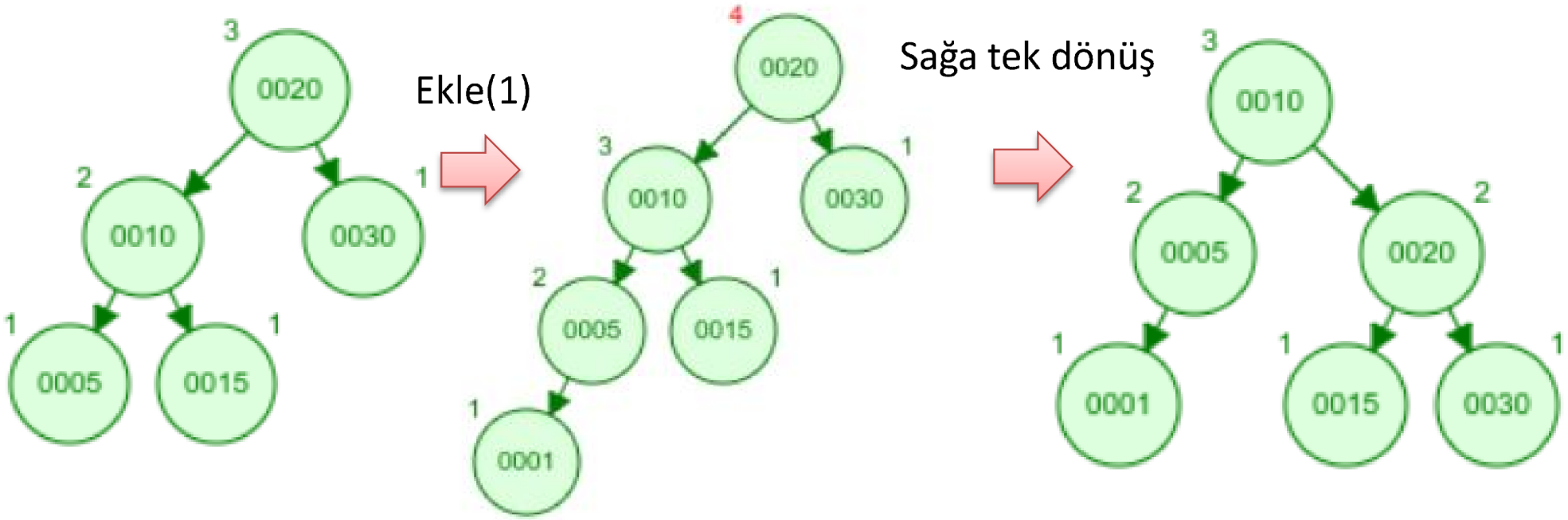
Örnek: Ağaç sağ-ağır

Sağ alt ağaç sol ağır: Sağa –sola dönüş (çift dönüş) durumu



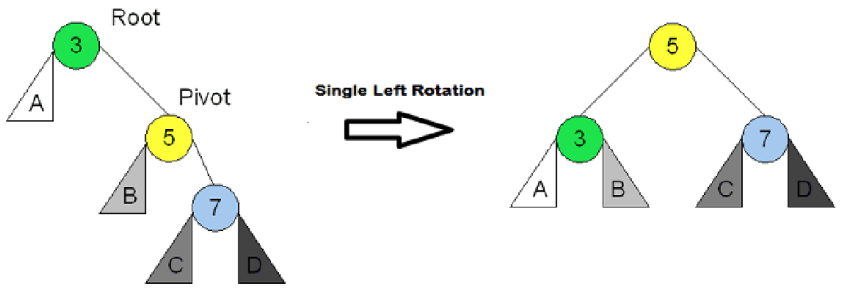
Örnek: sağa tek döndürme

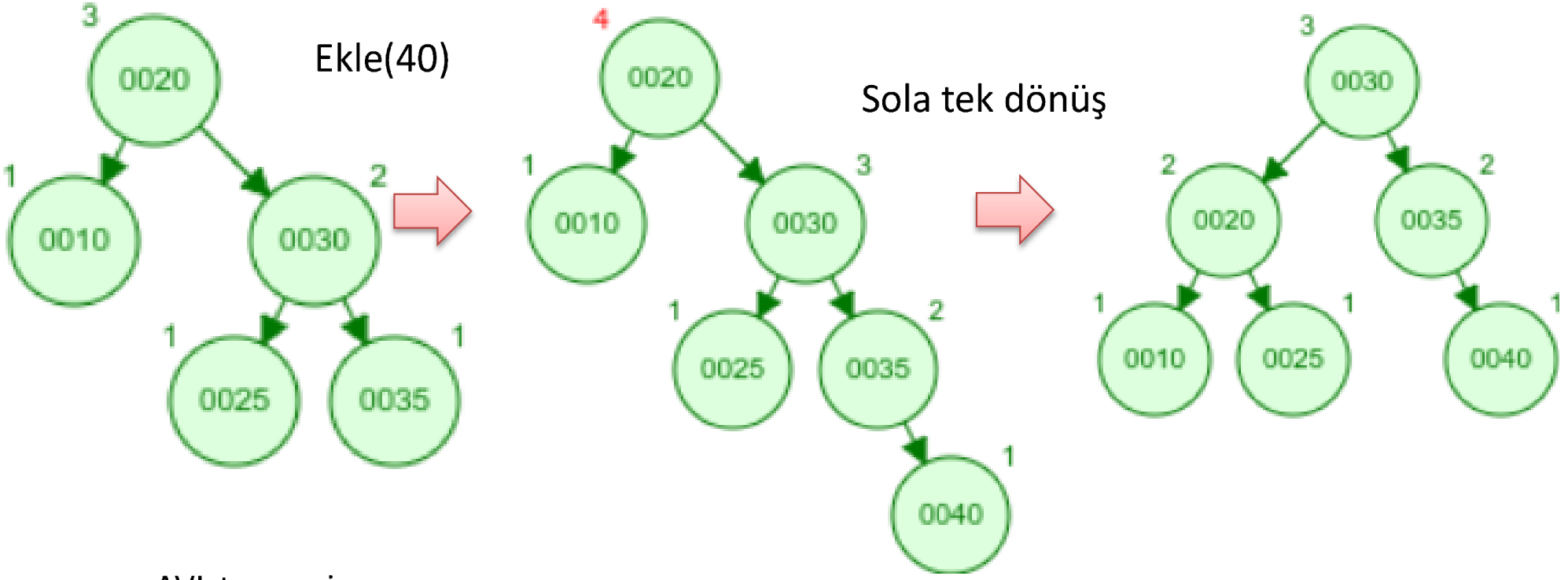




- AVL tree animasyonu:
- https://www.cs.usfca.edu/~galles/visualization/AVLtree.html

