NANYANG TECHNOLOGICAL UNIVERSITY
School of Electrical & Electronic Engineering

IE2108 Data Structures and Algorithms

Tutorial No. 6 (Sem 1, AY2022-2023)

1. The mergesort algorithm is given as follows:

```
Algorithm mergesort(A,i,j) {
  if (i == j)
    return
  m = (i + j)/2
  mergesort(A, i, m)
  mergesort(A, m + 1, j)
  merge(A, i, m, j)
}
```

Trace the steps of the algorithm on the following input array:

11	29	28	23	20	14	5	3	15	16

2. Write down a recurrence relation and use it to find the worst-case time complexity of the mergesort algorithm.

3. Write an algorithm that, given an array A consisting of a sorted subarray of size m followed by a sorted subarray of size n, merges them into A using an extra array B of size $min\{m,n\}$. What is the worst-case time complexity of the algorithm?

4. Bubblesort is another sorting algorithm. Its pseudocode is shown below:

```
Algorithm bubblesort(A) {
  n = A.last
  for (i = 1 to n-1) {
    for (j = n downto i+1) {
      if (A[j] < A[j-1]) {
        swap A[j] with A[j-1]
      }
    }
  }
}
```

Trace the steps of the algorithm on the following input array:

11	29	28	23	20

5. What is the worst-case time complexity of bubblesort?