

Insertion Sort

Textbook

Insertion Sort



Overview

Insertion sort works in a very similar way to selection sort. Selection sort finds the smallest value in the unsorted list and adds it to the sorted list. Insertion sort takes the next unsorted value and *inserts* it into its correct place in the sorted list.

6 5 3 1 8 7 2 4

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Pseudocode

Here is pseudocode for insertion sort:

```
1 function InsertionSort(list)
2
3   insert_spot = 0
4   val_to_insert = 0
5
6   for all elements (i) in list:
7     val_to_insert = list[i]
8     insert_spot = i
9
10    while insert_spot > 0 and list[insert_spot-1] > val_to_insert:
11      list[insert_spot] = list[insert_spot - 1]
12      insert_spot = insert_spot - 1
13    end while
14
15    list[insert_spot] = val_to_insert
16
17  end for
18  return list
19 end InsertionSort
```

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Insertion Sort Resources

- [Wikipedia](#)

- [TutorialsPoint](#)

Project

Write a Python Insertion Sort program that sorts the array found in the attached file "sorting_list.py". Your program will need to read the "sorting_list.py" file, sort the numbers found there, and print the sorted numbers in the correct position.

Checkpoint

Insertion Sort

1. Create a program that will insertion sort a list in Python.

Consider the following list:

```
arr = [10, 32, 4, 90, 15, 20, 89, 1, 3, 45, 42, 87, 91, 18, 25, 76, 38, 12]
```

2. The program will then take in a number input from the user.
3. The program will add the number to the list.
4. The program will sort the list using insertion sort.
5. Print the resulting list.

For example:

Input: 44

Output: [1, 3, 4, 10, 12, 15, 18, 20, 25, 32, 38, 42, 44, 45, 76, 87, 89, 90, 91]

Another example:

Input: 80

Output: [1, 3, 4, 10, 12, 15, 18, 20, 25, 32, 38, 42, 45, 76, 80, 87, 89, 90, 91]

Questions (4)

1. In insertion sorting, each iteration of the for-loop looks for which value?

MULTIPLE CHOICE

Choose the correct answer:

- A. The largest value in the remaining list.
- B. The smallest value in the remaining list.
- C. The next index value in the list.
- D. The last index value in the list.

2. Which method of sorting takes the next item of the list into consideration and then puts it in the correct place in order?

MULTIPLE CHOICE

Choose the correct answer:

- A. Bubble sort
- B. Insertion sort
- C. Selection sort

3. Which method of sorting moves through the list, comparing the values next to each other and puts the larger one to the right?

MULTIPLE CHOICE

Choose the correct answer:

- A. Bubble sorting
- B. Selection sorting
- C. Insertion sorting

4. Which method of sorting searches through a list for the next smallest value?

MULTIPLE CHOICE

Choose the correct answer:

- A. Bubble sorting
- B. Insertion sorting
- C. Selection sorting

Answer Keys & Solutions

Checkpoint Solutions

Insertion Sort

```
1 answer = int(input("Enter a number 0 - 100"))
2
3 arr = [10, 32, 4, 90, 15, 20, 89, 1, 3, 45, 42, 87, 91, 18, 25, 76, 38, 12]
4
5 arr.append(answer)
6
7 def insertionSort(sort_list):
8     for i in range(1, len(sort_list)):
9         key = sort_list[i]
10        j = i-1
11        while j >= 0 and key < sort_list[j] :
12            sort_list[j + 1] = sort_list[j]
13            j -= 1
14        sort_list[j + 1] = key
15
16 insertionSort(arr)
17
18 print(arr)
```

Questions

1. In insertion sorting, each iteration of the for-loop looks for which value?

MULTIPLE CHOICE

Correct Answer:

- A. The largest value in the remaining list. ✗ Incorrect
- B. The smallest value in the remaining list. ✗ Incorrect
- C. The next index value in the list. ✓ Correct
- D. The last index value in the list. ✗ Incorrect

Explanation:

Insertion sorting takes each item one by one and inserts it into the correct place in the new list.

2. Which method of sorting takes the next item of the list into consideration and then puts it in the correct place in order?

MULTIPLE CHOICE

Correct Answer:

A. Bubble sort

✗ Incorrect

B. Insertion sort

✓ Correct

C. Selection sort

✗ Incorrect

Explanation:

Insertion sorting takes each item one by one and inserts it into the correct place in the new list.

3. Which method of sorting moves through the list, comparing the values next to each other and puts the larger one to the right?

MULTIPLE CHOICE

Correct Answer:

A. Bubble sorting

✓ Correct

B. Selection sorting

✗ Incorrect

C. Insertion sorting

✗ Incorrect

Explanation:

Bubble sorting looks at the values in a list as pairs, comparing the two.

4. Which method of sorting searches through a list for the next smallest value?

MULTIPLE CHOICE

Correct Answer:

A. Bubble sorting

✗ Incorrect

B. Insertion sorting

✗ Incorrect

C. Selection sorting

✓ Correct

Explanation:

Selection sorting then takes that next smallest value and puts it into a new list.