

CENG 201 Veri Yapıları 11: Sıralama Algoritmaları

Öğr.Gör. Şevket Umut ÇAKIR

Pamukkale Üniversitesi

Hafta 11

Anahat

① Seçmeli Sıralama

② Kabarcık Sıralama

③ (Araya)Eklemeli Sıralama

Sıralama Algoritmaları

- Eldeki n adet değeri ya da elemanı mantıksal bir sıraya göre sıralamayı sağlayan algoritmalara *Sıralama Algoritmaları* adı verilir
- Karşılaştırmalı ve karşılaştırmasız türleri bulunmaktadır.
- En yaygın örneği n elemanlı bir dizinin sıralanmasıdır.

- Tüm diziyi arayarak en küçük eleman bulunur ve ilk elemanla yer değiştirilir.
- Kalan dizide(ilke eleman hariç) en küçük eleman bulunur ve dizideki ikinci elemanla yer değiştirilir.
- Bu şekilde dizideki bütün elemanlar uygun sıraya gelene kadar işleme devam edilir.

Seçmeli Sıralama Örneği

$i=0$

6	12	19	16	14	5
---	----	----	----	----	---

$i=1$

5	12	19	16	14	6
---	----	----	----	----	---

$i=2$

5	6	19	16	14	12
---	---	----	----	----	----

Seçmeli Sıralama Örneği

i=0

6	12	19	16	14	5
---	----	----	----	----	---

 $i=2$

5	6	19	16	14	12
---	---	----	----	----	----

$$i=1$$

5	12	19	16	14	6
---	----	----	----	----	---

 $i=3$

5	6	12	16	14	19
---	---	----	----	----	----

Seçmeli Sıralama Örneği

i=0

6	12	19	16	14	5
---	----	----	----	----	---

 $i=2$

5	6	19	16	14	12
---	---	----	----	----	----

$$i=4$$

5	6	12	14	16	19
---	---	----	----	----	----

 $i=1$

5	12	19	16	14	6
---	----	----	----	----	---

 $i=3$

5	6	12	16	14	19
---	---	----	----	----	----

Seçmeli Sıralama Örneği

i=0

6	12	19	16	14	5
---	----	----	----	----	---

$$j=2$$

5	6	19	16	14	12
---	---	----	----	----	----

i=4

5	6	12	14	16	19
---	---	----	----	----	----

 $i=1$

5	12	19	16	14	6
---	----	----	----	----	---

$$i=3$$

5	6	12	16	14	19
---	---	----	----	----	----

sıralanmış dizi

5	6	12	14	16	19
---	---	----	----	----	----

Seçmeli Sıralama Kodu

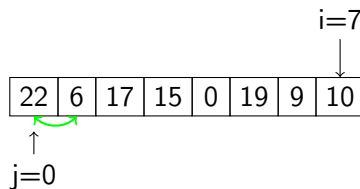
```
1 void sort(int arr[])
2 {
3     int n = arr.length;
4     // One by one move boundary of unsorted subarray
5     for (int i = 0; i < n-1; i++)
6     {
7         // Find the minimum element in unsorted array
8         int min_idx = i;
9         for (int j = i+1; j < n; j++)
10             if (arr[j] < arr[min_idx])
11                 min_idx = j;
12         // Swap the found minimum element with the first
13         // element
14         int temp = arr[min_idx];
15         arr[min_idx] = arr[i];
16         arr[i] = temp;
17     }
18 }
```

- En kötü durumda kaç karşılaştırma yapılır?

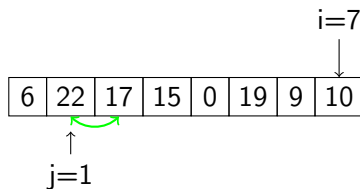
Kabarcık Sıralama

- Baştan sona doğru elemanlar ikili olarak(komşusuyla birlikte) birer kabarcık olarak düşünülür.
- Kabarcık içindeki elemanlar karşılaştırılır ve sıralanır.
- İlk turun sonunda en büyük eleman en sona yerleşmiş olur.
- Bu işlem $n - 1$ defa yapıldığında dizi sıralanmış olur.