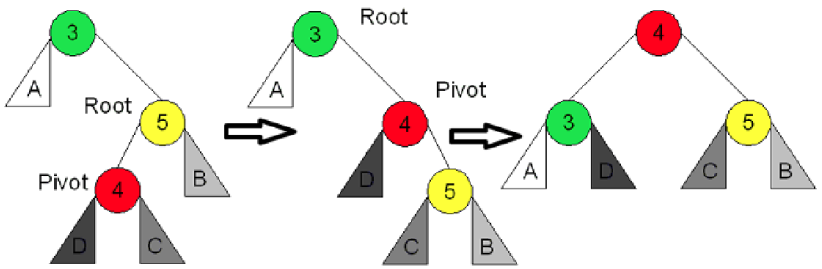
Örnek: sola tek döndürme

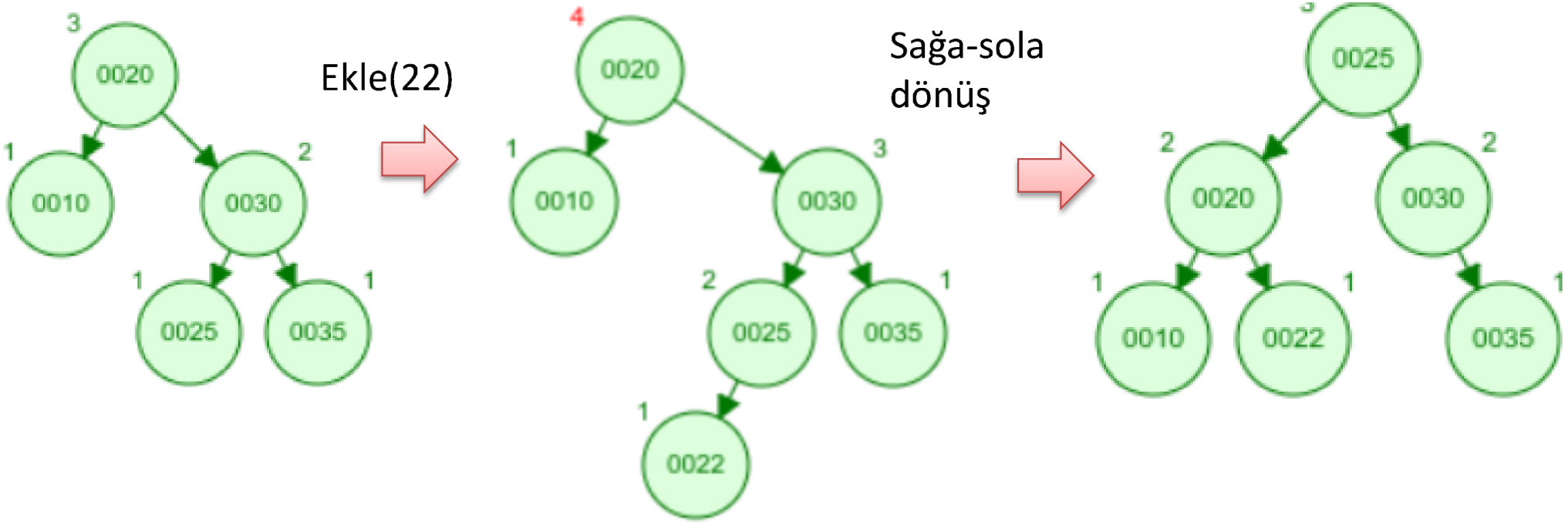




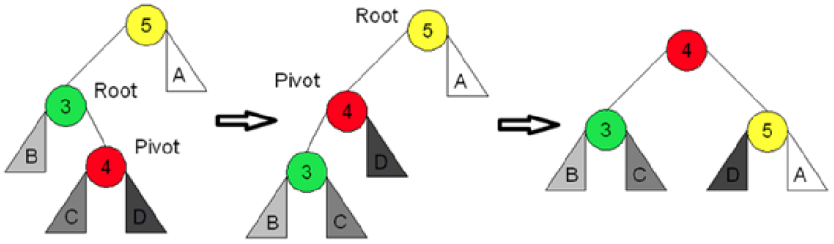
- AVL tree animasyonu:
- https://www.cs.usfca.edu/~galles/visualization/AVLtree.html

