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insertion_sort.py

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1
2 # HSLU / ICS/AI ML : Modul ADS : Algorithmen & Datenstrukturen
3 # Path   : uebung01/al/aufgabe04
4 # Version: Mon Feb 17 19:34:32 CET 2025
5
6 import random
7 import sys
8 from time import time
9
10
11 def insertion_sort(data):
12     """Sorts a list with the Insertion-Sort algorithm.
13
14     p    List of comparable elements which will be sorted.
15     """
16
17     # TODO: Implement here...
18
19
20 def verify(originalData, sortedData):
21     correctSorted = originalData.copy()
22     correctSorted.sort()
23     for i in range(len(originalData)):
24         if correctSorted[i] != sortedData[i]:
25             print("ERROR: wrong sorted!")
26             print("Original : ", originalData)
27             print("Sorted   : ", sortedData)
28             print(f"index[{i}]: should be: {correctSorted[i]}, but is: {sortedData[i]}")
29             sys.exit(1)
30
31
32 if __name__ == '__main__':
33
34     data = [5, 4, 2, 3, 1]
35     originalData = data.copy()
36     print(data)
37
38     insertion_sort(data)
39
40     print(data)
41     verify(originalData, data)

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42
43 # Makeing some test to measure the time needed of insertion_sort().
44 # Creating int-lists, beginning with length of 2^minExponent
45 # until the last array with length of 2^maxExponent.
46 minExponent = 9
47 maxExponent = 13
48 lastTime = sys.float_info.max
49 for exp in range(minExponent, maxExponent + 1):
50     length = pow(2, exp)
51     MEASUREMENTS = 10
52     minTime = sys.float_info.max
53     for i in range(MEASUREMENTS):
54         data = list(range(length))
55         random.shuffle(data)
56         start = time()
57         insertion_sort(data)
58         end = time()
59         timeSpent = end - start
60         if timeSpent < minTime:
61             minTime = timeSpent
62         print(f"List-Size: {length:6,d}          Time: {minTime*1e3:7.1f} ms          Ratio
to last: {minTime / lastTime:.1f}")
63     lastTime = minTime
64
65
66     """ Session-Log:
67
68     [5, 4, 2, 3, 1]
69     [1, 2, 3, 4, 5]
70     List-Size:      512          Time:      4.2 ms          Ratio to last: 0.0
71     List-Size: 1,024          Time:     18.5 ms          Ratio to last: 4.4
72     List-Size: 2,048          Time:     78.8 ms          Ratio to last: 4.3
73     List-Size: 4,096          Time:    312.7 ms          Ratio to last: 4.0
74     List-Size: 8,192          Time:   1248.7 ms          Ratio to last: 4.0
75
76     """
77
78

```