National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Design and Analysis of Algorithms	Course Code:	CS2009
Degree Program:	BSCS	Semester:	FALL 2022
Due Date:	Monday, February 13, 2023	Total Marks:	10 + 10 + 10 = 30
Section:	ALL	Page(s):	2
Exam Type:	Assignment 1		

Student : Name:_____ Roll No._____ Section:_____

Instruction/Notes:

Loop invariants

Use loop invariants to prove the correctness of the following algorithms

Note: Use the code given in this assignment.

a) Find Min

```
MINIMUM(A)
1   min = A[1]
2   for i = 2 to A.length
3       if min > A[i]
4           min = A[i]
5   return min
```

b) Bubble Sort

```
BUBBLESORT(A)
1   for i = 1 to A.length − 1
2       for j = A.length downto i + 1
3           if A[j] < A[j − 1]
4               exchange A[j] with A[j − 1]
```

c) Selection Sort

SELECTIONSORT(A)

1 **for** $j = 1$ **to** $A.length - 1$
2      $smallest\_index = j$
3   **for** $i = j + 1$ **to** $A.length$
4   **if** $A[i] < A[smallest\_index]$
5              $smallest\_index = i$
6   exchange $A[j]$ with $A[smallest\_index]$