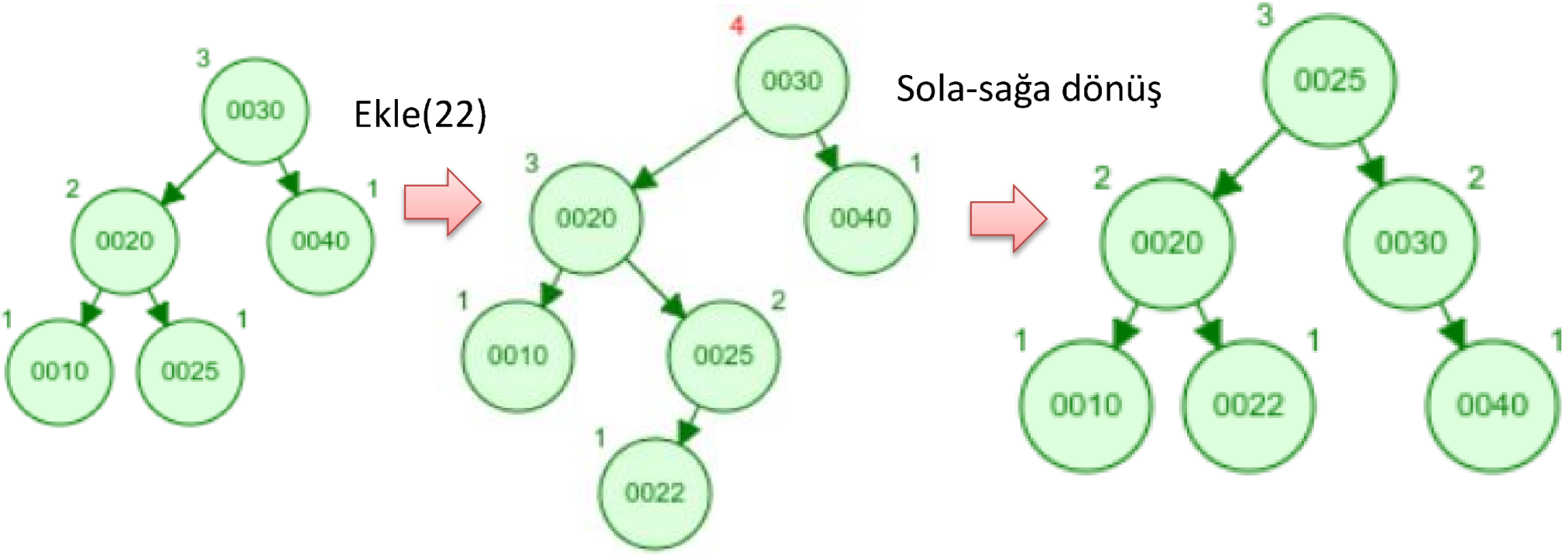
Örnek: sağa-sola döndürme





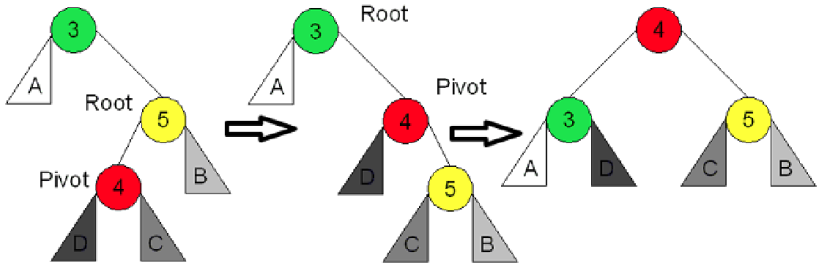
Örnek: sola-sağa döndürme



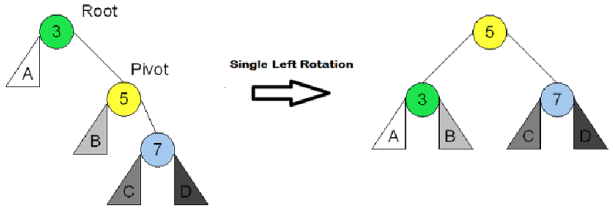


Döndürme işleminin belirlenmesi

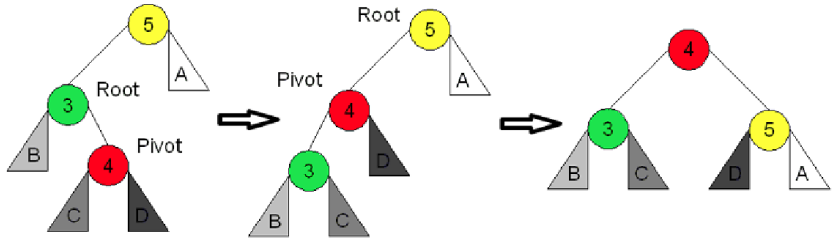
- If (Ağaç sağ ağır) (h(sag(d))-h(sol(d))==2)
  - If (sağ alt ağaç sol ağır ise)
    - Çift dönüş



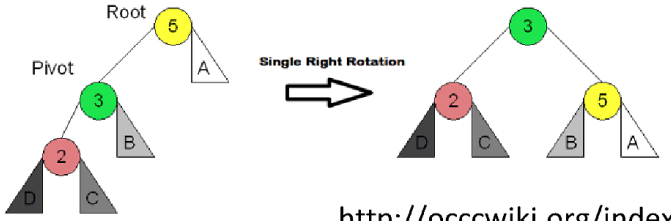
  - Else
    - Tek dönüş



- Else if (Ağaç sol ağır) (h(sag(d))-h(sol(d))==-2)
  - If (sol alt ağaç sağ ağır)
    - Çift dönüş



