Algoritmos de ordenamiento

Basados en comparación

1

Búsqueda Lineal

2

Búsqueda Lineal

56	4564	456	45	5	76	56	6

3

Búsqueda Binaria
(números ordenados)

4

Búsqueda Binaria
(números ordenados)

5	45	68	96	174	398	437	600

5

Búsqueda Binaria
(palabras ordenadas)

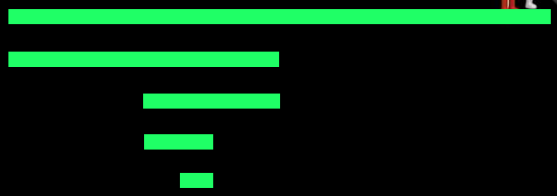
6

Búsqueda Binaria

¿Qué número entre 1 y 64 estoy pensando?
Si adivinas antes del 6to intento, ¡ganas!

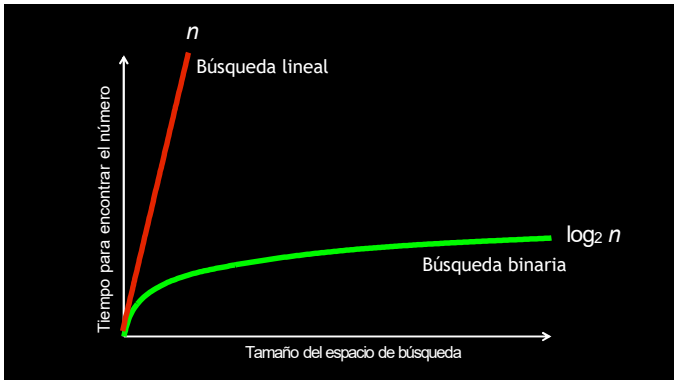
7

Búsqueda Binaria



El tamaño del espacio de búsqueda disminuye a la mitad en cada iteración => bastan $\log_2 n$ iteraciones

8



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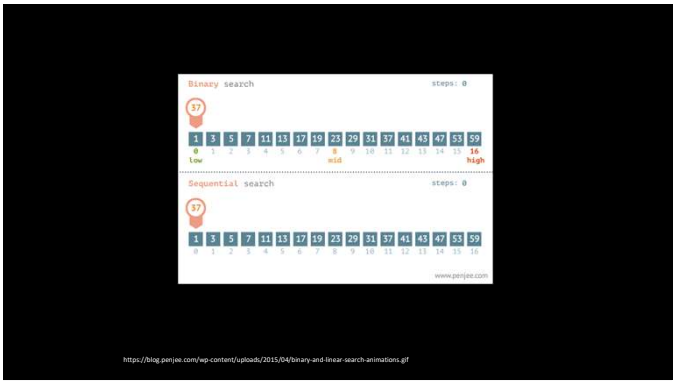


https://blog.penjee.com/wp-content/uploads/2015/04/binary-and-linear-search-animations.gif

10

Para poder usar búsqueda binaria, los datos deben estar ordenados

11

Algoritmos de ordenamiento

12

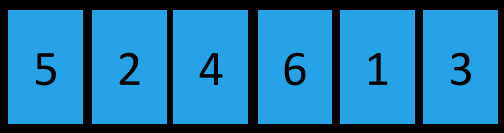
- Bubble sort
- Selection sort
- Insertion sort
- Merge sort
- Quick sort

13

Bubble sort

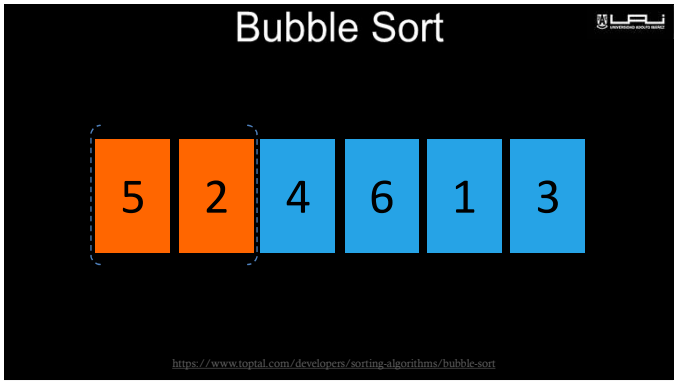
14

Bubble Sort

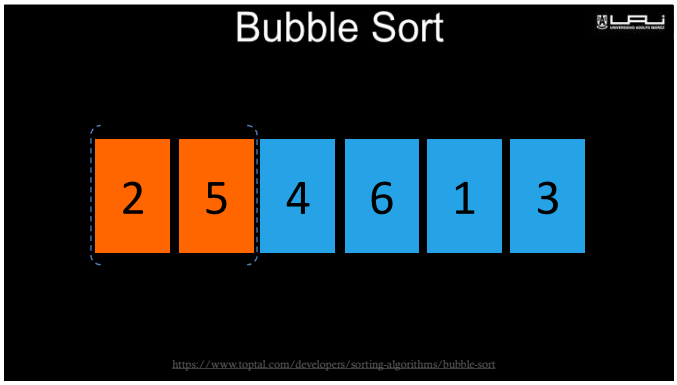


https://www.toptal.com/developers/sorting-algorithms/bubble-sort

15


Bubble Sort
5
2
4
6
1
3
https://www.toptal.com/developers/sorting-algorithms/bubble-sort

16


Bubble Sort
2
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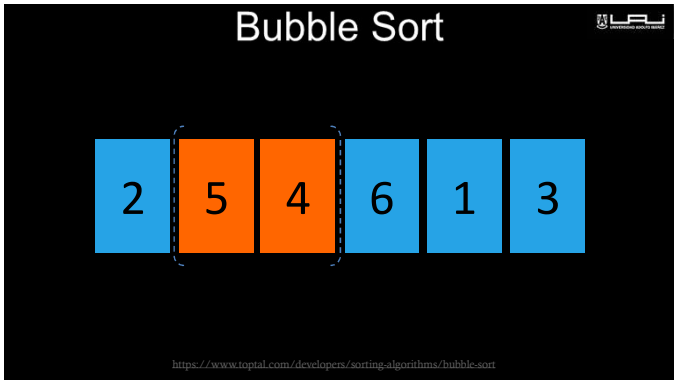
https://www.toptal.com/developers/sorting-algorithms/bubble-sort

17


Bubble Sort
2
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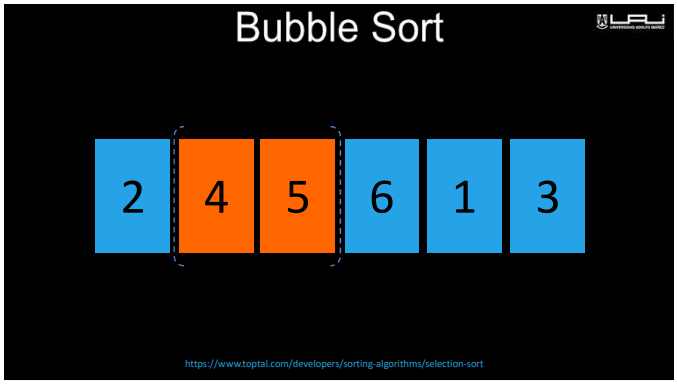
https://www.toptal.com/developers/sorting-algorithms/bubble-sort

18


Bubble Sort
2
4
5
6
1
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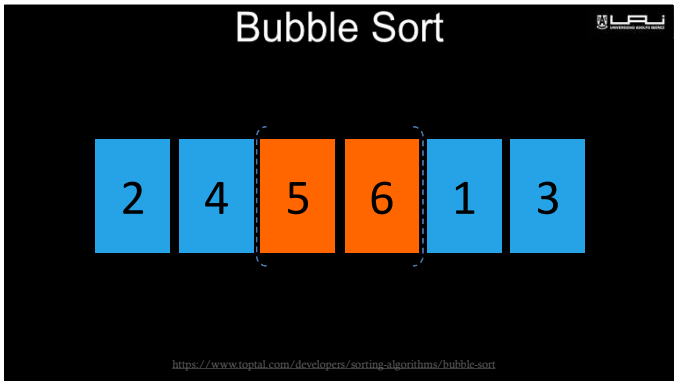
https://www.toptal.com/developers/sorting-algorithms/selection-sort

19


Bubble Sort
2
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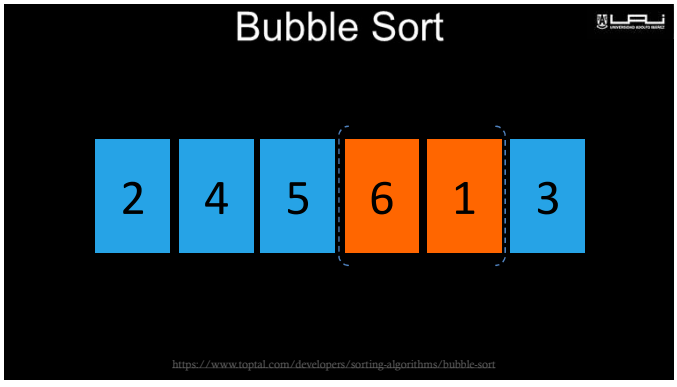
20


