Bölüm 8: Öncelikli Kuyruk

Veri Yapıları

Öncelikli Kuyruk (Priority Queue)

- Öğeler öncelik sırasına göre saklanır.
- Öncelikli işlemlerin yönetiminde kullanılır.
- Kuyruktan en yüksek öncelikli öğeyi çıkarmak için O(1) zaman yeterlidir.

Temel Kavramlar

- **Öncelik Kuyruğu**: Öğelerin saklandığı yapı.
- **Öncelik**: Her öğeye atanan öncelik değeri.
- **En Yüksek Öncelik**: Kuyruğun başında bulunan düğümün öncelik değeri.
- **FIFO İlkesi**: Eşit öncelikteki öğeler arasındaki sıra.

Kullanım Alanları

- **İşletim Sistemleri**: Görev sıralamasında kullanılır.
- **Çizge Algoritmaları**: Dijkstra ve A* algoritmaları gibi.
- **Acil Durum Yönetimi**: Hasta sıralaması ve olay yönetimi.
- **Veri Sıkıştırma**: Huffman kodlaması.

Temel İşlemler

- **Ekleme (Insertion):** Öğe eklenirken konumu önceliğine göre bulunur.
- **Çıkarma (Extraction):** En yüksek öncelikli öğe çıkarılır.
- **Sorgulama (Peek):** Öncelikli öğeyi döndürür, kuyruktan çıkarmaz.
- **Boş mu (isEmpty):** Kuyruğun boş olup olmadığını söyler.

Dizi Temelli Gerçekleştirim

- Öğeler basit bir şekilde dizide tutulur.
- Öncelikli öğe dizinin başında saklanır.
- Öğe ekleme ve çıkarma işlemlerinden sonra sıralama bozulabilir.
- Dizinin her işlemden sonra sıralı kalması zor ve karmaşık olabilir.

Bağlı Liste Temelli Gerçekleştirim

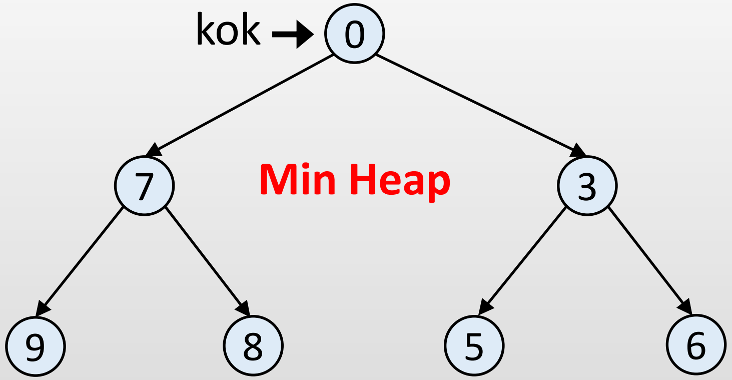
- Öğeler bağlı liste yapısında saklanır.
- Öğeler önceliklerine göre bağlı listede uygun konuma eklenir.
- Öncelikli öğe listenin başında saklanır.

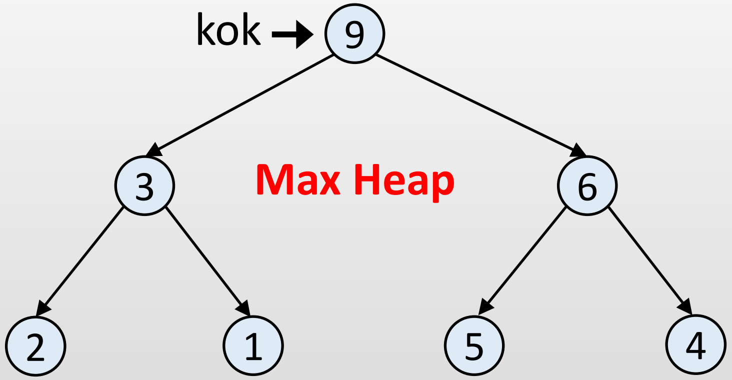
İkili Heap Gerçekleştirimi

- İkili heap (min-heap veya max-heap) yaygın kullanılan bir veri yapısıdır.
- En yüksek öncelikli öğe kök düğümde bulunur.
- Öğe ekleme ve çıkarma işlemleri O(log n) zaman karmaşıklığına sahiptir.
- Thread-safe değildir.

İkili Heap

- İkili Heap, özel bir ikili ağaç yapısıdır.
- Min-Heap ve Max-Heap olmak üzere iki türü vardır.
- **Min-Heap:** Kök düğümde en düşük öncelik değerine sahip öğe bulunur.
- **Max-Heap:** Kök düğümde en yüksek öncelik değerine sahip öğe bulunur.

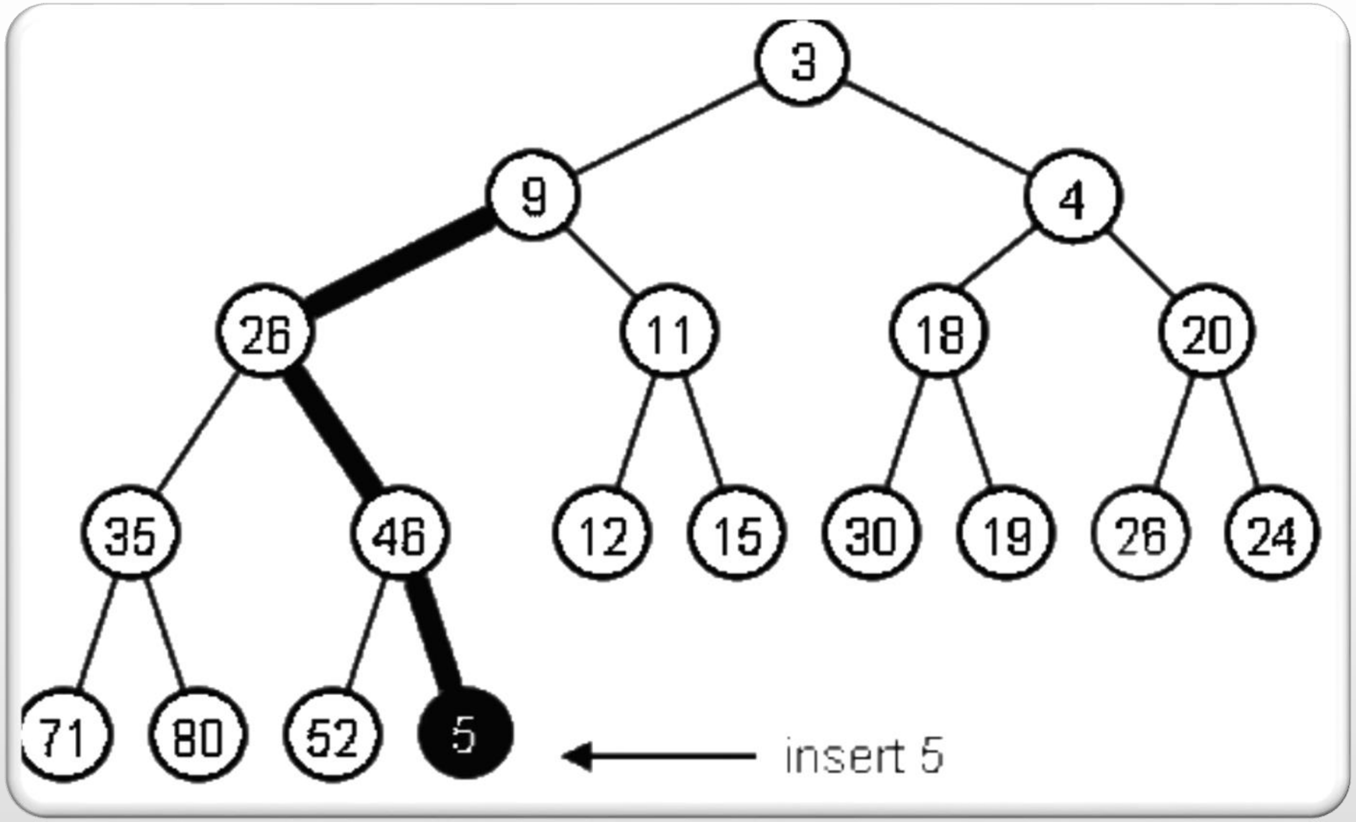


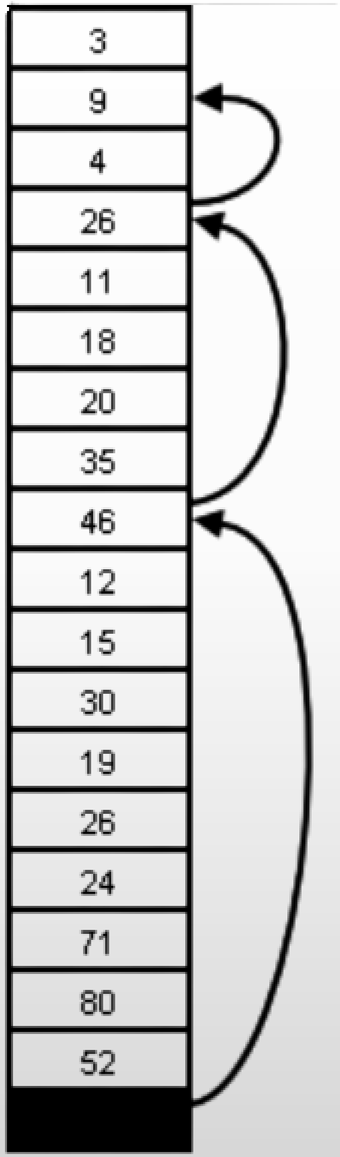


Öğe Ekleme

- Ağacın boşta olan ilk yaprak düğümüne öğe eklenir.
- Öğe ekledikten sonra, ağacın yapısı bozulabilir.
- Max-heap yapısında ebeveyn çocuk düğümlerden yüksek değere sahiptir.
- Ağacın tekrar dengelenmesi için "heapify" adı verilen bir işlem yapılır.

Öğe Ekleme





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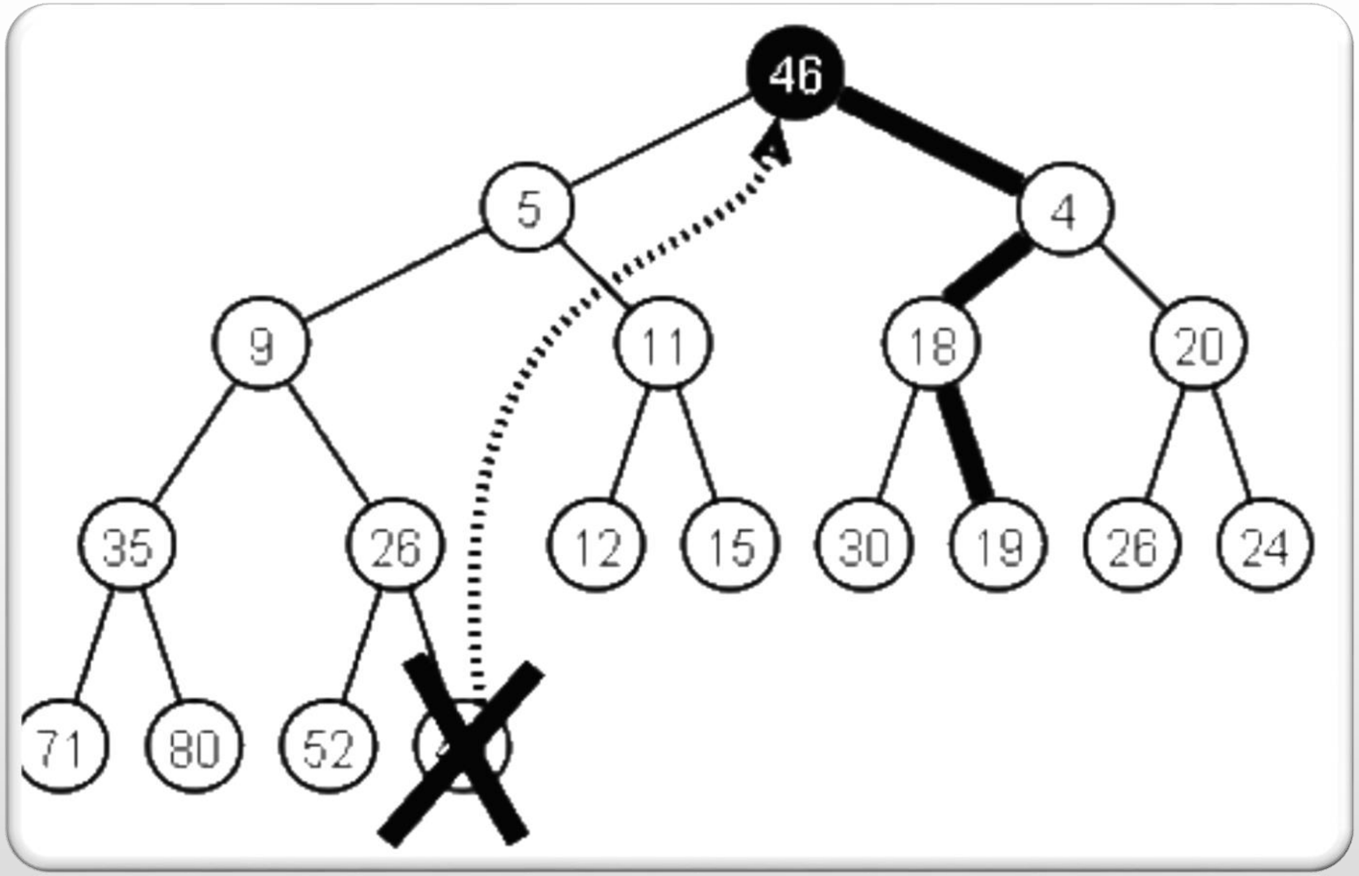
Öğe Çıkarma

- Kök düğümde bulunan öğe çıkarılır.
- Ağacın boş olmayan son yaprak düğümü kök’e taşınır.
- Bu işlemden sonra ağacın yapısı bozulabilir.
- Max-heap yapısında ebeveyn çocuk düğümlerden yüksek değere sahiptir.
- Ağacın tekrar dengelenmesi için "heapify" adı verilen bir işlem yapılır.
- heapify işlemi O(log n) zaman karmaşıklığına sahiptir.

Öğe Çıkarma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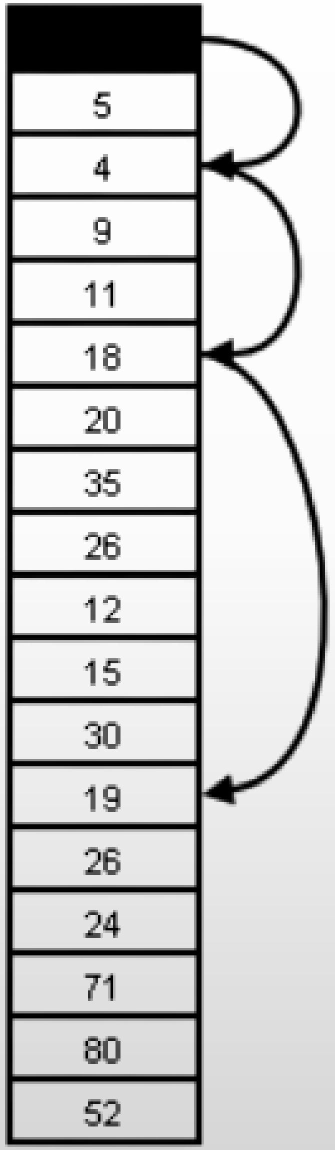
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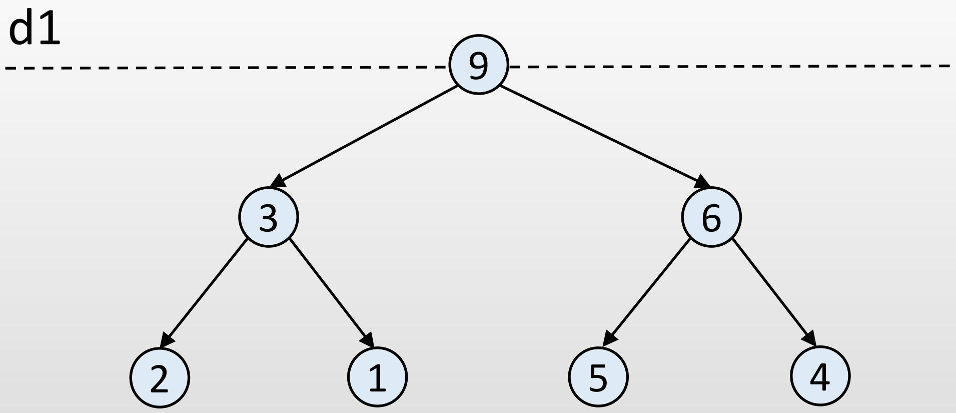
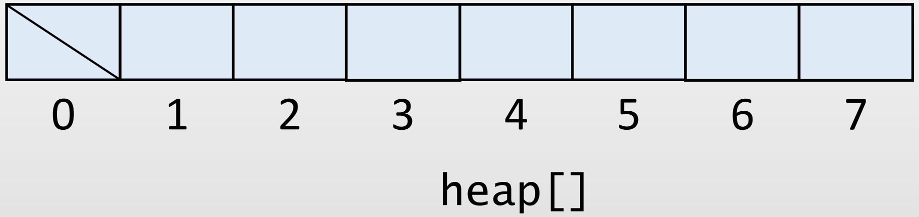
İkili Heap Gösterimi

- Dizinin ilk elemanı boş bırakılır. Heap, tam ikili ağaçtır. Değerler soldan sağa düzey ağaç dolaşımı ile dizi içinde saklanır.

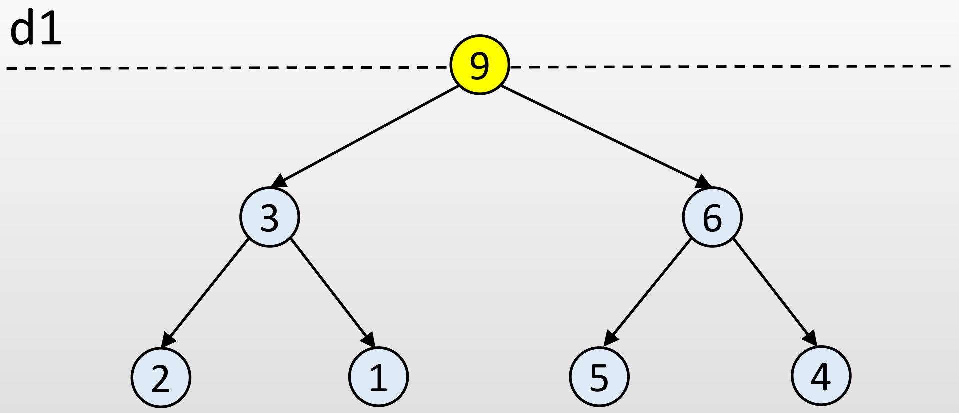


Max Heap



İkili Heap Gösterimi

- Dizinin ilk elemanı boş bırakılır. Heap, tam ikili ağaçtır. Değerler soldan sağa düzey ağaç dolaşımı ile dizi içinde saklanır.



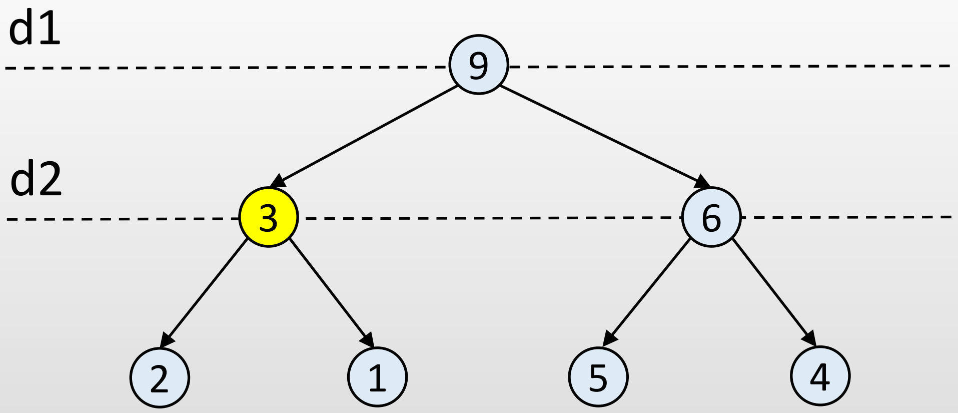
Max Heap

╲	9						
0	1	2	3	4	5	6	7

heap[]

İkili Heap Gösterimi

- Dizinin ilk elemanı boş bırakılır. Heap, tam ikili ağaçtır. Değerler soldan sağa düzey ağaç dolaşımı ile dizi içinde saklanır.



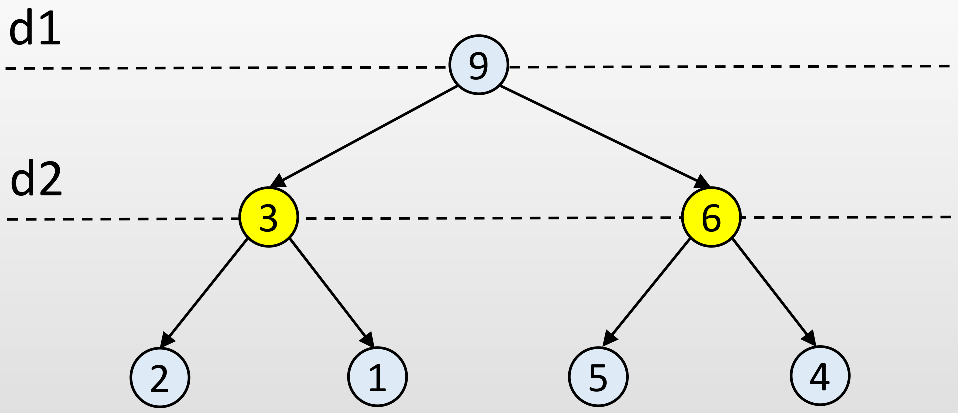
Max Heap

0	1	2	3	4	5	6	7
	9	3					

heap[]

İkili Heap Gösterimi

- Dizinin ilk elemanı boş bırakılır. Heap, tam ikili ağaçtır. Değerler soldan sağa düzey ağaç dolaşımı ile dizi içinde saklanır.



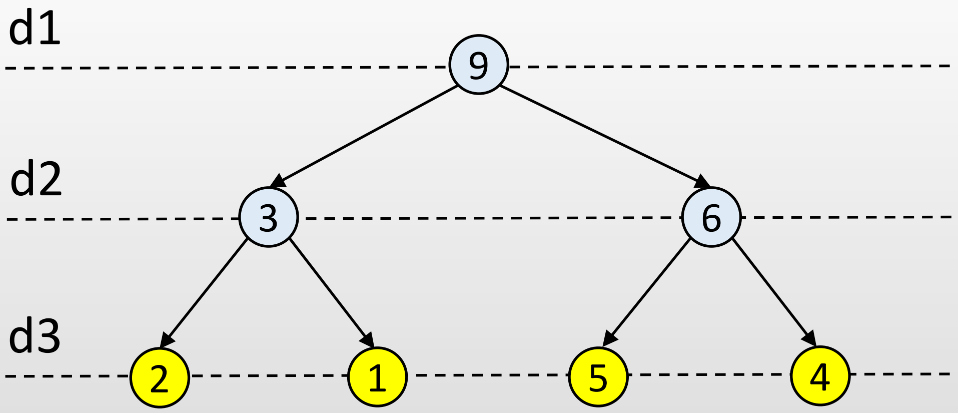
Max Heap

	9	3	6				
0	1	2	3	4	5	6	7

heap[]

İkili Heap Gösterimi

- Dizinin ilk elemanı boş bırakılır. Heap, tam ikili ağaçtır. Değerler soldan sağa düzey ağaç dolaşımı ile dizi içinde saklanır.



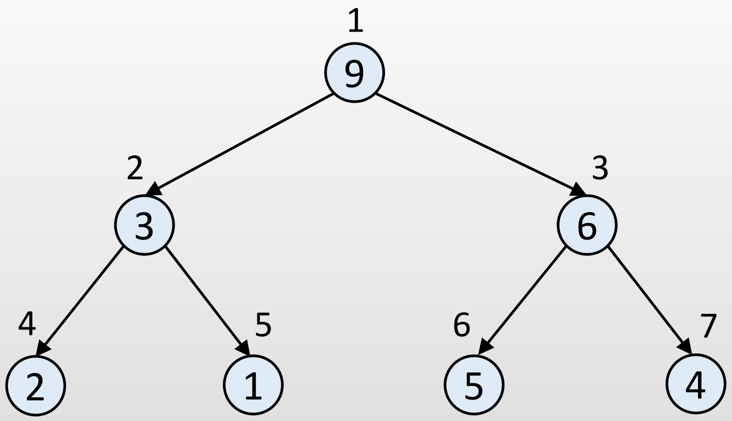
Max Heap

	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]

İkili Heap Gösterimi

- Dizinin ilk elemanı boş bırakılır. Heap, tam ikili ağaçtır. Değerler soldan sağa düzey ağaç dolaşımı ile dizi içinde saklanır.



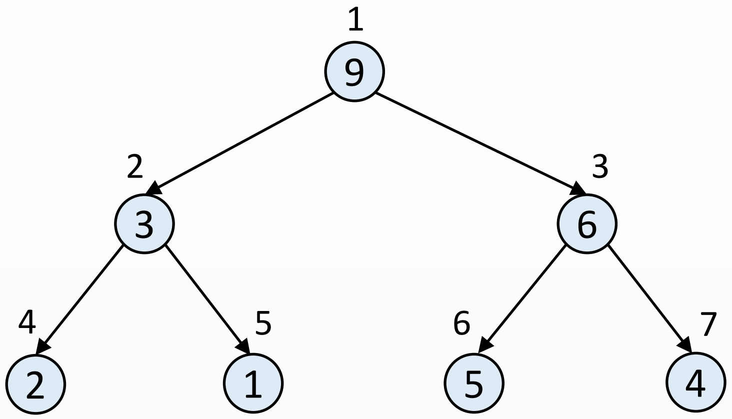
Max Heap

	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]

Sercan KÜLCÜ, Tüm hakları saklıdır.

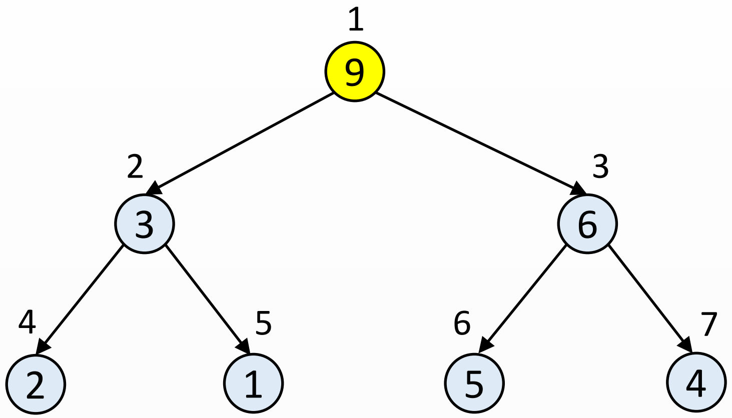
Ebeveyn ve Çocuk Hesaplamaları



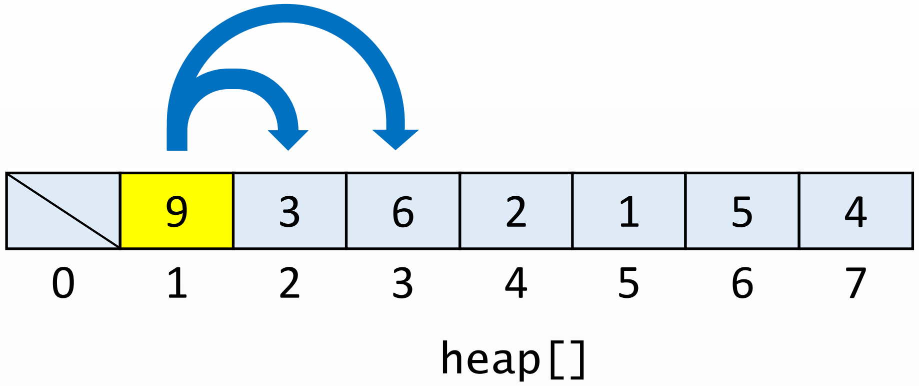
Max Heap

	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]

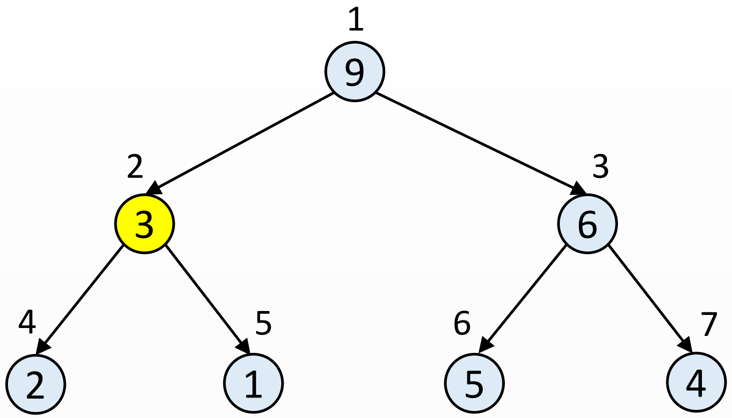


Max Heap

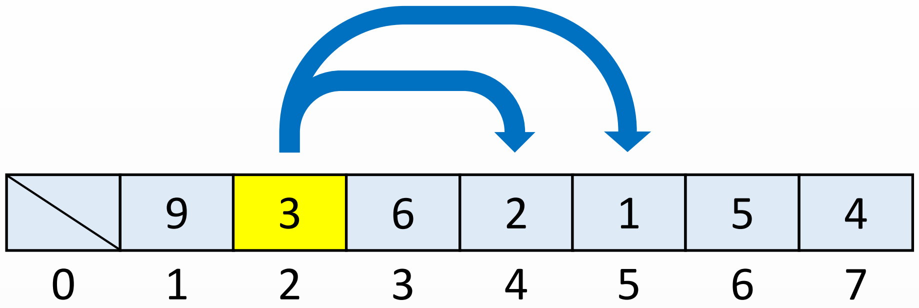


	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]

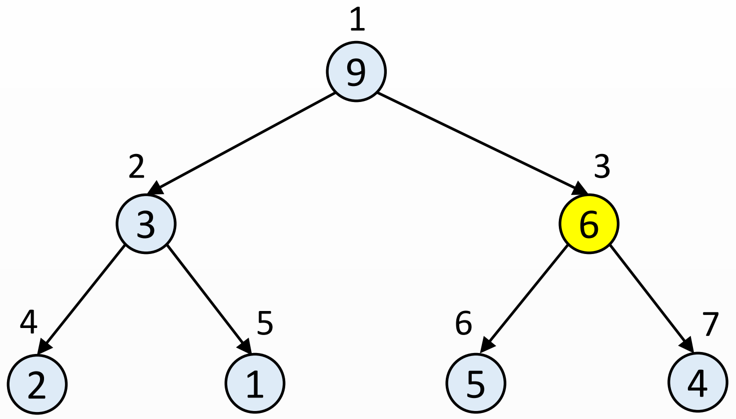


Max Heap

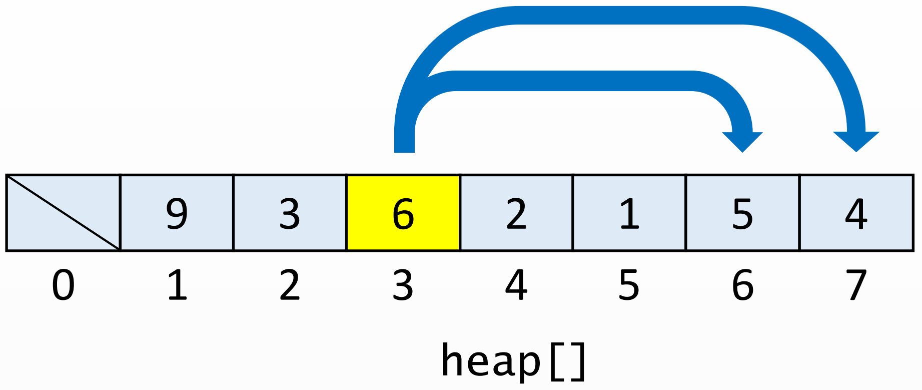


	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]



Max Heap



	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]

Çocuklar:

indeks 1 → 2, 3

indeks 2 → 4, 5

indeks 3 → 6, 7

indeks k → 2*k, 2*k + 1

Ebeveyn:

indeks 7 → $\lfloor 7/2 \rfloor = 3$

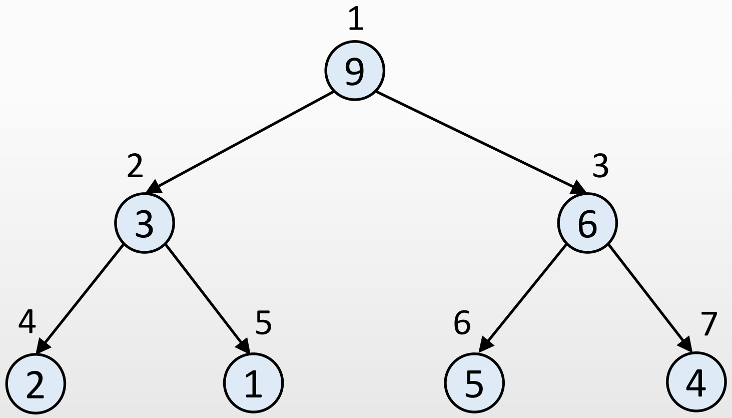
indeks 6 → $\lfloor 6/2 \rfloor = 3$

indeks 5 → $\lfloor 5/2 \rfloor = 2$

indeks k → $\lfloor k/2 \rfloor$

İkili Max Heap Ağacı

- Her bir düğümün değeri, çocuklarının değerinden büyüktür.
- En büyük değer kök düğümde bulunur. Kök düğümün indeksi 1’dir.