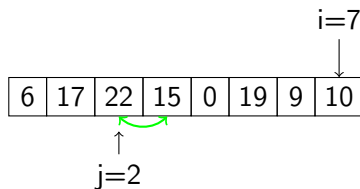
Kabarcık Sıralama Örneği



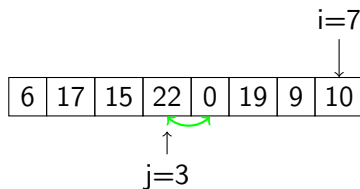
Kabarcık Sıralama Örneği



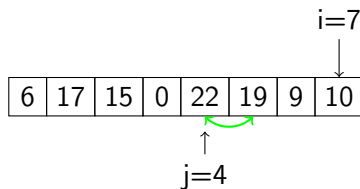
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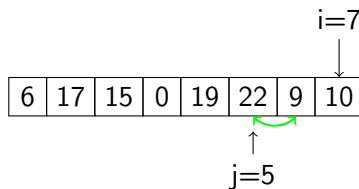
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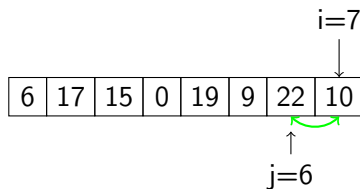
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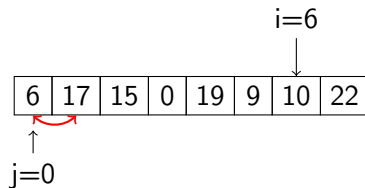
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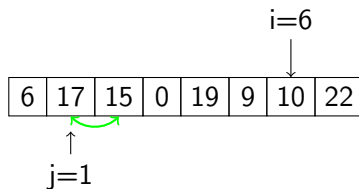
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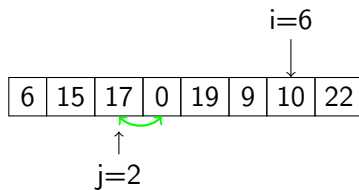
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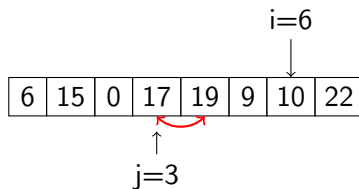
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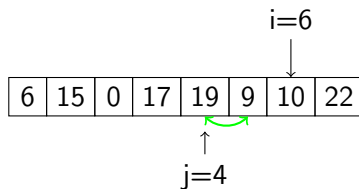
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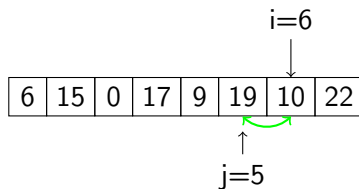
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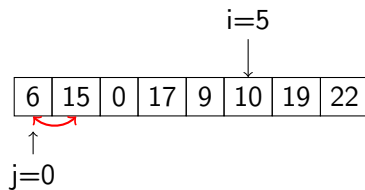
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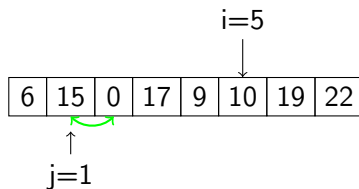
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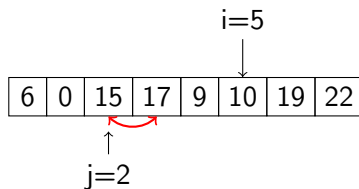
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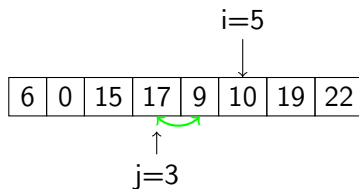
Kabarcık Sıralama Örneği



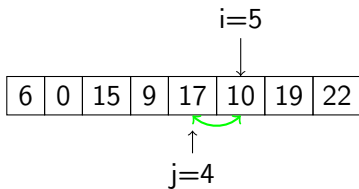
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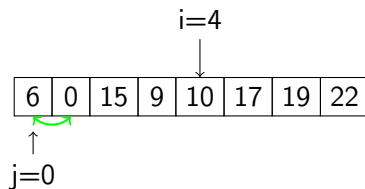
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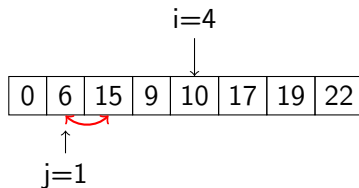
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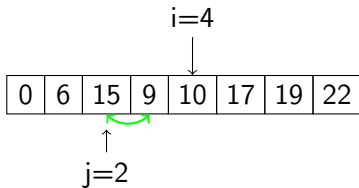
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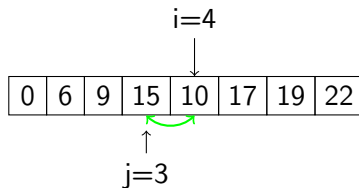
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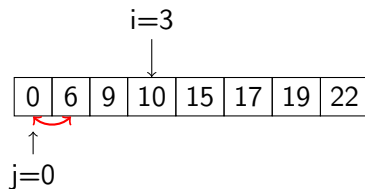
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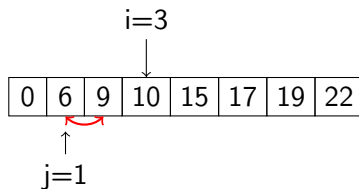
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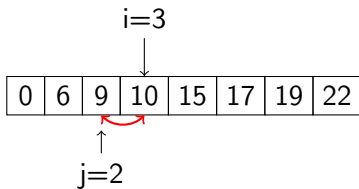
Kabarcık Sıralama Örneği