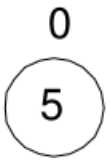
  - Else
    - Tek dönüş



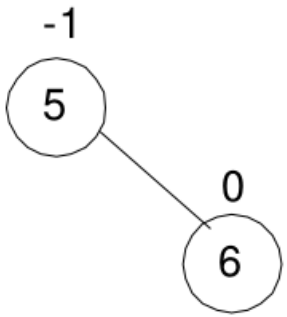
http://occcwiki.org/index.php/AVL_Trees

Örnek: Elemanlar: 5, 6, 8, 3, 2, 4, 7

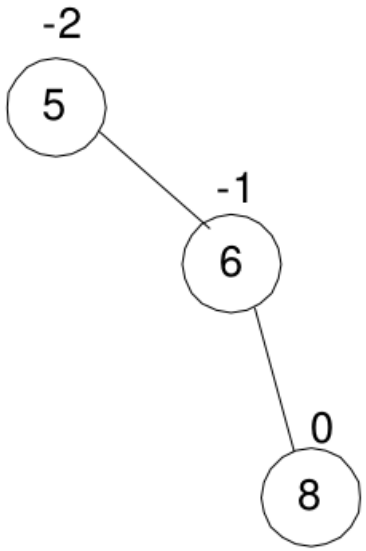
Ekle(5)

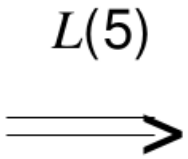


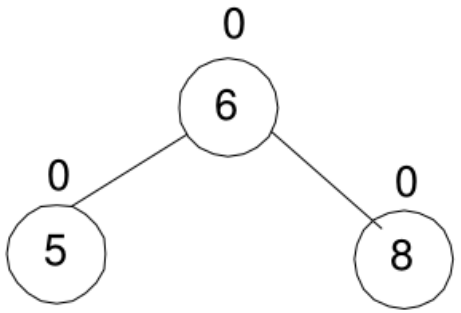
Ekle(6)



Ekle(8)