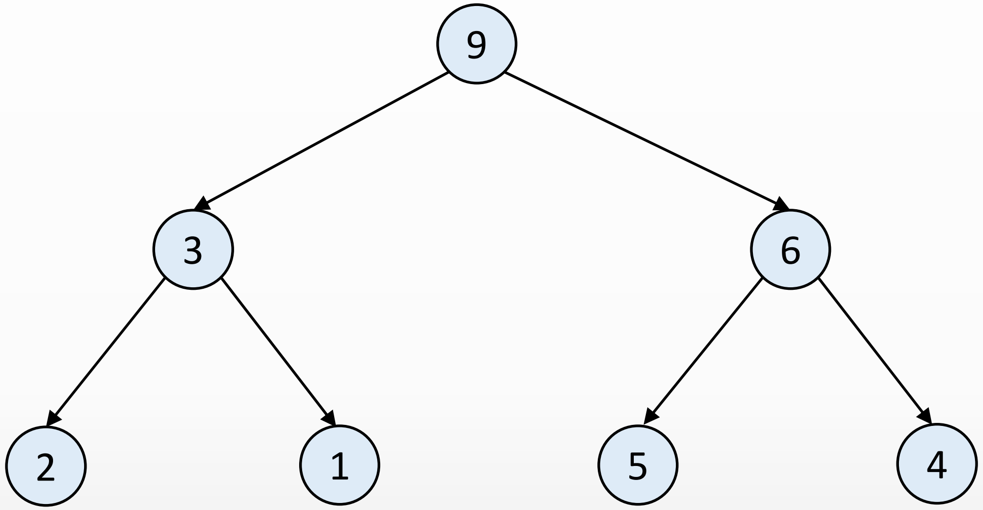
Max Heap

	9	3	6	2	1	5	4
0	1	2	3	4	5	6	7

heap[]

Aşağıdan Yukarıya Heap Ağacına Dönüştürme

- Max heap ikili ağacının her bir düğümünün değeri, çocuklarının değerlerinden büyüktür.
- Heap ağacına bir öğe eklendikten sonra bu özellik bozulabilir.
- Bu nedenle öğelerin yerlerinin değiştirilmesi gerekir.
- Ağaç aşağıdan yukarıya doğru taranarak yeniden heap ağacına dönüştürme işlemi (yüzdür - swim) uygulanır (bottom-up heapify).



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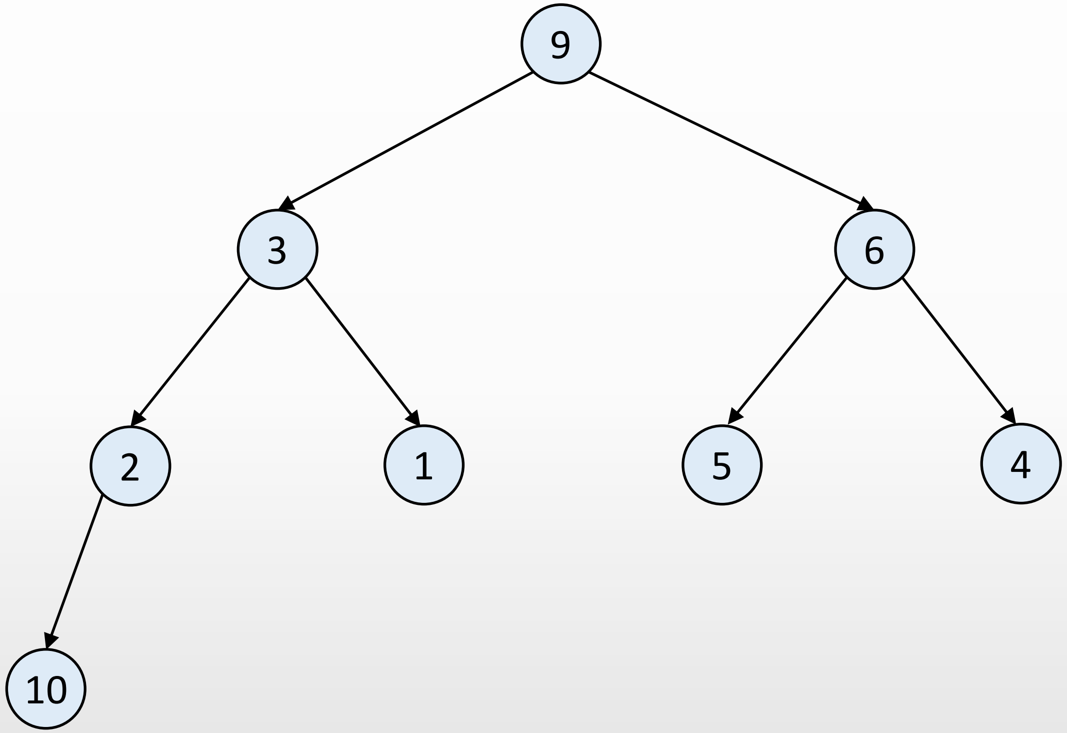

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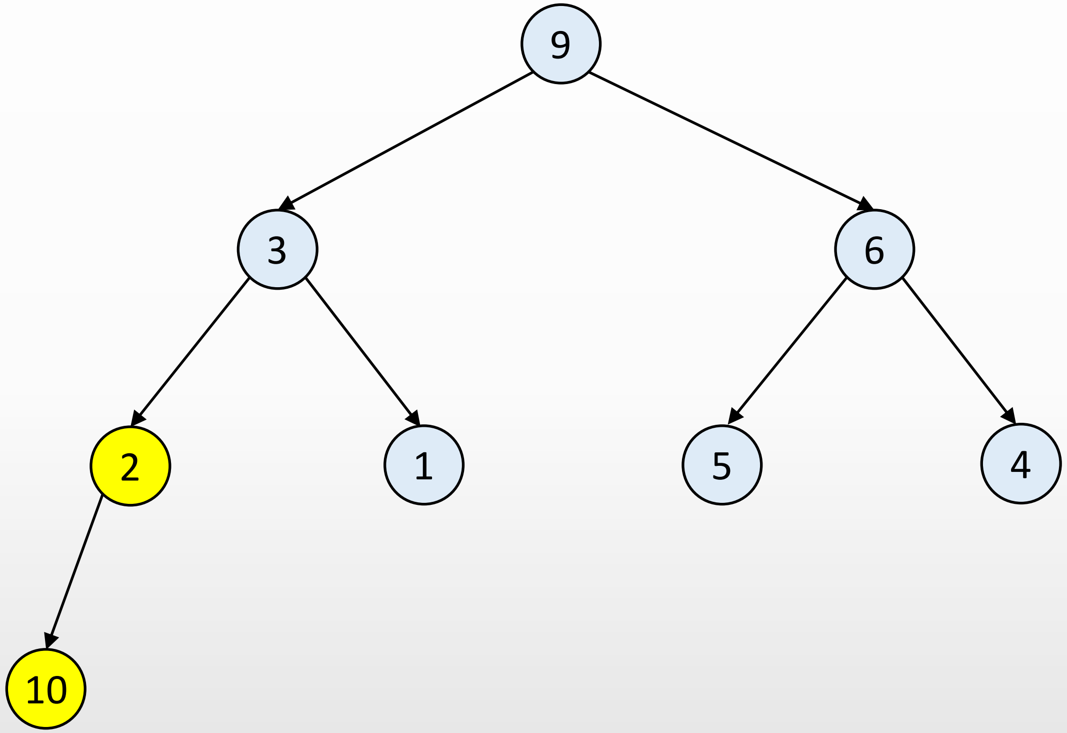

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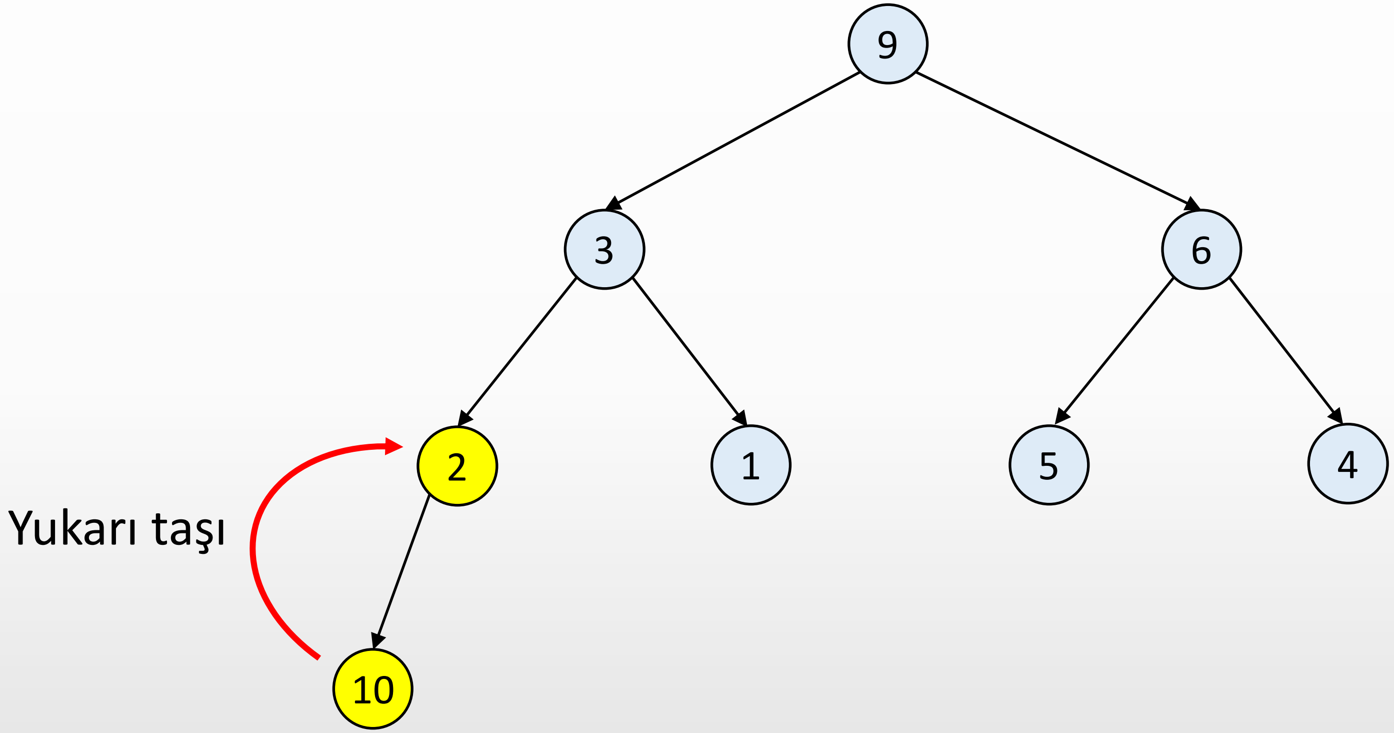

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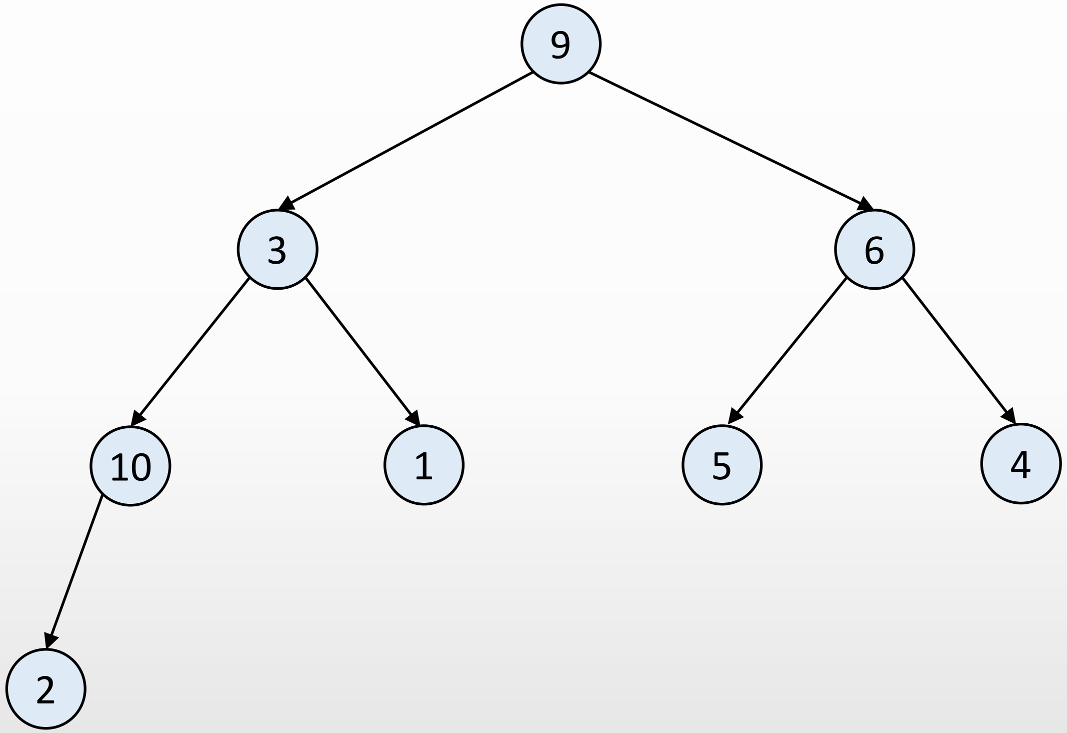

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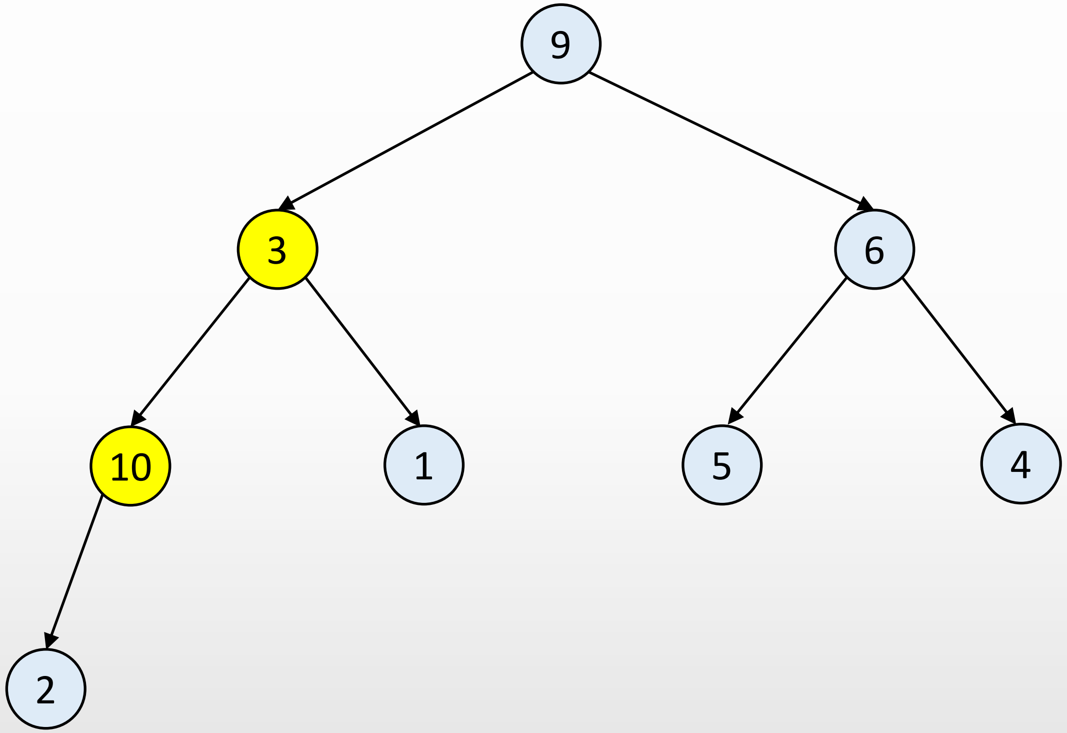

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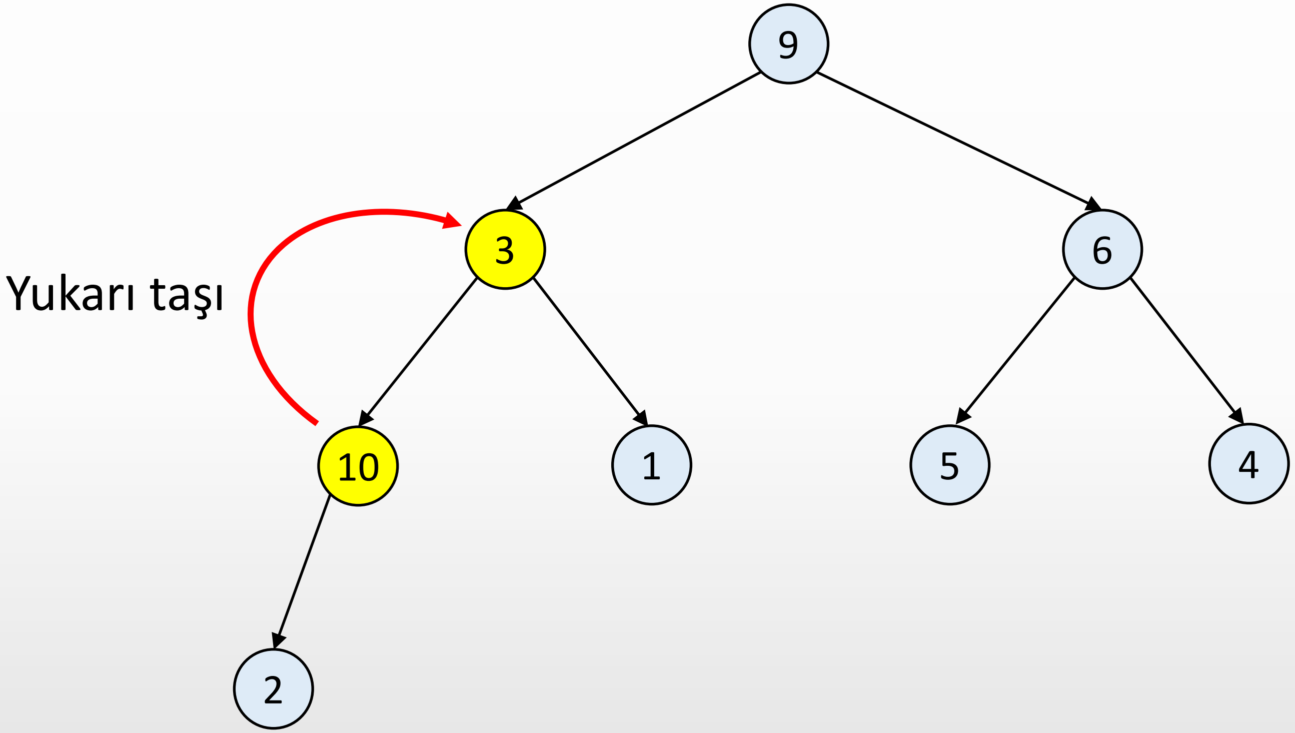

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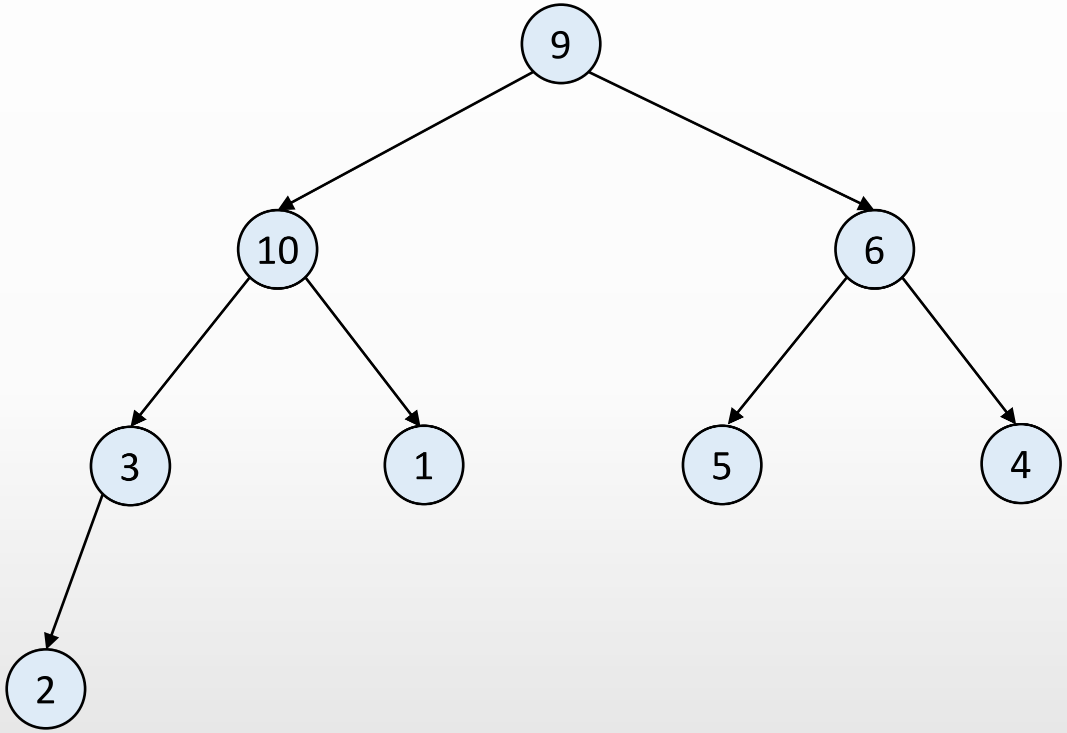

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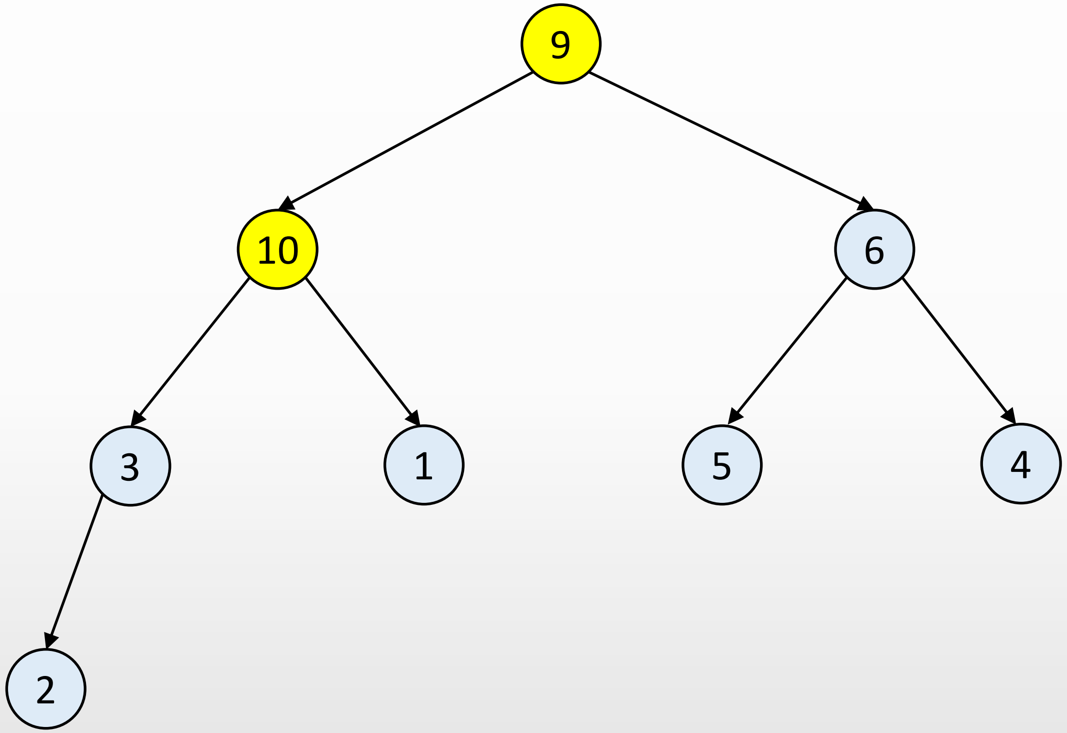

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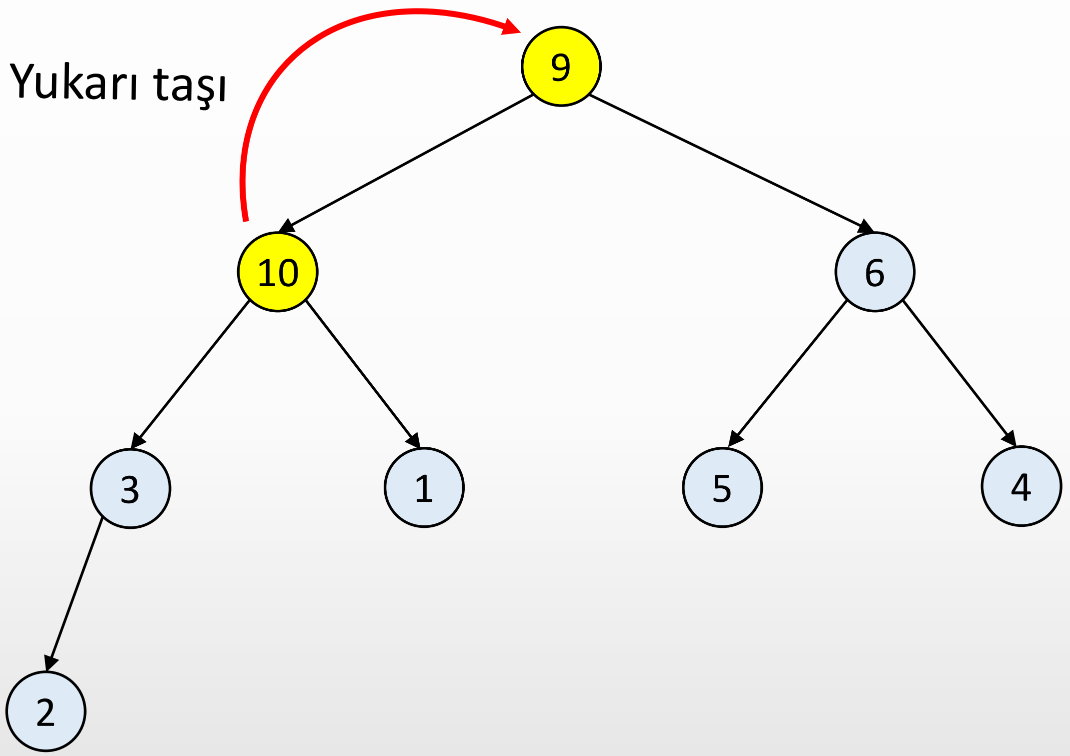

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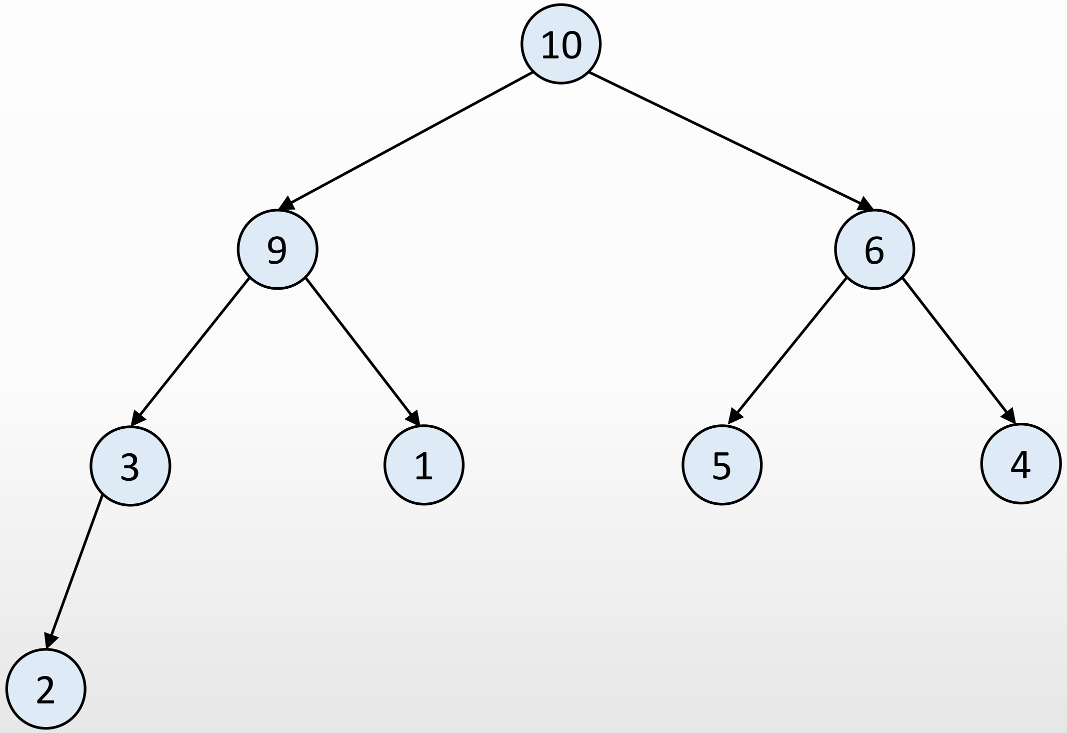
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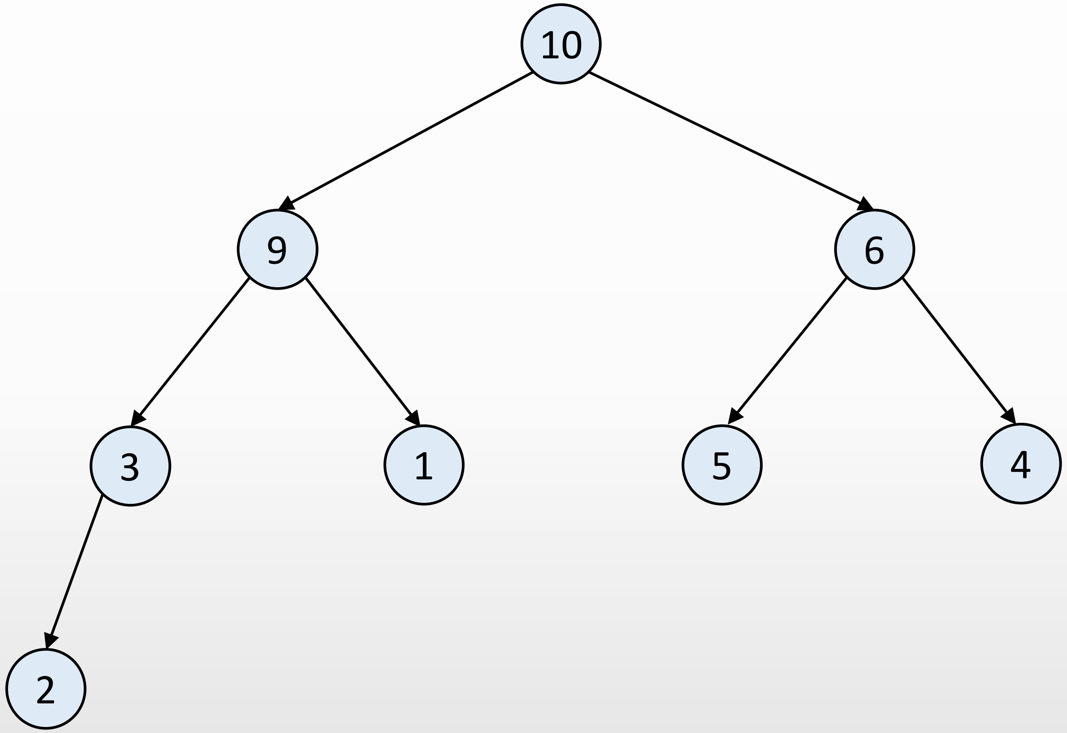

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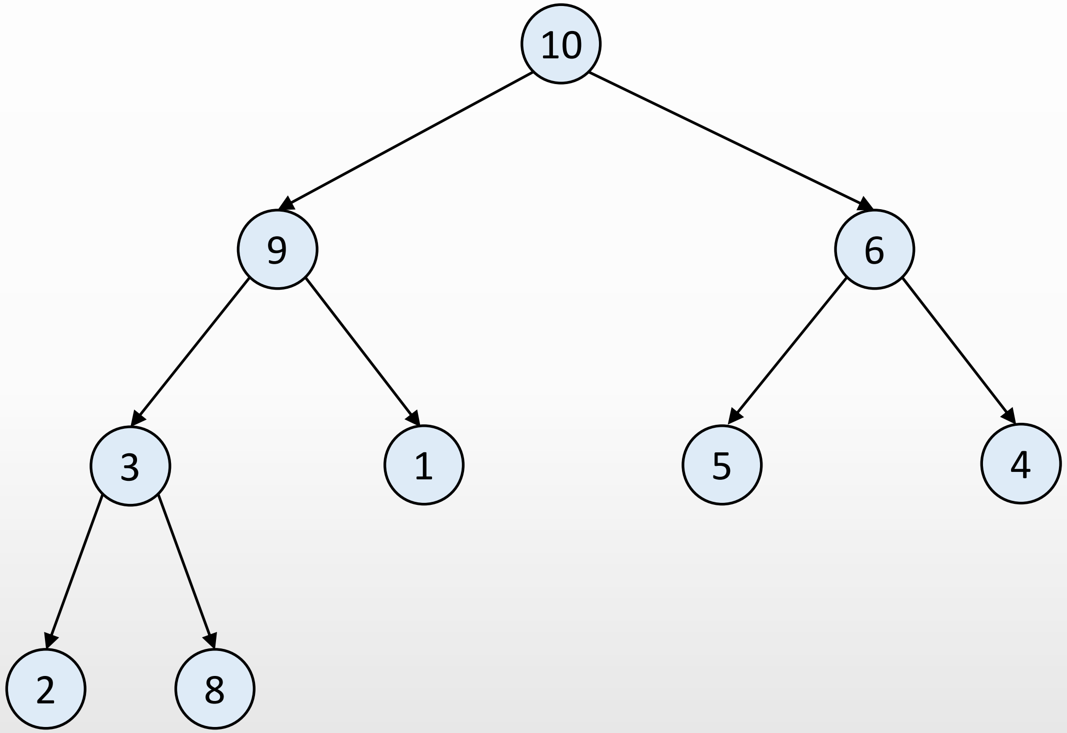