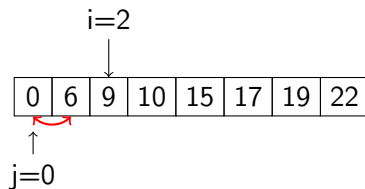
Kabarcık Sıralama Örneği



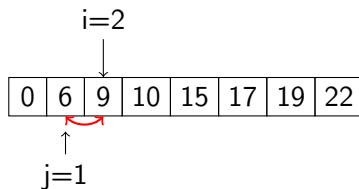
Kabarcık Sıralama Örneği



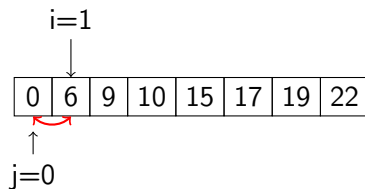
Kabarcık Sıralama Örneği



Kabarcık Sıralama Örneği



Kabarcık Sıralama Örneği



Kabarcık Sıralama Kodu

```
1 void bubbleSort(int arr[])
2 {
3     int n = arr.length;
4     for (int i = 0; i < n-1; i++)
5         for (int j = 0; j < n-i-1; j++)
6             if (arr[j] > arr[j+1])
7                 {
8                     // swap arr[j+1] and arr[i]
9                     int temp = arr[j];
10                    arr[j] = arr[j+1];
11                    arr[j+1] = temp;
12                }
13 }
```

Kabarcık Sıralama Geliştirme

- Geliştirme uygulanabilir mi?

Kabarcık Sıralama Geliştirme

- Geliştirme uygulanabilir mi?
- Eğer son turda hiç bir yer değiştirme olmadıysa dizi sıralanmış demektir. Algoritma sonlandırılabilir.

- En kötü durumda kaç karşılaştırma yapılır?

Eklemeli Sıralama

- İskambil kağıtlarını dizmeye benzerdir.
- Dizinin bir tarafı sıralanmış olarak kabul edilir.
- Sıralı olmayan bir kısımdan eleman seçilip sıralı olan kısımdaki uygun konumuna yerleştirilir.
- Bütün elemanlar sıralı kısma gelene kadar işlemler devam ettirilir.

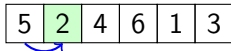
Eklemeli Sıralama Örneği

$j=1$

5	2	4	6	1	3
---	---	---	---	---	---

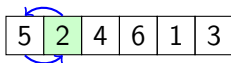
Eklemeli Sıralama Örneği

$j=1$

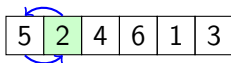
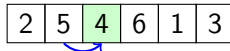


Eklemeli Sıralama Örneği

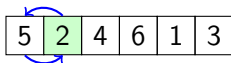
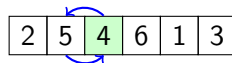
$j=1$



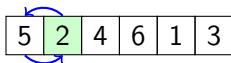
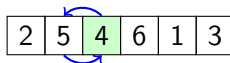
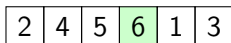
Eklemeli Sıralama Örneği

 $j=1$  $j=2$ 

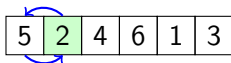
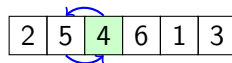
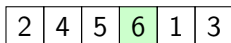
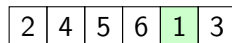
Eklemeli Sıralama Örneği

 $j=1$  $j=2$ 

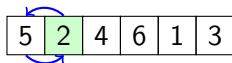
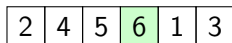
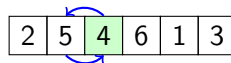
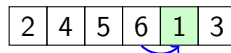
Eklemeli Sıralama Örneği

 $j=1$  $j=2$  $j=3$ 

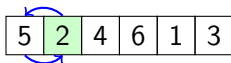
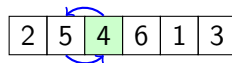
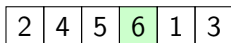
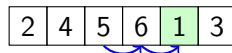
Eklemeli Sıralama Örneği

