

Ch3: Insertion-Sort

305234

Algorithm Analysis and Design

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Insertion-Sort vs Cards



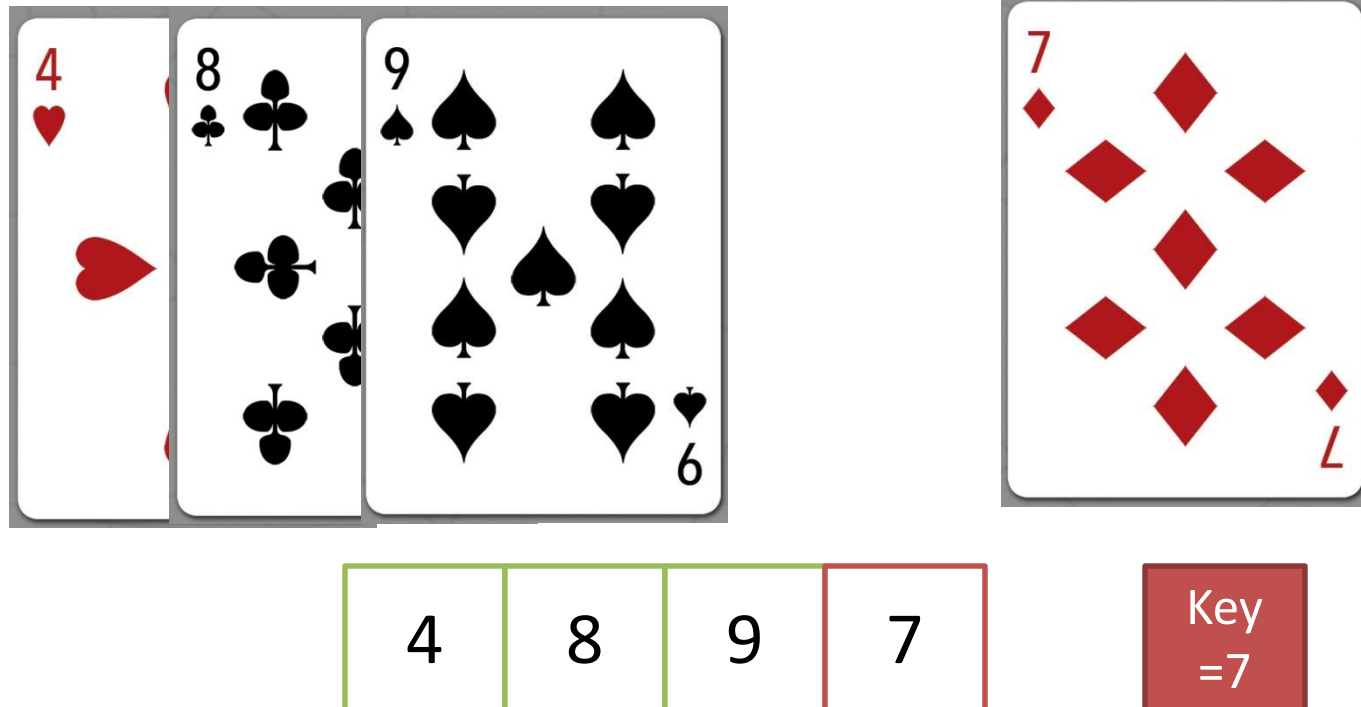
Photos are taken from : <https://www.findabet.co.uk/poker-hands.php>
<http://www.elioimporting.com/contents/en-us/d55.html>
<https://www.pokerstars.com/poker/games/rules/hand-rankings/>

