Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603 110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

UCS2403: DESIGN & ANALYSIS OF ALGORITHMS

Assignment 4

1. Use the tool Hypothesis to generate counterexamples to show that the output of the buggy code is indeed wrong, by comparing it against your correct code.

   (a) Counting Inversions

      i. Consider the Python codes given in (1) and (2) below for finding the count of inversions in a list.

```
(1) def count_inversions1(nums):
        count = 0
        for i in range(1, len(nums)):
            if nums[i] < nums[i - 1]:
                count += 1
        return count


(2) def count_inversions2(nums):
        nums.sort()
        count = 0
        for i in range(1, len(nums)):
            if nums[i] < nums[i - 1]:
                count += 1
        return count
```

   (b) Comparison count sort

```
def comparison_count_sort(nums):
    count = [0] * len(nums)
    nums_sorted = [0] * len(nums)
    for i in range(len(nums) - 1):
        for j in range(i + 1, len(nums)):
            if nums[i] > nums[j]:
                count[i] += 1
            elif nums[i] < nums[j]:
                count[j] += 1
    for i in range(len(nums)):
```

```
            nums_sorted[count[i]] = nums[i]
    return nums_sorted
```

2. (a) Using the technique of divide-and-conquer, write a recursive program to find the maximum value in a given (unsorted) list of numbers.

   (b) Write the recurrence relation to find the time complexity of the algorithm. Find a closed form expression for the time complexity.