Insertion Sort

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Java

Insertion Sort

Key represents the next value to sort.

Left side of the key is completely **sorted.**

Insert the **Key value** into the sorted set, move everything up.

iteration	4	3	2	10	12	1	5	6

Example - Insertion Sort **Green = key, Red = move**

iteration	4	3	2	10	12	1	5	6
0	4	**3**	2	10	12	1	5	6
1	3	4	**2**	10	12	1	5	6
2	2	3	4	**10**	12	1	5	6
3	2	3	4	10	**12**	1	5	6
4	2	3	4	10	12	**1**	5	6
5	1	2	3	4	10	12	**5**	6
6	1	2	3	4	5	10	12	**6**
7	1	2	3	4	5	6	10	12

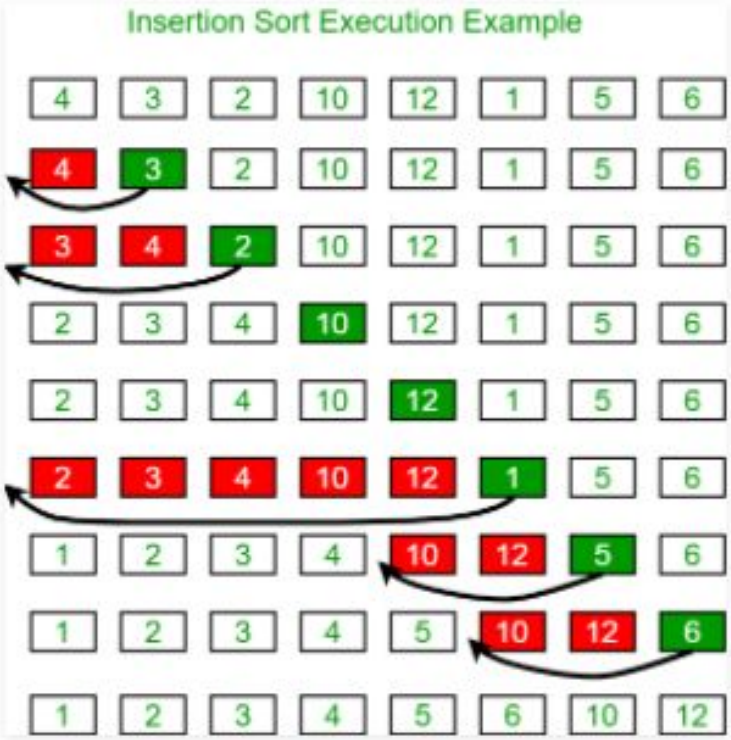
Insertion Sort - Code

```
public static void insertionSort(int [] arr){
    int outer, inner, key;

    for(outer = 1; outer < arr.length; outer++){
        key = arr[outer];
        inner = outer-1;

        while(inner >= 0 && arr[inner] > key){
            arr[inner + 1] = arr[inner];
            inner = inner - 1;
        }
        arr[inner + 1] = key;
    }
}
```

Sorting - Insertion Sort



Sorting - Insertion Sort

```
/* Function to sort an array using insertion sort*/
void insertionSort(int arr[], int n)
{
    int i, key, j;
    for (i = 1; i < n; i++)
    {
        key = arr[i];
        j = i - 1;

        /* Move elements of arr[0..i-1], that are
        greater than key, to one position ahead
        of their current position */
        while (j >= 0 && arr[j] > key)
        {
            arr[j + 1] = arr[j];
            j = j - 1;
        }
        arr[j + 1] = key;
    }
}
```

Runtime = O(?)

Sorting - Insertion Sort

```
/* Function to sort an array using insertion sort*/
void insertionSort(int arr[], int n)
{
    int i, key, j;
    for (i = 1; i < n; i++)
    {
        key = arr[i];
        j = i - 1;

        /* Move elements of arr[0..i-1], that are
        greater than key, to one position ahead
        of their current position */
        while (j >= 0 && arr[j] > key)
        {
            arr[j + 1] = arr[j];
            j = j - 1;
        }
        arr[j + 1] = key;
    }
}
```

Runtime = $O(n^2)$

Because of 2 nested loops

Lab: Implement Insertion Sort

Create an array of 200 random values,
Sort them with Insertion Sort and print.