 $j=1$  $j=2$  $j=3$  $j=4$ 

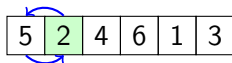
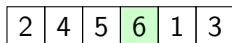
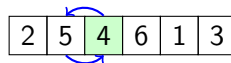
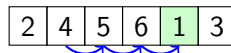
Ekleme Sıralama Örneği

$$j=1$$

$$j=3$$

$$j=2$$

$$j=4$$


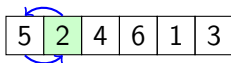
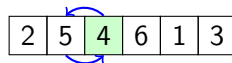
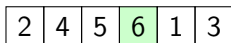
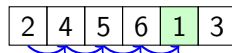
Eklemeli Sıralama Örneği

 $j=1$  $j=2$  $j=3$  $j=4$ 

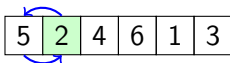
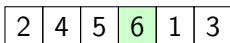
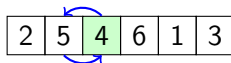
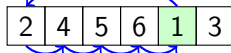
Ekleme Sıralama Örneği

$$j=1$$

$$j=3$$
 $j=2$ 
$$j=4$$


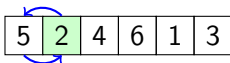
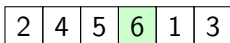
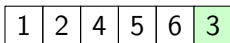
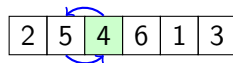
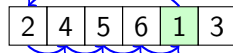
Eklemeli Sıralama Örneği

 $j=1$  $j=2$  $j=3$  $j=4$ 

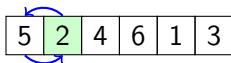
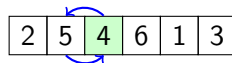
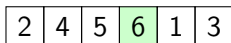
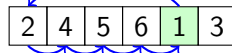
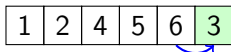
Eklemleri Sıralama Örneği

$$j=1$$

$$j=3$$
 $j=2$ ~~j=4~~

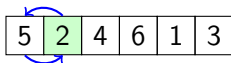
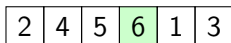
Eklemeli Sıralama Örneği

$$j=1$$

$$j=3$$

$$j=5$$
 $j=2$  $j=4$ 

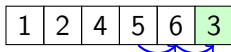
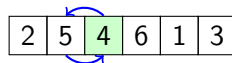
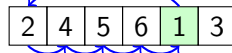
Eklemeli Sıralama Örneği

 $j=1$  $j=2$  $j=3$  $j=4$  $j=5$ 

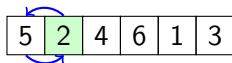
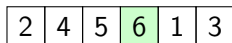
Ekleme Sıralama Örneği

$$j=1$$

$$j=3$$


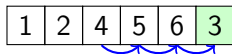
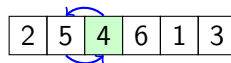
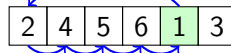
j=5

 $j=2$  $j=4$ 

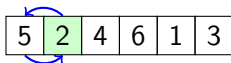
Ekleme Sıralama Örneği

$$j=1$$
 $j=3$ 

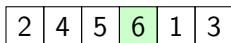
j=5

 $j=2$  $j=4$ 

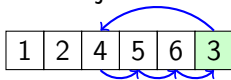
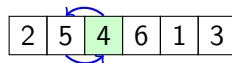
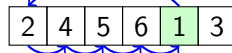
Ekleme Sıralama Örneği

$$j=1$$


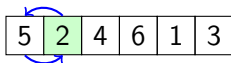
j=3



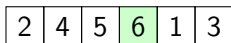
j=5

 $j=2$  $j=4$ 

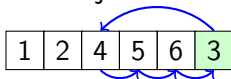
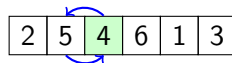
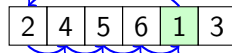
Ekleme Sıralama Örneği

$$j=1$$


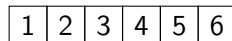
j=3



j=5


$$j=2$$
 $j=4$ 

sıralanmış dizi



Eklemeli Sıralama Kod

```
1 void sort(int arr[])
2 {
3     int n = arr.length;
4     for (int i=1; i<n; ++i)
5     {
6         int key = arr[i];
7         int j = i-1;
8         /* Move elements of arr[0..i-1], that are
9            greater than key, to one position ahead
10            of their current position */
11         while (j>=0 && arr[j] > key)
12         {
13             arr[j+1] = arr[j];
14             j = j-1;
15         }
16         arr[j+1] = key;
17     }
18 }
```

- En kötü durumda kaç karşılaştırma yapılır?

Algoritma Karmaşıklıkları

Algoritma	Karmaşıklık
Seçmeli Sıralama	$O(n^2)$
Kabarcık Sıralama	$O(n^2)$
Eklemeli Sıralama	$O(n^2)$

Sıralama Algoritmaları Bağlantıları

- Animasyonlu web sitesi
- YouTube Yöresel Danslar
- Görselleştirme