Bubble Sort
2
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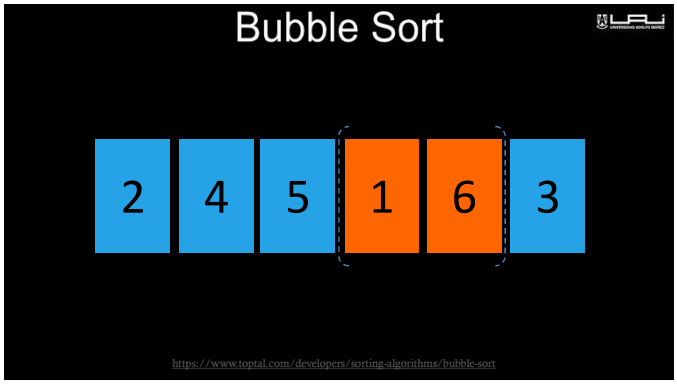
Bubble Sort
2
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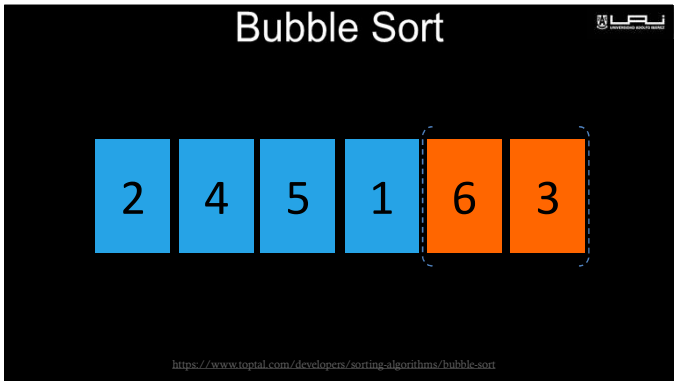
22


Bubble Sort
2
4
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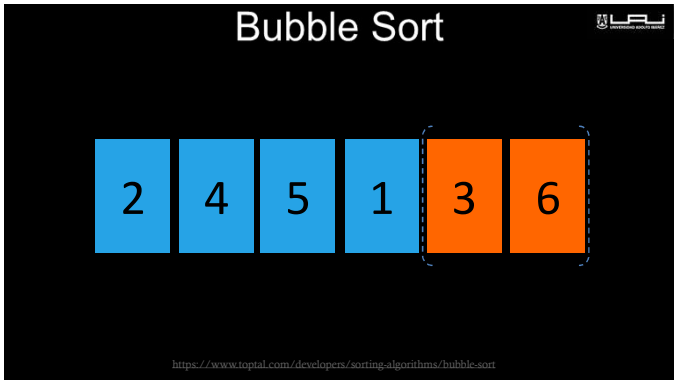
23


Bubble Sort
2
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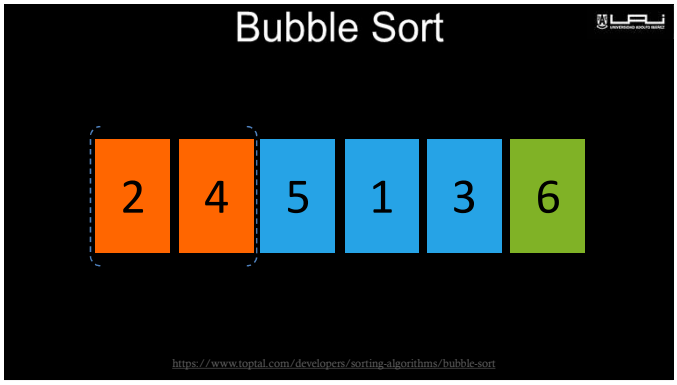
24


Bubble Sort
2
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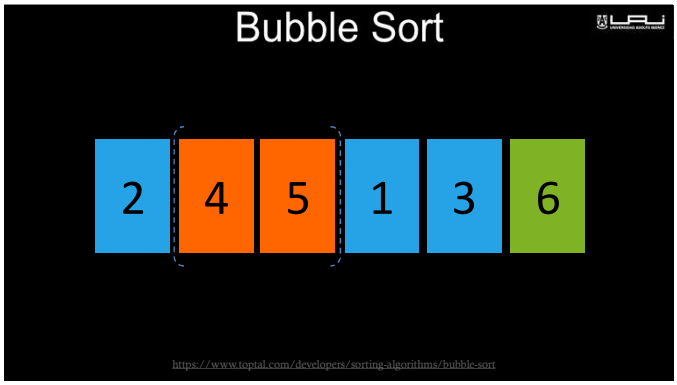
25


Bubble Sort
2
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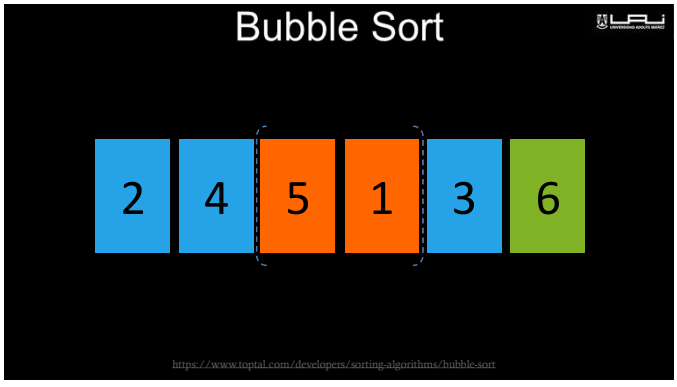
26


Bubble Sort
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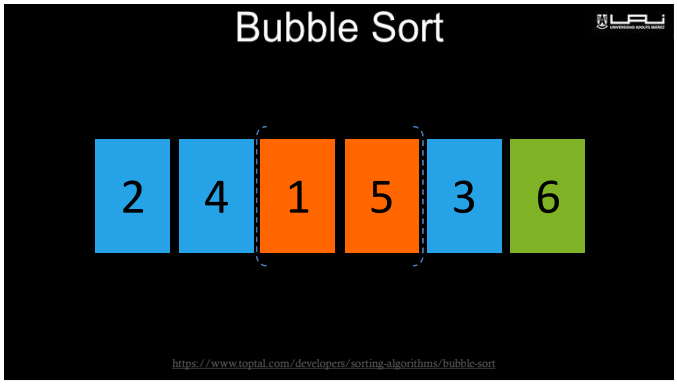
27


Bubble Sort
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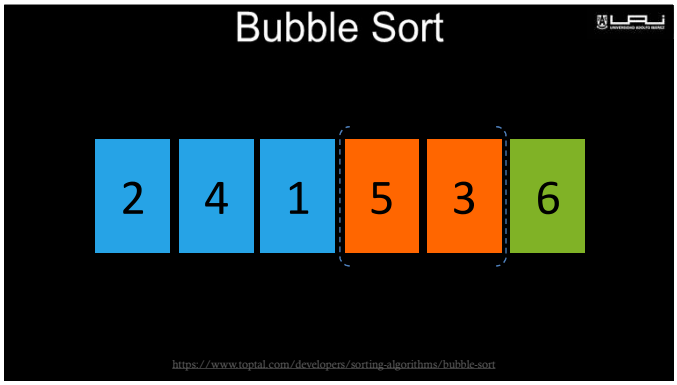
28


Bubble Sort
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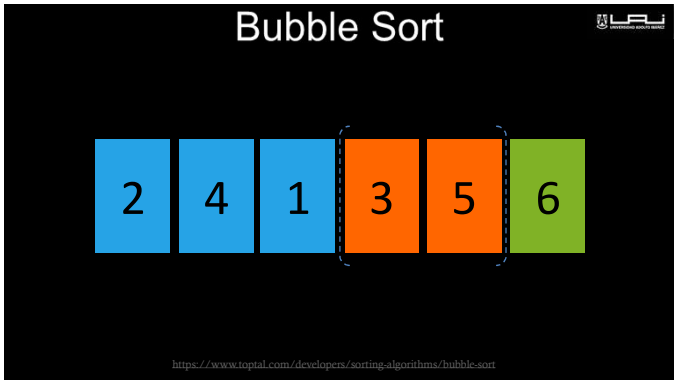
29


Bubble Sort
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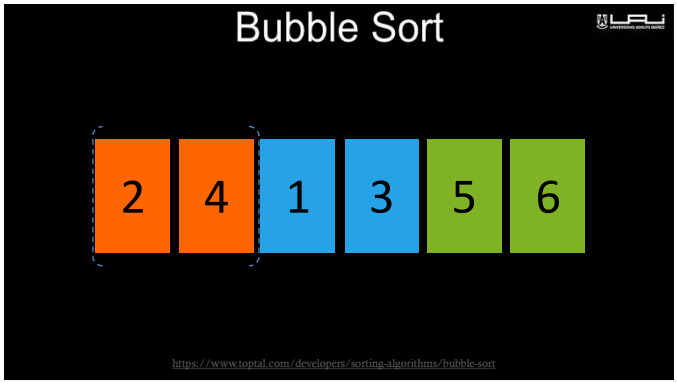
30


Bubble Sort
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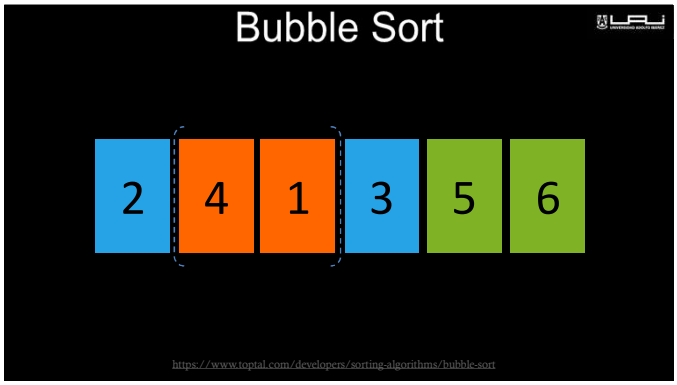
31