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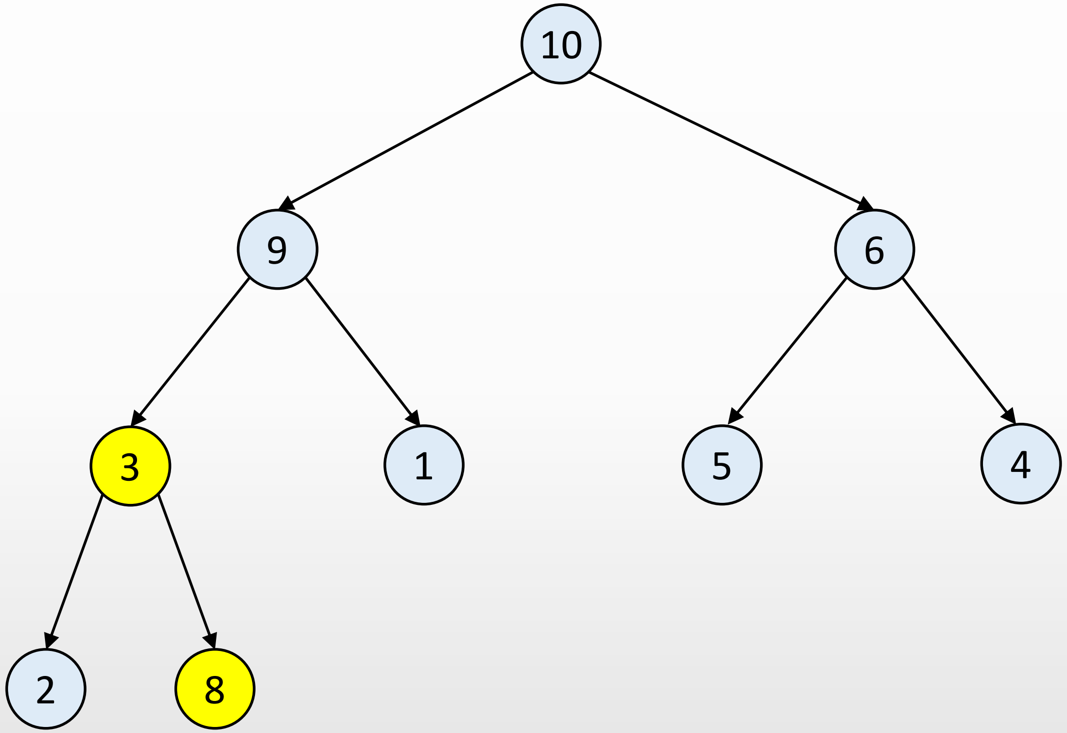

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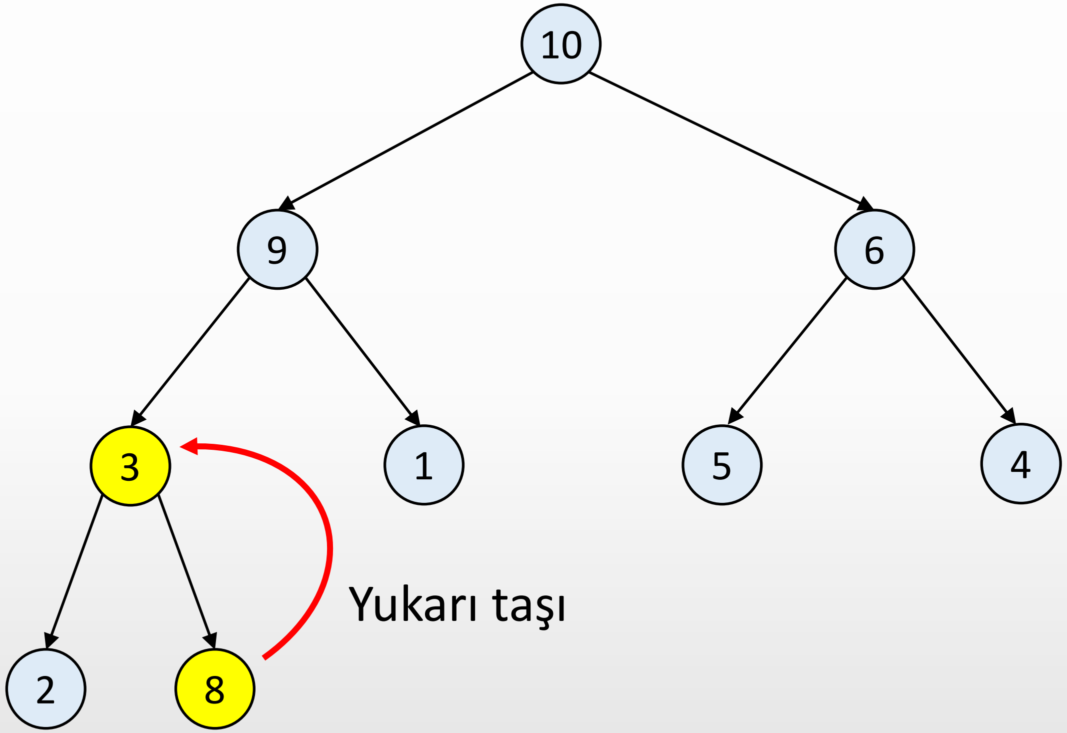

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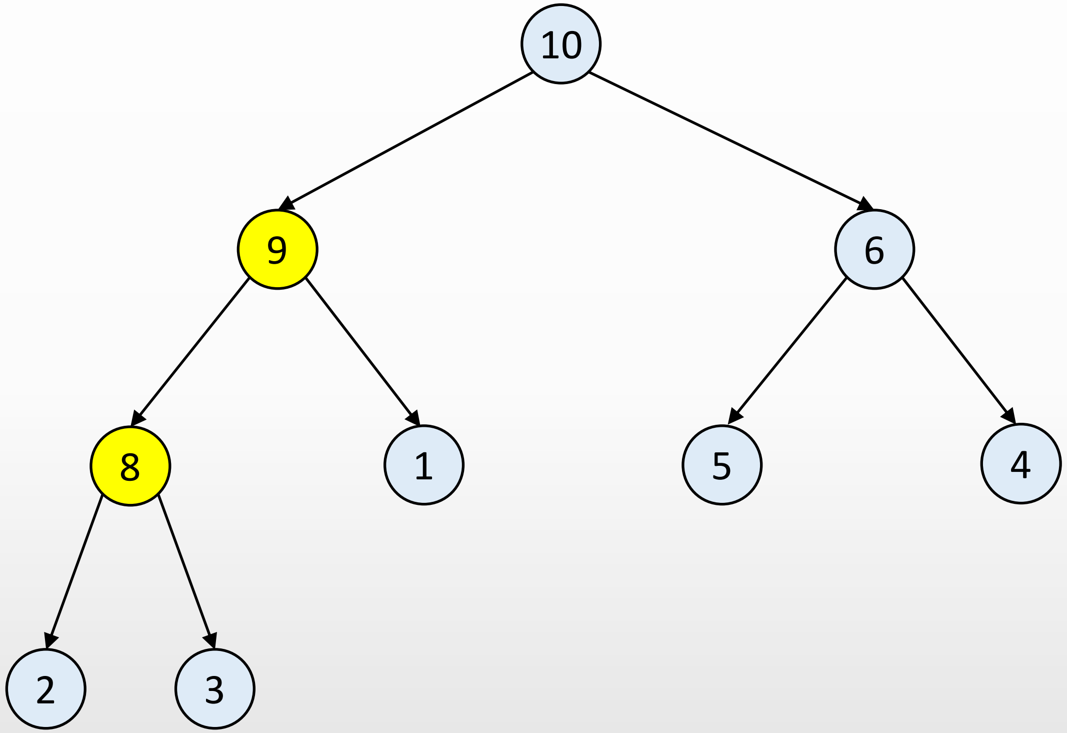

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Sercan KÜLCÜ, Tüm hakları saklıdır.

Aşağıdan Yukarıya Heap Ağacına Dönüştürme

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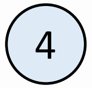

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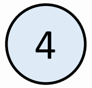

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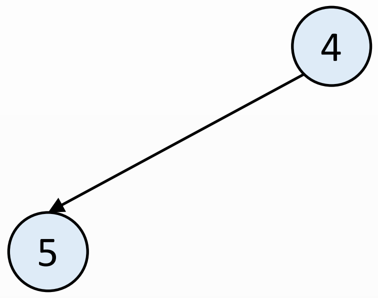

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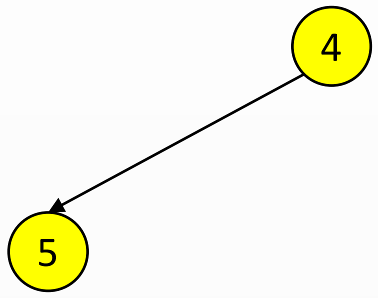

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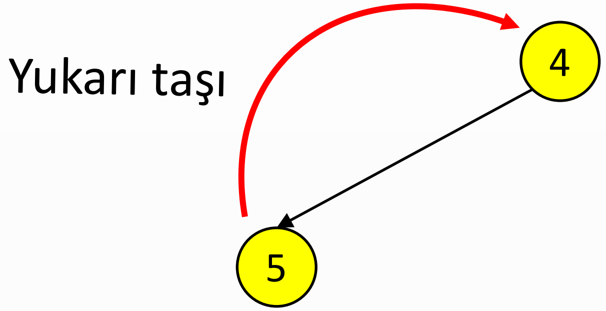

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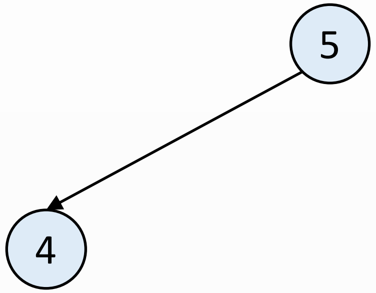

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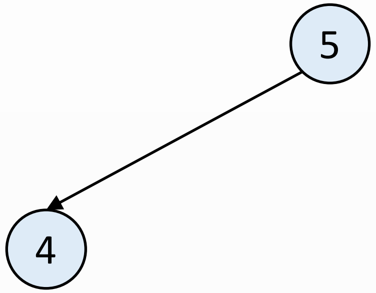

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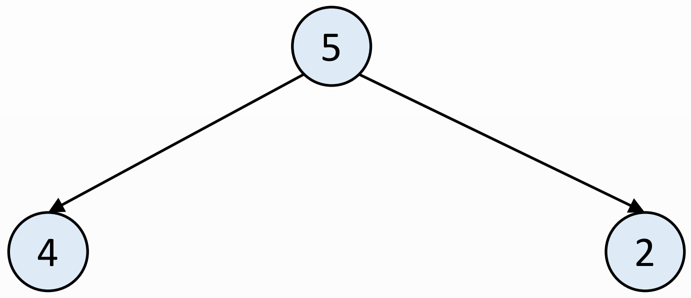

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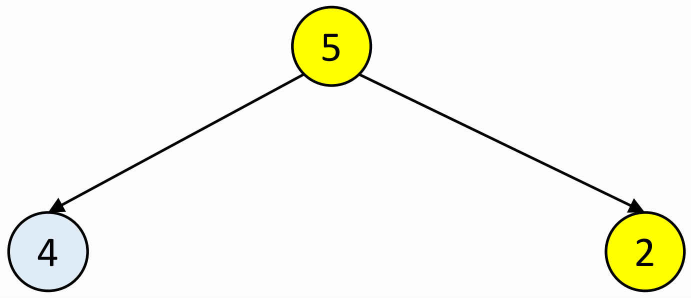

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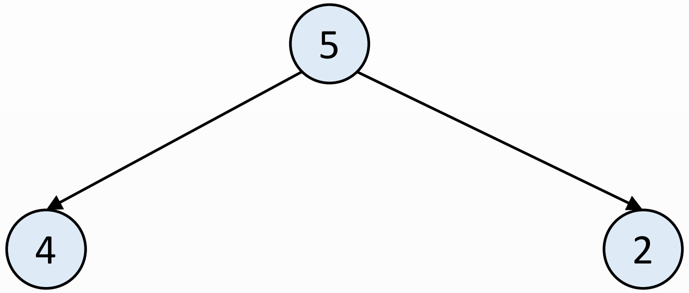

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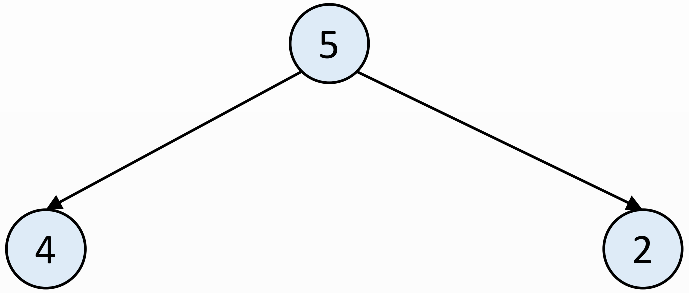

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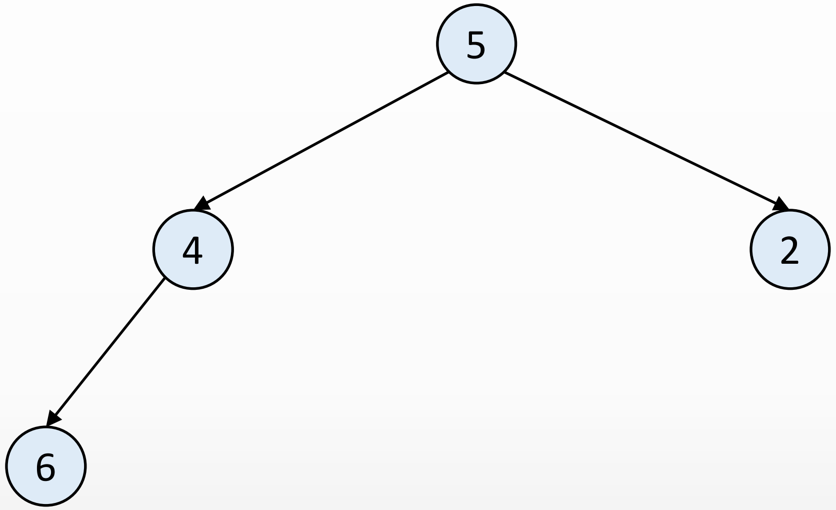
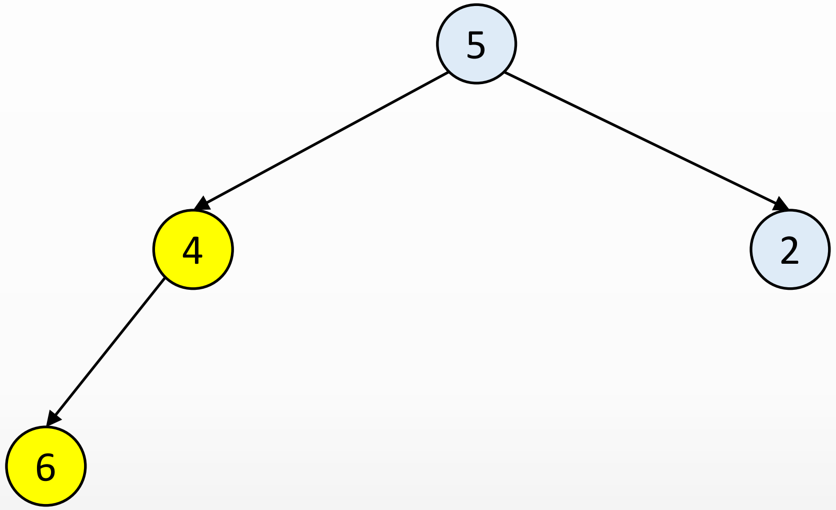
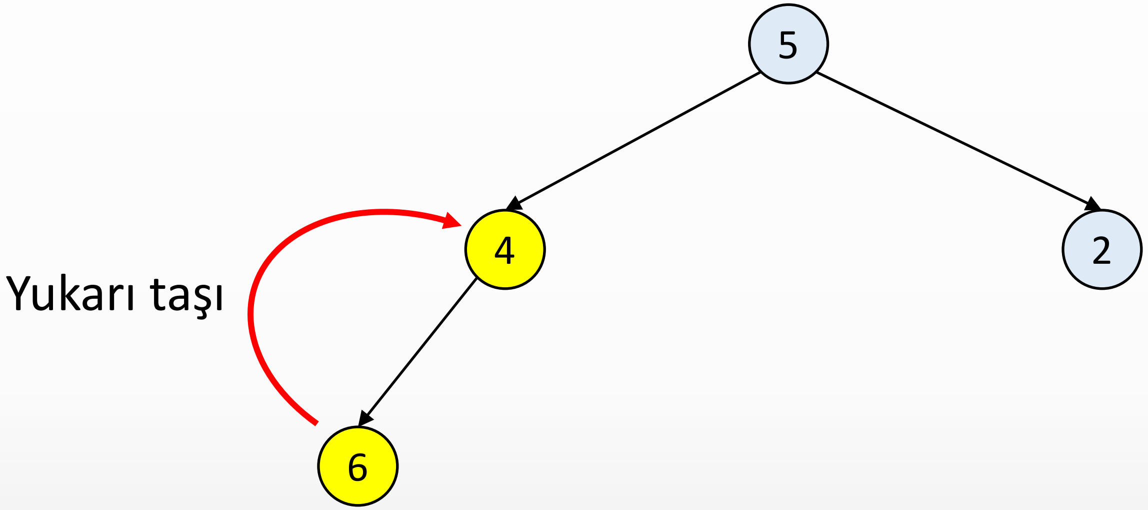
ekle(6)
```



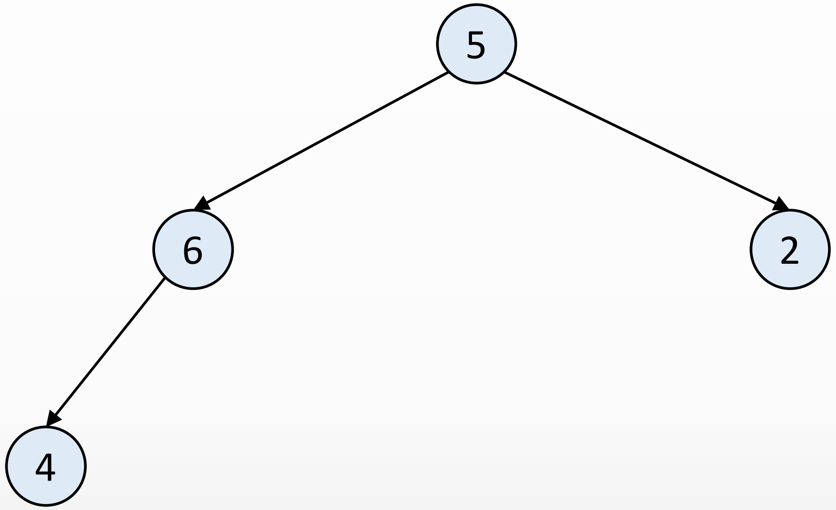
```
ekle(6)
```



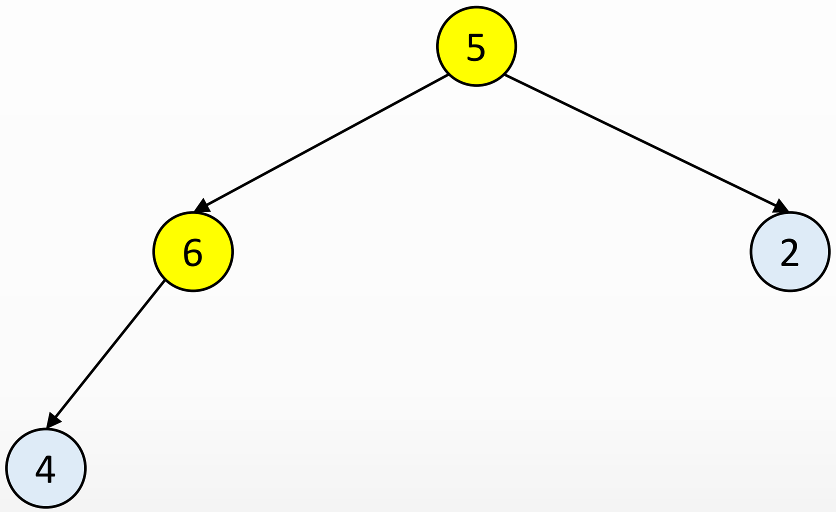
```
ekle(6)
```



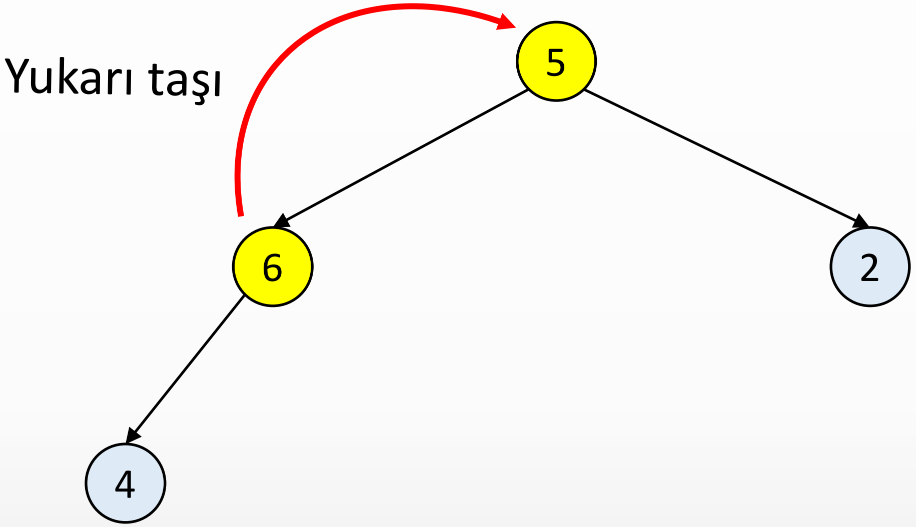
ekle(6)



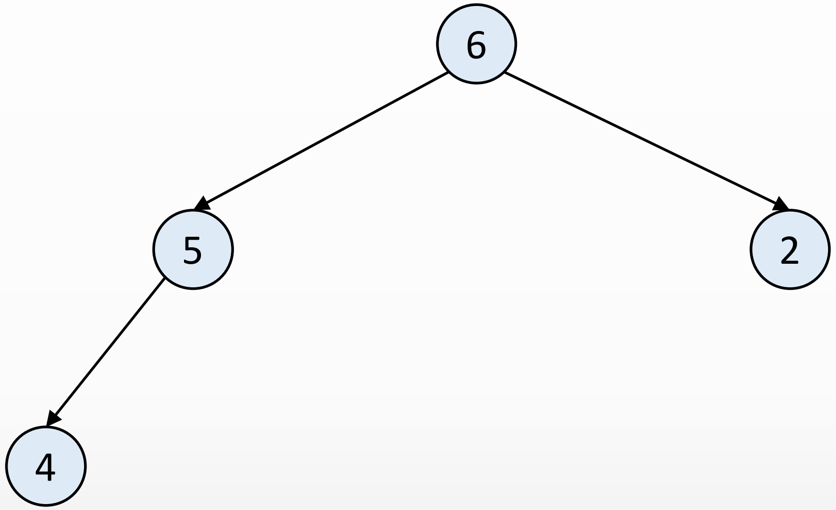
```
ekle(6)
```



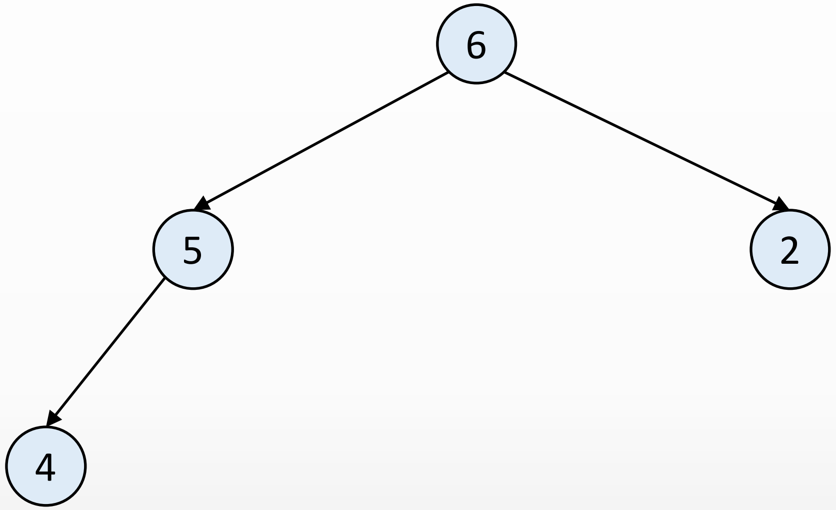
```
ekle(6)
```



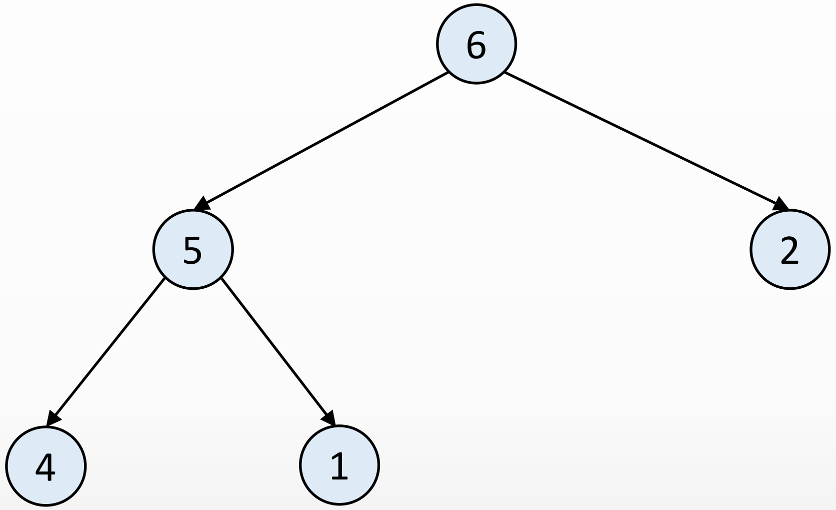
ekle(6)



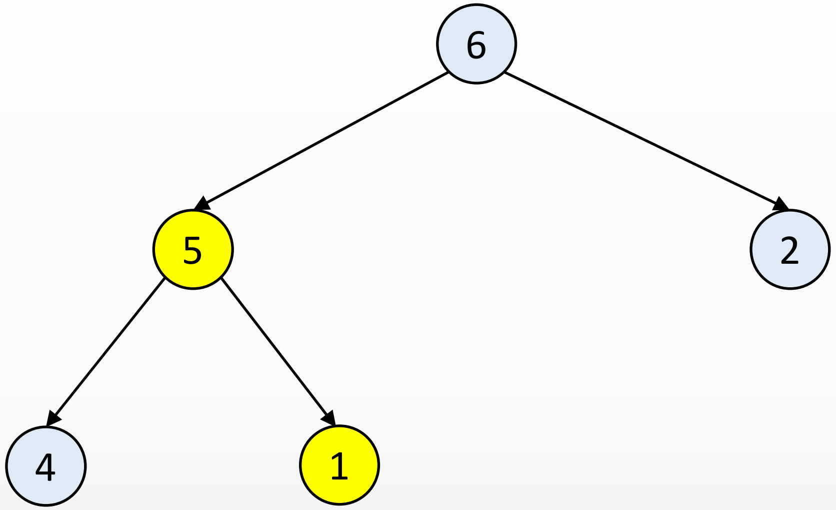
```
ekle(6)
```



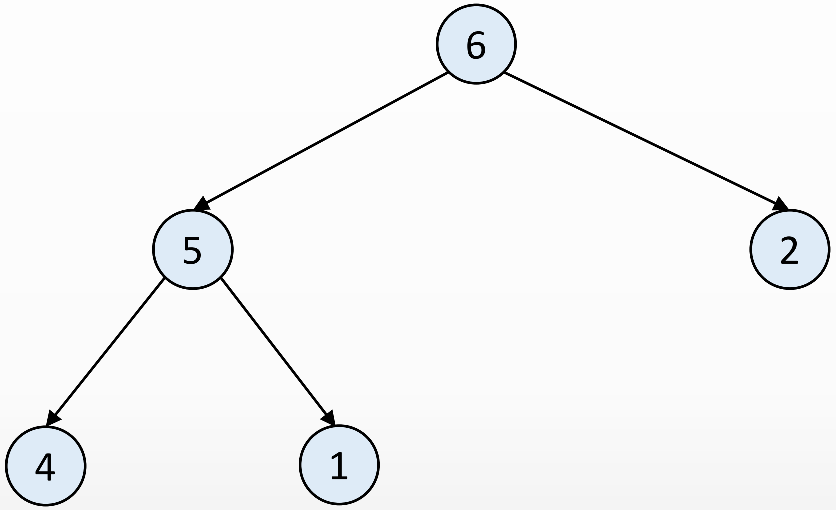
```
ekle(1)
```



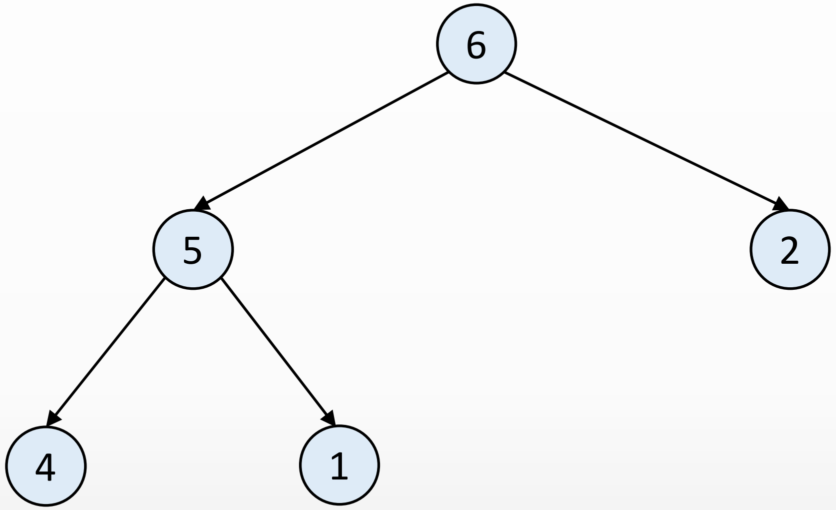
`ekle(1)`



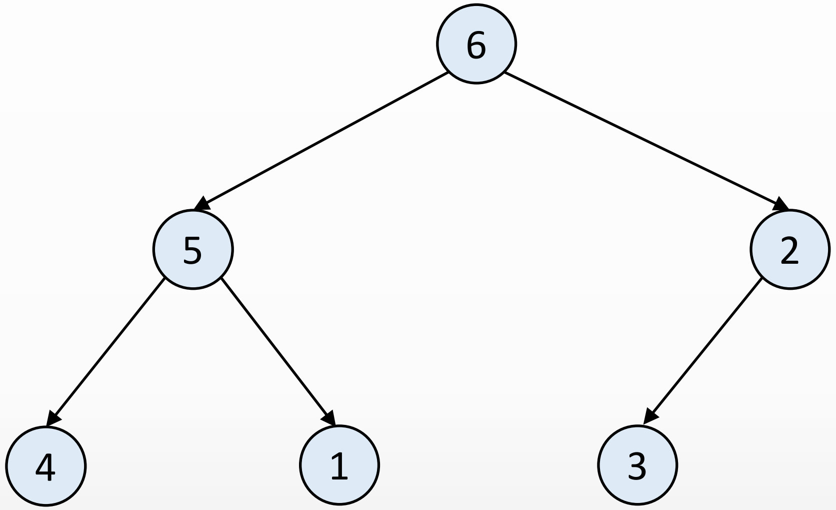
```
ekle(1)
```



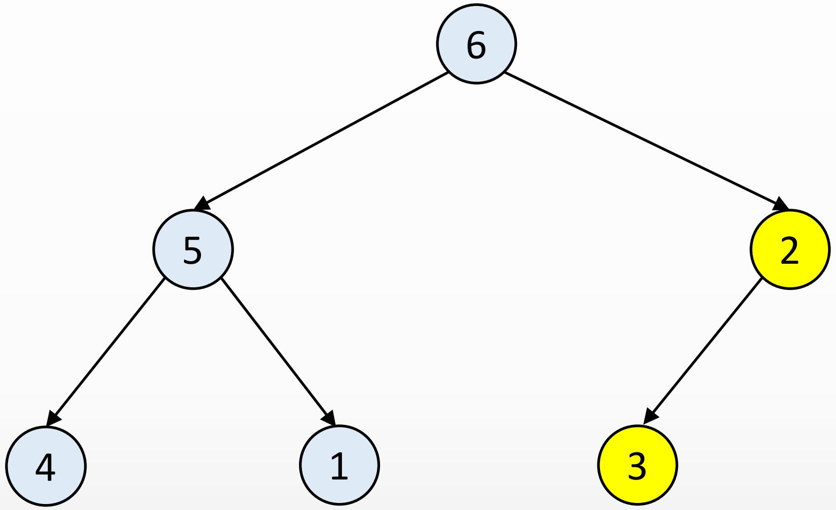
ekle(1)



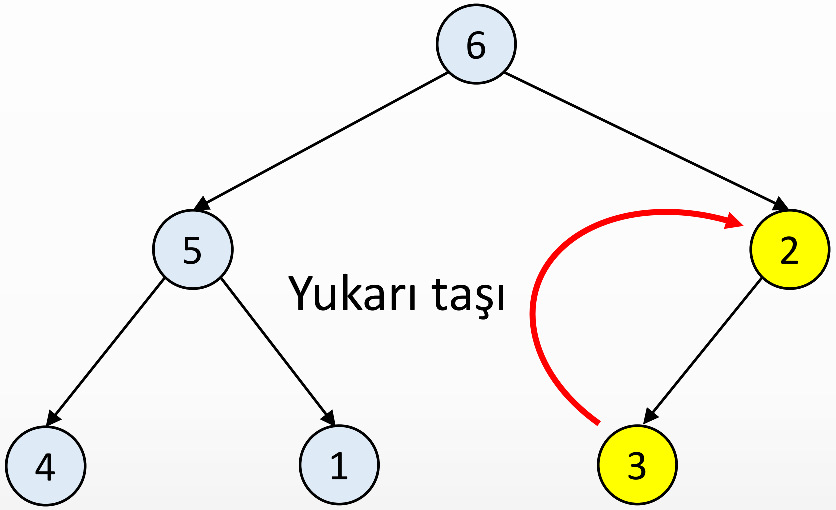
```
ekle(3)
```



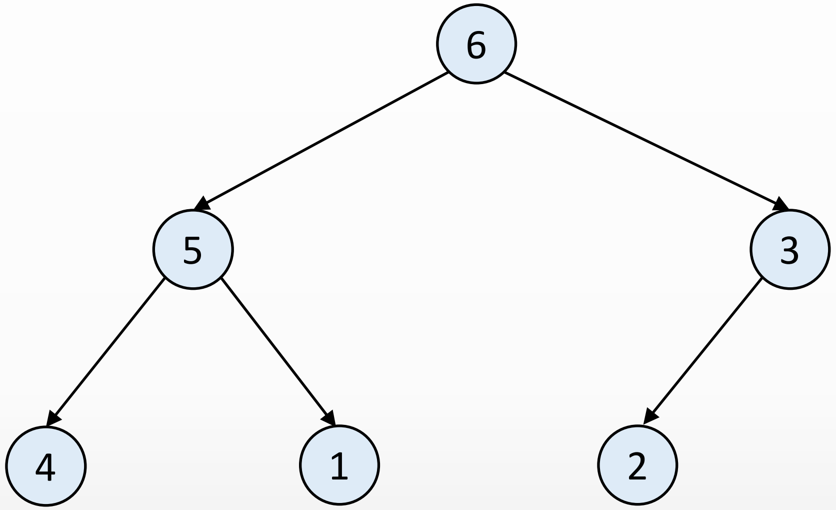
```
ekle(3)
```



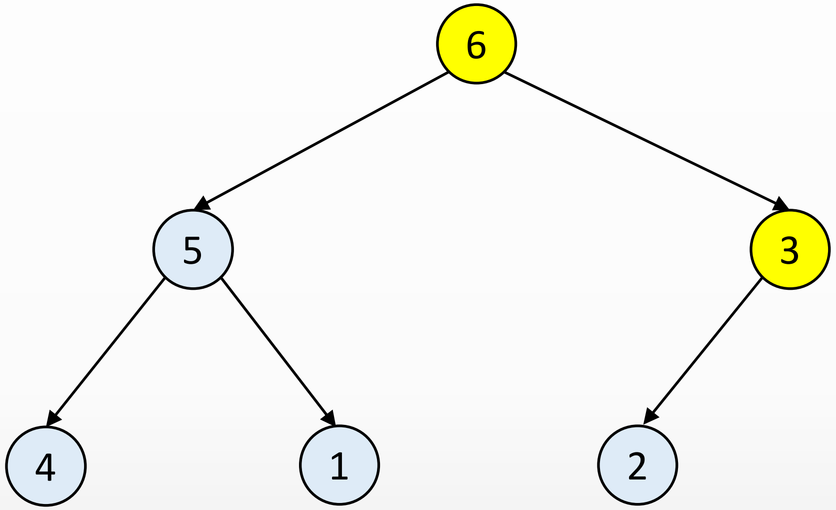
```
ekle(3)
```



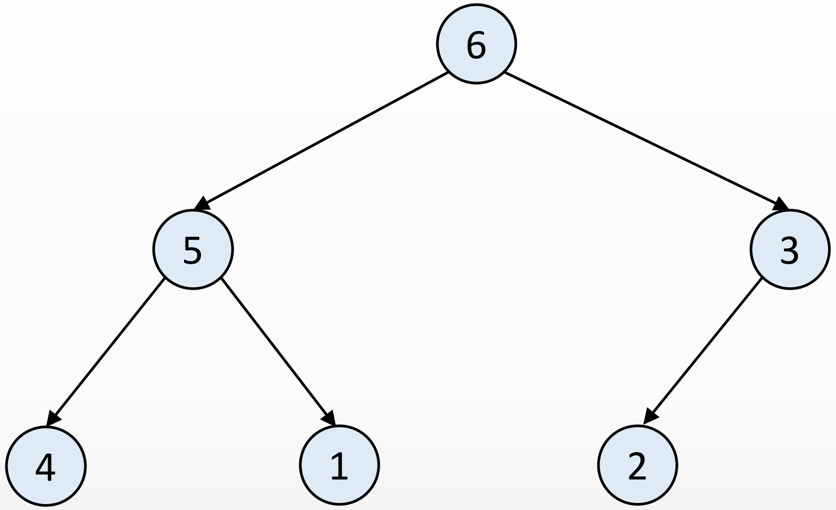
ekle(3)



ekle(3)



