

# DSAA Assignment1

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## 1 Answer 1.1

24	5	6	23	42	45	2	1	8
1	5	6	23	42	45	2	24	8
1	2	6	23	42	45	5	24	8
1	2	5	23	42	45	6	24	8
1	2	5	6	42	45	23	24	8
1	2	5	6	8	45	23	24	42
1	2	5	6	8	23	45	24	42
1	2	5	6	8	23	24	45	42
1	2	5	6	8	23	24	42	45

## 2 Answer 1.2

**Loop invariant:** At the start of each iteration of the for loop of lines 2 – 6, the subarray  $A[1 \dots j - 1]$  consists of the element originally in  $A[1 \dots n]$ , but in sorted order. Besides, all of the elements  $A[1 \dots j - 1]$  are smaller or equal to the elements in  $A[j \dots n]$

**Initialisation:** For  $j = 1$  the empty subarray has no element (trivial)

**Maintenance:** The inner for loop find the index of the minimum of  $A[j \dots n]$  and swap the value of  $A[j]$  and  $A[\textit{smallest}]$ . Then because  $A[j \dots n] \geq A[1 \dots j - 1]$ , we can get  $A[j] \geq A[j - 1]$ . As a result, the subarray  $A[1 \dots j]$  is sorted. Meanwhile,  $A[1 \dots j - 1] \leq A[j + 1 \dots n]$  and  $A[j] \leq A[j + 1 \dots n]$ . So  $A[1 \dots j] \leq A[j + 1 \dots n]$ . Then by the end of the iteration, the loop invariant still holds for step  $j + 1$

**Termination:** The loop ends when  $j = n$ . Then the loop invariant for  $j = n$  says that the subarray  $A[1 \dots n - 1]$  is sorted and all of the elements are smaller than  $A[n]$ . Then the  $A[1 \dots n]$  is sorted.

3 Answer 1.3

lines

times

1

1

2

n

3

n-1

4

n-j

5

n-j-1

6

n-1

$sum = 1 + n + n - 1 + \sum_{j=1}^{n-1} (n - j) + \sum_{j=1}^{n-1} (n - j - 1) + n - 1$

There is no best-case or worst-case ,for all the cases, we have:

$sum = 3n - 1 + \frac{n(n - 1)}{2} + \frac{(n - 1)(n - 2)}{2}$

$= n^2 + n$

If we also assume that one execution of each line of the algorithm takes time 1 for INSERTIONSORT. We can get the runtime:

best-case:  $5n - 4$   
worst-case:  $\frac{3}{2}n^2 + \frac{7}{2}n - 4$

We solve the inequalities

$$\begin{cases} n^2 + n \geq 5n - 4 \\ n^2 + n \geq \frac{3}{2}n^2 + \frac{7}{2}n - 4 \end{cases}$$

After solve the inequalities, we can get that for all the  $n \in [2, \infty]$ ,SELECTIONSORT is **worse** than the **best-case** of INSERTIONSORT but **better** than the **worst-case** of INSERTIONSORT.  
**ps:** If n=1 SELECTIONSORT > INSERTIONSORT

4 Answer 1.4

SUSTech Online Judge

讨论版

常见问题

问题

来源/分类

状态

排名

竞赛&作业

[

问题

状态

排名

OI 排名

统计

]

中

EN

12310401

Contest1159 - CS217 2024 Fall Lab1

Start Time: 2024-09-10 19:00:00

End Time: 2024-09-17 16:00:00

Current Time: 2024-9-11 18:05:58

Status:Running

Private

[Status]

[Standing]

[Statistics]

题目编号	标题	来源/分类	正确	提交
Y 1514 Problem A	InsertionSort		41	103
Y 1515 Problem B	SelectionSort		40	69
Y 1540 Problem C	Double Median (Easy Version)		37	67
Y 1541 Problem D	Lucky number (Easy Version)		37	59