Bubble Sort
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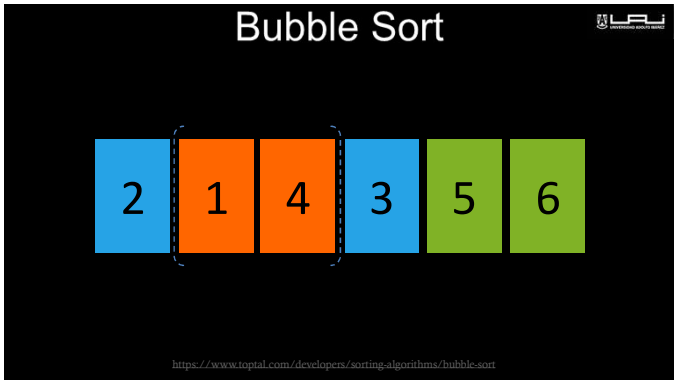
32


Bubble Sort
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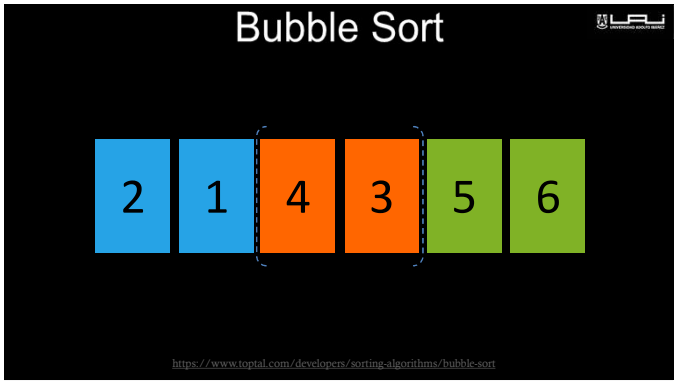
33


Bubble Sort
2
1
4
3
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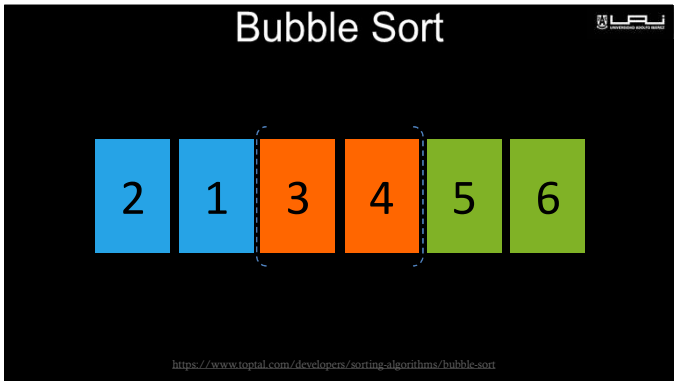
6
https://www.toptal.com/developers/sorting-algorithms/bubble-sort

34


Bubble Sort
2
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6
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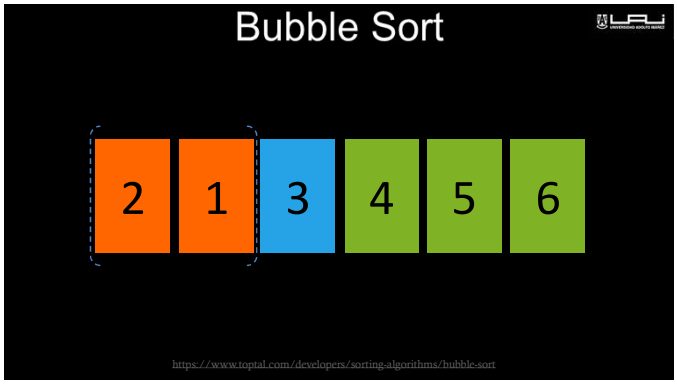
35


Bubble Sort
2
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4
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6
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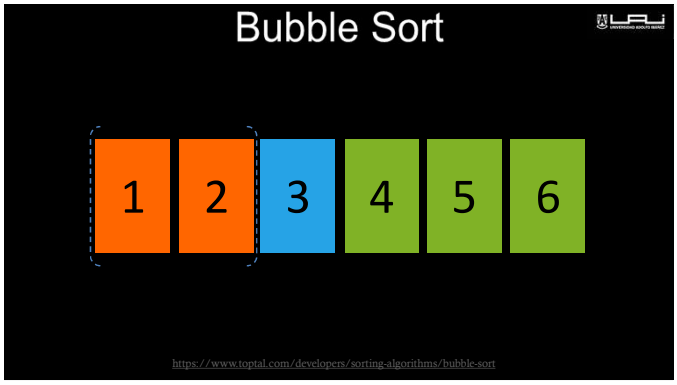
36


Bubble Sort
1
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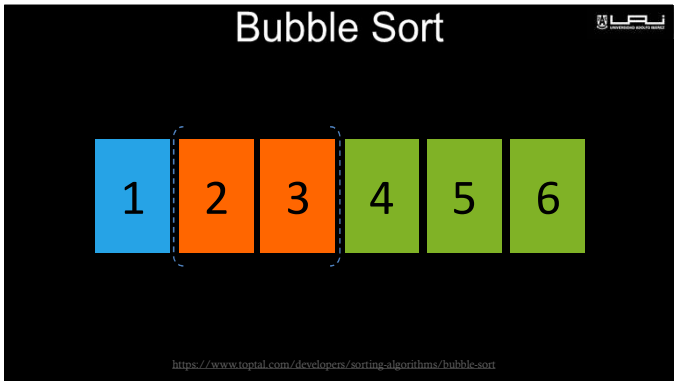
37


Bubble Sort
1
2
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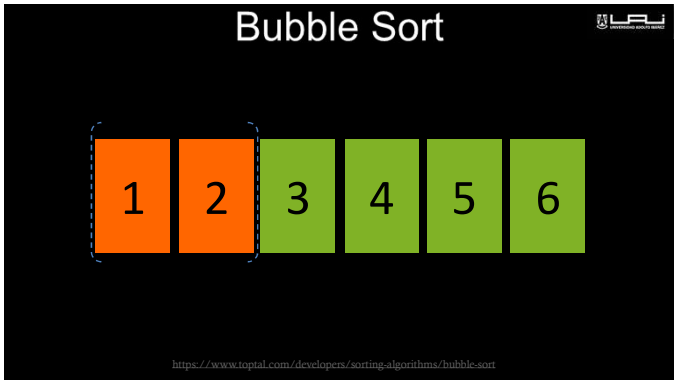
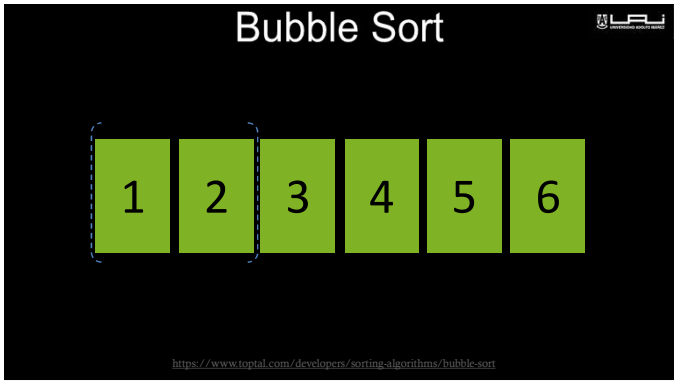
https://www.toptal.com/developers/sorting-algorithms/bubble-sort

38


Bubble Sort
1
2
3
4
5
6
https://www.toptal.com/developers/sorting-algorithms/bubble-sort

39

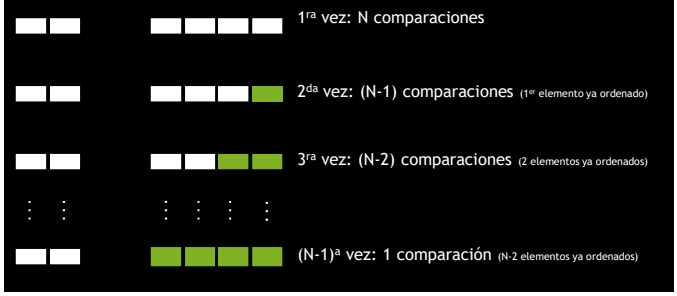
Bubble Sort



40

Bubble Sort

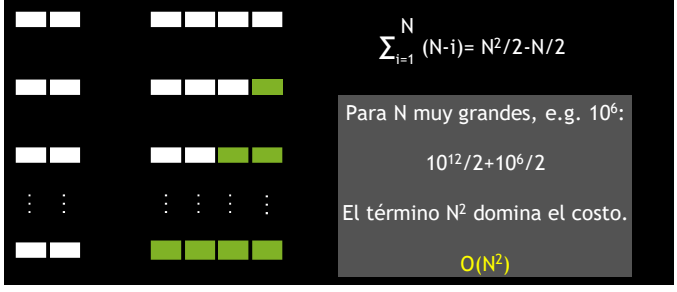
¿Cuántas comparaciones para N elementos?



41

Bubble Sort

¿Cuántas comparaciones para N elementos?



$$\sum_{i=1}^{N} (N-i) = N^2/2 - N/2$$

Para N muy grandes, e.g. 10^6:

$10^{12}/2 + 10^6/2$

El término N^2 domina el costo.