```
ekle(3)
```



```
ekle(3)
```

Sercan KÜLCÜ, Tüm hakları saklıdır.

Max Heap Ağacına Eleman Ekleme

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

Max Heap Ağacına Eleman Ekleme

```
MaxOK ok = new MaxOK(3);
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

null	null	null	null
0	1	2	3

heap[]

```
MaxOK ok = new MaxOK(3);
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	null	null	null
0	1	2	3

heap[]

```
MaxOK ok = new MaxOK(3);
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	null	null	null
0	1	2	3

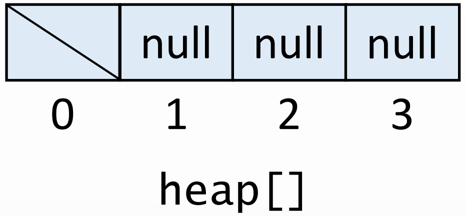
heap[]

```
heap.length = 4
```

```
MaxOK ok = new MaxOK(3);
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```



null null null

0 1 2 3

heap[]

```
n = 0
heap.length = 4
```

```
MaxOK ok = new MaxOK(3);
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	null	null	null
0	1	2	3

heap[]

```
n = 0
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	null	null	null
0	1	2	3

heap[]

```
n = 0
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	null	null	null
0	1	2	3

heap[]

```
x = 4
n = 0
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	null	null	null
0	1	2	3

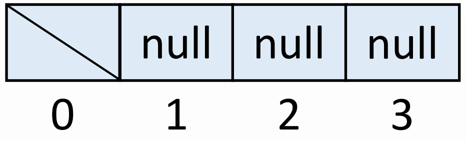
heap[]

```
x = 4
n = 0
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```



	null	null	null
0	1	2	3

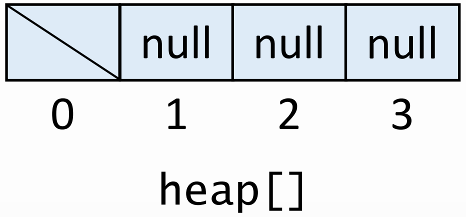
heap[]

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

```
x = 4
n = 0
heap.length = 4
```

```
ekle(4)
```



	null	null	null
0	1	2	3

heap[]

```
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 4
n = 1
heap.length = 4


ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
k = 1
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
k = 1
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
k = 1
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
→ }
}
```

	4	null	null
0	1	2	3

heap[]

```
k = 1
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 4
n = 1
heap.length = 4
```

```
ekle(4)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
n = 1
heap.length = 4
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
n = 1
heap.length = 4


ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 5
n = 1
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 5
n = 1
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	null	null
0	1	2	3

heap[]

```
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	5	null
0	1	2	3

heap[]

```
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	5	null
0	1	2	3

heap[]

```
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	5	null
0	1	2	3

heap[]

```
k = 2
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	5	null
0	1	2	3

heap[]

```
k = 2
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	5	null
0	1	2	3

heap[]

```
k/2 = 1
k = 2
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	5	null
0	1	2	3

heap[]

```
gecici = 5
k/2 = 1
k = 2
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	4	4	null
0	1	2	3

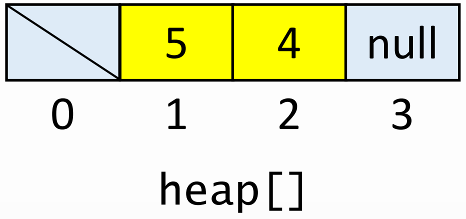
heap[]

gecici = 5
k/2 = 1
k = 2
x = 5
n = 2
heap.length = 4

ekle(5)

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```



```
gecici = 5
k/2 = 1
k = 2
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	null
0	1	2	3

heap[]

```
k = 1
x = 5
n = 2
heap.length = 4


ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	null
0	1	2	3

heap[]

```
k = 1
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
→ }
```

	5	4	null
0	1	2	3

heap[]

```
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	null
0	1	2	3

heap[]

```
x = 5
n = 2
heap.length = 4
```

```
ekle(5)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	null
0	1	2	3

heap[]

```
n = 2
heap.length = 4
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	null
0	1	2	3

heap[]

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

```
n = 2
heap.length = 4
```

```
ekle(2)
```

	5	4	null
0	1	2	3

heap[]

```
x = 2
n = 2
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
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    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	null
0	1	2	3

heap[]

```
public void ekle(int x) {
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    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

```
x = 2
n = 2
heap.length = 4
```

```
ekle(2)
```

	5	4	null
0	1	2	3

heap[]

```
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
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  n++;
  heap[n] = x;
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private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
x = 2
n = 3
heap.length = 4


ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
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    heap[k / 2] = gecici;
    k = k / 2;
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}
```

	5	4	2
0	1	2	3

heap[]

```
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```java
public void ekle(int x) {
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    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
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}

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    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
k = 3
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
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    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
k = 3
x = 2
n = 3
heap.length = 4


ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
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private void yuzdur(int k) {
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    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
k/2 = 1
k = 3
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
k/2 = 1
k = 3
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

╲	5	4	2
0	1	2	3

heap[]

```
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
x = 2
n = 3
heap.length = 4
```

```
ekle(2)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

n = 3
heap.length = 4

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2
0	1	2	3

heap[]

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

```
n = 3
heap.length = 4
```

```
ekle(6)
```

	5	4	2
0	1	2	3

heap[]

```
→ public void ekle(int x) {
    if (n == heap.length - 1) {
      buyut(2 * heap.length);
    }
    n++;
    heap[n] = x;
    yuzdur(n);
  }

  private void yuzdur(int k) {
    while (k > 1 && heap[k / 2] < heap[k]) {
      int gecici = heap[k];
      heap[k] = heap[k / 2];
      heap[k / 2] = gecici;
      k = k / 2;
    }
  }
```

```
x = 6
n = 3
heap.length = 4


ekle(6)
```

	5	4	2
0	1	2	3

heap[]

```
x = 6
n = 3
heap.length = 4
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

0	1	2	3
	5	4	2

heap[]

```
x = 6
n = 3
heap.length = 4
```

```
ekle(6)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	null	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 6
n = 3
heap.length = 8


ekle(6)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

0	1	2	3	4	5	6	7
	5	4	2	null	null	null	null

heap[]

x = 6
n = 4
heap.length = 8

ekle(6)

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 6
n = 4
heap.length = 8


ekle(6)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

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    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k = 4
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 2
k = 4
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 2
k = 4
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
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  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	4	2	6	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 2
k = 4
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

╲	5	4	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 2
k = 4
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	6	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 2
k = 4
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	6	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 2
k = 2
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	6	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k = 2
x = 6
n = 4
heap.length = 8


ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	6	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 1
k = 2
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
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  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	6	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 1
k = 2
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	6	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 1
k = 2
x = 6
n = 4
heap.length = 8


ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	5	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 1
k = 2
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
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  n++;
  heap[n] = x;
  yuzdur(n);
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  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 1
k = 2
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 6
k/2 = 1
k = 1
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k = 1
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
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private void yuzdur(int k) {
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    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
k = 1
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
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private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
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    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 6
n = 4
heap.length = 8


ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
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private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
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    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 6
n = 4
heap.length = 8
```

```
ekle(6)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
n = 4
heap.length = 8
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
n = 4
heap.length = 8
```

```
ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
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private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

```
x = 1
n = 4
heap.length = 8
```

```
ekle(1)
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 1
n = 4
heap.length = 8
```

```
ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	null	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
public void ekle(int x) {
  if (n == heap.length - 1) {
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  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

```
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 1
n = 5
heap.length = 8


ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
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private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
k = 5
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
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  n++;
  heap[n] = x;
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  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

0	1	2	3	4	5	6	7
	6	5	2	4	1	null	null

heap[]

```
k = 5
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
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private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 2
k = 5
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 2
k = 5
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 2
k = 5
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 1
n = 5
heap.length = 8
```

```
ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 1
n = 5
heap.length = 8


ekle(1)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
n = 5
heap.length = 8
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 5
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 5
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	null	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	3	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	3	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 6
heap.length = 8


ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	3	null
0	1	2	3	4	5	6	7

heap[]

```
k = 6
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	3	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 3
k = 6
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	3	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 3
k = 6
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	3	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 3
k/2 = 3
k = 6
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
→   int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	2	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 3
k/2 = 3
k = 6
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 3
k/2 = 3
k = 6
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
gecici = 3
k/2 = 3
k = 3
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
k = 3
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 1
k = 3
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 1
k = 3
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
k/2 = 1
k = 3
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```java
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
x = 3
n = 6
heap.length = 8
```

```
ekle(3)
```

```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

	6	5	3	4	1	2	null
0	1	2	3	4	5	6	7

heap[]

```
n = 6
heap.length = 8
```

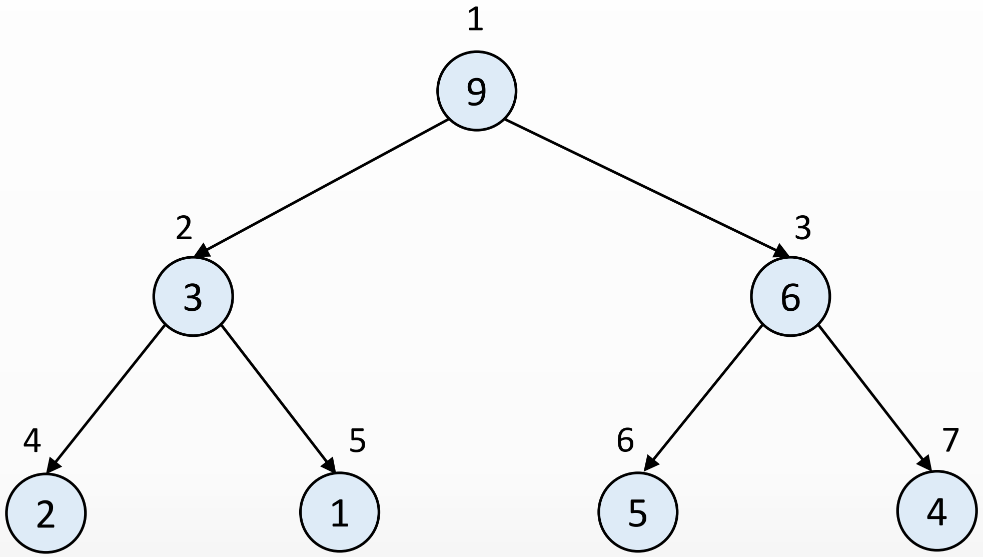
```
public void ekle(int x) {
  if (n == heap.length - 1) {
    buyut(2 * heap.length);
  }
  n++;
  heap[n] = x;
  yuzdur(n);
}

