National University of Computer & Emerging Sciences, Karachi
Fall-2019 Department of Computer Science
Mid Term-1
24th September 2018, 11:00 AM – 12:00 PM

Course Code: CS302	**Course Name:** Design and Analysis of Algorithm
Instructor Name / Names: Dr. Muhammad Atif Tahir, Waqas Sheikh, Zeshan Khan	
Student Roll No:	**Section:**

Instructions:

- Return the question paper.
- Read each question completely before answering it. There are **5 questions** on **2 pages.**
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 60 minutes. **Max Marks: 12.5**

Question # 1 **[1.5 marks]**

Are these following statement true or false? Prove your answer by computing the values of n_0, c_1, c_2 or by contradiction. [Θ is Theta]
[Remove One]

A. $n^2 + 4^5 = \Theta(n^2)$
B. $2\hat{}n + 2n = \Omega(n^2)$
C. $2n + 4^{\log_2 n} - 5 = \Theta(n^2)$

Question # 2 **[1.5 marks]**

Question # 3 **[1.5 marks]**

(a) What is meant by Design and Analysis of Algorithms?
(b) List two topics in Computer Science that are more important than studying computer program performance.
(c) Write down the formal definition of Small-Oh Notation i.e. in terms of f(n) and g(n)

Question # 4 **[4 marks]**

Given a sorted array containing duplicates, Design efficient algorithm using divide & conquer approach to find the frequency of each element. For example, Input = {1,1,1,5,5,6,6,8,9}. Output:
1 appears 3 times
5 appears 2 times
6 appears 2 times
8 appears 1 time
9 appears 1 time

Question # 5 **[2+1+1.5=4.5 marks]**

Solve the following recurrences to compute the time complexity.

A. $T(n) = 2T(n-1) + 1$ [Master Theorem]
B. $T(n) = 32T\left(\frac{n}{4}\right) - n^2 logn$
C. $T(n) = 7T\left(\frac{n}{3}\right) + n^2$

BEST OF LUCK