Insertion-Sort vs Cards



Insertion-Sort vs Cards

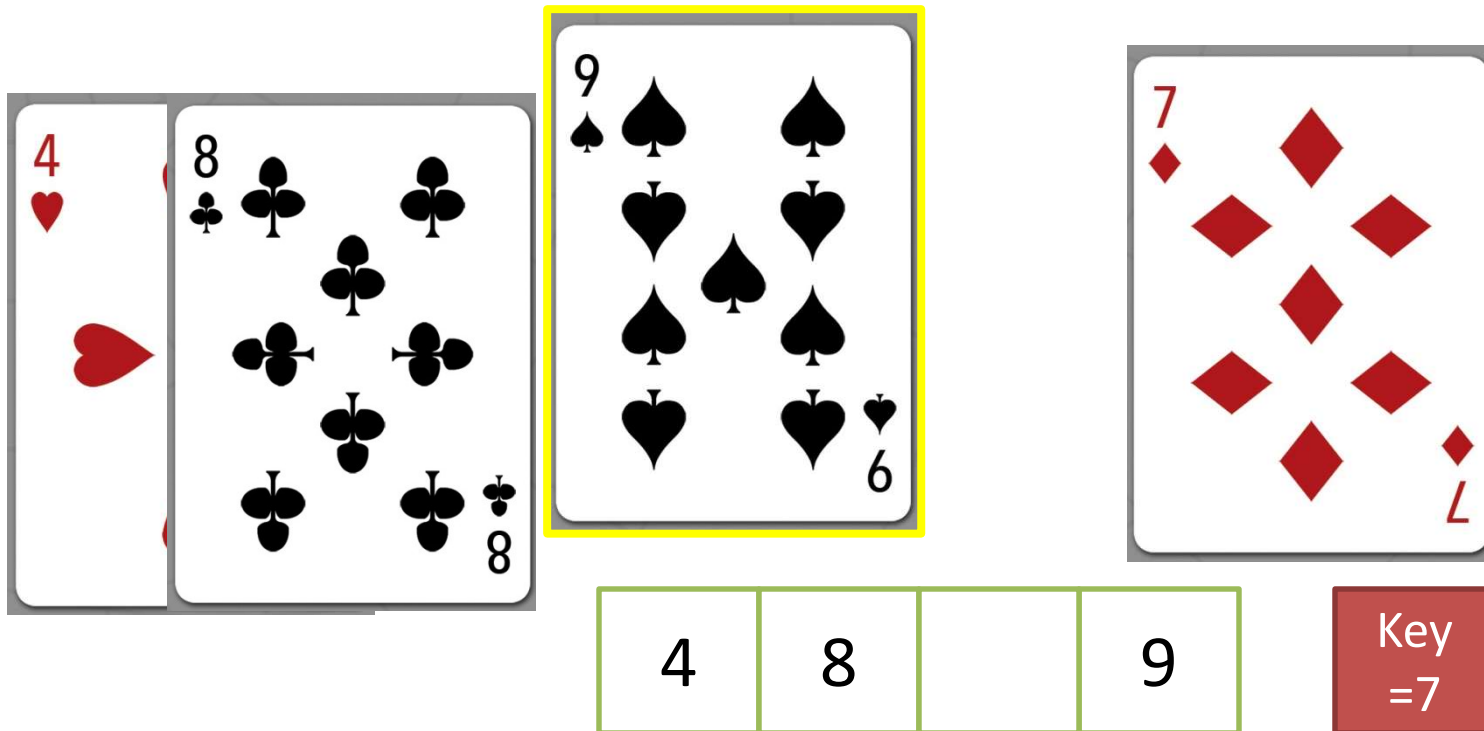
- We have a sorted cards on the left hand side and we compare each card to the new coming one.



Photos are taken from: https://www.maxplayingcards.com/en/2013/10/07/bicycle-demograffik-deck-the-multi-cultural-playing-cards/dpc_hearts/