$O(N^2)$

42

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Objetivo

Sin embargo, deseamos intercambiar los valores (swap) para que queden de esta forma

x	y
15	34

43

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Primera idea

```
int x= 34;
int y= 15;

x= y;
y= x;
```

x	y
34	15

44

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Primera idea

```
int x= 34;
int y= 15;

x= y;
y= x;
```

x	y
34	15

45

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Primera idea

```
int x=34;
int y=15;

x= y;
y= x;
```

x	y
15	15

46

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

creamos una variable de uso temporal

Segunda idea

```
int x=34;
int y=15;
int swp;

swp = x;
x = y;
y = swp;
```

x	y	swp
34	15	

47

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Segunda idea

```
int x=34;
int y=15;
int swp;

swp = x;
x = y;
y = swp;
```

x	y	swp
34	15	34

48

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Segunda idea

```
int x=34;
int y=15;
int swp;

swp = x;
x = y;
y = swp;
```

x	y	swp
15	15	34

49

Swap

Suponga que tenemos dos variables (x,y) con los siguientes valores

x	y
34	15

Segunda idea

```
int x=34;
int y=15;
int swp;

swp = x;
x = y;
y = swp;
```

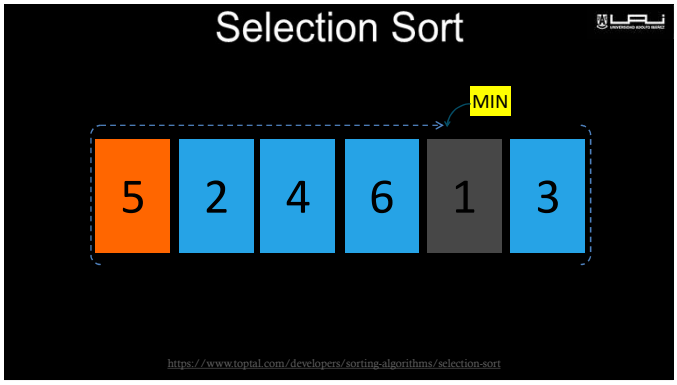
x	y	swp
15	34	34

50

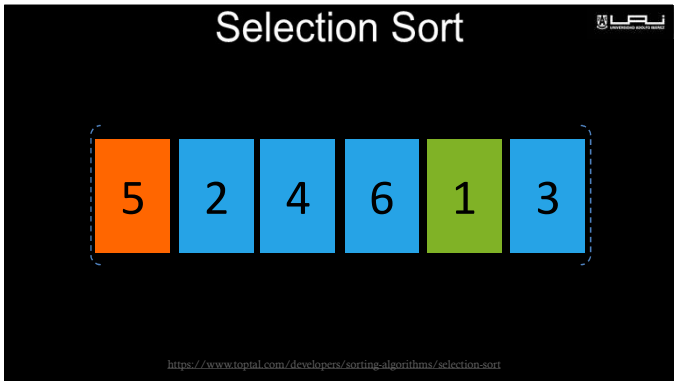
Selection sort

51

51


Selection Sort
MIN
5
2
4
6
1
3
https://www.toptal.com/developers/sorting-algorithms/selection-sort

52


Selection Sort
5
2
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1
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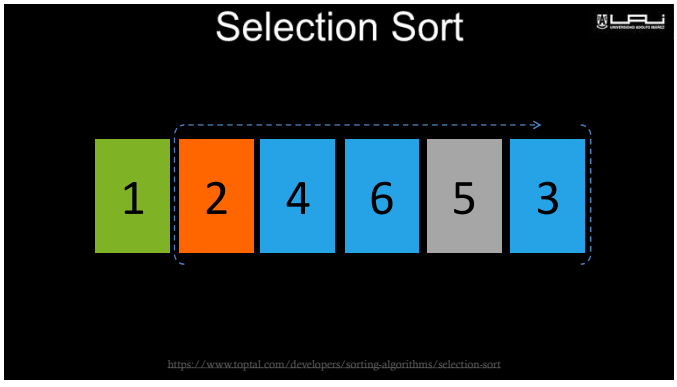
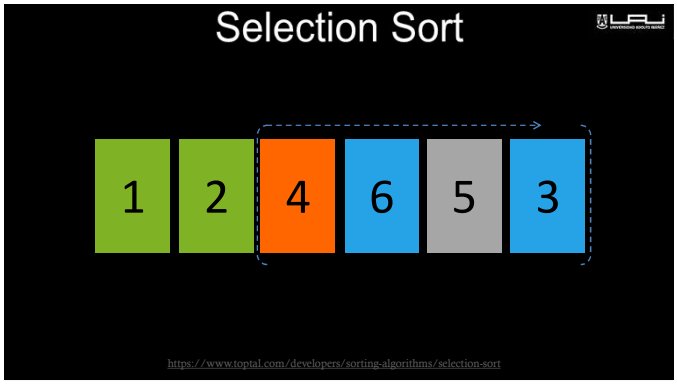
53


Selection Sort
1
2
4
6
5
3
https://www.toptal.com/developers/sorting-algorithms/selection-sort

54


Selection Sort
1
2
4
6
5
3
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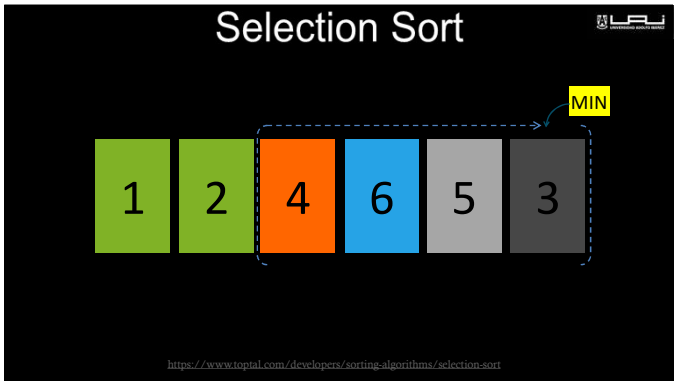
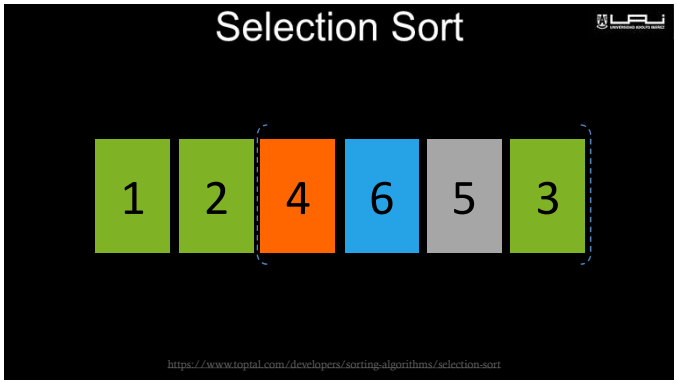
55


Selection Sort
MIN
1
2
4
6
5
3
https://www.toptal.com/developers/sorting-algorithms/selection-sort

56


Selection Sort
1
2
4
6
5
3
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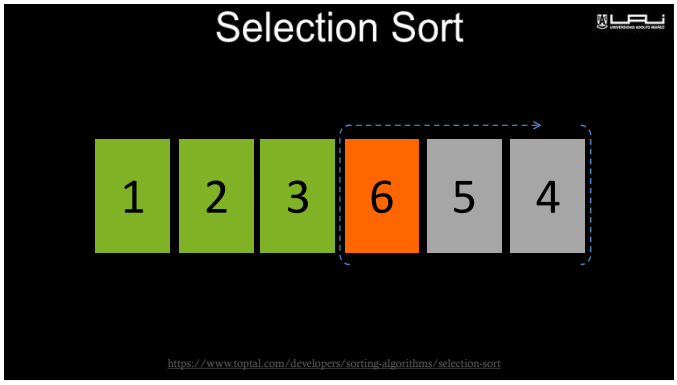
57


Selection Sort
1
2
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6
5
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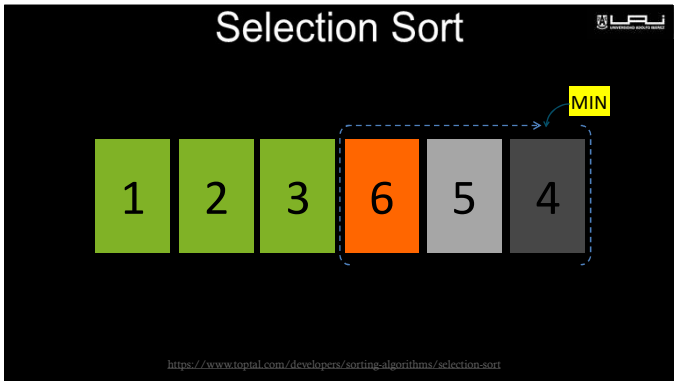
https://www.toptal.com/developers/sorting-algorithms/selection-sort