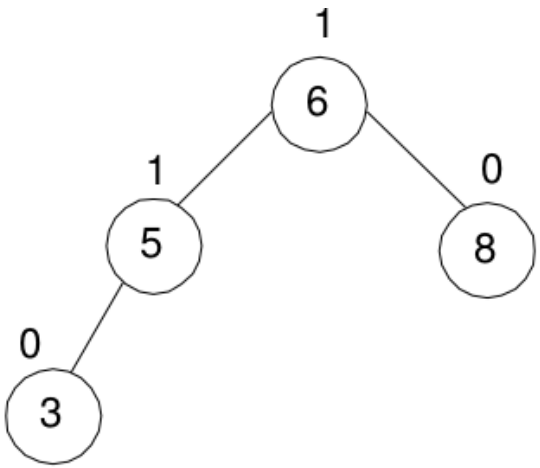




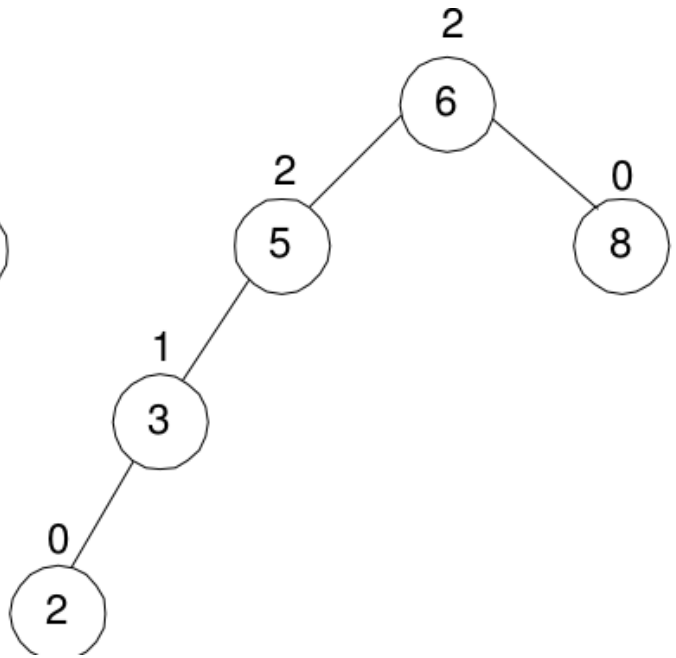


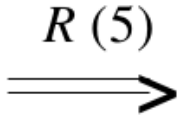
Örnek: Elemanlar: 5, 6, 8, 3, 2, 4, 7

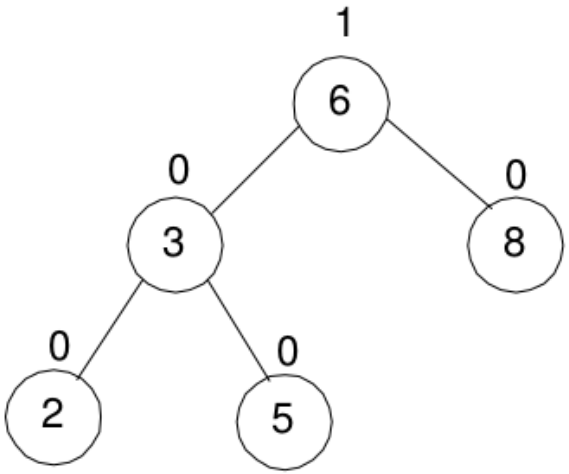
Ekle(3)



Ekle(2)