private void yuzdur(int k) {
  while (k > 1 && heap[k / 2] < heap[k]) {
    int gecici = heap[k];
    heap[k] = heap[k / 2];
    heap[k / 2] = gecici;
    k = k / 2;
  }
}
```

Yukarıdan Aşağıya Heap Ağacına Dönüştürme

Yukarıdan Aşağıya Heap Ağacına Dönüştürme

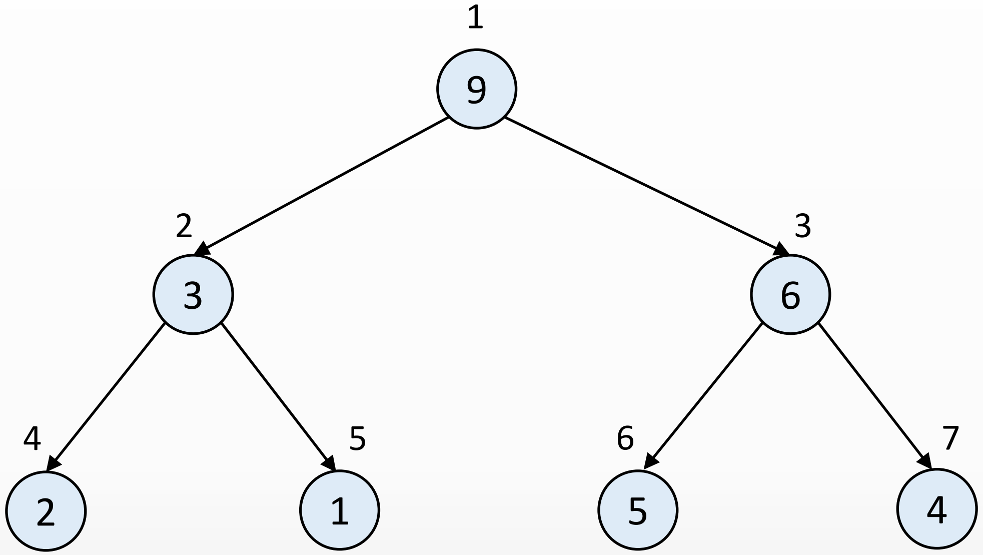
- Max heap ikili ağacının her bir düğümünün değeri, çocuklarının değerlerinden büyüktür.
- Heap ağacından bir öğe çıkarıldıktan sonra bu özellik bozulabilir.
- Bu nedenle öğelerin yerlerinin değiştirilmesi gerekir.
- Ağaç yukarıdan aşağıya doğru taranarak yeniden heap ağacına dönüştürme işlemi (batır - sink) uygulanır (top-down heapify).

silMax()



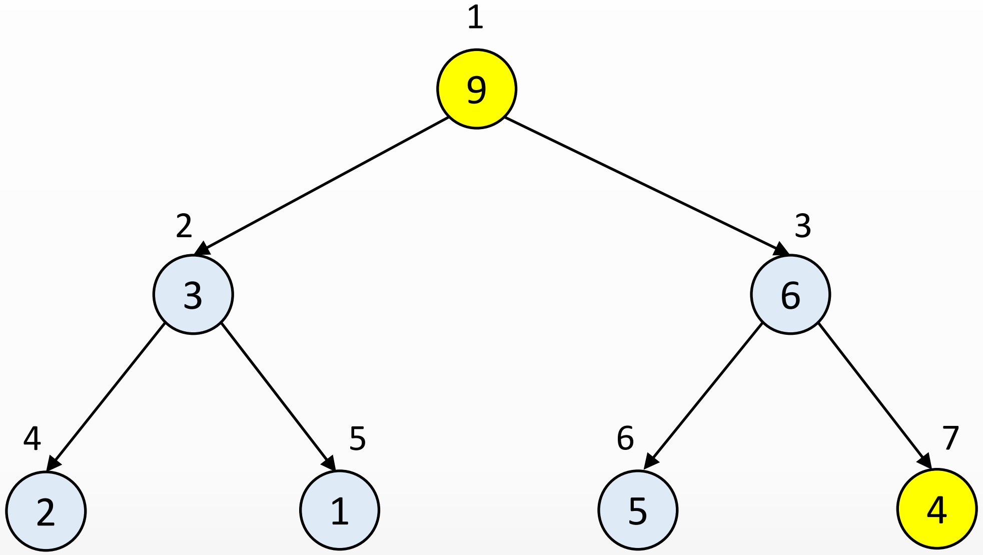
silMax()

max = 9

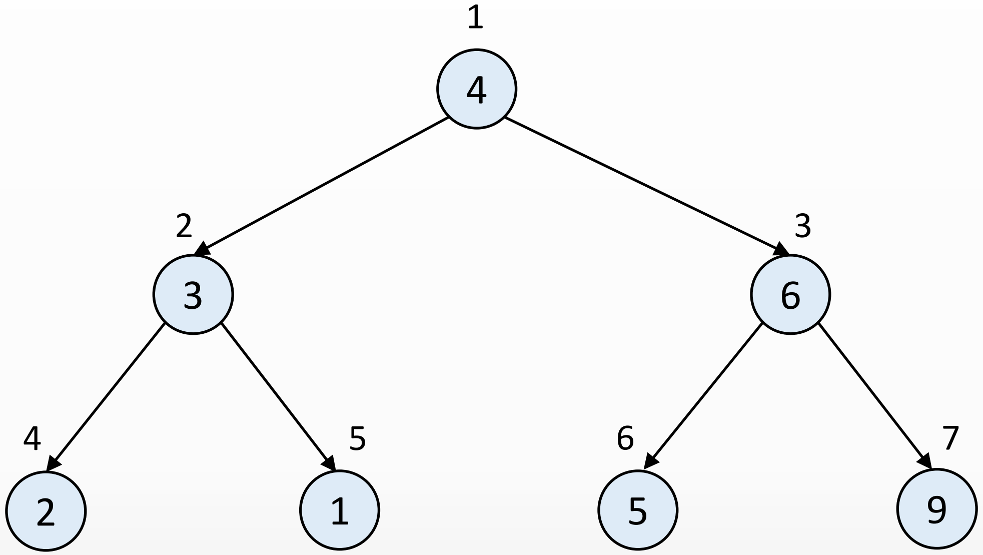


silMax()

max = 9



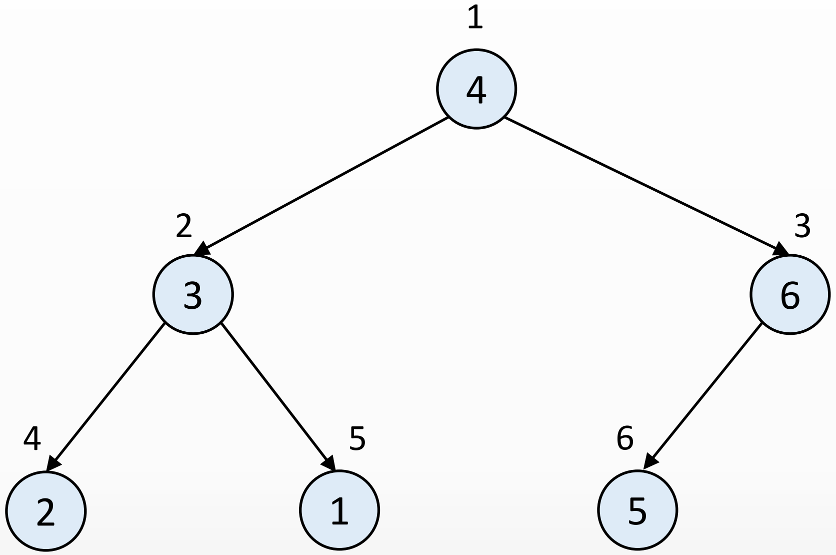
silMax()



max = 9

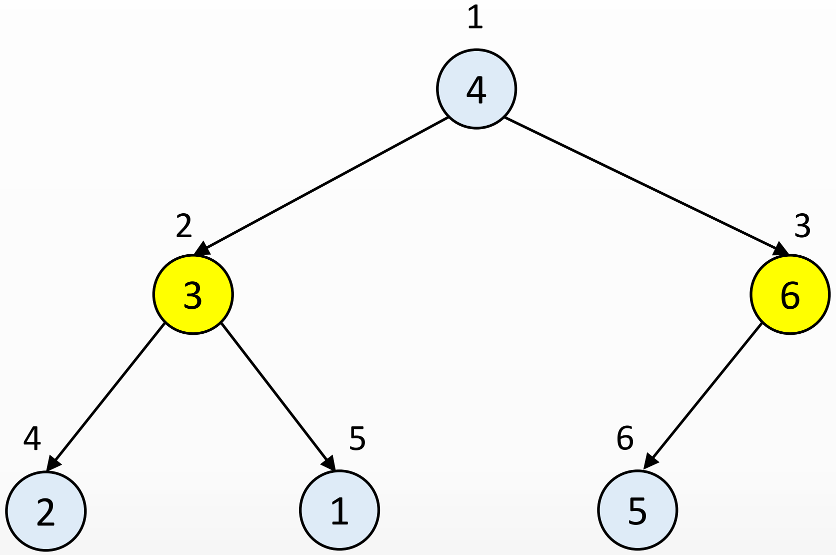
silMax()

max = 9



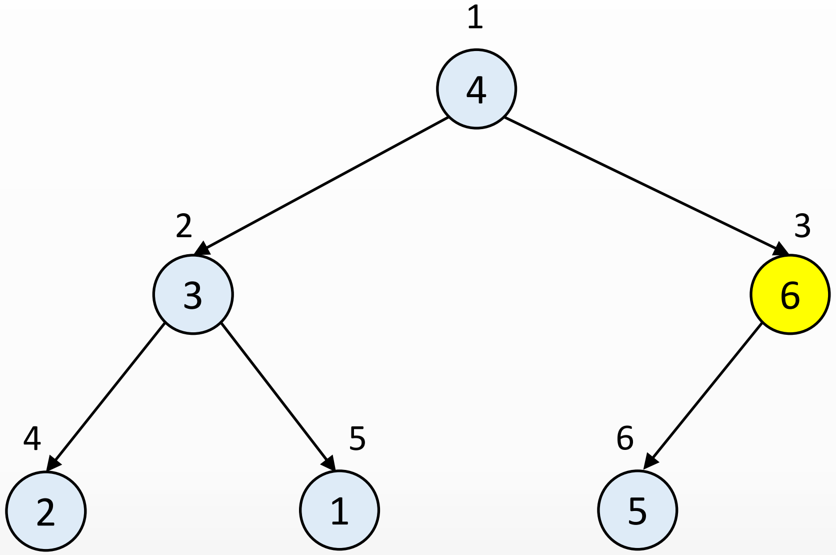
silMax()

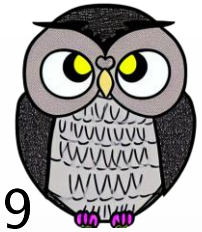
max = 9



silMax()

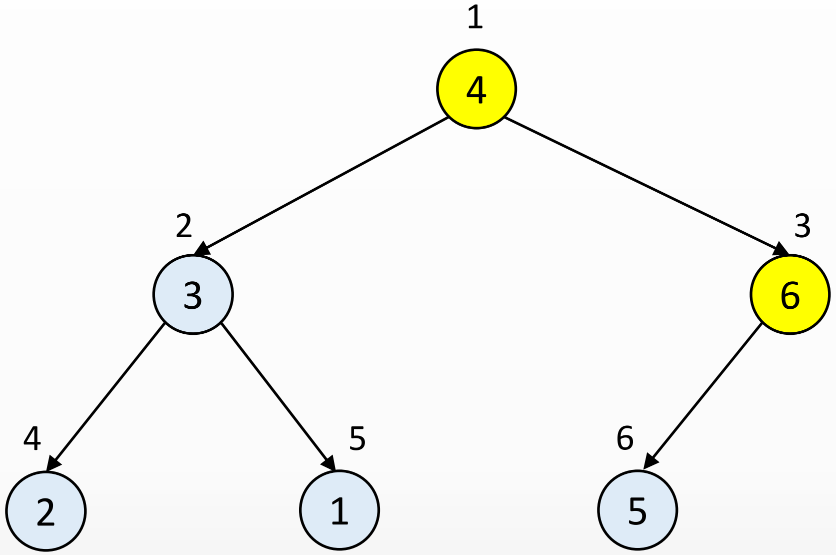
max = 9

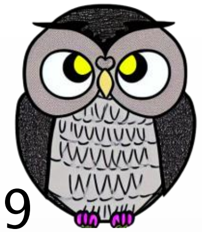




silMax()

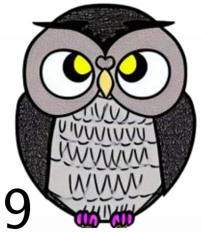
max = 9

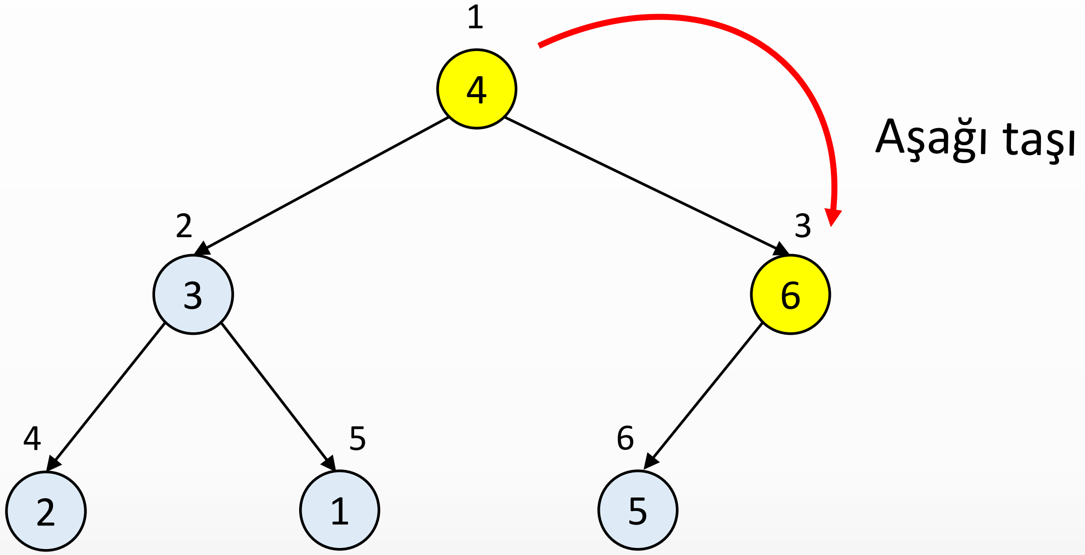




silMax()

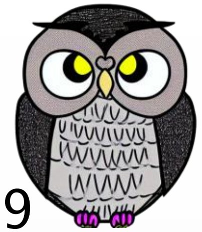
max = 9

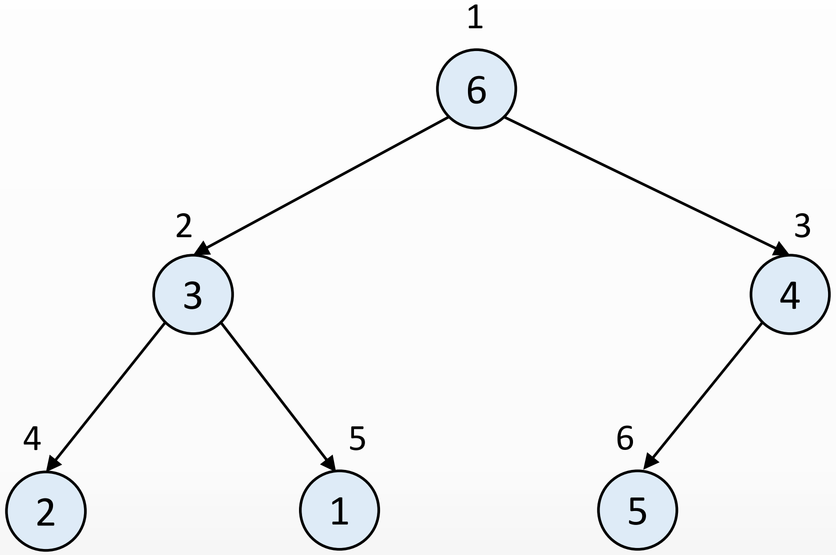




silMax()

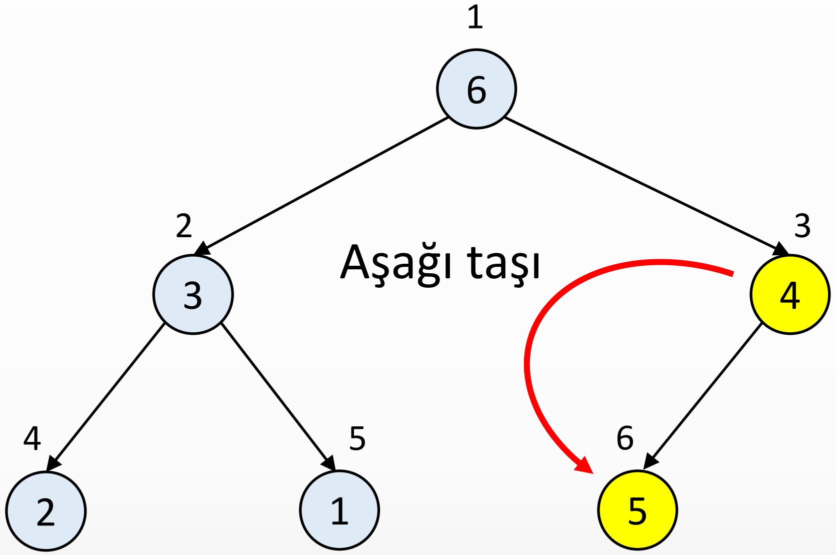
max = 9





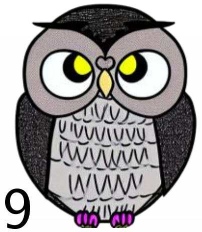
silMax()

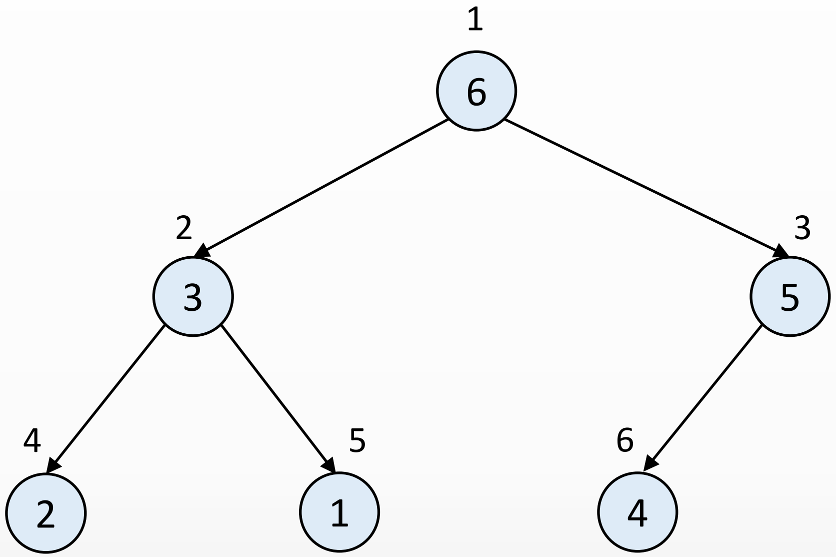
max = 9



silMax()

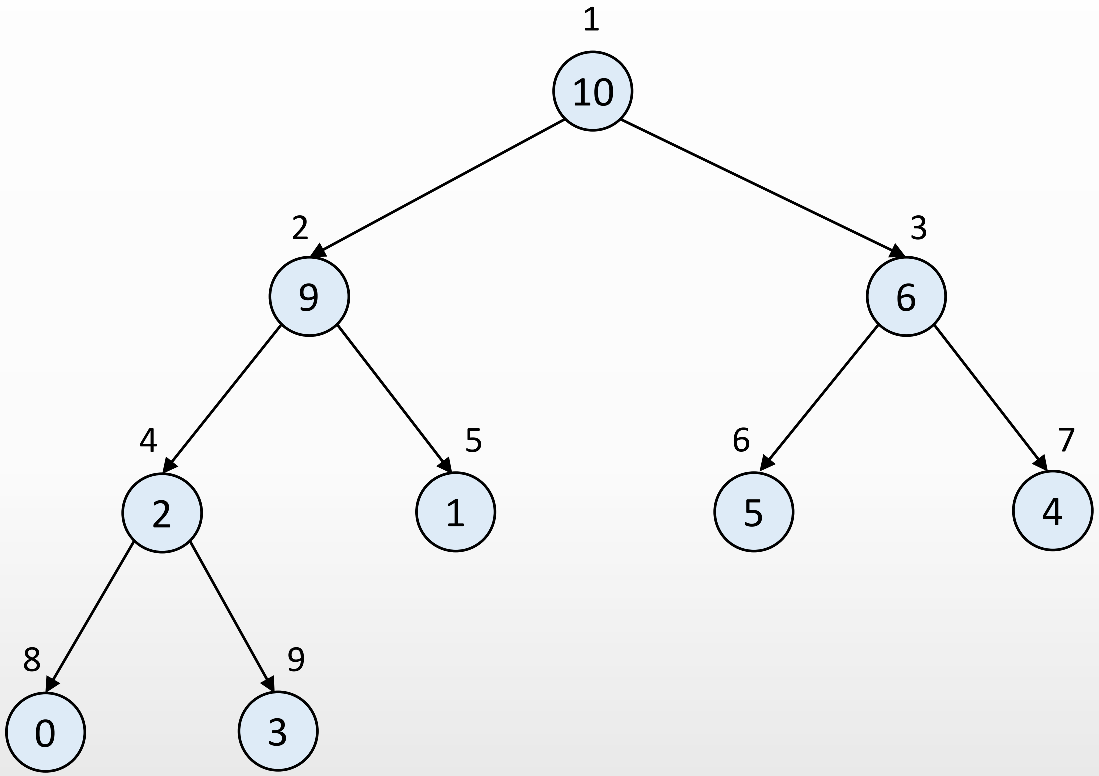
max = 9



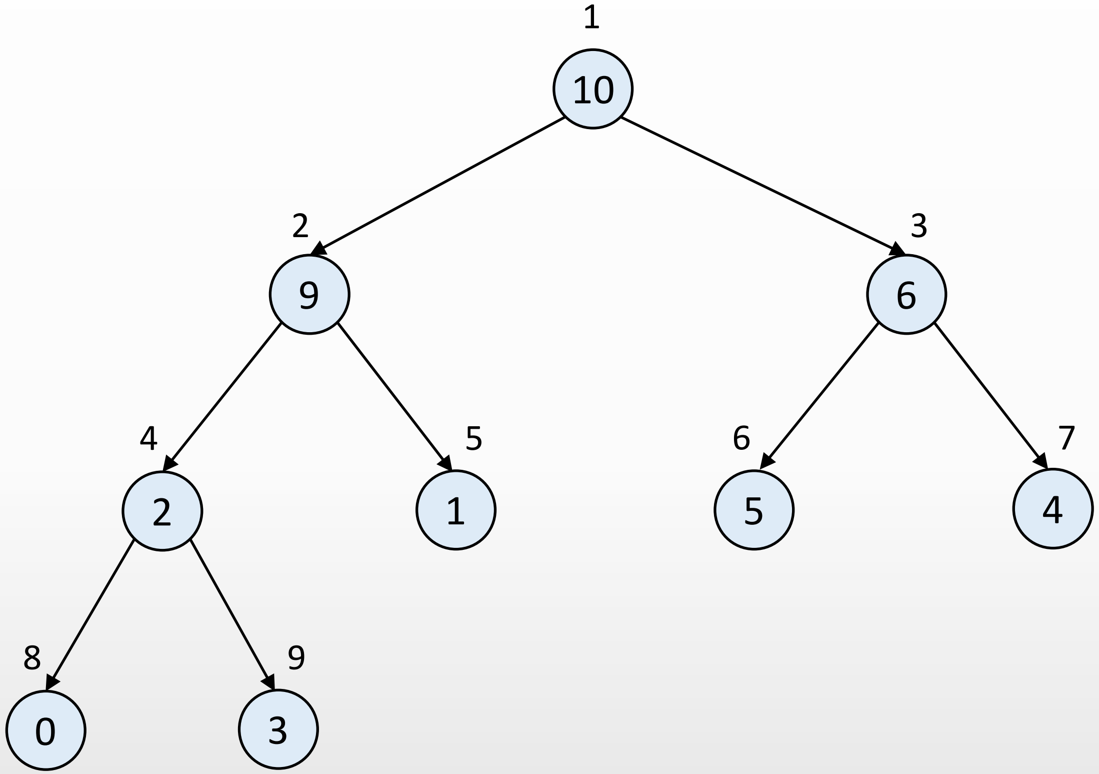


Yukarıdan Aşağıya Heap Ağacına Dönüştürme

Sercan KÜLCÜ, Tüm hakları saklıdır.

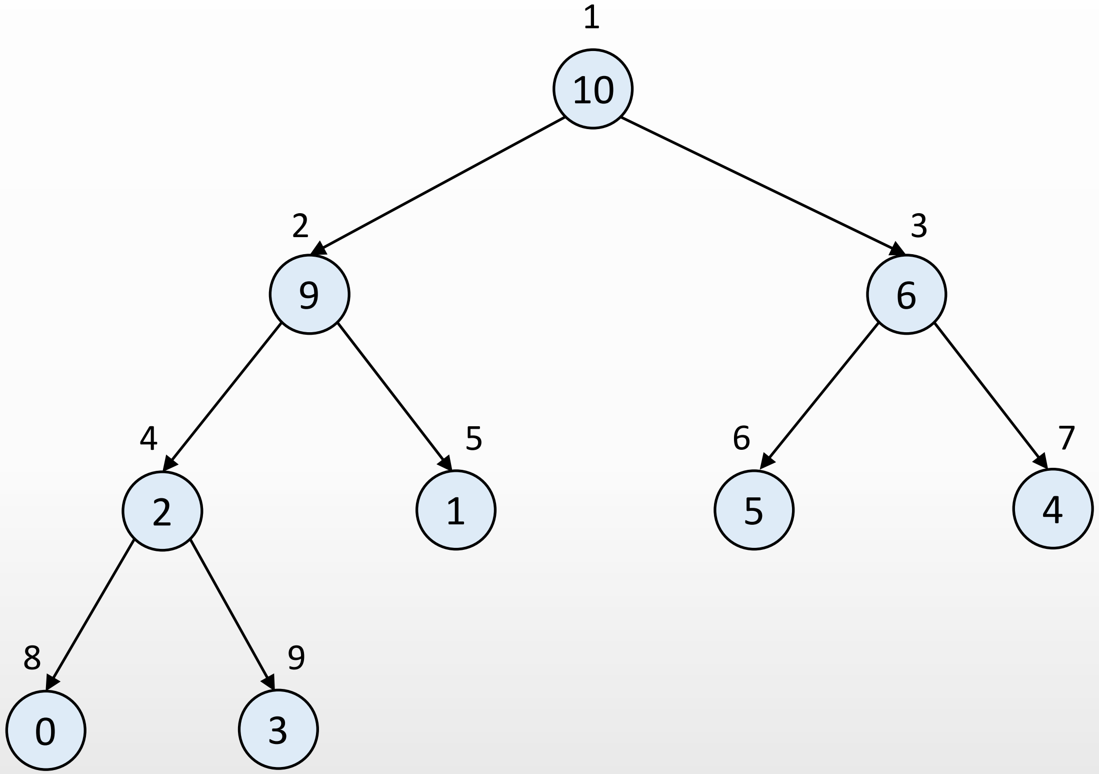

1
10
2
9
3
6
4
2
5
1
6
5
7
4
8
0
9
3

silMax()



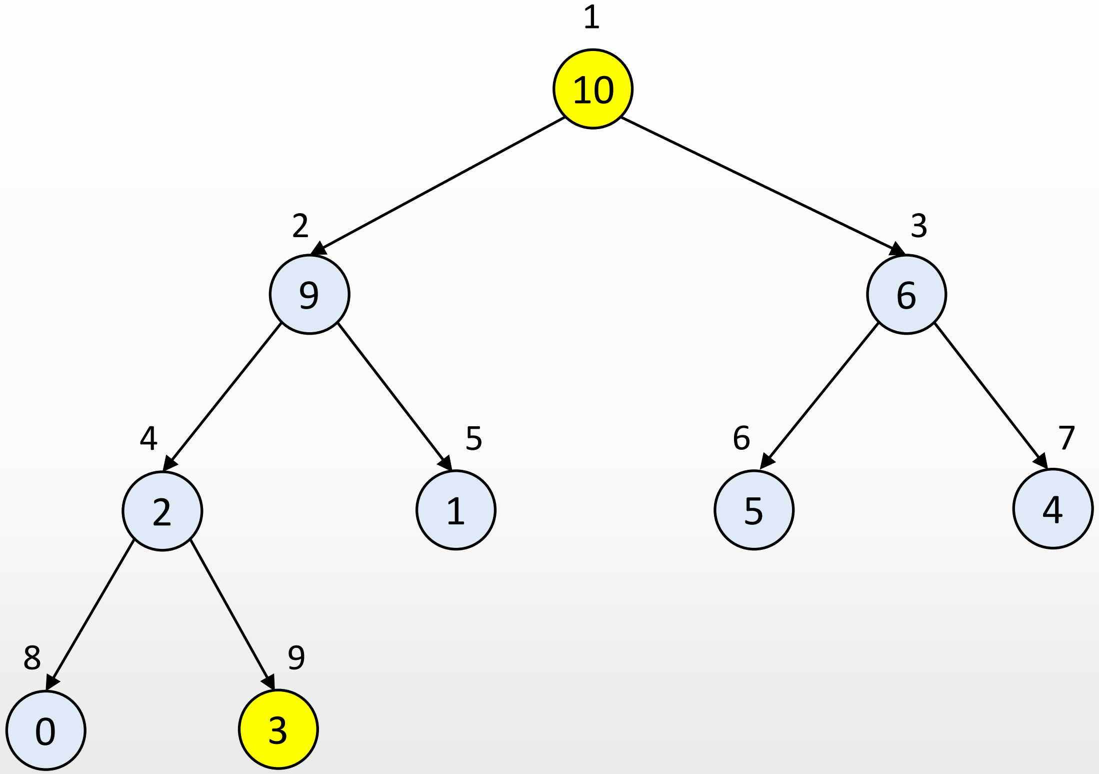
silMax()

max = 10



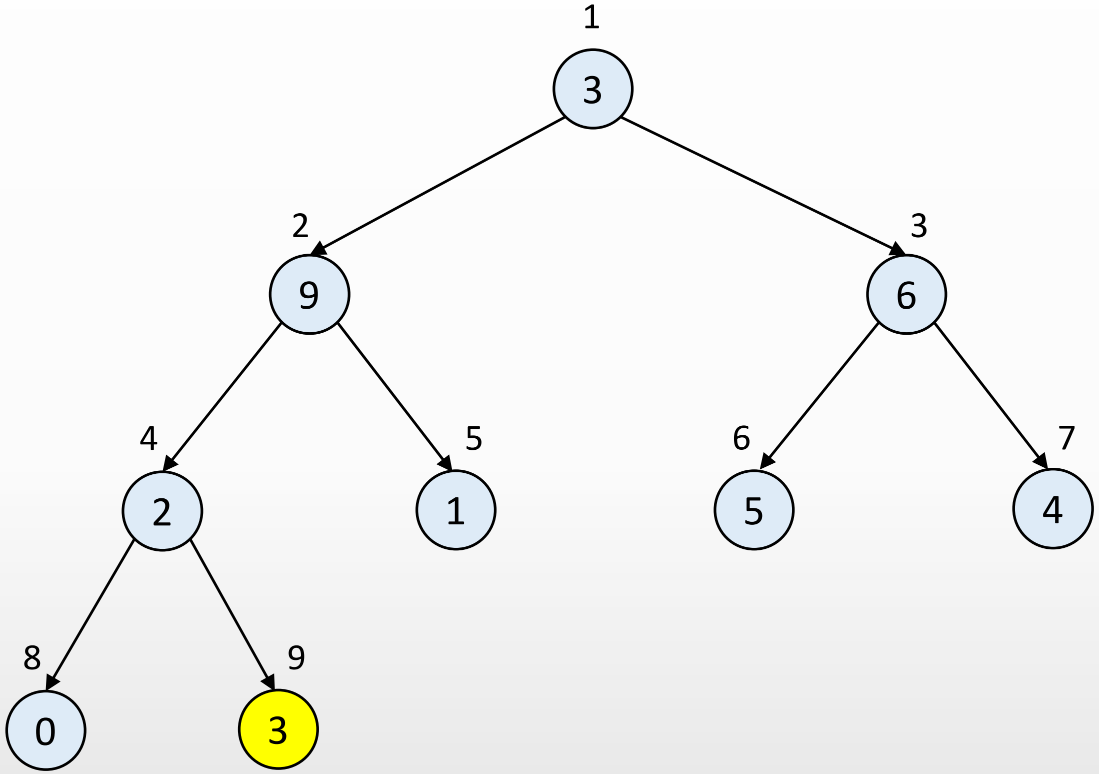
silMax()

max = 10



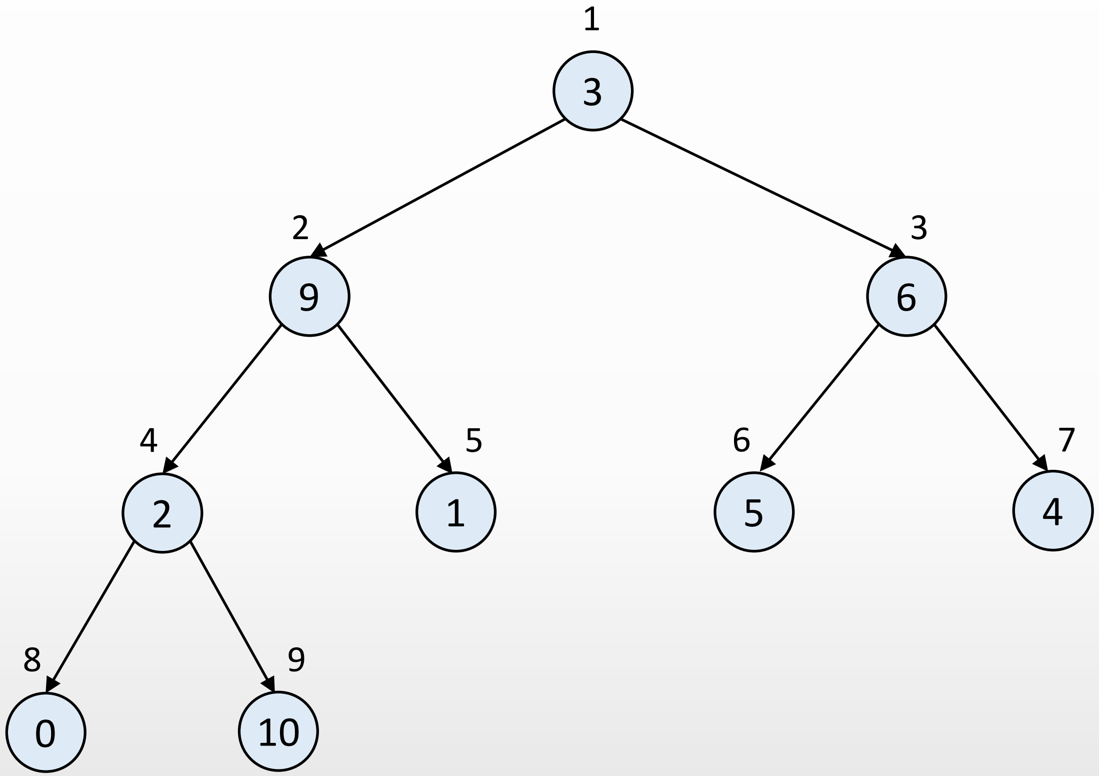
silMax()

max = 10



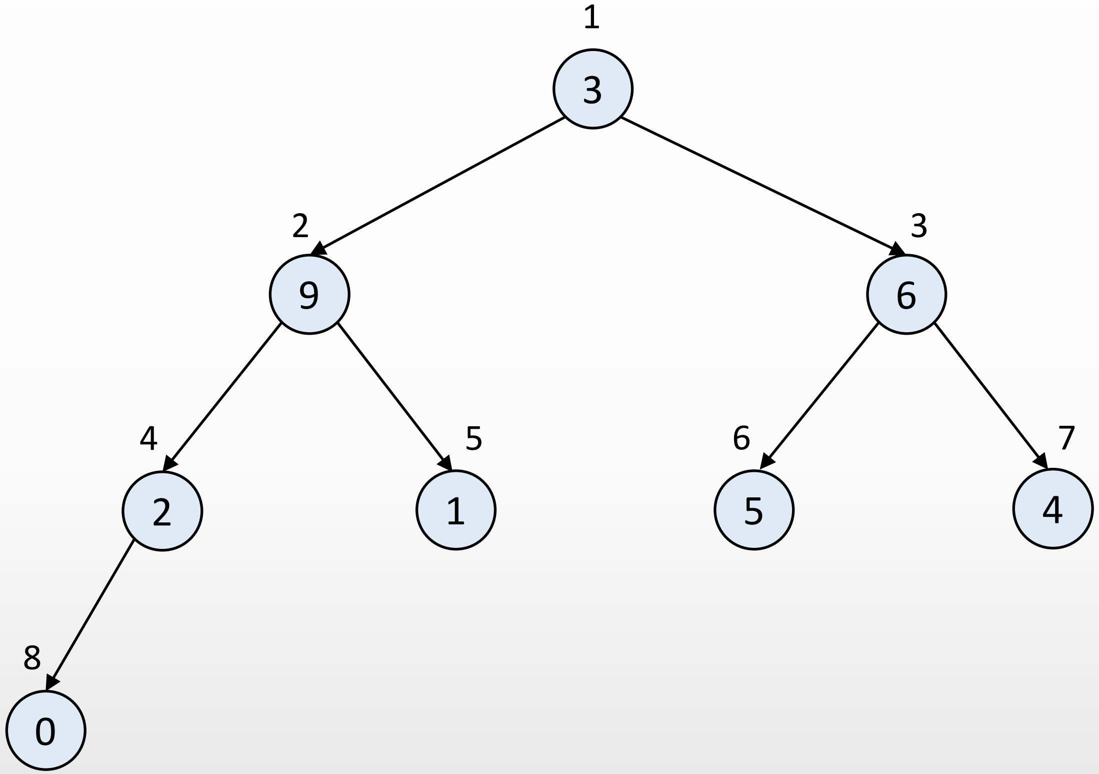
silMax()

max = 10



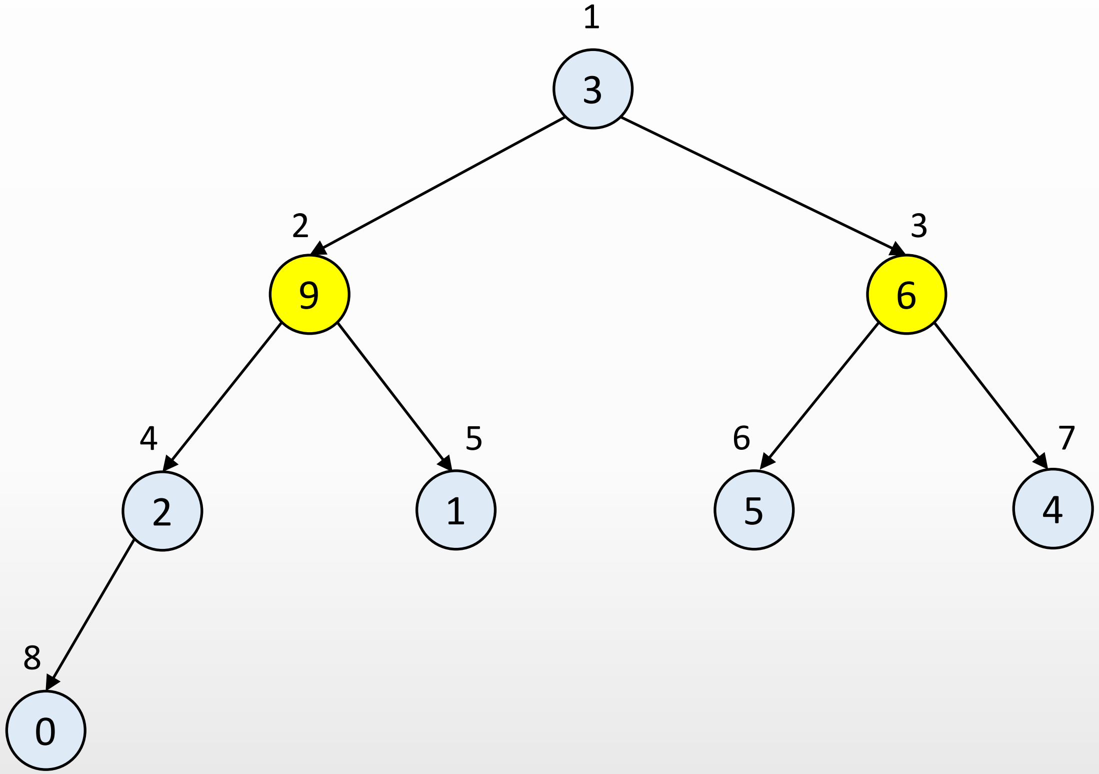
silMax()

max = 10



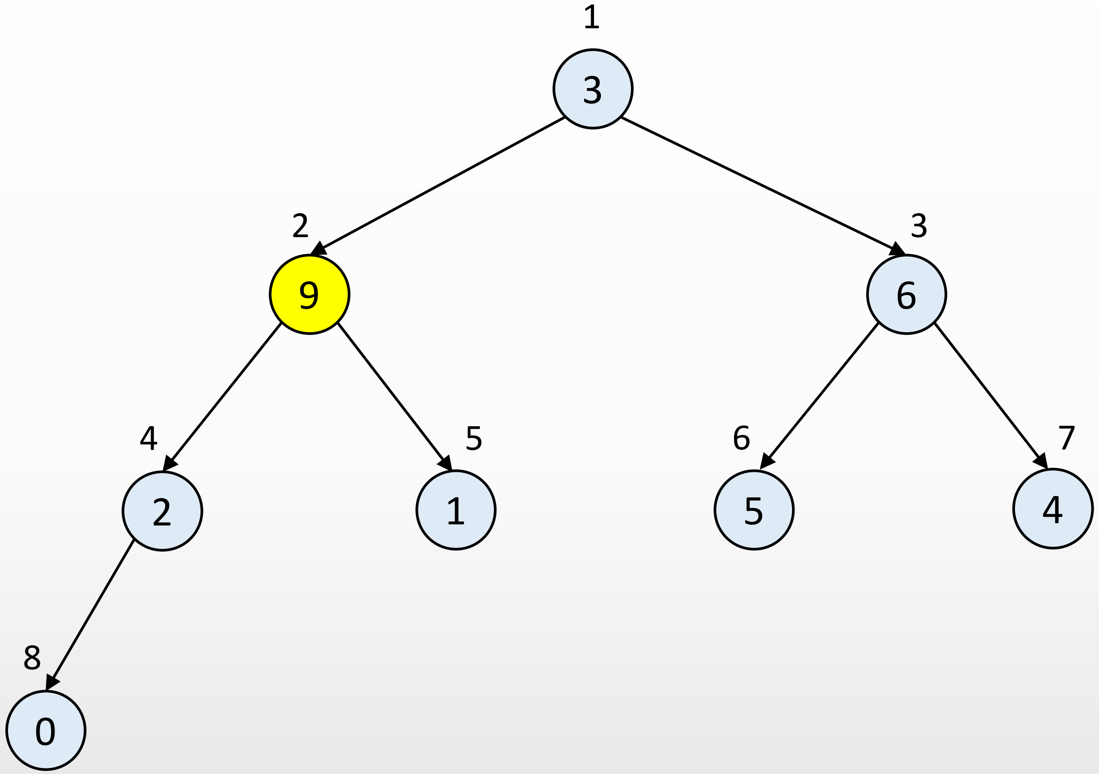
silMax()

max = 10



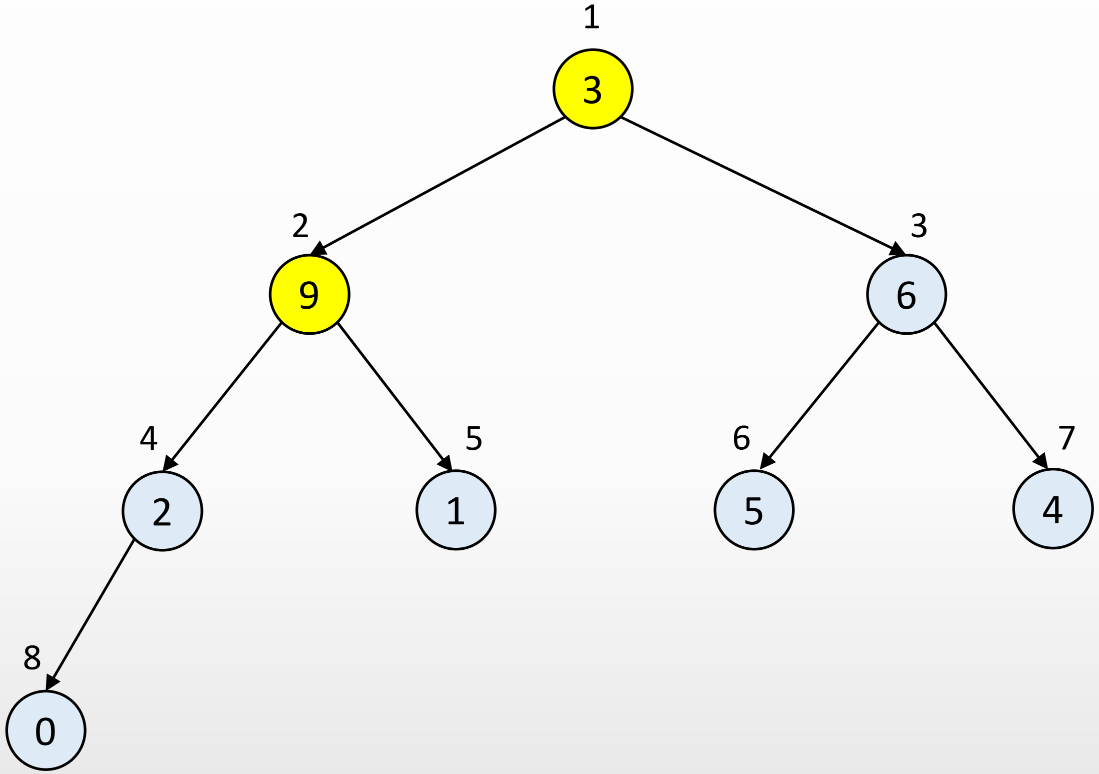
silMax()

max = 10



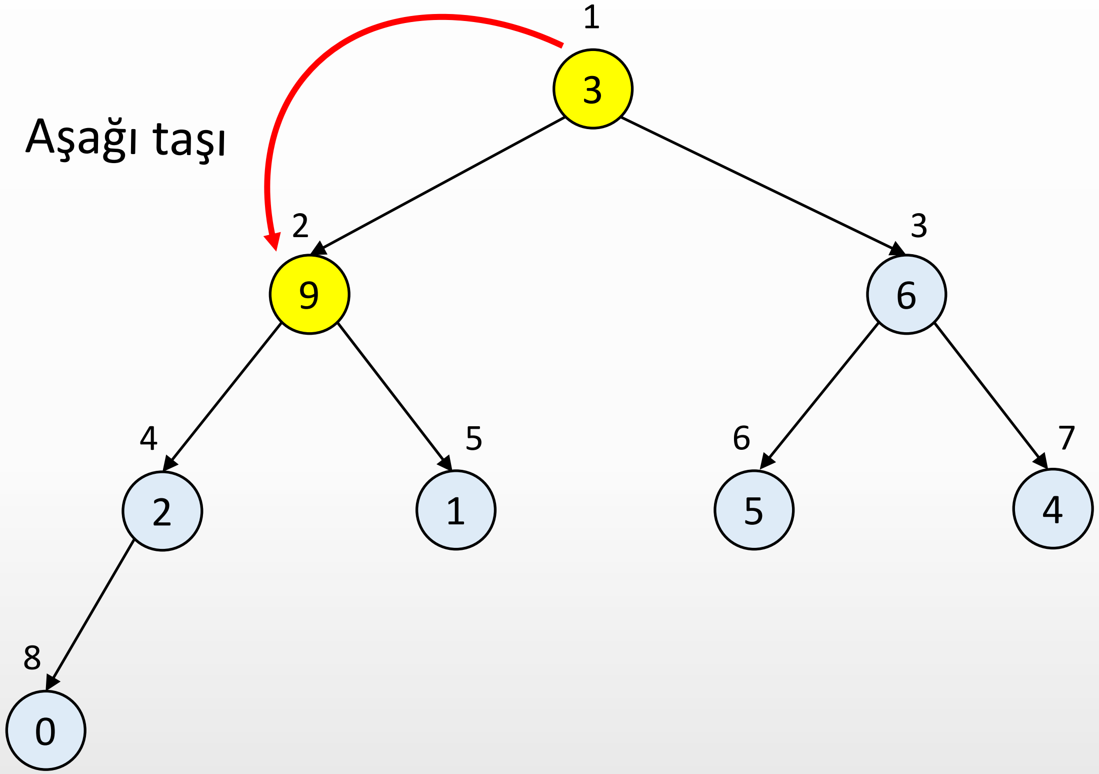
silMax()

max = 10



`silMax()`