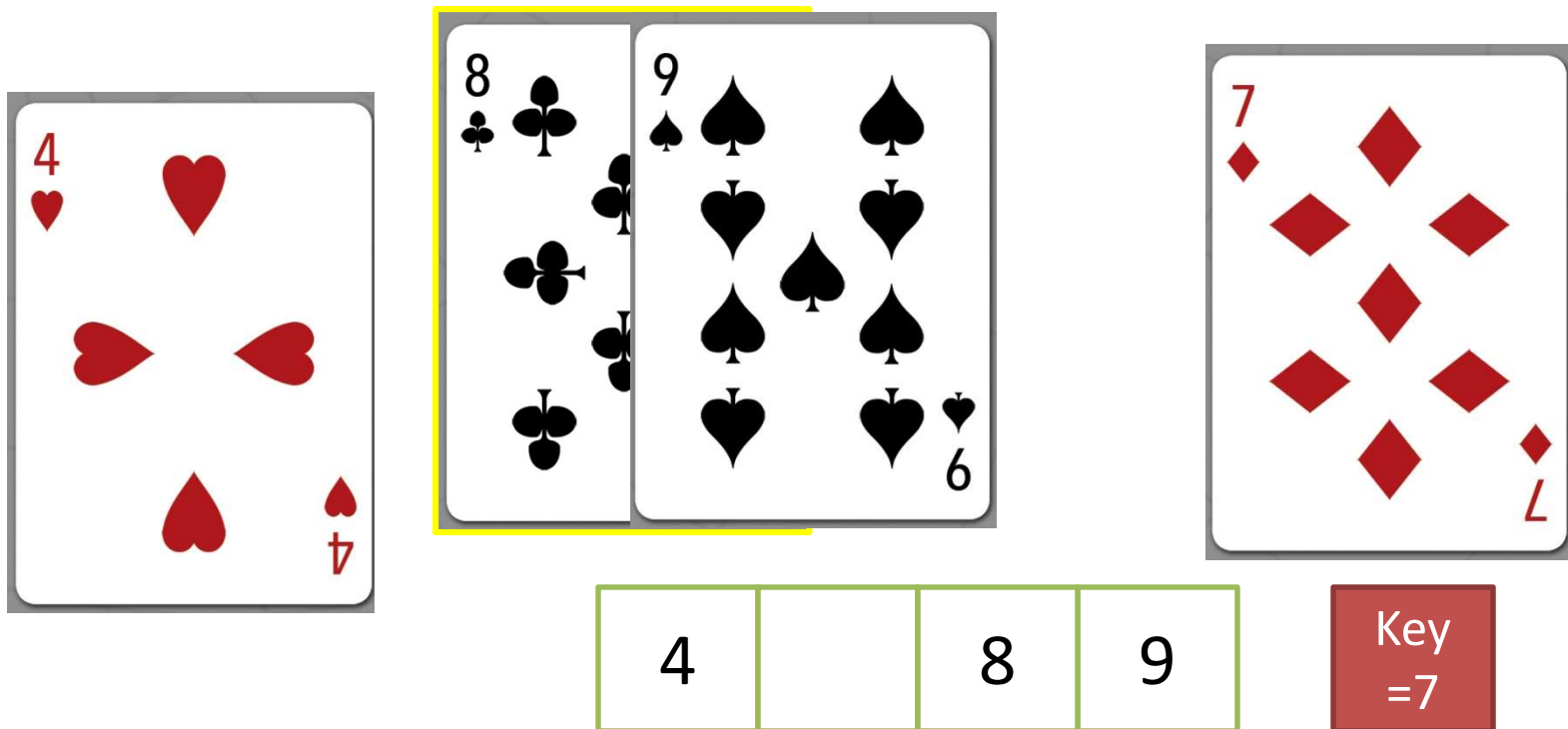
Insertion-Sort vs Cards

- If the card at position i on the left hand side is greater than the new card, then
 - we move card no. i one step to the right.



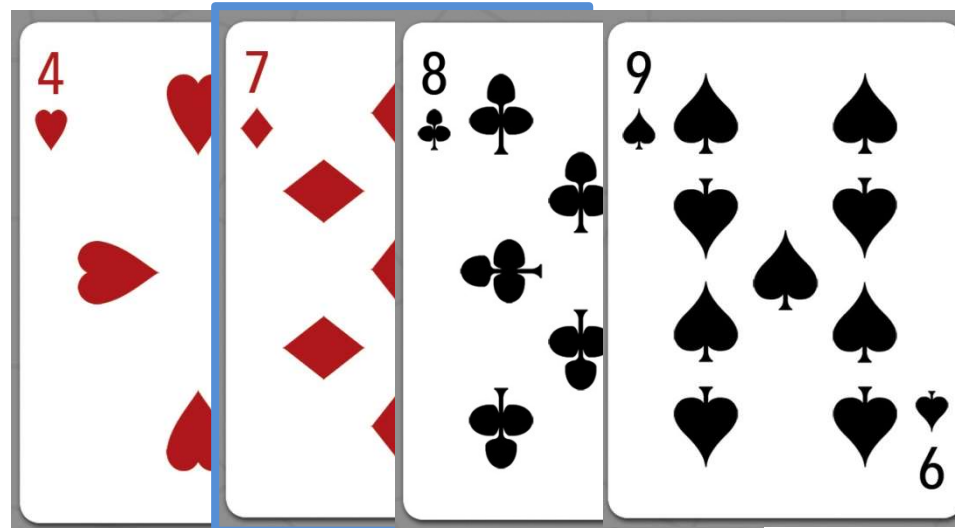
Insertion-Sort vs Cards

- Repeat the previous step until we find a card at position j that is less than the new card. We press the new card at position $j+1$



Insertion-Sort vs Cards

- We insert the new card.



Key
=7

Pseudocode: Insertion-Sort

```
for j=2 to length[A]
  do key = A[ j ]

  i = j - 1
  while i > 0 and A[ i ] > key
    do A[i+1] = A[ i ]
    i = i - 1
  A[i+1]=key
```