58


Selection Sort
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1
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5
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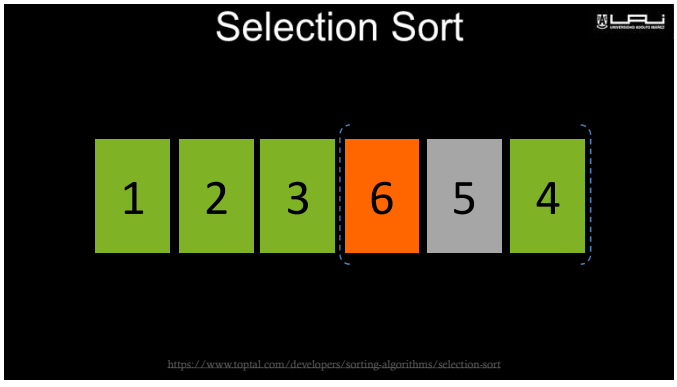
59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1
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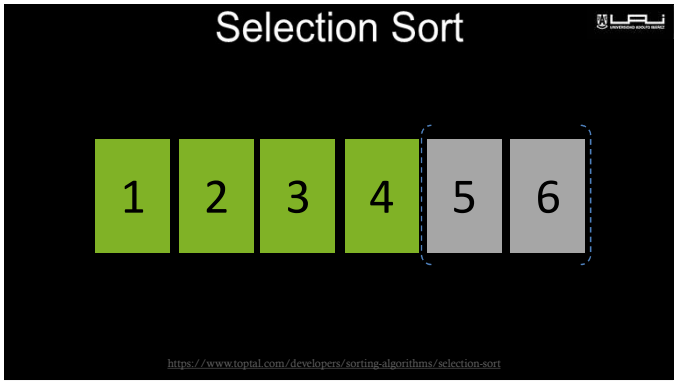
https://www.toptal.com/developers/sorting-algorithms/selection-sort

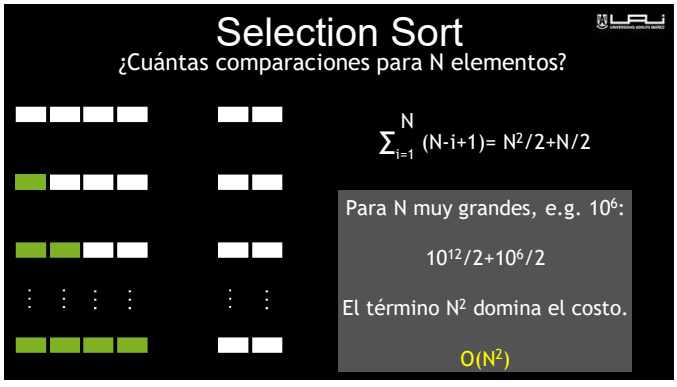
60


Selection Sort
1
2
3
4
5
6
https://www.toptal.com/developers/sorting-algorithms/selection-sort

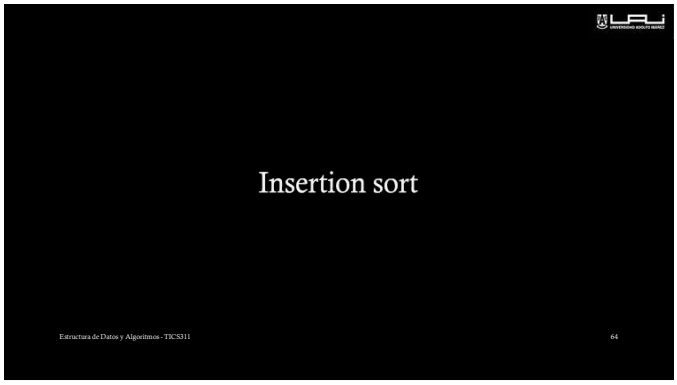
61


Selection Sort
¿Cuántas comparaciones para N elementos?
1ra vez: N comparaciones
2da vez: (N-1) comparaciones (1er elemento ya ordenado)
3ra vez: (N-2) comparaciones (2 elementos ya ordenados)
(N-1)a vez: 1 comparación (N-2 elementos ya ordenados)

62


Selection Sort
¿Cuántas comparaciones para N elementos?
$\sum_{i=1}^{N} (N-i+1) = N^2/2+N/2$
Para N muy grandes, e.g. 10^6:
$10^{12}/2+10^6/2$
El término N^2 domina el costo.
$O(N^2)$

63


Insertion sort
Estructura de Datos y Algoritmos - TICS311
64

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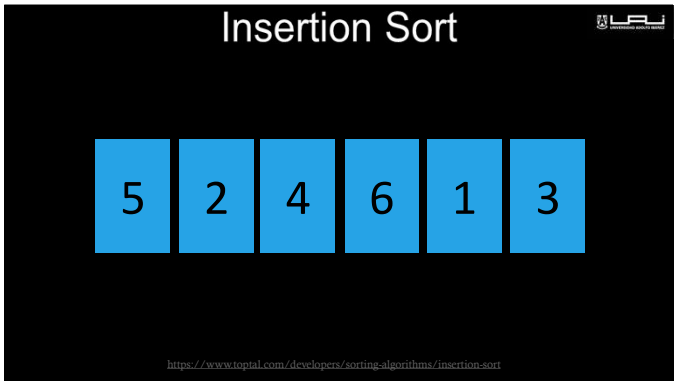
Insertion Sort
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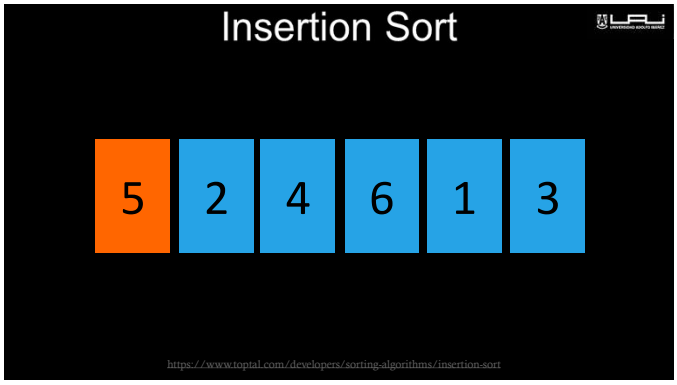
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

65


Insertion Sort
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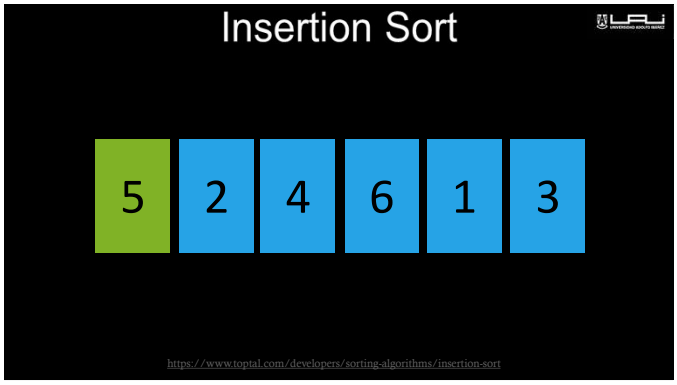
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

66


Insertion Sort
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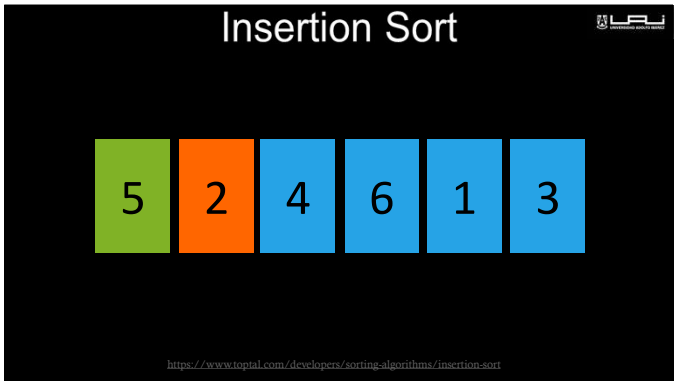
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

67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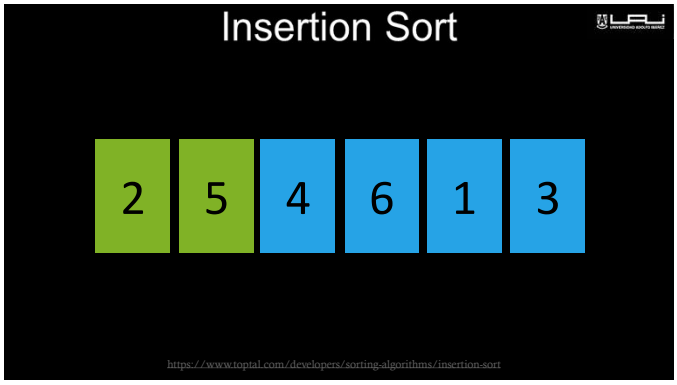
68


Insertion Sort
2
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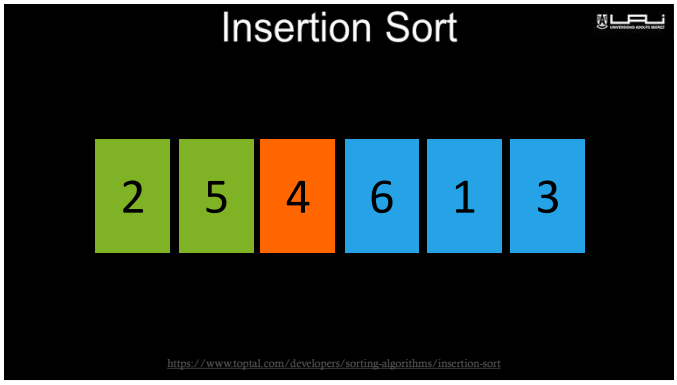
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