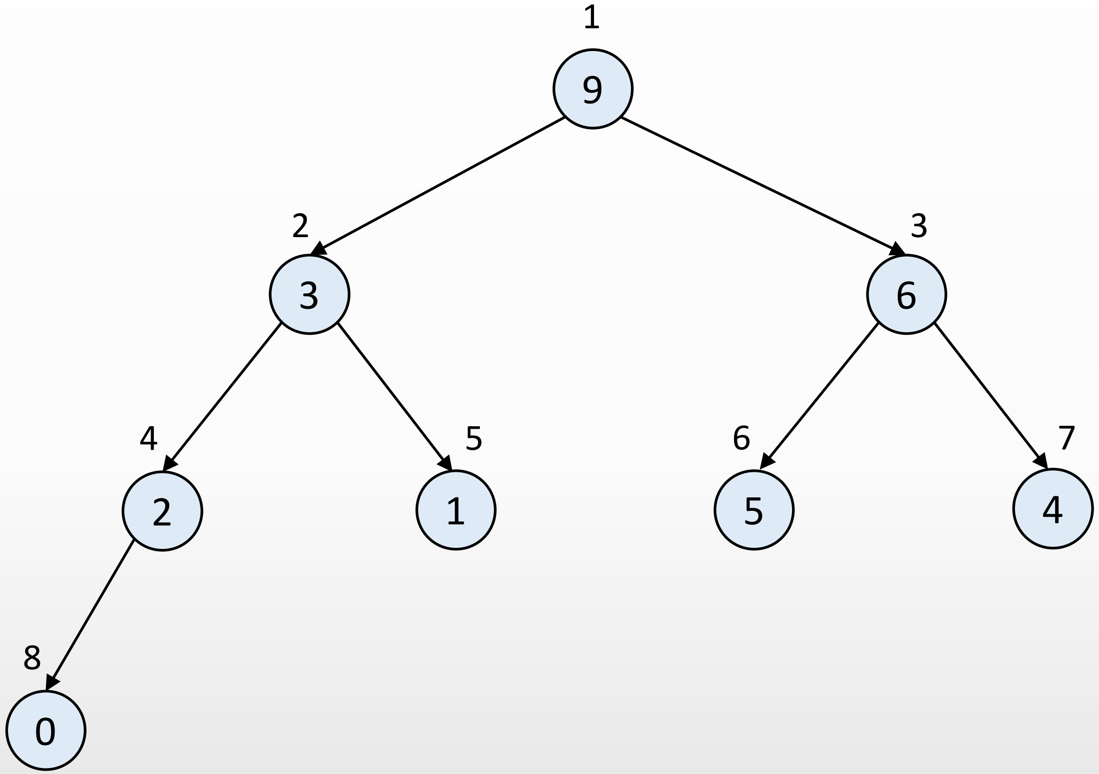
`max = 10`



Aşağı taşı

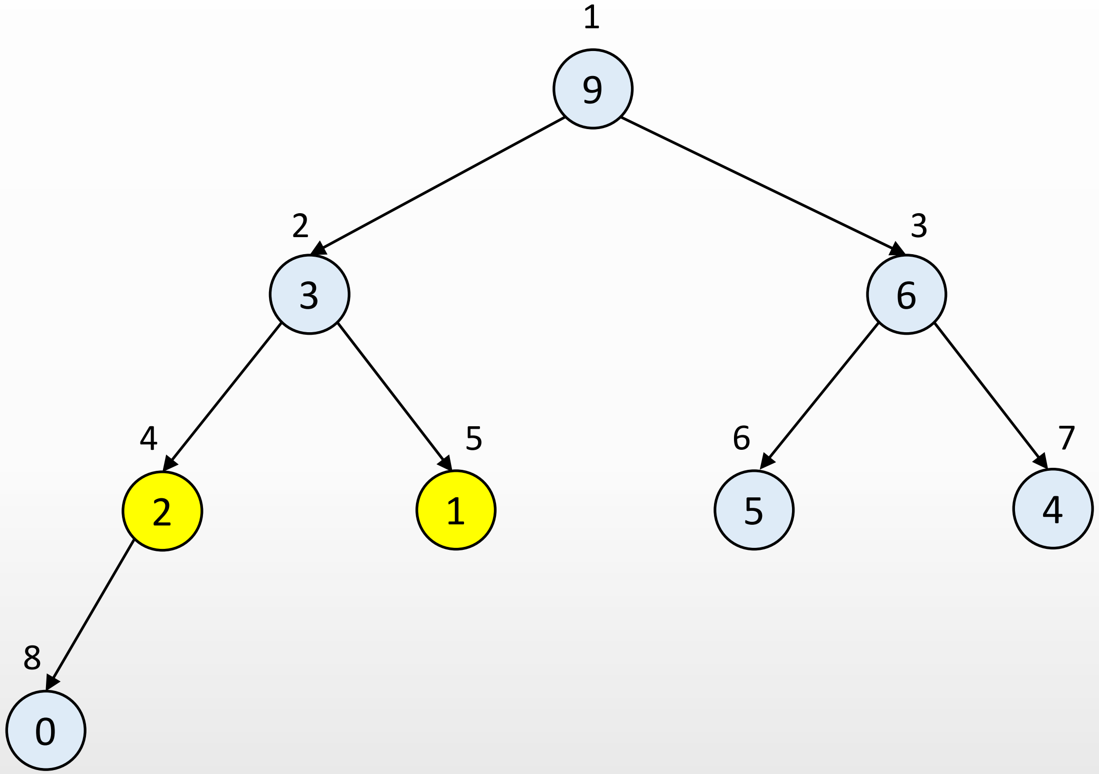
silMax()

max = 10



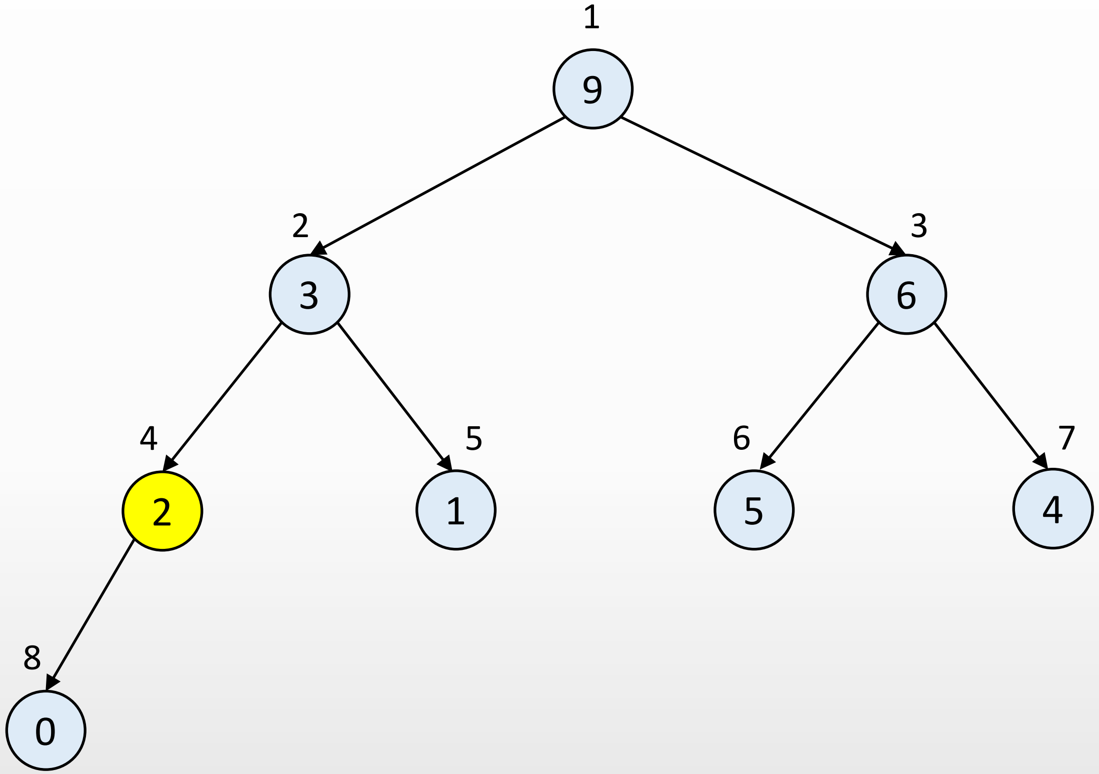
silMax()

max = 10



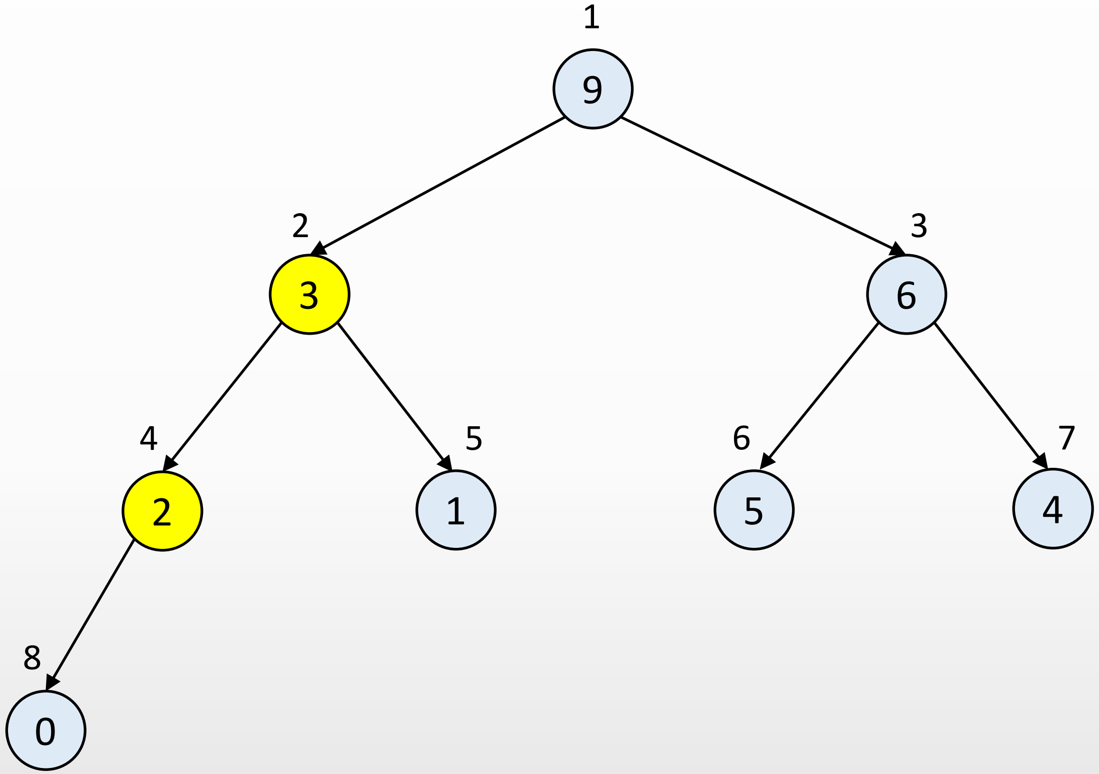
silMax()

max = 10



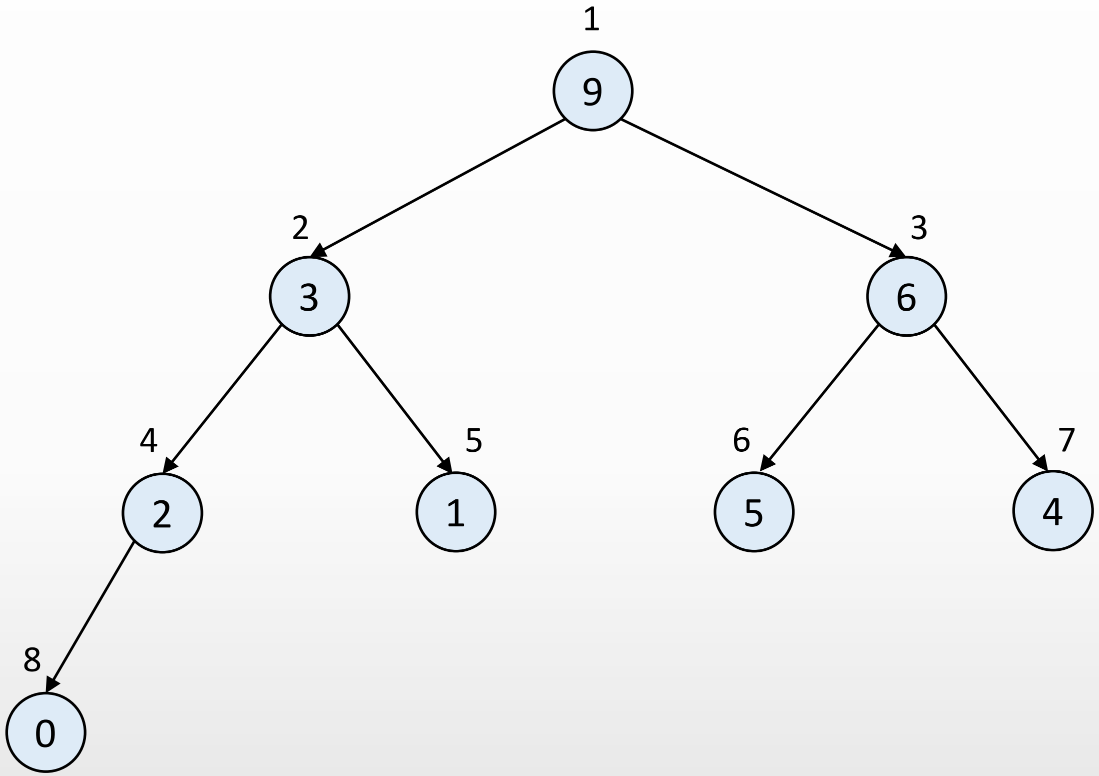
silMax()

max = 10



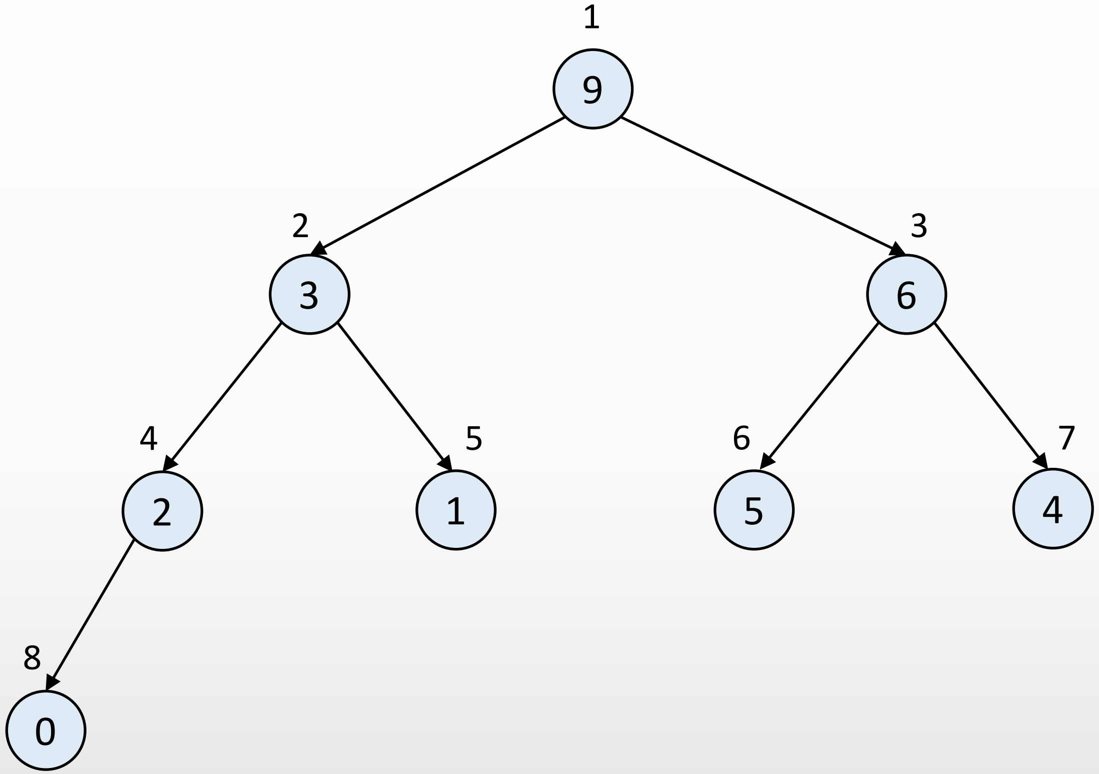
silMax()

max = 10



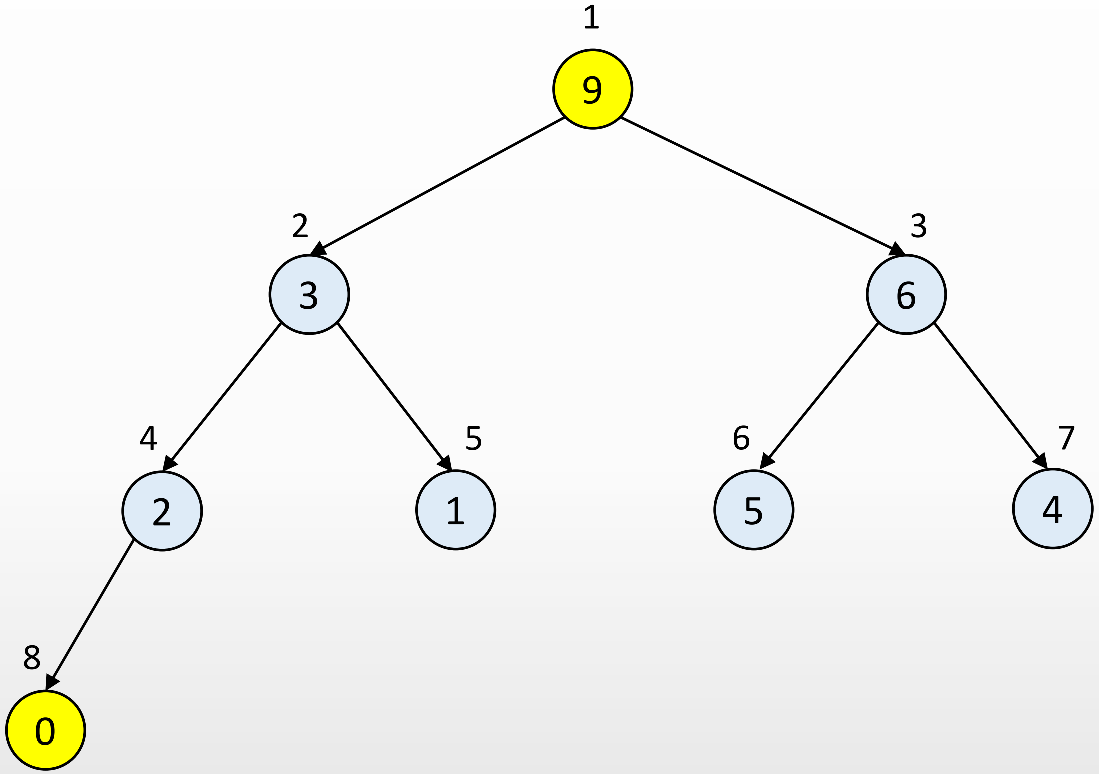
silMax()

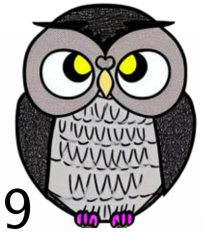
max = 9



silMax()

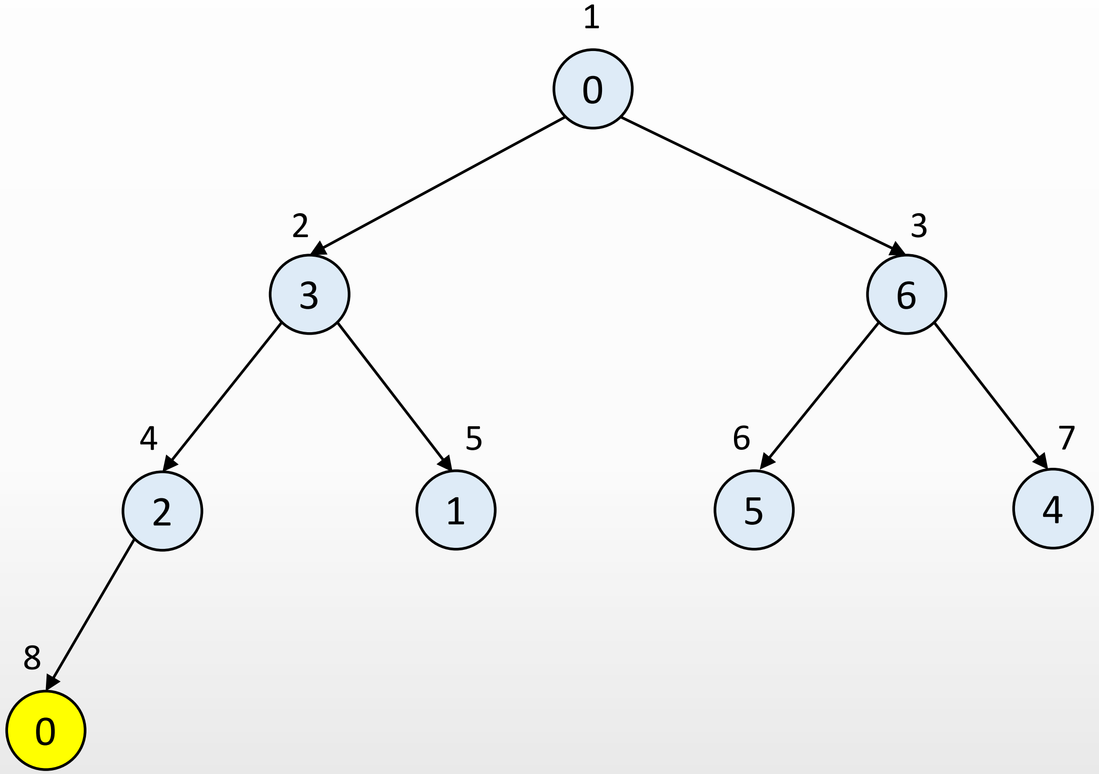
max = 9

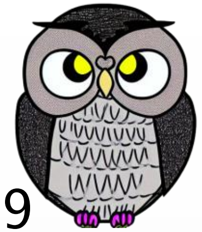




silMax()

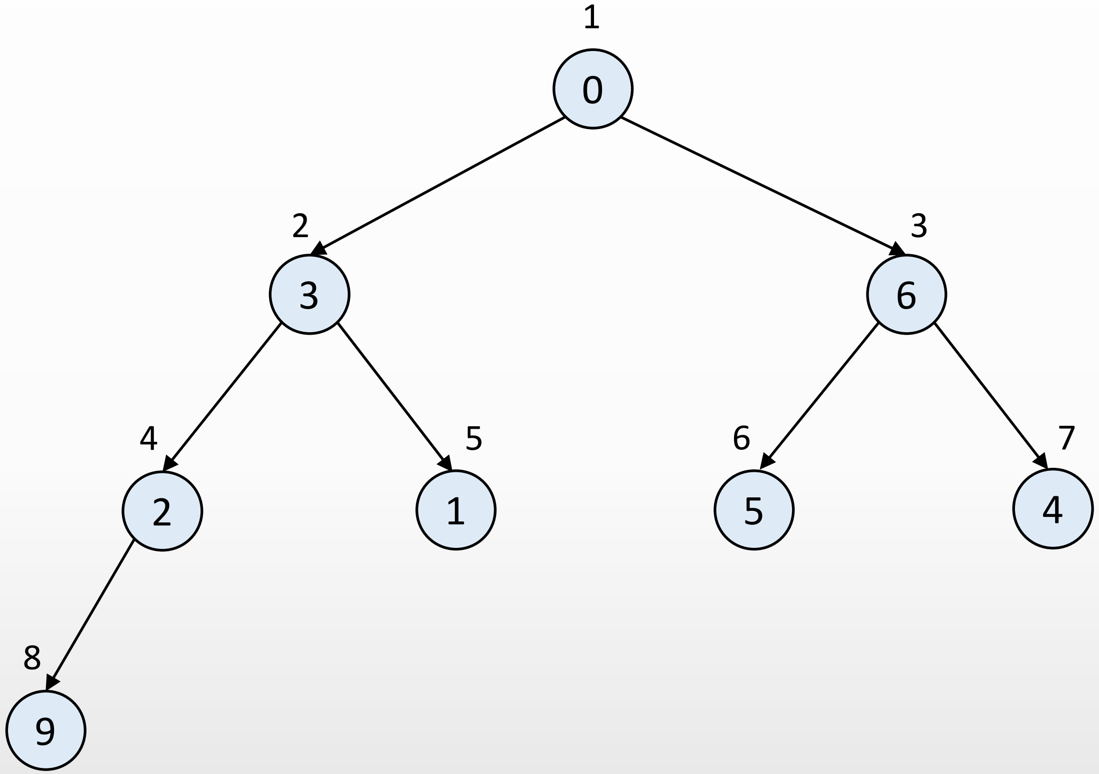
max = 9





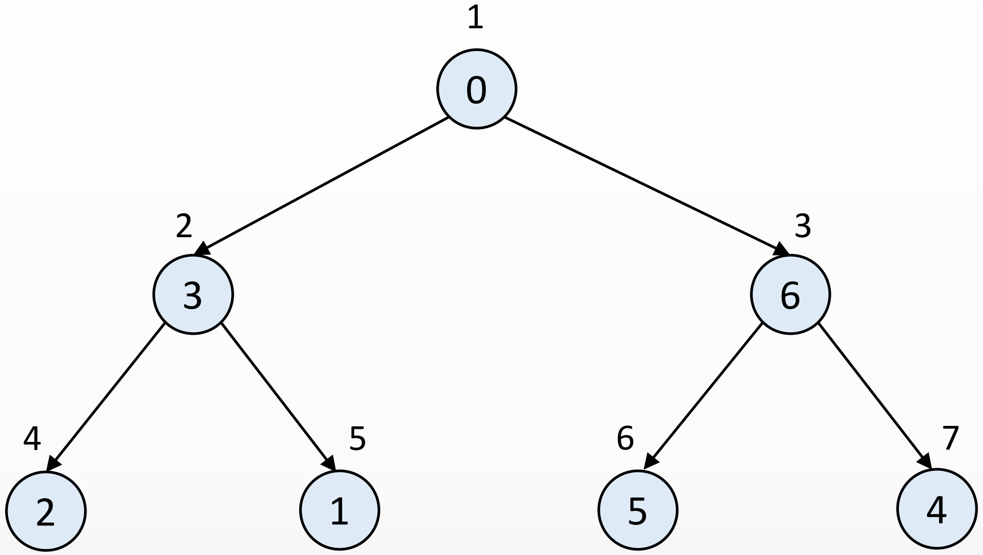
silMax()

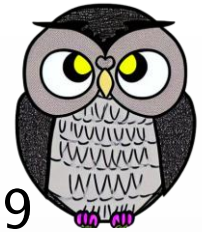
max = 9



silMax()

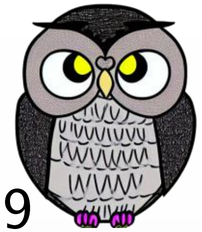
max = 9

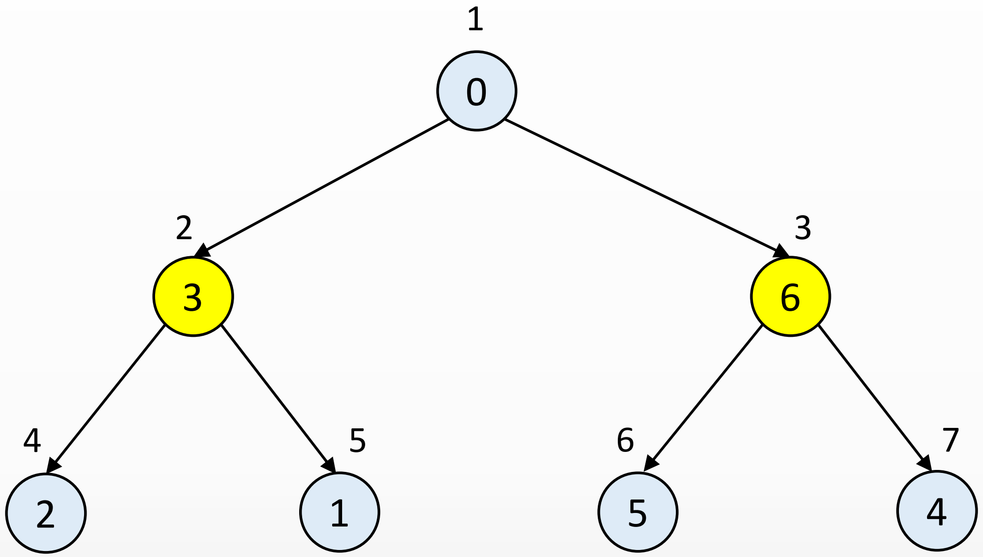




silMax()

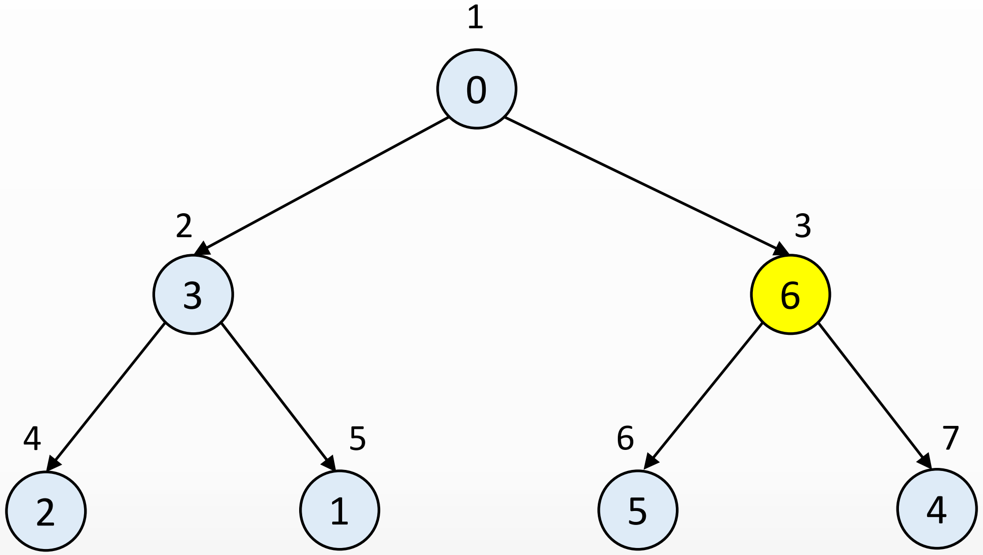
max = 9

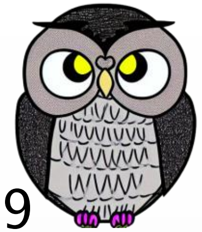




silMax()

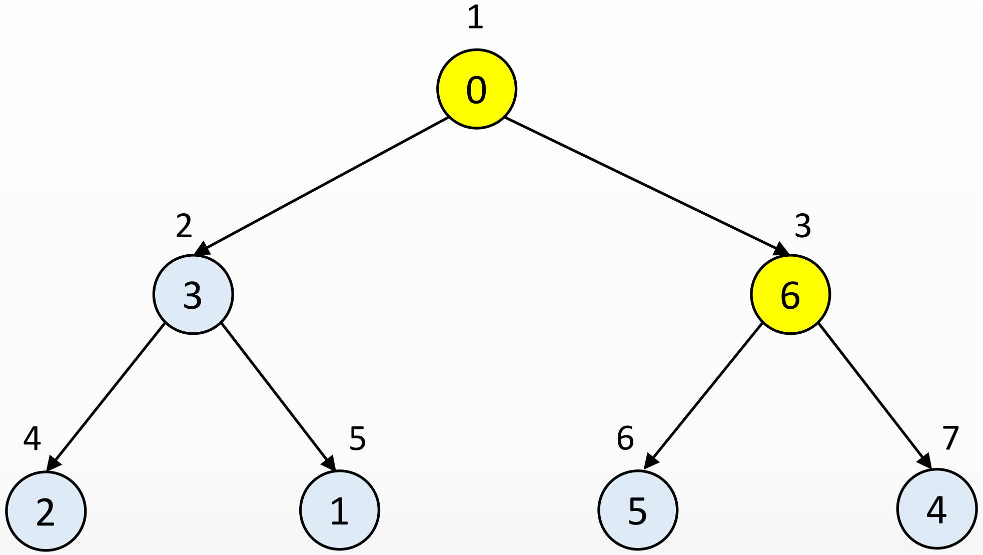
max = 9





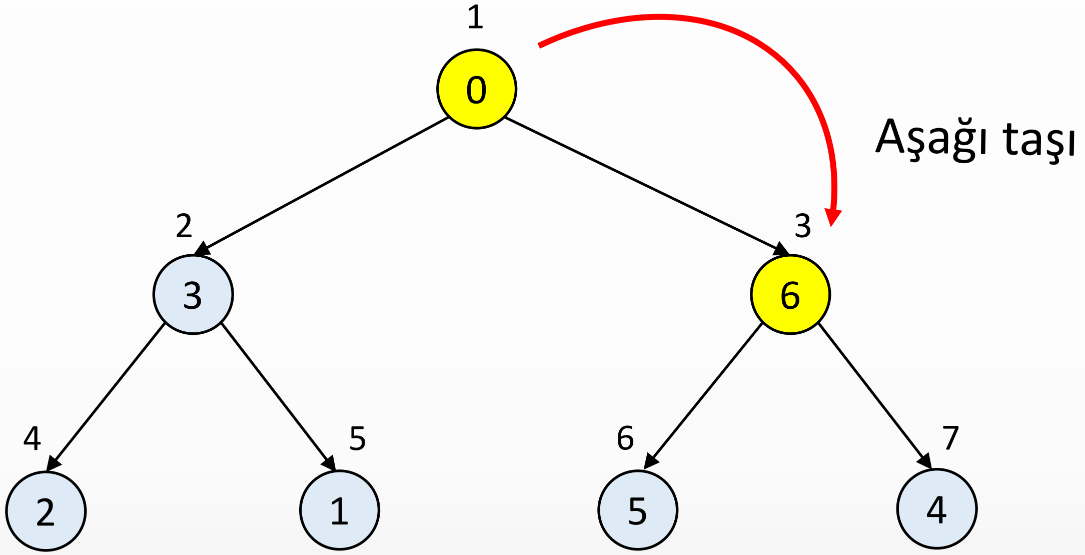
silMax()

max = 9



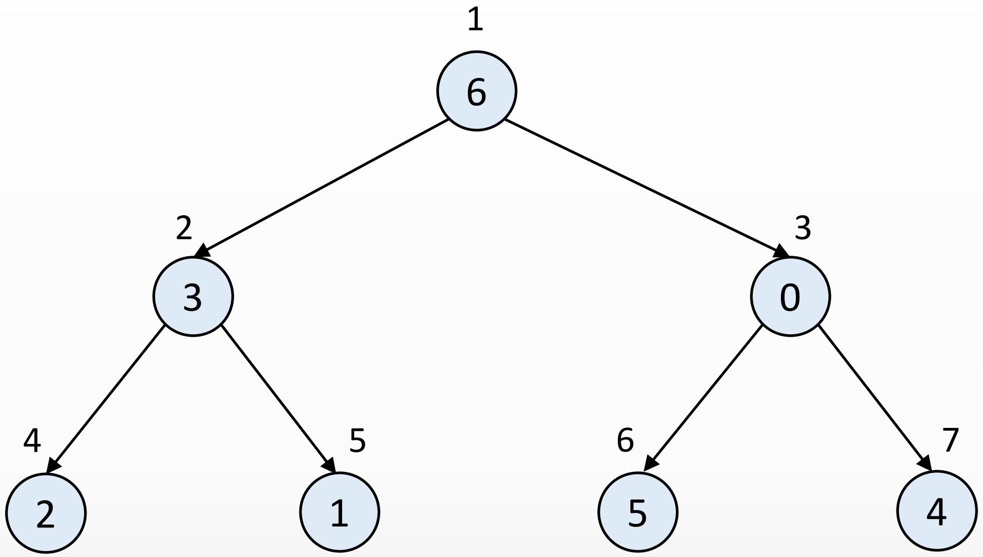
silMax()

max = 9



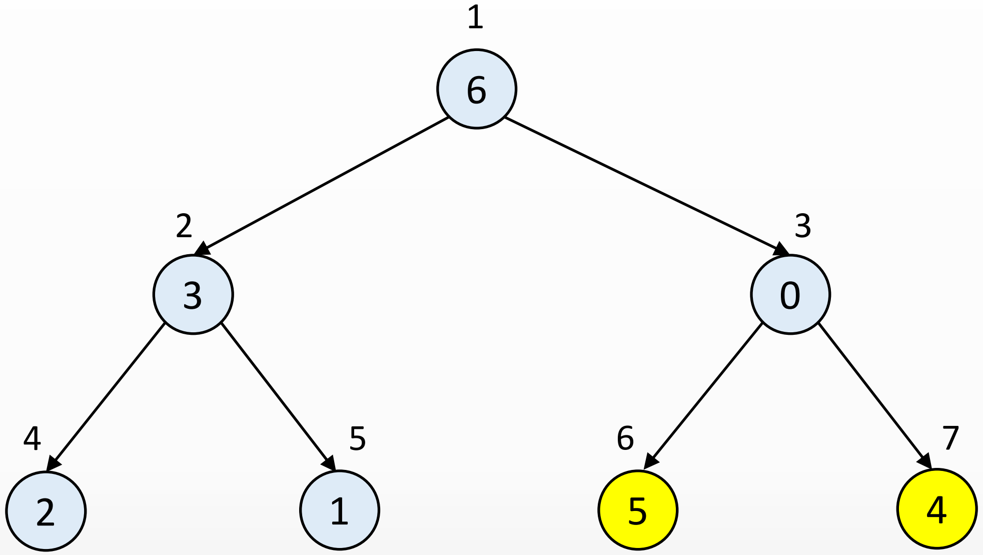
silMax()

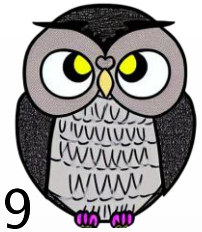
max = 9



silMax()

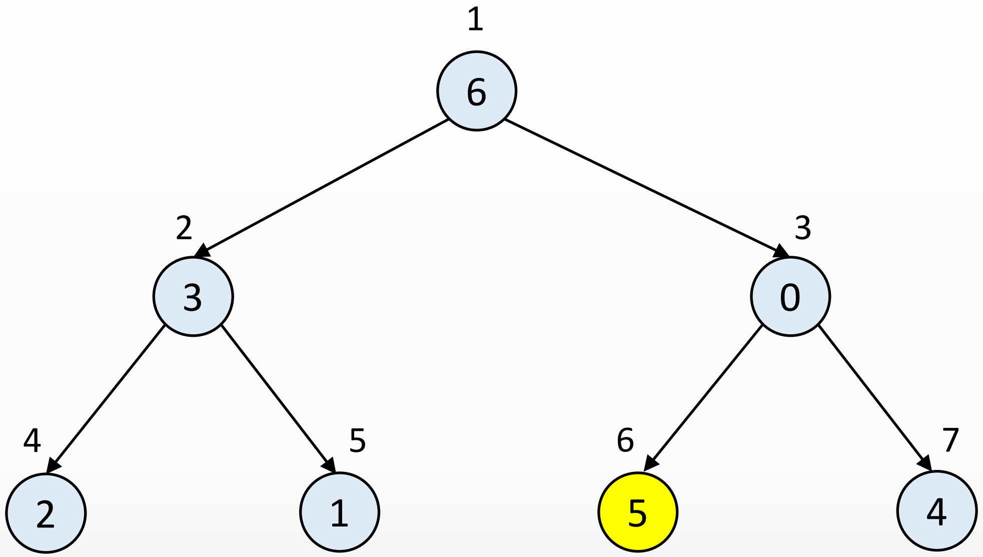
max = 9





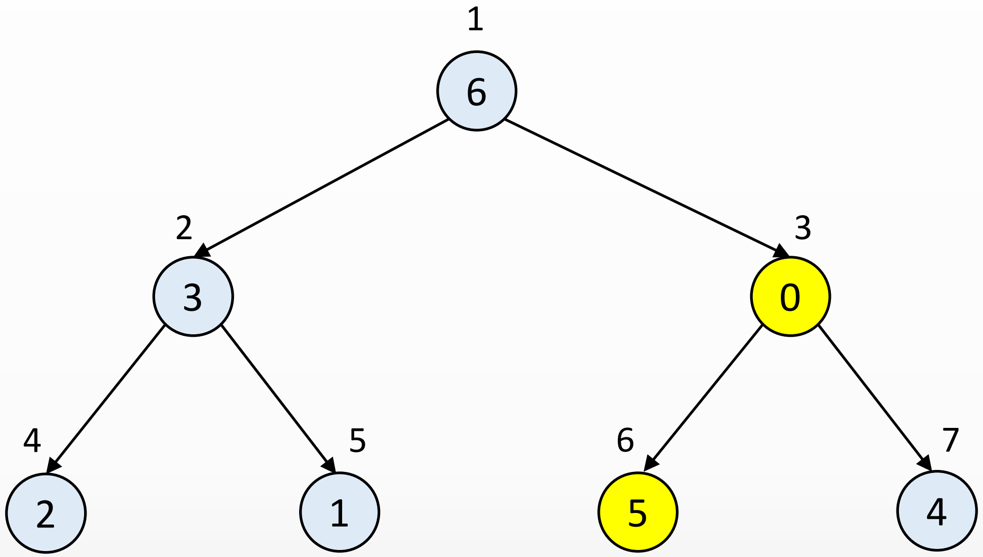
silMax()

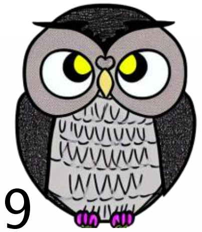
max = 9



silMax()

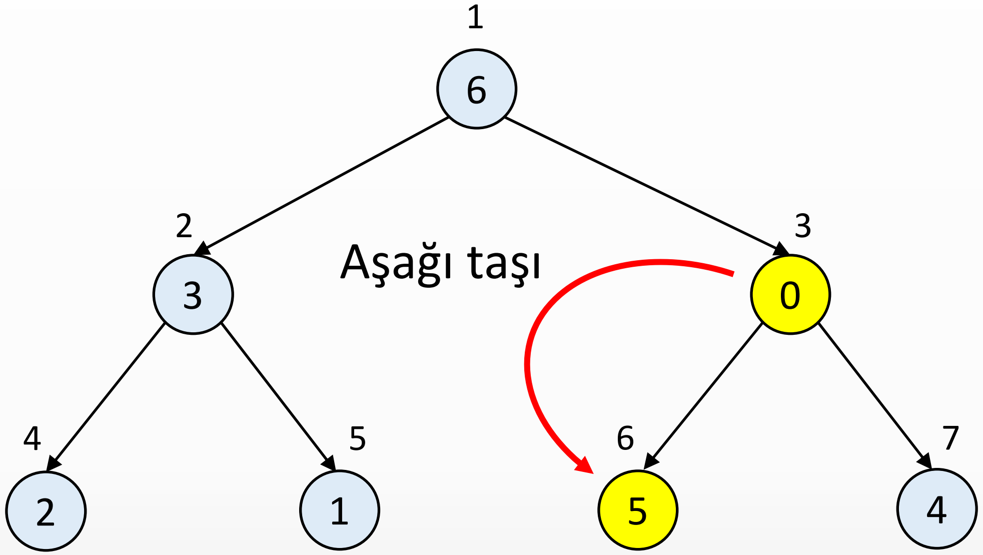
max = 9





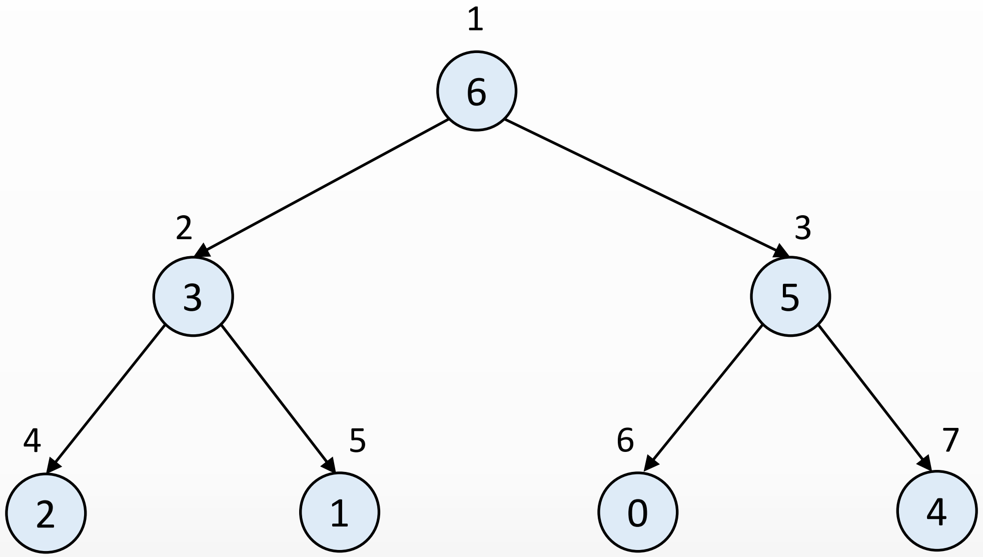
silMax()

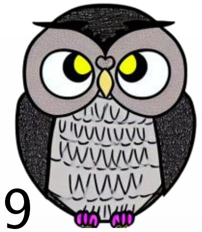
max = 9



silMax()

max = 9



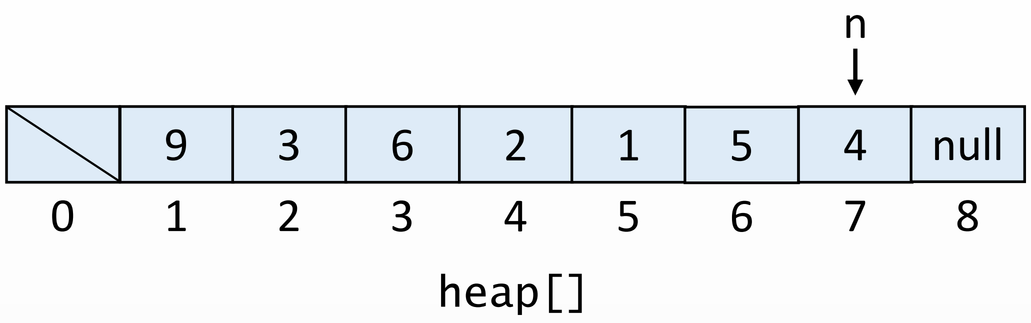


Max Heap Ağacında En Büyük Elemanı Silme

	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

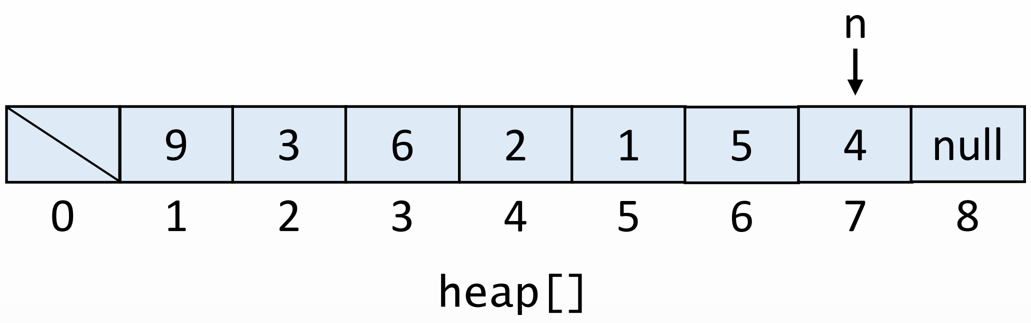


								n
	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

n = 7

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



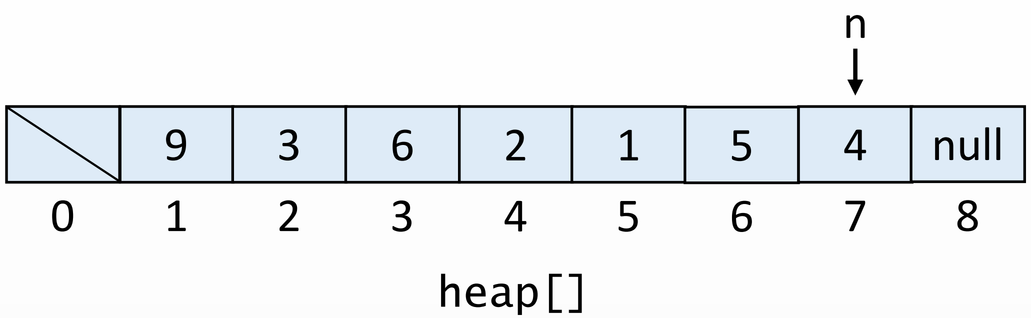
	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

n = 7

silMax()

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



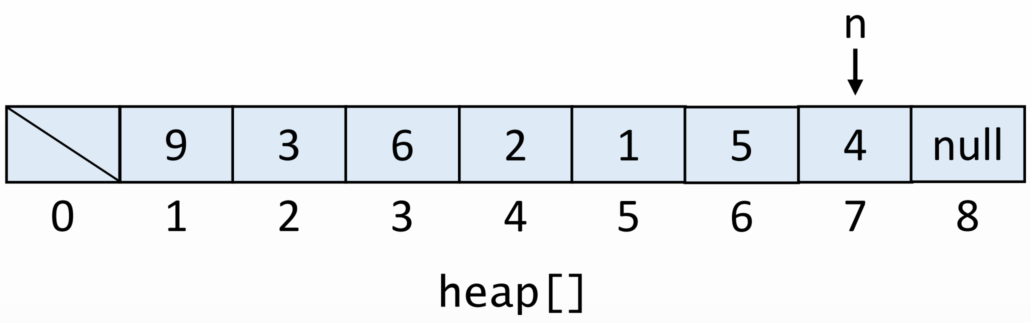
							n	
	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

n = 7

silMax()



	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
max = 9
n = 7
```

```
silMax()
```

