DS2030 DSA for DS Name:

Quiz 1: 50 minutes Roll Number:

Instructions

Answer all the questions below. Write your answers directly on the quiz paper in the spaces provided. The total marks for the quiz is 30 points. Allocate your time wisely. *Describe the algorithms using the pseudo-code notation used in the class or Python syntax.You are not allowed to use Python list operations unless explicitly stated.*

1. (2 points) Write a Python code snippet to remove all even numbers from a **Python list**.

2. (4 points) Describe an algorithm to find the middle element of a singly linked list in one pass.

3. (2 points) What is the time complexity of the following `find_min` function? Justify your answer.

```
    def find_min(arr):
        min_val = arr[0]
        for num in arr:
            if num < min_val:
                min_val = num
        return min_val
```

4. (2 points) Give an example of a scenario where using a stack would be more appropriate than using a queue. Explain your reasoning.

5. (2 points) Write an algorithm function that uses a stack to check if a given string is a palindrome. A palindrome is a string that reads the same forward and backward. For example, “adam”, “racecar”, and ”level” are palindromes, while “hello” and “world” are not. You can assume that the check is case-insensitive and all the functions of a Stack are already defined.

6. (6 points) Write the algorithm that merges two *sorted* singly linked lists into one sorted singly linked list. Your function should take the heads of two *sorted* linked lists as input and return the head of the merged sorted list. The algorithm must use the existing nodes in the linked lists and not create new nodes.

7. (6 points) Prove that $T(n) = 3n^2 + 5n + 2$ is $\Theta(n^2)$.

8. (6 points) Given a binary tree, write the algorithm to find the **Lowest Common Ancestor (LCA)** of two given nodes in the tree. The LCA of two nodes p and q in a binary tree is defined as the deepest node that has both p and q as descendants (where we allow a node to be a descendant of itself).