69


Insertion Sort
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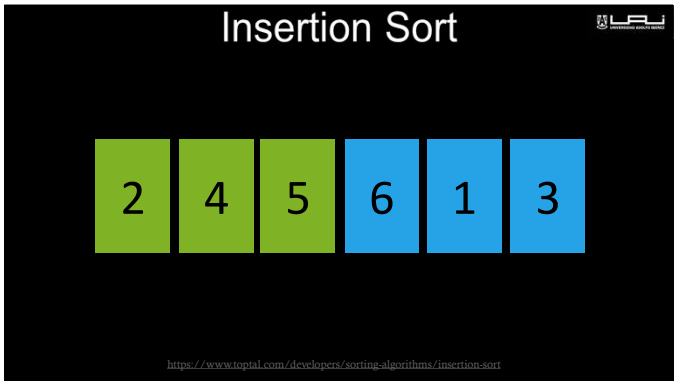
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

70


Insertion Sort
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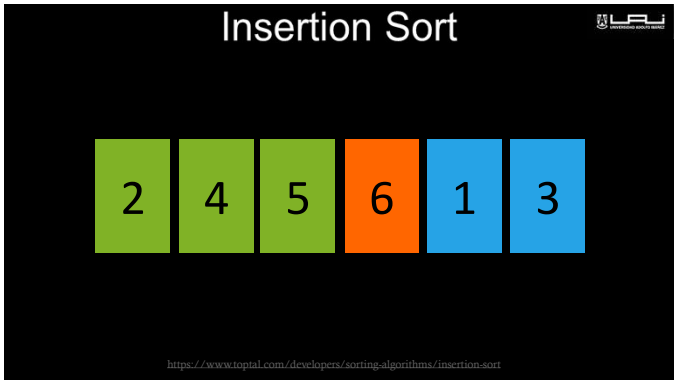
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

71


Insertion Sort
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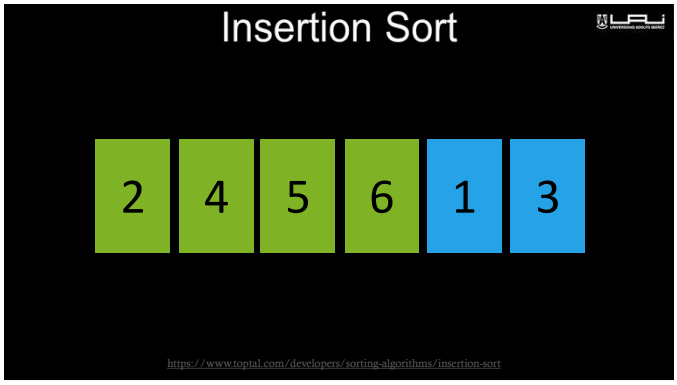
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

72


Insertion Sort
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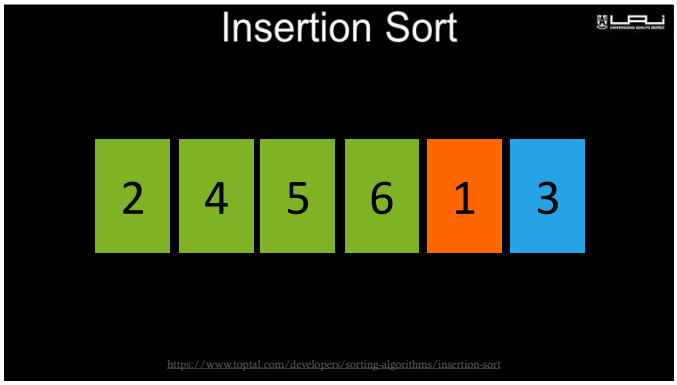
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

73


Insertion Sort
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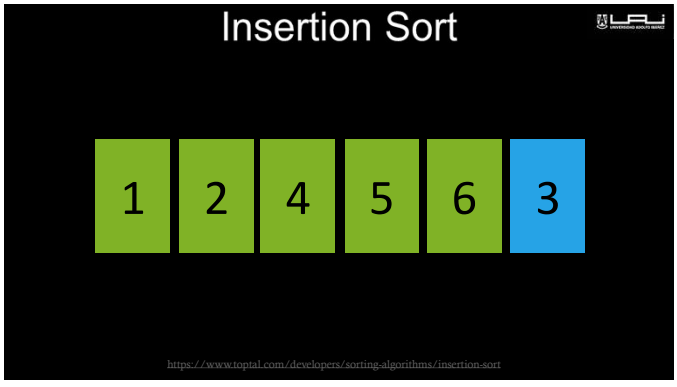
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

74


Insertion Sort
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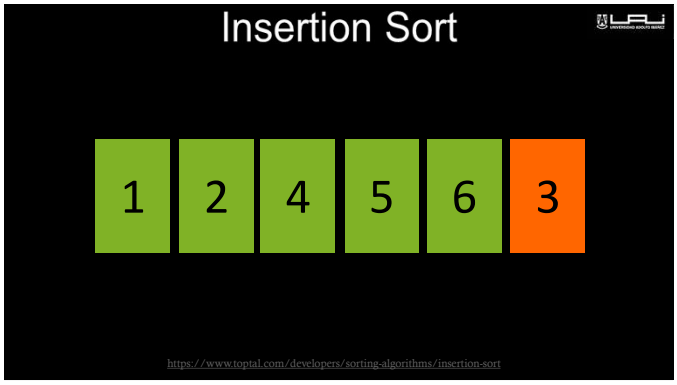
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

75


Insertion Sort
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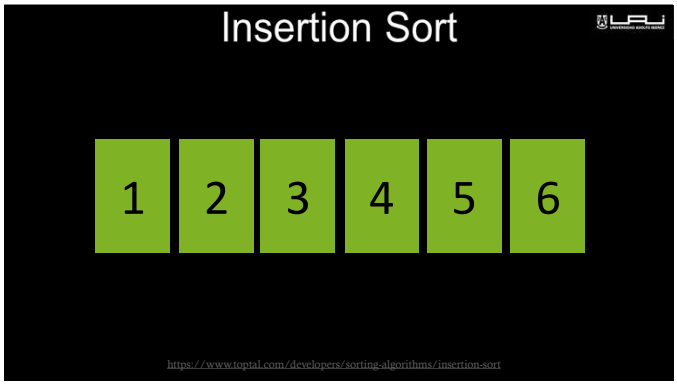
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

76


Insertion Sort
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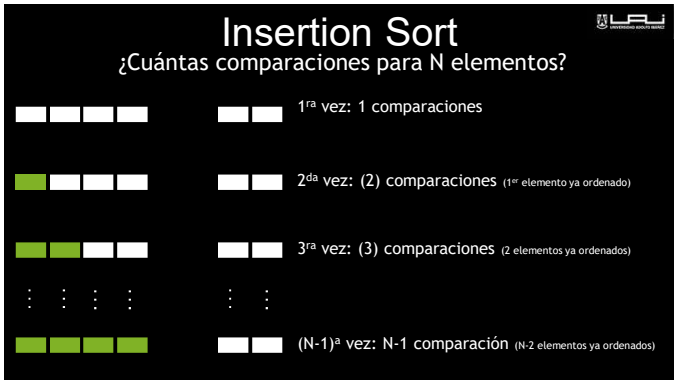
https://www.toptal.com/developers/sorting-algorithms/insertion-sort

77


Insertion Sort
¿Cuántas comparaciones para N elementos?
1ra vez: 1 comparaciones
2da vez: (2) comparaciones (1er elemento ya ordenado)
3ra vez: (3) comparaciones (2 elementos ya ordenados)
(N-1)ª vez: N-1 comparación (N-2 elementos ya ordenados)

78

Insertion Sort

¿Cuántas comparaciones para N elementos?

$$\sum_{i=1}^{N} (N-i+1) = N^2/2+N/2$$

Para N muy grandes, e.g. 10^6:

$10^{12}/2+10^6/2$

El término N^2 domina el costo.

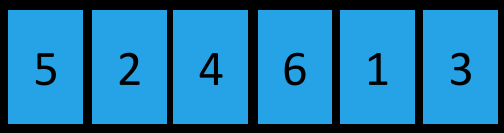
$O(N^2)$

79

Merge sort

80

Merge Sort



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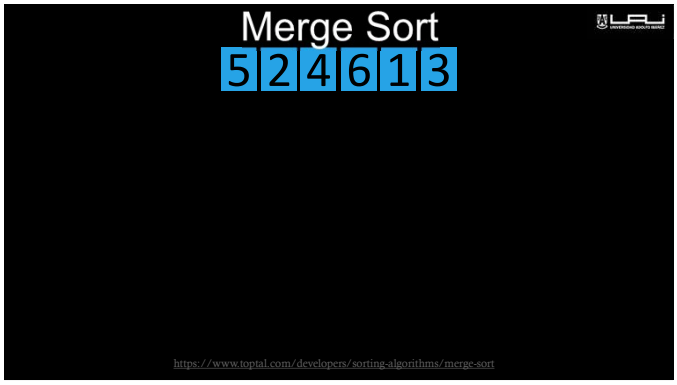
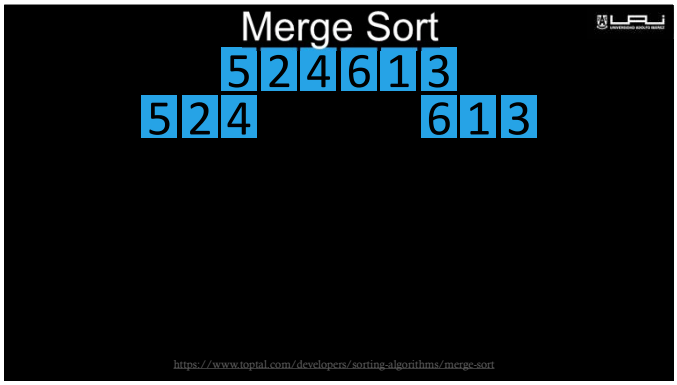
81