n ↓

	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

```
max = 9
n = 7
```

```
silMax()
```

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

							n	
	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

```
max = 9
n = 7
```

```
silMax()
```

```java
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length – 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

n

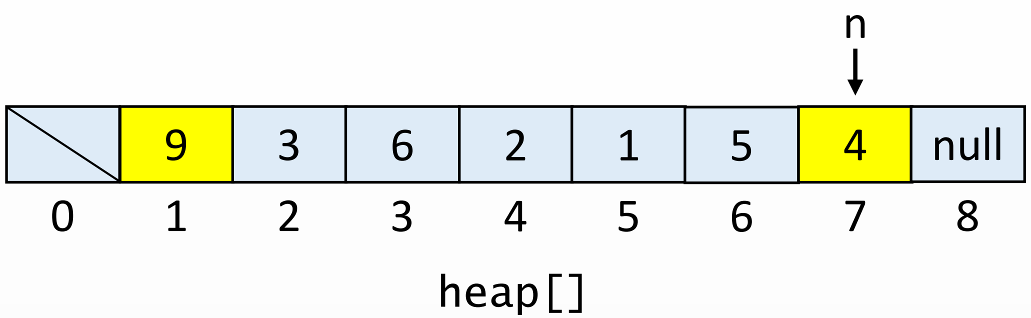
	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

b = 7
a = 1
max = 9
n = 7

silMax()

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



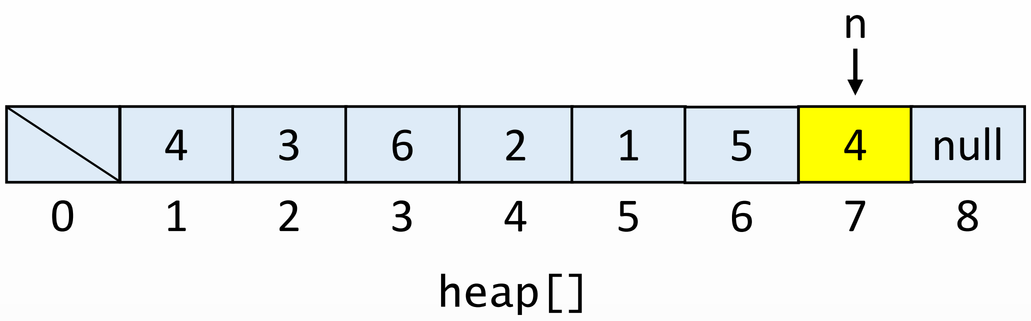
	9	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

gecici = 9
b = 7
a = 1
max = 9
n = 7

silMax()

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



	4	3	6	2	1	5	4	null
0	1	2	3	4	5	6	7	8

heap[]

```
gecici = 9
b = 7
a = 1
max = 9
n = 7
```

```
silMax()
```

```java
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

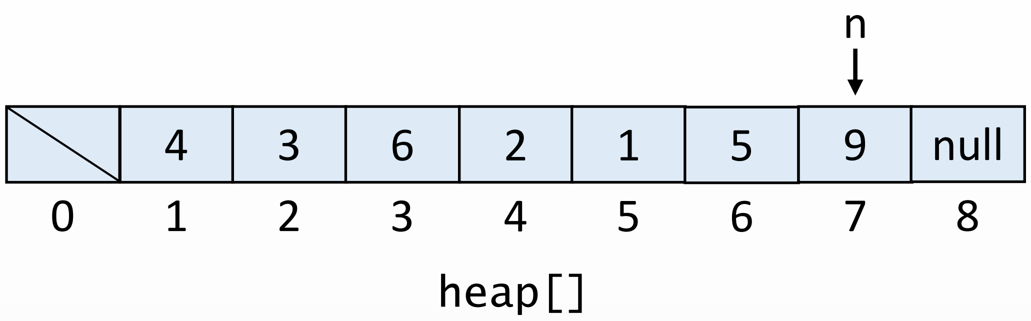
							n ↓	
	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

```
gecici = 9
b = 7
a = 1
max = 9
n = 7
```

silMax()

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
→ heap[b] = gecici;
}
```



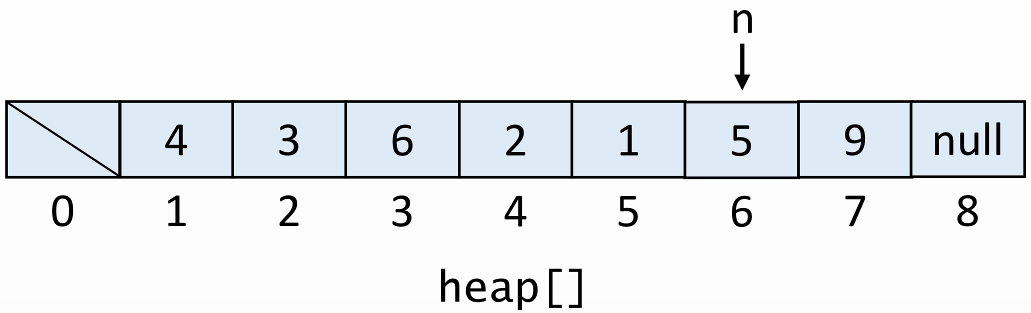
							n ↓	
	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

```
max = 9
n = 7
```

```
silMax()
```

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



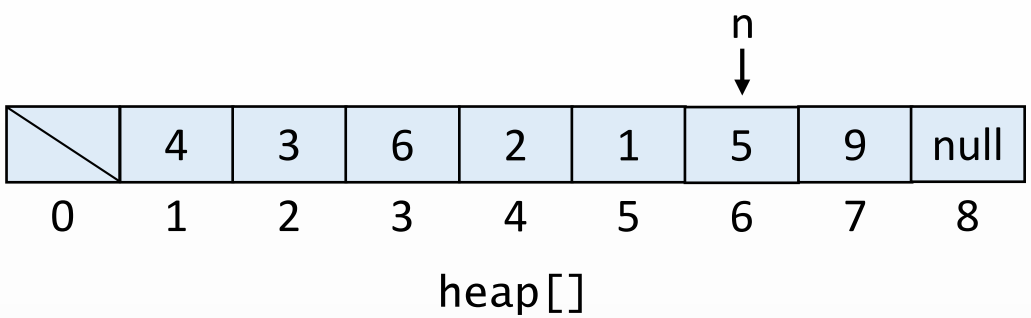
	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
max = 9
n = 6
```

```
silMax()
```



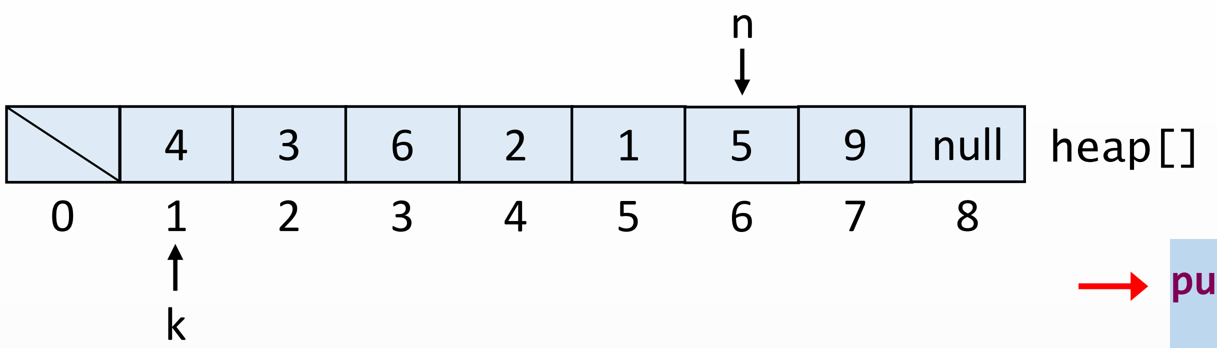
	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

max = 9
n = 6

silMax()



n

	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

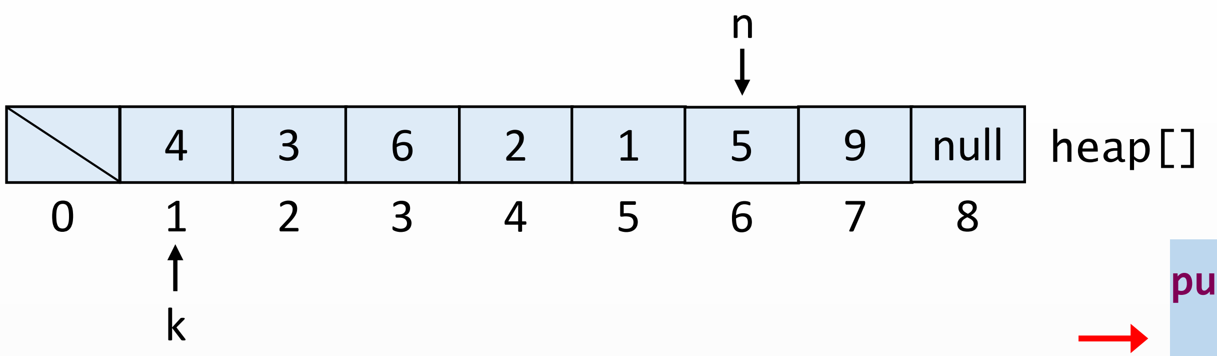
heap[]

k

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
k = 1
max = 9
n = 6
```

silMax()



n

	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

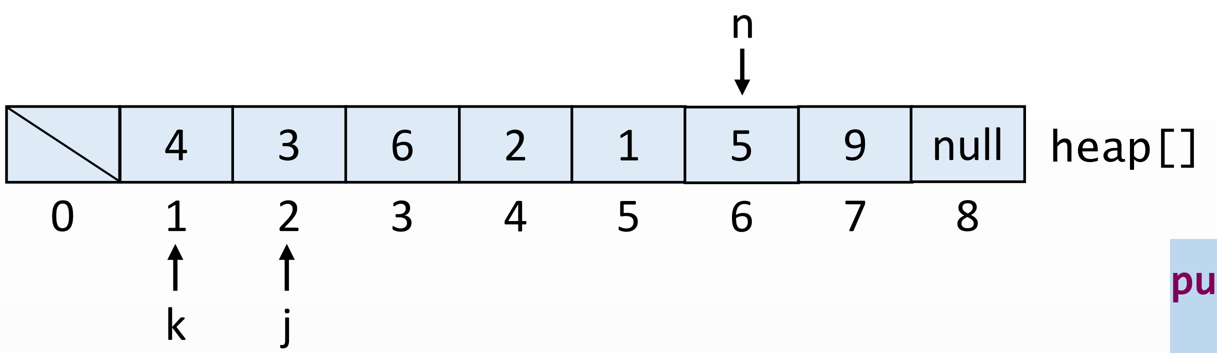
heap[]

k

```java
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
k = 1
max = 9
n = 6
```

```
silMax()
```

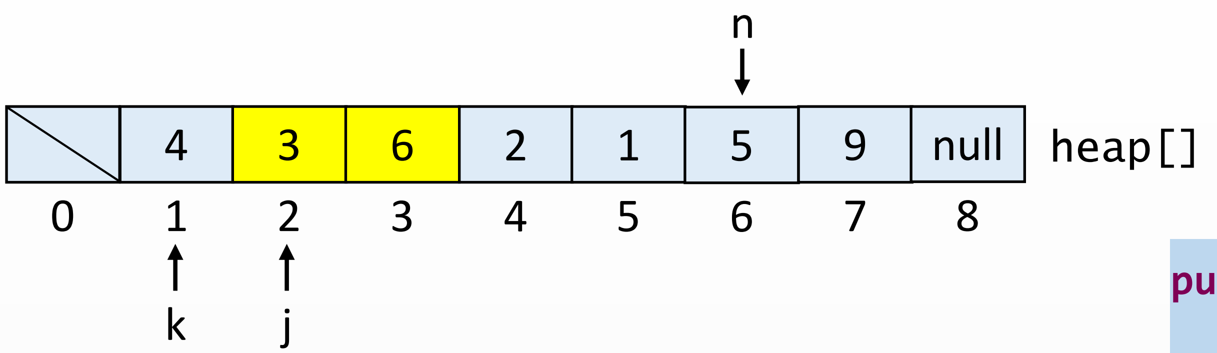


	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

```
j = 2
k = 1
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

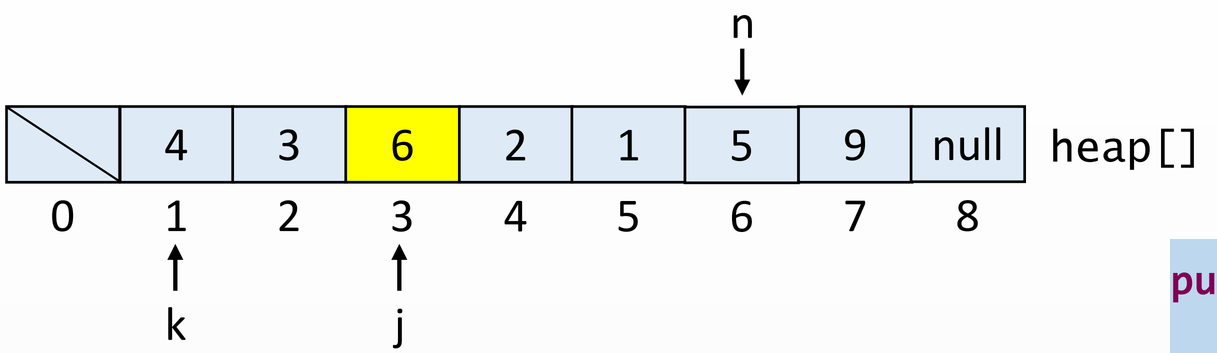


0	1	2	3	4	5	6	7	8
	4	3	6	2	1	5	9	null

```
j = 2
k = 1
max = 9
n = 6
```

silMax()

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



n

	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

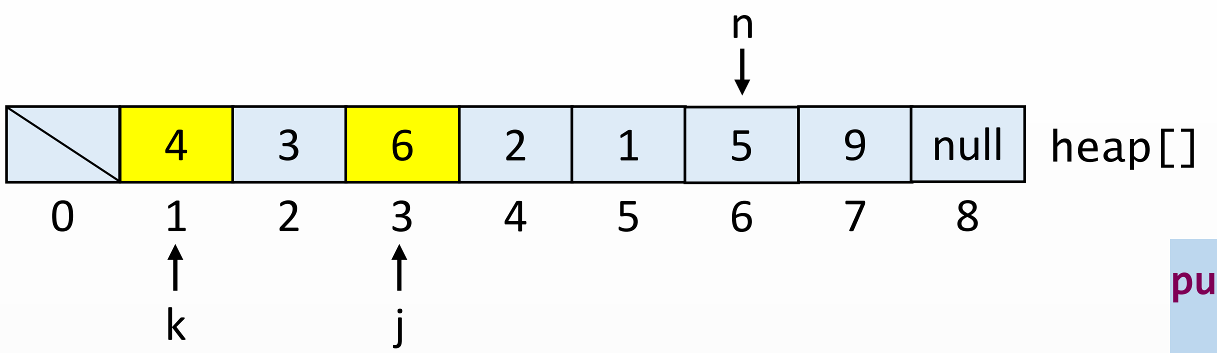
k

j

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```



n

	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

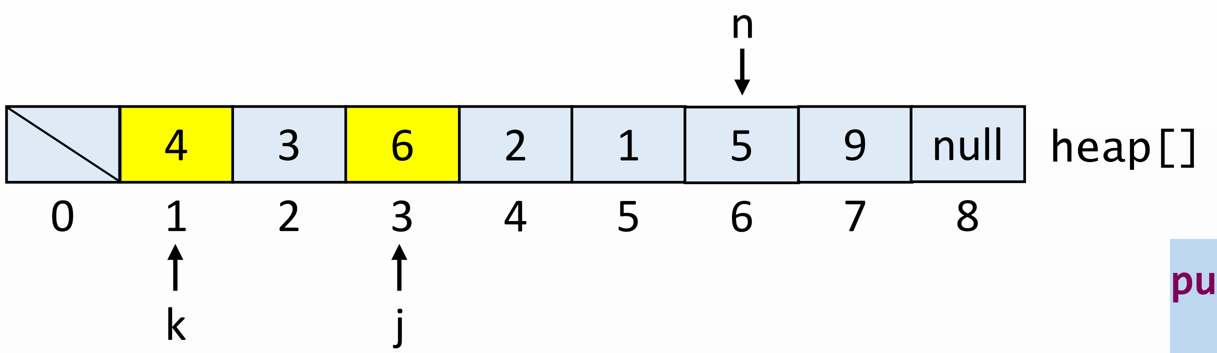
k

j

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```



	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

```
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
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      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```
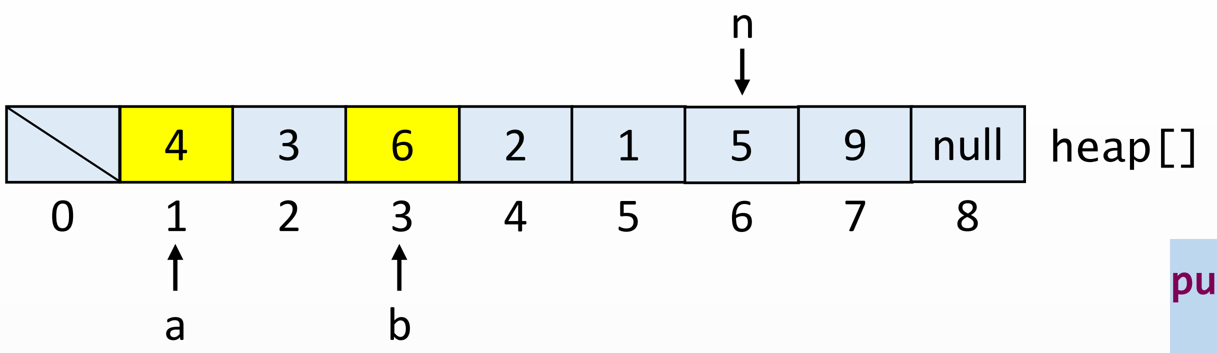



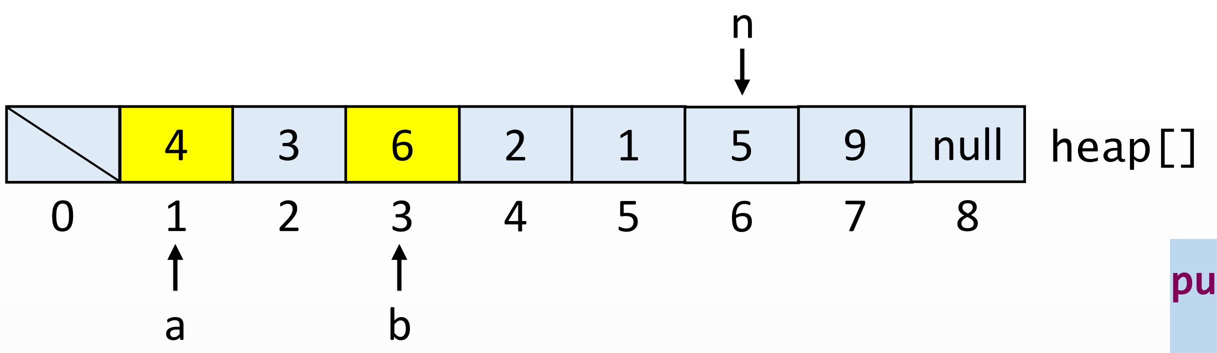
	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

```
b = 3
a = 1
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

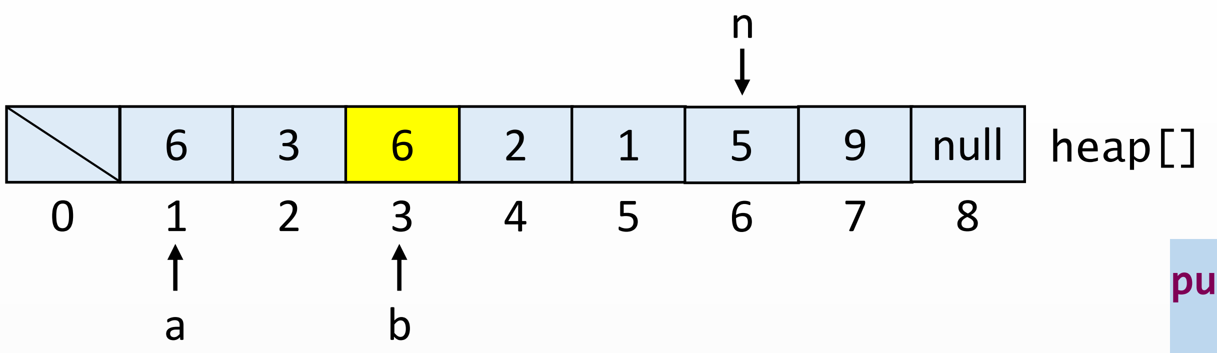


	4	3	6	2	1	5	9	null
0	1	2	3	4	5	6	7	8

```
gecici = 4
b = 3
a = 1
j = 3
k = 1
max = 9
n = 6
```

silMax()

