MCAC 301: Design and Analysis of Algorithms

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Stable Sorting

A Meteorological department collects weather data of various cities taken at different times of the day. Each record consists of "Name of the city, Time of the day (when the data was collected), temperature". Their weather data analyst wants to analyse and produce report for each city.
Sort the data on cities using Insertion Sort? And, answer the following question:

- For a city, does it's relative ordering change wrt the time? (Remember the entire input was sorted on time as the records were created as and when the sample was collected.

Data before sorting

S.No.	City	Time Stamp	Temp.(C)
1	Delhi	5:00	27
2	Bangalore	6:00	21
3	Delhi	12:00	31
4	Bangalore	13:00	28
5	Delhi	15:00	32

Iteration 1

i=2, Key= Bangalore

	S.No.	City	Time Stamp	Temp.(C)
	1	Delhi	5:00	27
	3	Delhi	12:00	31
	4	Bangalore	13:00	28
	5	Delhi	15:00	32
Temp =	2	Bangalore	6:00	21

Iteration 1

i=2, Key= Bangalore

j=1, After comparing Delhi and Bangalore

	S.No.	City	Time Stamp	Temp.(C)
	1	Delhi	5:00	27
	3	Delhi	12:00	31
	4	Bangalore	13:00	28
	5	Delhi	15:00	32
Temp =	2	Bangalore	6:00	21

Iteration 1

i=2, Key= Bangalore
Inserting the key

S.No.	City	Time Stamp	Temp.(C)
2	Bangalore	6:00	21
1	Delhi	5:00	27
3	Delhi	12:00	31
4	Bangalore	13:00	28
5	Delhi	15:00	32

Iteration 2

i=3, Key= Delhi

	S.No.	City	Time Stamp	Temp.(C)
	2	Bangalore	6:00	21
	1	Delhi	5:00	27
	4	Bangalore	13:00	28
	5	Delhi	15:00	32
Temp=	3	Delhi	12:00	31

Iteration 2

i=3, Key= Delhi
j=2, after comparing Delhi and Delhi.
and inserting the key.

S.No.	City	Time Stamp	Temp.(C)
2	Bangalore	6:00	21
1	Delhi	5:00	27
3	Delhi	12:00	31
4	Bangalore	13:00	28
5	Delhi	15:00	32

Iteration 3

i=4, Key= Bangalore

	S.No.	City	Time Stamp	Temp.(C)
	2	Bangalore	6:00	21
	1	Delhi	5:00	27
	3	Delhi	12:00	31
	5	Delhi	15:00	32
Temp=	4	Bangalore	13:00	28

Iteration 3

i=4, Key= Bangalore

j=3, after comparing Bangalore and Delhi with S.No.3.

	S.No.	City	Time Stamp	Temp.(C)
	2	Bangalore	6:00	21
	1	Delhi	5:00	27
	3	Delhi	12:00	31
	5	Delhi	15:00	32
Temp=	4	Bangalore	13:00	28

Iteration 3

i=4, Key= Bangalore

j=2, after comparing Bangalore and Delhi with S.No.1.

	S.No.	City	Time Stamp	Temp.(C)
	2	Bangalore	6:00	21
	1	Delhi	5:00	27
	3	Delhi	12:00	31
	5	Delhi	15:00	32
Temp=	4	Bangalore	13:00	28

Iteration 3

i=4, Key= Bangalore
j=1, after comparing Bangalore and Bangalore
and inserting the key

S.No.	City	Time Stamp	Temp.(C)
2	Bangalore	6:00	21
4	Bangalore	13:00	28
1	Delhi	5:00	27
3	Delhi	12:00	31
5	Delhi	15:00	32

Iteration 4

i=5, key= Delhi

	S.No.	City	Time Stamp	Temp.(C)
	2	Bangalore	6:00	21
	4	Bangalore	13:00	28
	1	Delhi	5:00	27
	3	Delhi	12:00	31
Temp=	5	Delhi	15:00	32

Iteration 4

i=5, key= Delhi
j=4, after comparing Delhi and Delhi
and inserting the key.

S.No.	City	Time Stamp	Temp.(C)
2	Bangalore	6:00	21
4	Bangalore	13:00	28
1	Delhi	5:00	27
3	Delhi	12:00	31
5	Delhi	15:00	32

Stable Sorting

A sorting algorithm is said to be stable if it maintains the relative ordering of the equal keys.

Insertion Sort is Stable.

In-Place Sorting

A sorting algorithm is said to be in-place if it takes constant amount of extra space.
How much extra space does IS take?
Insertion Sort is In-place.