

King Fahd University of Petroleum and Minerals
College of Computer Science and Engineering
Information and Computer Science Department

ICS 353-01: Design and Analysis of Algorithms
Fall Semester 2018-2019
Quiz#1, Tuesday September 11th, 2018.

Name:

ID#:

1. (10 points) Using the definition of Big O(), show that $n^3 + 7n^2 + 18n$ is in $O(n^3)$.

To find $c > 0$ and $n_0 \in \mathbb{Z}^+$ such that

$$n^3 + 7n^2 + 18n \leq cn^3 \quad \forall n \geq n_0$$

Since $n^3 + 7n^2 + 18n \leq n^3 + 7n^3 + 18n^3 = 26n^3 \quad \forall n \geq 1$, it is obvious that we can choose $c = 26$ and $n_0 = 1$.

2. (10 points) Answer the following questions with respect to the array

2, 5, 3, 14, 4, 1

- (6 points) Apply the Insertion Sort Algorithm on the above array, showing all intermediate steps.
- (2 points) What is the number of element comparisons that were carried out by the algorithm.
- (2 points) What is the number of element assignments that were carried out by the algorithm.

a.

	Array elements after iteration	2	5	3	14	4	1	# elt. Comp.	# elt. Assgn.
$x = 5$	1	2	5	3	14	4	1	1	2
$x = 3$	2	2	3	5	14	4	1	2	3
$x = 14$	3	2	3	5	14	4	1	1	2
$x = 4$	4	2	3	4	5	14	1	3	4
$x = 1$	5	1	2	3	4	5	14	5	7

b. Number of element comparisons = $1+2+1+3+5 = 12$

c. Number of element assignments = $2+3+2+4+7 = 18$