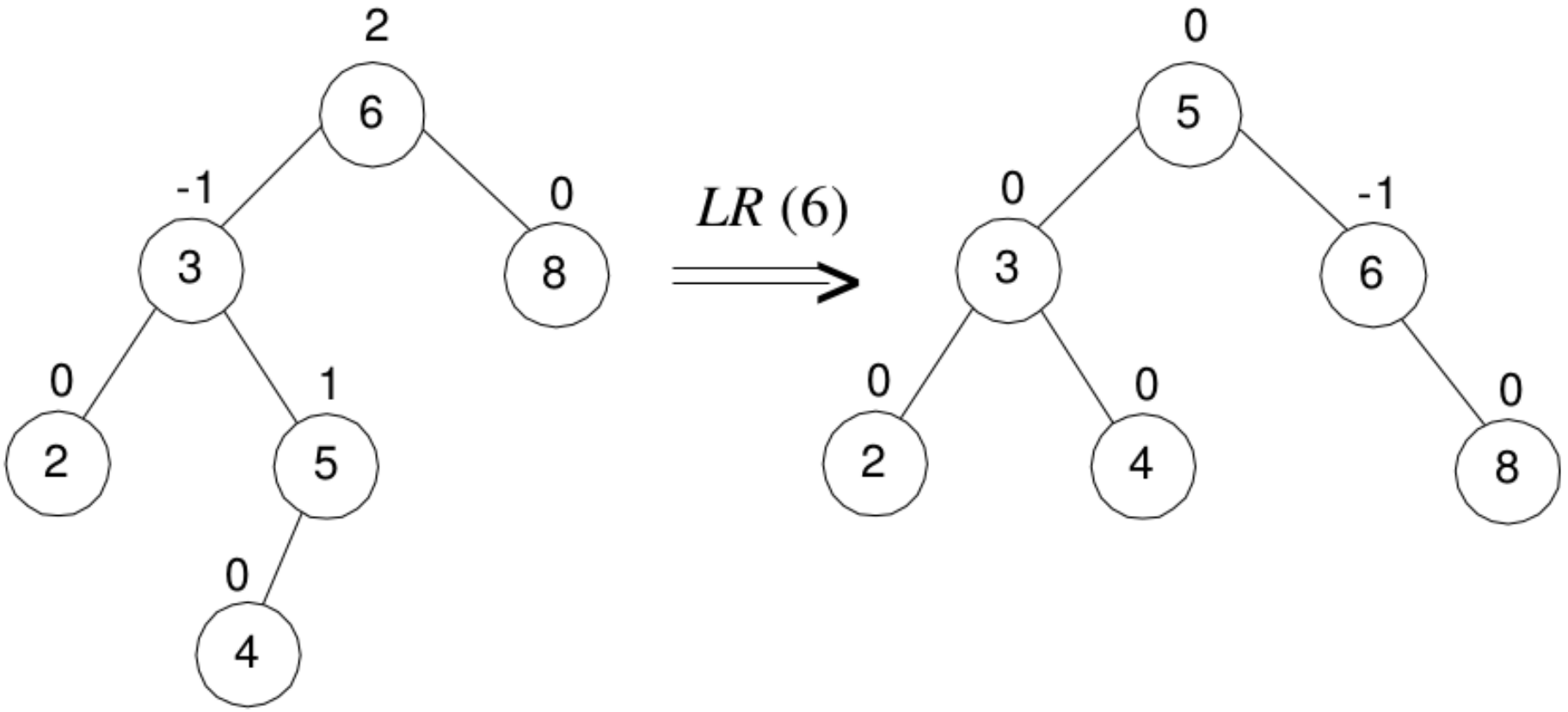






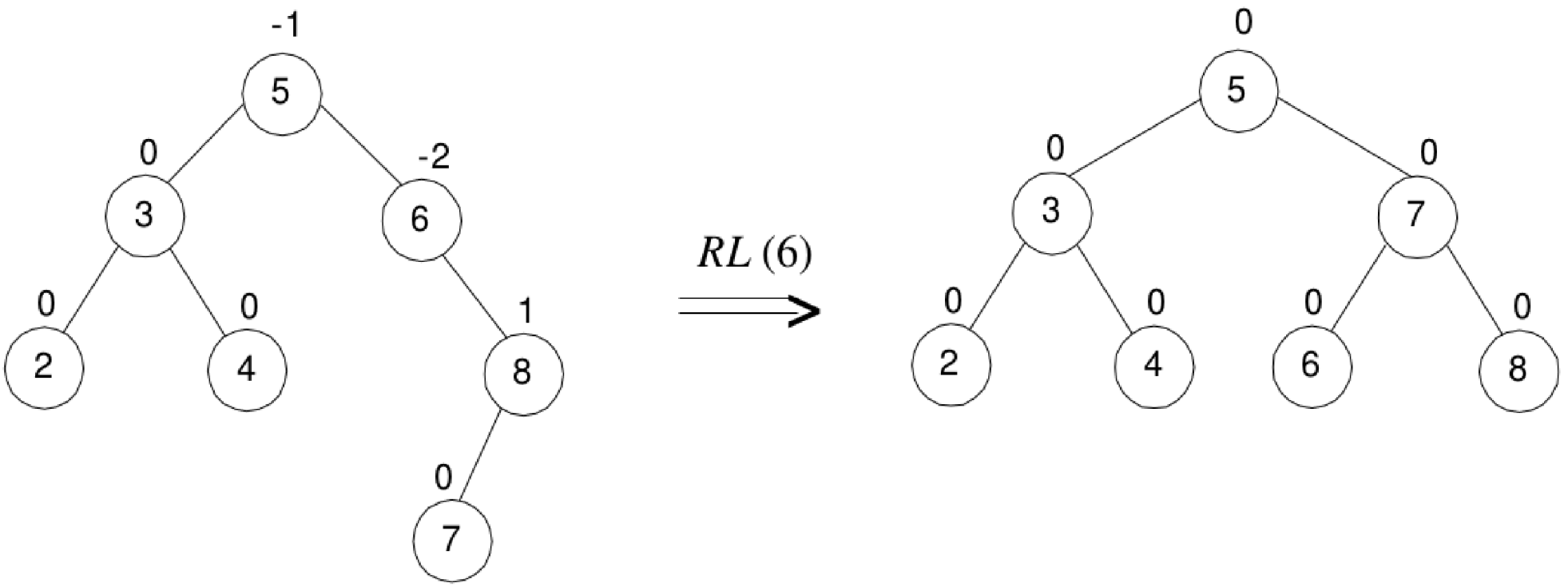
Örnek: Elemanlar: 5, 6, 8, 3, 2, 4, 7

Ekle(4)



Örnek: Elemanlar: 5, 6, 8, 3, 2, 4, 7

Ekle(7)



AVL Analizi

- Arama ve Ekleme: O(logn)
- Silme çok karmaşık olmasına rağmen: O(logn)
- Dengeleme işlemi ekleme hızını sadece bir c sabiti kadar yavaşlatır.
- Dezavantajları:
  - Sık yapılan dönüş işlemleri
  - Karmaşık yapı