Merge Sort
5 2 4 6 1 3
https://www.toptal.com/developers/sorting-algorithms/merge-sort

82


Merge Sort
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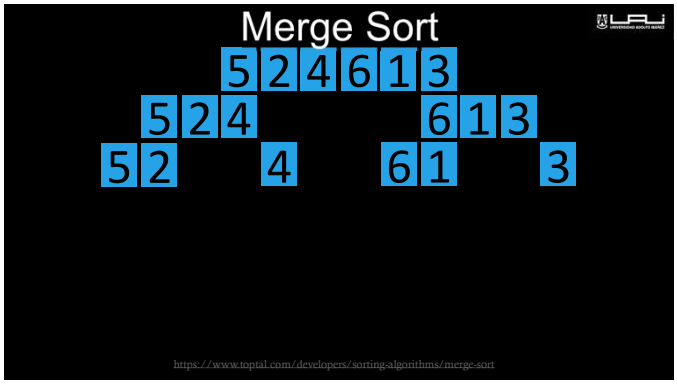
5 2 4 6 1 3
https://www.toptal.com/developers/sorting-algorithms/merge-sort

83


Merge Sort
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5 2 4 6 1 3
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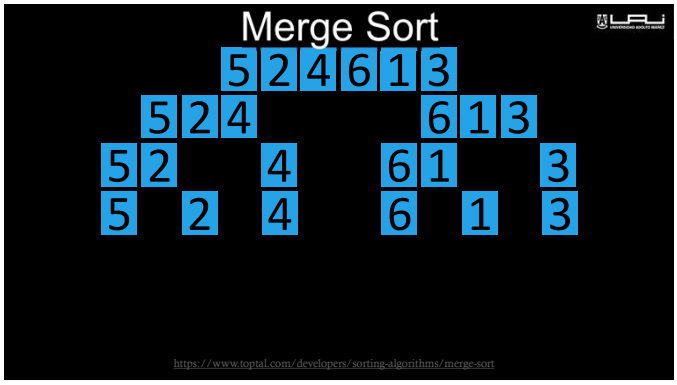
https://www.toptal.com/developers/sorting-algorithms/merge-sort

84


Merge Sort
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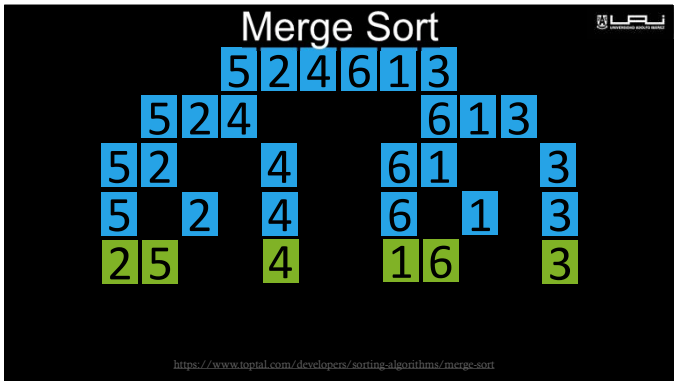
https://www.toptal.com/developers/sorting-algorithms/merge-sort

85


Merge Sort
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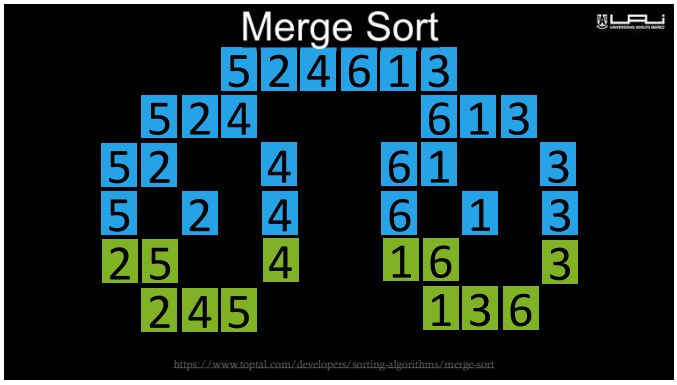
https://www.toptal.com/developers/sorting-algorithms/merge-sort

86


Merge Sort
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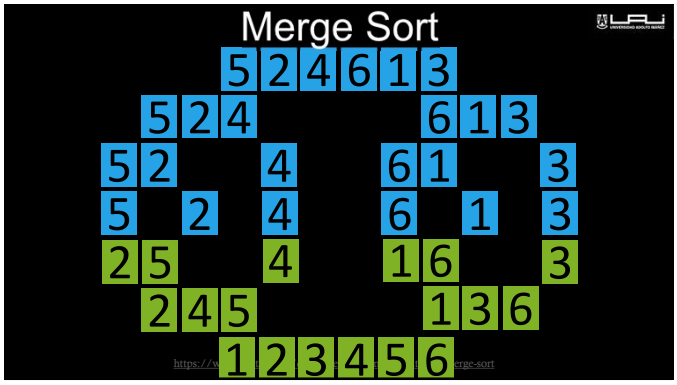
https://www.toptal.com/developers/sorting-algorithms/merge-sort

87


Merge Sort
5 2 4 6 1 3
5 2 4
6 1 3
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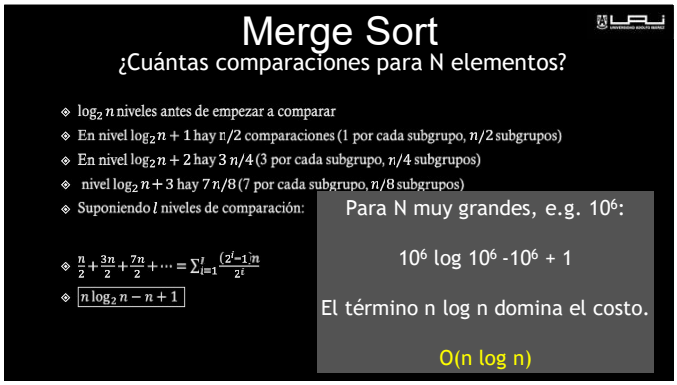
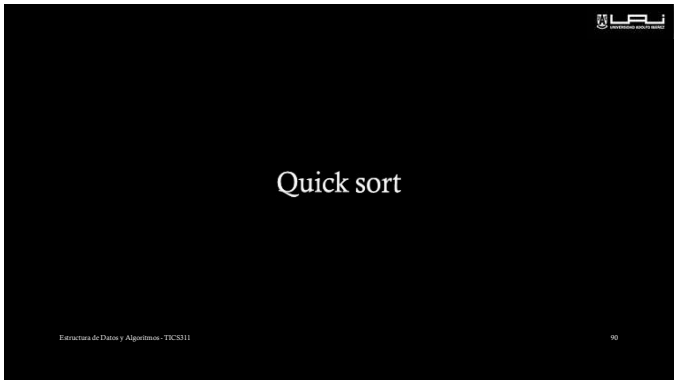
3
2 4 5
1 3 6
1 2 3 4 5 6

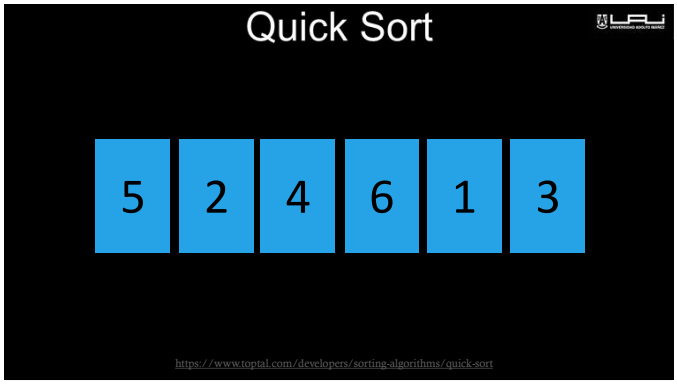
88


Merge Sort
¿Cuántas comparaciones para N elementos?
$\log_2 n$ niveles antes de empezar a comparar
En nivel $\log_2 n + 1$ hay $n/2$ comparaciones (1 por cada subgrupo, $n/2$ subgrupos)
En nivel $\log_2 n + 2$ hay $3\,n/4$ (3 por cada subgrupo, $n/4$ subgrupos)
nivel $\log_2 n + 3$ hay $7\,n/8$ (7 por cada subgrupo, $n/8$ subgrupos)
Suponiendo l niveles de comparación:
$\frac{n}{2} + \frac{3n}{2} + \frac{7n}{2} + \cdots = \sum_{i=1}^{l} \frac{(2^i - 1)n}{2^i}$
$n \log_2 n - n + 1$
Para N muy grandes, e.g. 10^6:
$10^6 \log 10^6 - 10^6 + 1$
El término n log n domina el costo.
O(n log n)