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

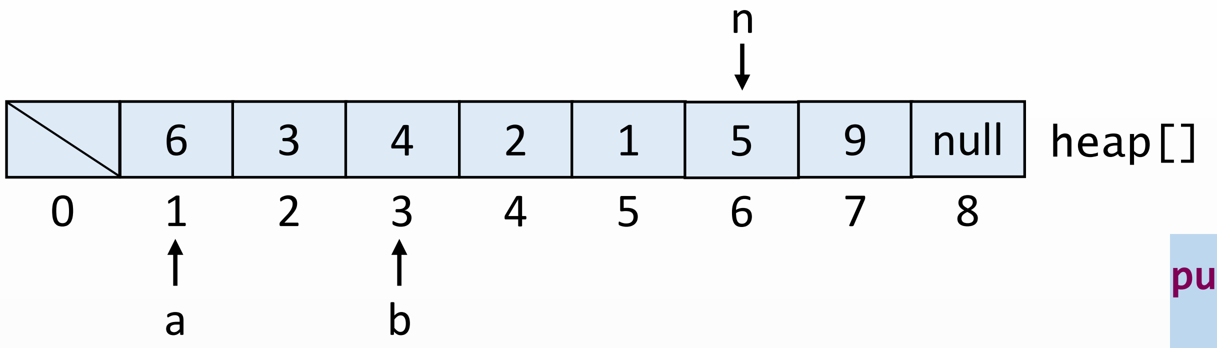


	6	3	6	2	1	5	9	null	heap[]
0	1	2	3	4	5	6	7	8	

```
gecici = 4
b = 3
a = 1
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



n

	6	3	4	2	1	5	9	null
0	1	2	3	4	5	6	7	8

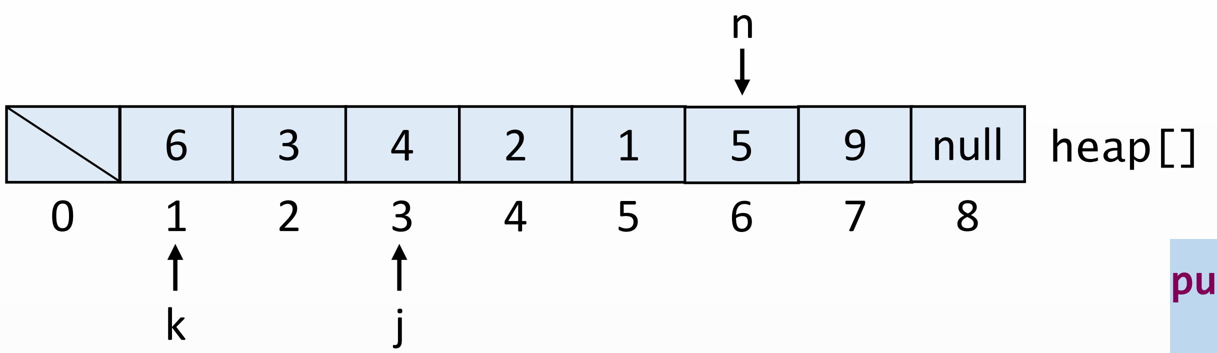
heap[]

```
gecici = 4
b = 3
a = 1
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```

```java
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



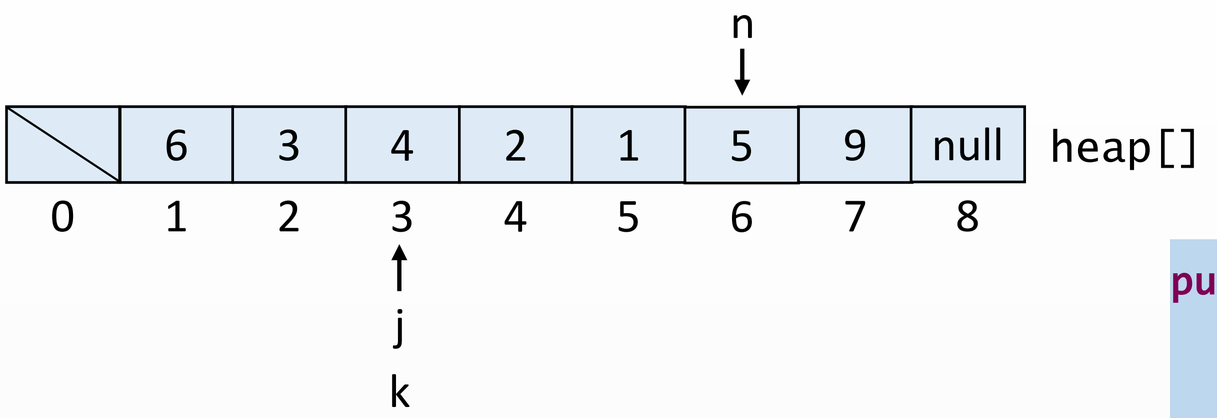
						n			
	6	3	4	2	1	5	9	null	heap[]
0	1	2	3	4	5	6	7	8	
	k		j						

```
j = 3
k = 1
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



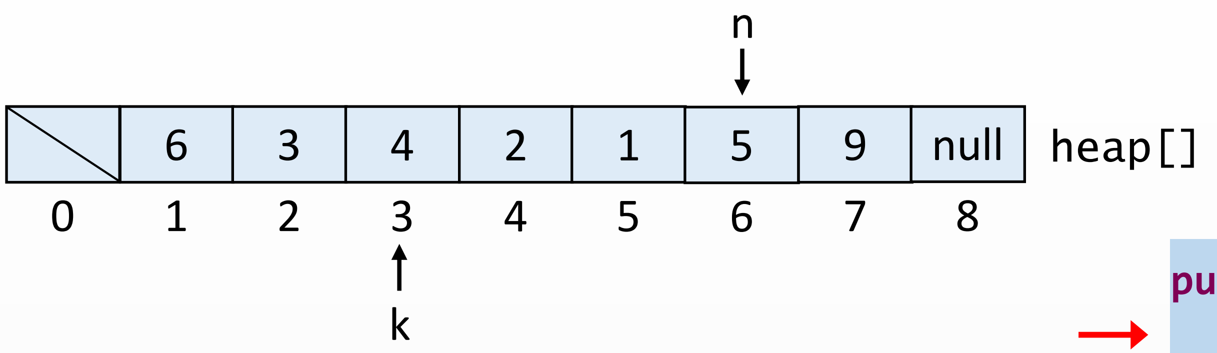
	6	3	4	2	1	5	9	null	heap[]
0	1	2	3	4	5	6	7	8	

```
j = 3
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



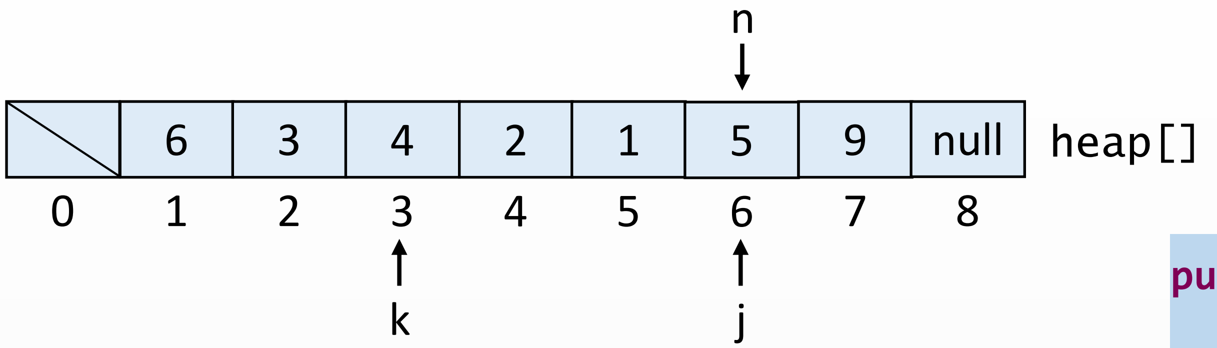
0	1	2	3	4	5	6	7	8
	6	3	4	2	1	5	9	null

```
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



n

	6	3	4	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

k

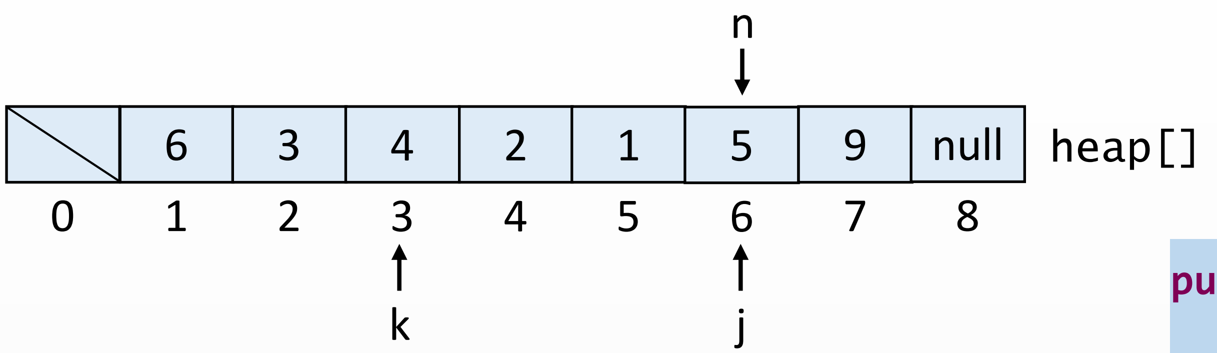
j

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```



0	1	2	3	4	5	6	7	8
	6	3	4	2	1	5	9	null

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
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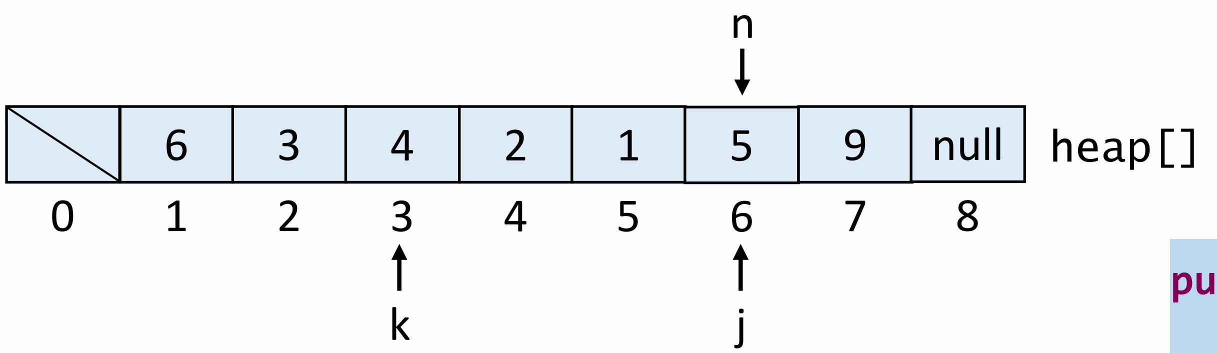
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
j = 6
k = 3
max = 9
n = 6
```

silMax()



n

	6	3	4	2	1	5	9	null	heap[]
0	1	2	3	4	5	6	7	8	

k

j

```
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
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    yerDegistir(k, j);
    k = j;
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public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
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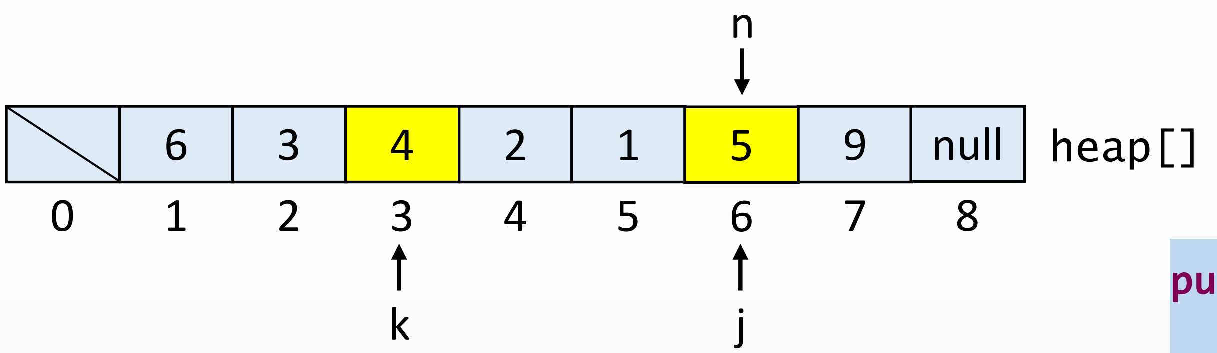
```



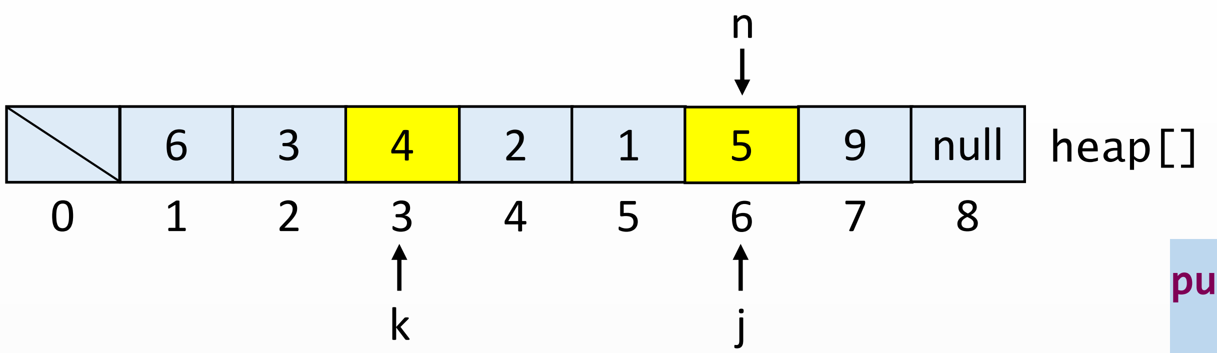
0	1	2	3	4	5	6	7	8
	6	3	4	2	1	5	9	null

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```

```
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```



	6	3	4	2	1	5	9	null	heap[]
0	1	2	3	4	5	6	7	8	

```
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
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    k = j;
  }
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public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
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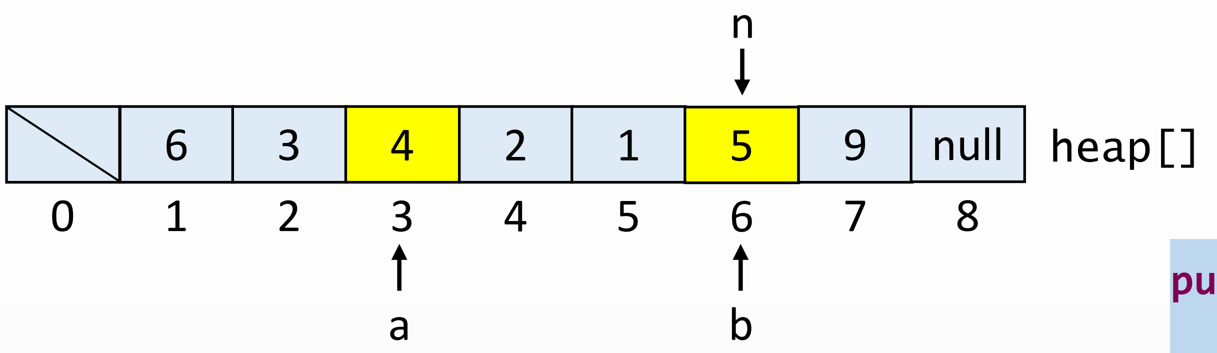


						n			
	6	3	4	2	1	5	9	null	heap[]
0	1	2	3	4	5	6	7	8	
			a			b			

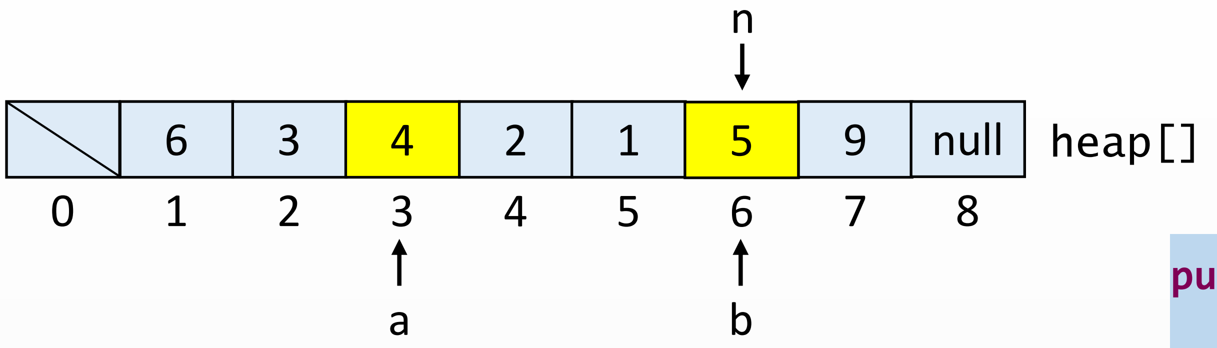
```
b = 5
a = 4
j = 6
k = 3
max = 9
n = 6
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}
```

silMax()

→

```
public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



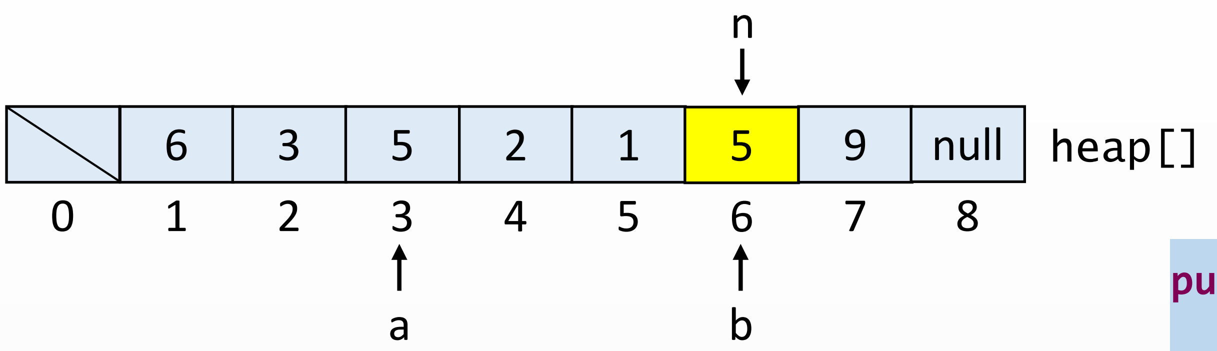
0	1	2	3	4	5	6	7	8
	6	3	4	2	1	5	9	null

```
gecici = 4
b = 5
a = 4
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



n

	6	3	5	2	1	5	9	null
0	1	2	3	4	5	6	7	8

heap[]

a

b

```
gecici = 4
b = 5
a = 4
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
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public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
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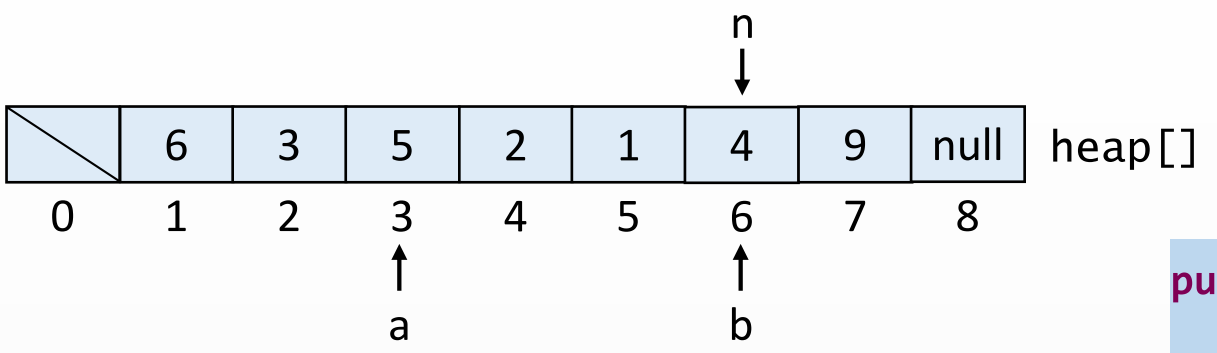
}
```



	6	3	5	2	1	4	9	null
0	1	2	3	4	5	6	7	8

```
gecici = 4
b = 5
a = 4
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
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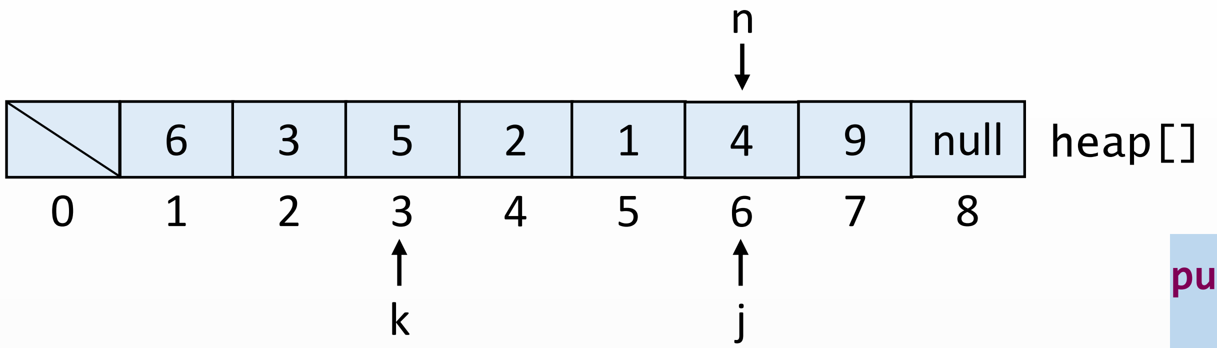
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



0	1	2	3	4	5	6	7	8
	6	3	5	2	1	4	9	null

```
j = 6
k = 3
max = 9
n = 6
```

```
silMax()
```

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
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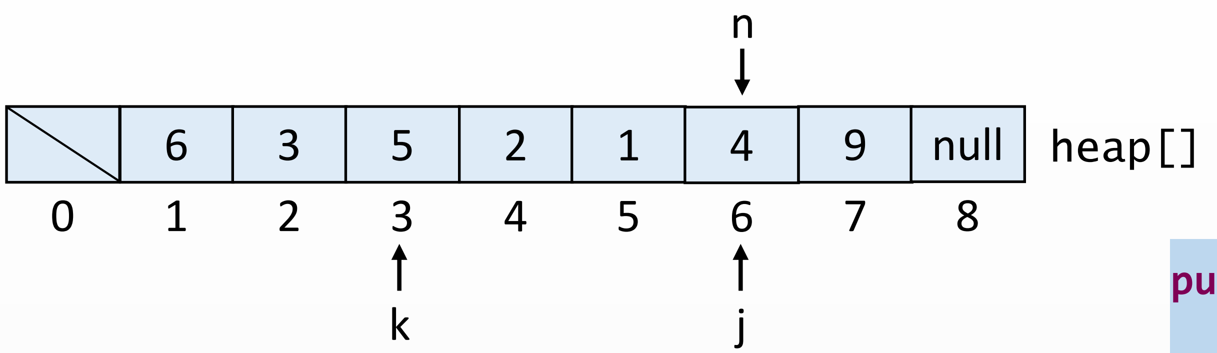
}
```



0	1	2	3	4	5	6	7	8
	6	3	5	2	1	4	9	null

```
j = 6
k = 6
max = 9
n = 6
```

silMax()

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
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  int gecici = heap[a];
  heap[a] = heap[b];
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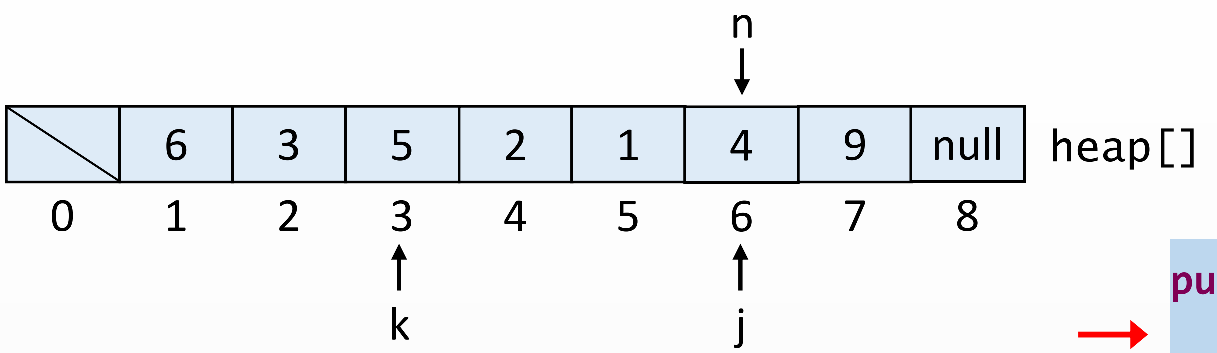
}
```



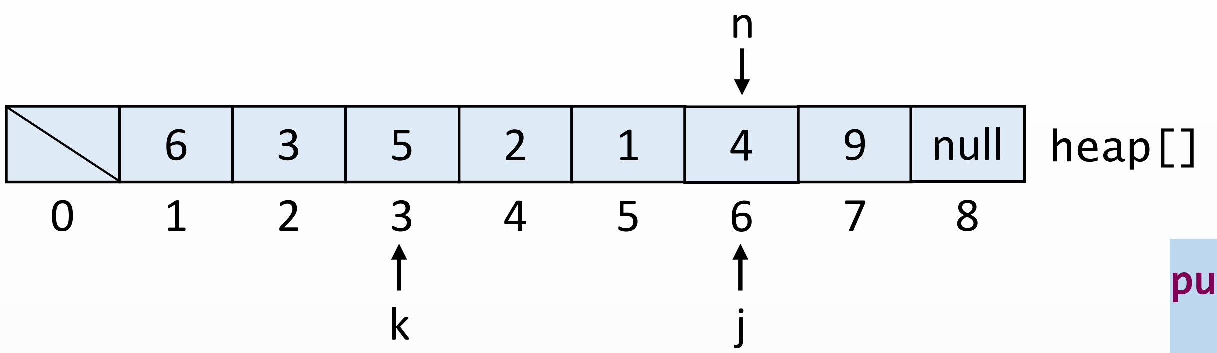
0	1	2	3	4	5	6	7	8
	6	3	5	2	1	4	9	null

```
j = 6
k = 6
max = 9
n = 6
```

```
silMax()
```

```java
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
}
```



n

	6	3	5	2	1	4	9	null	heap[]
0	1	2	3	4	5	6	7	8	

k

j

j = 6
k = 6
max = 9
n = 6

silMax()

```
public void batir(int k) {
  while(2*k <= n) {
    int j = 2*k;
    if(j < n && heap[j] < heap[j+1]) {
      j++;
    }
    if(heap[k] >= heap[j]) {
      break;
    }
    yerDegistir(k, j);
    k = j;
  }
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
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n

	6	3	5	2	1	4	9	null
0	1	2	3	4	5	6	7	8

heap[]

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
  heap[n + 1] = null;
  if(n > 0 && (n == (heap.length - 1) / 4)) {
    kucult(heap.length / 2);
  }
  return max;
}

public void yerDegistir(int a, int b) {
  int gecici = heap[a];
  heap[a] = heap[b];
  heap[b] = gecici;
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```
max = 9
n = 6
```

```
silMax()
```

						n ↓			
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n = 6
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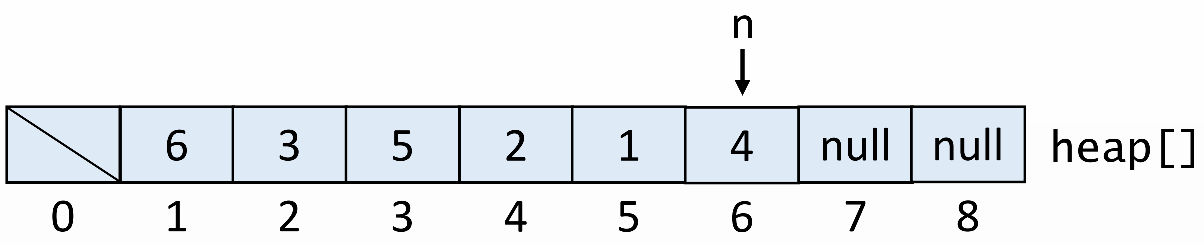
```
silMax()
```



n

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0	1	2	3	4	5	6	7	8	

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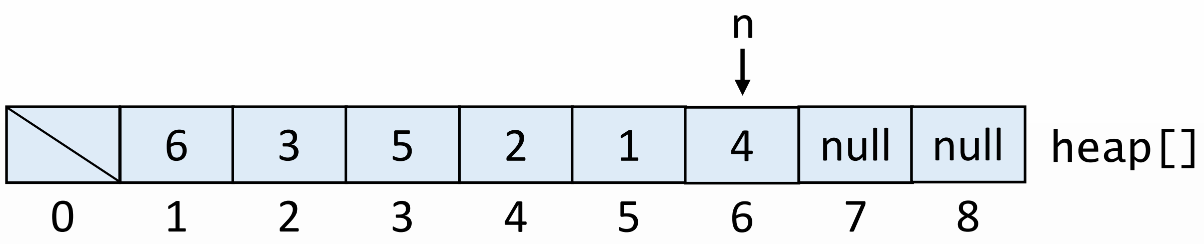
max = 9
n = 6

silMax()



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silMax()
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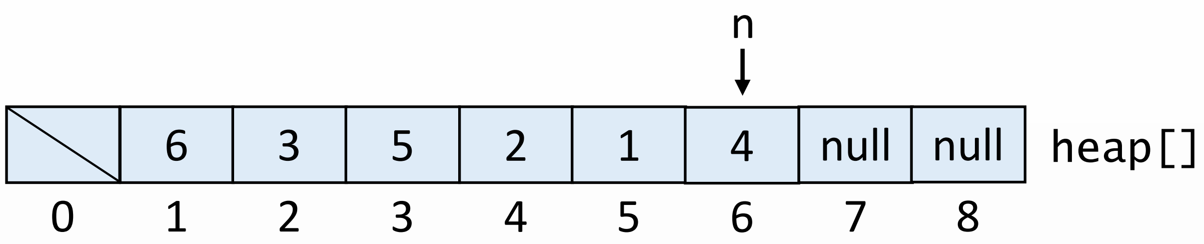

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  heap[n + 1] = null;
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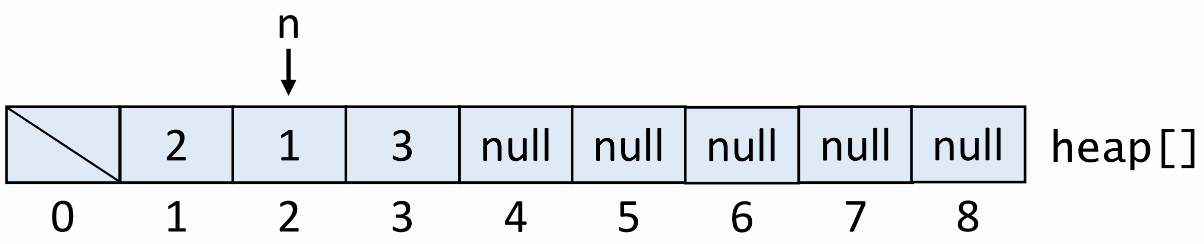

	2	1	3	null	null	null	null	null
0	1	2	3	4	5	6	7	8

max = 3
n = 2

```
public int silMax() {
  int max = heap[1];
  yerDegistir(1,n);
  n--;
  batir(1);
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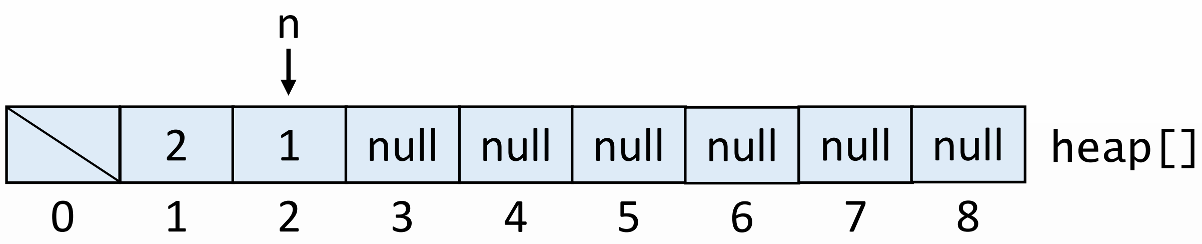

	2	1	null	null	null	null	null	null
0	1	2	3	4	5	6	7	8

heap[]

```
max = 3
n = 2
```

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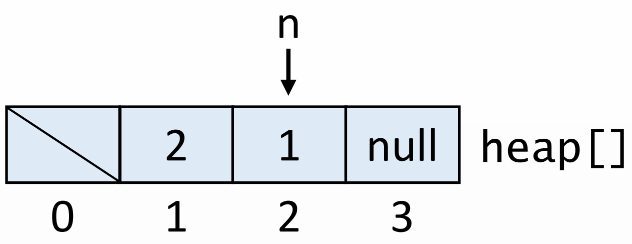

		n		
	2	1	null	heap[]
0	1	2	3	

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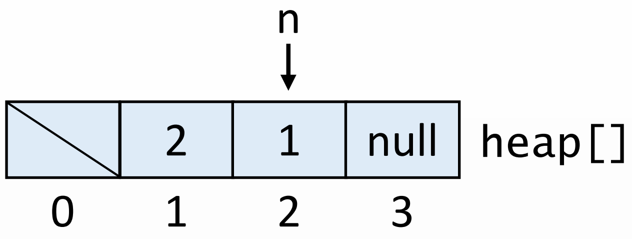

n

	2	1	null
0	1	2	3

heap[]

max = 3
n = 2

```
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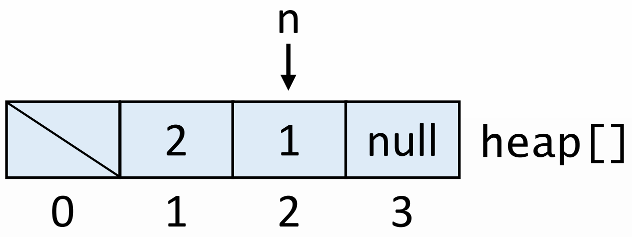

	2	1	null
0	1	2	3

heap[]

n = 2

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SON