Insertion-Sort

input

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

$j = 2$

Key
= 2

$i = 1$

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

$A[i] = 5 > \text{key} = 2$

$A[i+1] = A[i]$

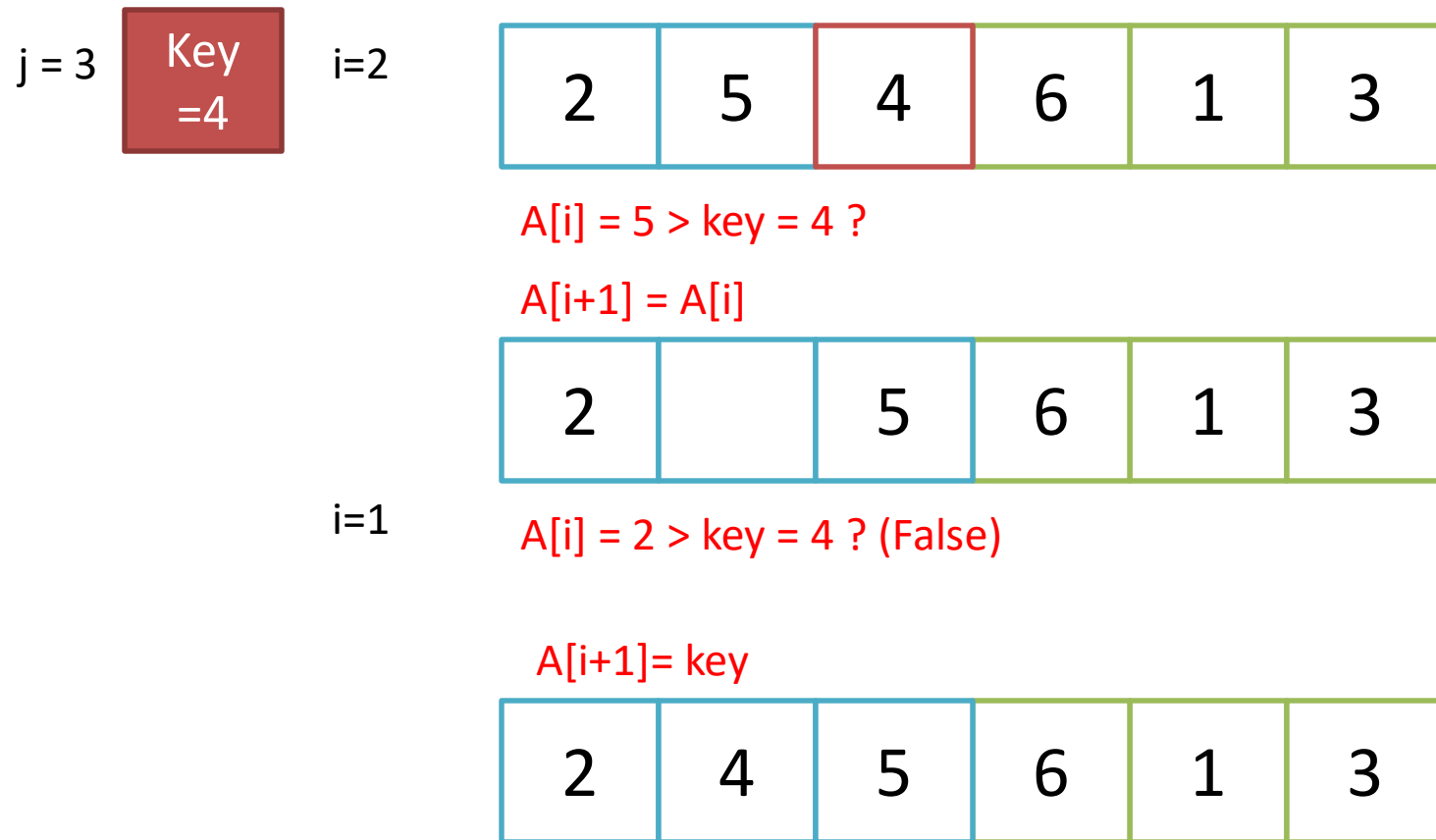
	5	4	6	1	3
--	---	---	---	---	---

$A[i+1] = \text{key}$

$i = 0$

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

Insertion-Sort



Insertion-Sort

$j = 4$ Key
=6 $i = 3$

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

$A[i] = 5 > \text{key} = 6$? (False)

$A[i+1] = A[i]$

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

Insertion-Sort

$j = 5$

Key
= 1

$i = 4$

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

$A[i] = 6 > \text{key} = 1$

$A[i+1] = A[i]$

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

$i = 3$

$A[i] = 5 > \text{key} = 1$

$A[i+1] = A[i]$

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

$i = 2$

$A[i] = 4 > \text{key} = 1$

$A[i+1] = A[i]$

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

Insertion-Sort

$j = 5$

Key
= 1

$i = 1$

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

$A[i] = 2 > \text{key} = 1$

$A[i+1] = A[i]$

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

$i = 0$

$A[i+1] = \text{key}$

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

Insertion-Sort

$j = 6$

Key =3

 $i = 5$

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

$A[i] = 6 > \text{key} = 3$

$A[i+1] = A[i]$

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

$i = 4$

$A[i] = 5 > \text{key} = 3$

$A[i+1] = A[i]$

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

$i = 3$

$A[i] = 4 > \text{key} = 3$

$A[i+1] = A[i]$

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

$i = 2$

$A[i] = 2 > \text{key} = 3 ?$ (False)

$A[i+1] = \text{key}$

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

Exercise insertion-sort

Input = [9,5,7,4,2]

j	key	i	Array
2			
3			
4			
5			