# COMSATS University Islamabad, Lahore Campus

**☑ Sessional-1 ☐ Sessional-II ☐ Terminal Examination – SPRING 2021**

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|---|---|---|---|---|---|---|---|
| Course Title: | Design and Analysis of Algorithms | | | | Course Code: | CSC301 | Credit Hours: 3 |
| Course Instructor/s: | Dr. Hasan Jamal | | | | Programme Name: | BS Computer Science | |
| Semester: | 5th | Batch: | SP19-BCS | Section: | A, B, C | Date: | 03/04/2021 |
| **Time Allowed:** | **1 Hour** | | | | **Maximum Marks:** | | **25** |
| Student's Name: | | | | | Reg. No. | | |

**Question 1:** **[Marks: 6 + 4 = 10]**

(a) Prove or disprove: $3^{n-1} \in \Theta(3^n)$

(b) Prove or disprove: $\frac{1}{3}n^2 - \frac{1}{2}n + \frac{2}{5} \in \Omega(n^2)$

**Question 2:** **[Marks: 10]**

For the following code snippet, provide a line-by-line analysis and construct function T($n$) that give the runtime of this code snippet as a function of "$n$". Also determine the Big-Oh of this code snippet.

```
1.  for (int i = 0; i < n; ++i)  {
2.      if ( i%2 != 0)
3.          sum += foobar( ) + foo( i) + bar( i);
4.      else
5.          sum += foo( i ) * bar( i );
6.  }
7.
8.  foobar ( ) {
9.      for (int i = 0; i < n; ++i)
10.         for (int j = 0; j < i; ++j)
11.             sum = bar( );
12.     return a;
13. }
14.
15. foo (a) {
16      for (int i = 1; i ≤ n*n; ++i)
17.         a =  a * i;
18.     return a;
19. }
20.
21. bar (a) {
22.     for (int i = 1; i ≤ n; ++i)
23.         a =  a * i;
24.     return a;
25. }
```

**Question 3:** **[Marks: 3 + 2 = 5]**

(a) Why we compare algorithms instead of programs. Give three reasons.

(b) If an algorithm provides a correct solution to a problem, why would you still want to analyze the algorithm?