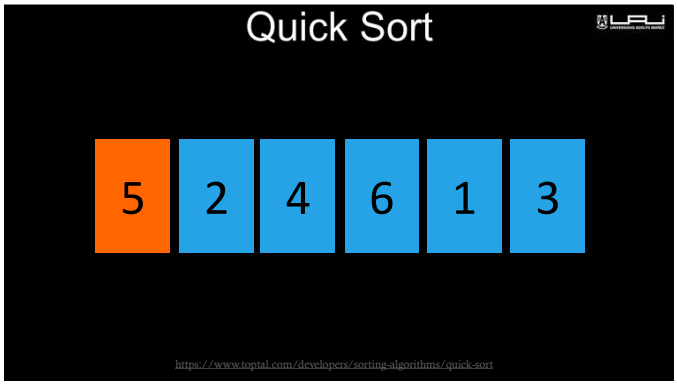
89


Quick sort
Estructura de Datos y Algoritmos - TICS311
90

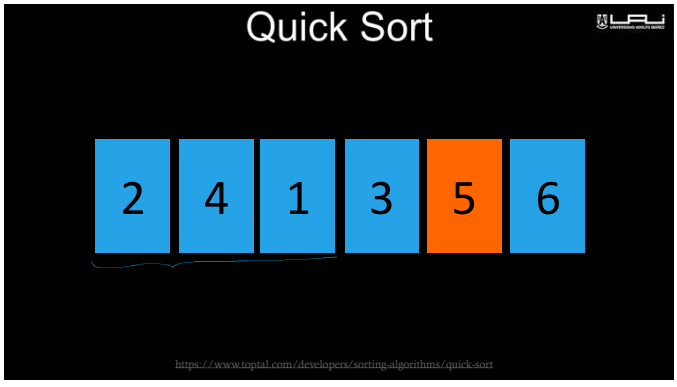
90


Quick Sort
5 2 4 6 1 3
https://www.toptal.com/developers/sorting-algorithms/quick-sort

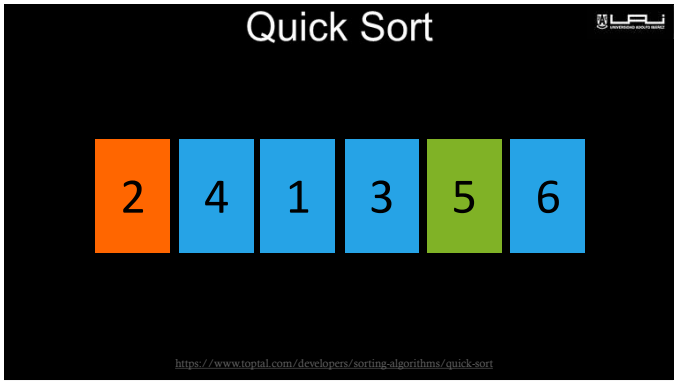
91


Quick Sort
5 2 4 6 1 3
https://www.toptal.com/developers/sorting-algorithms/quick-sort

92


Quick Sort
2 4 1 3 5 6
https://www.toptal.com/developers/sorting-algorithms/quick-sort

93


Quick Sort
2
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1
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5
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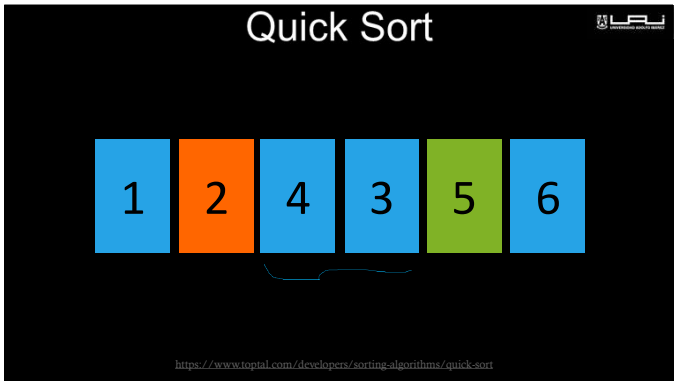
https://www.toptal.com/developers/sorting-algorithms/quick-sort

94


Quick Sort
1
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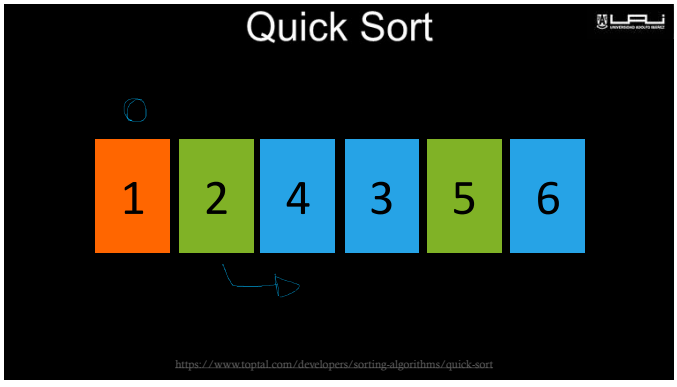
https://www.toptal.com/developers/sorting-algorithms/quick-sort

95


Quick Sort
1
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https://www.toptal.com/developers/sorting-algorithms/quick-sort

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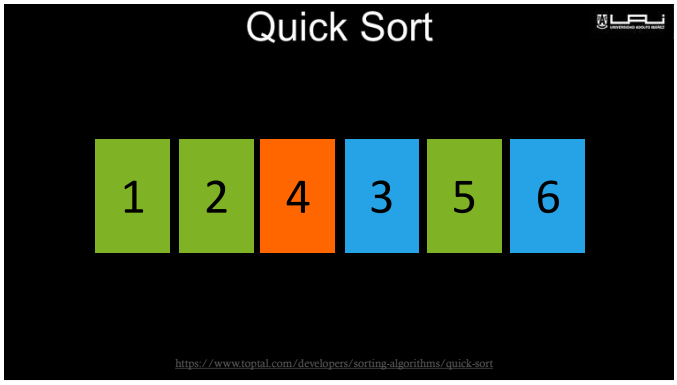
Quick Sort
1
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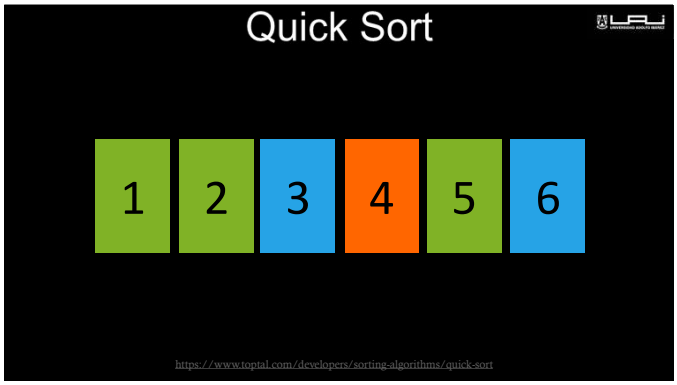
https://www.toptal.com/developers/sorting-algorithms/quick-sort

97


Quick Sort
1
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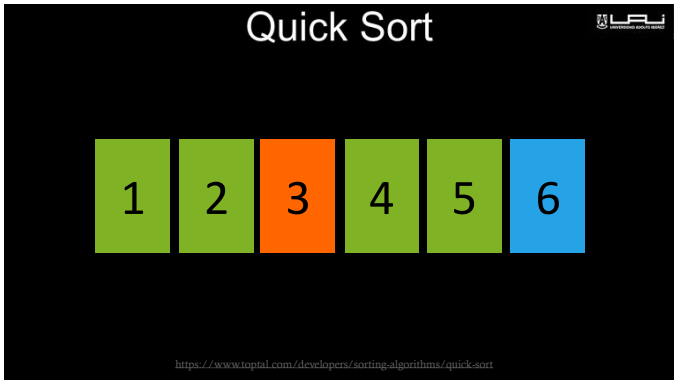
https://www.toptal.com/developers/sorting-algorithms/quick-sort

98


Quick Sort
1
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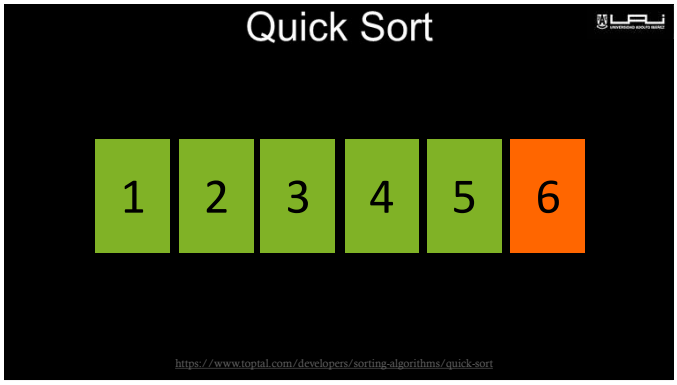
https://www.toptal.com/developers/sorting-algorithms/quick-sort

99

Quick Sort



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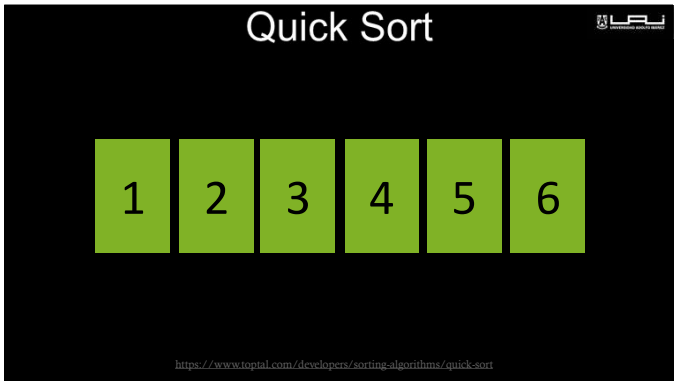
Quick Sort



101

Quick Sort

¿Cuántas comparaciones para N elementos?

TAREA (no evaluada como tarea)

102