Mahindra University Hyderabad

École Centrale School of Engineering

Minor–I

Program: B. Tech. Branch: CSE, AI, ECE and CAM Year: III Semester: I

Subject: Design and Analysis of Algorithm (CS/AI 3101)

Date: 15/09/2023 **Start Time: 10:00 AM**

Time Duration: 1.5 Hours **Max. Marks: 30**

Instructions:

1) **Answers written with pencil will not be evaluated.**
2) **Answer each question precisely and to the point.**

1. Answer the following question with respect to the given code snippet taking input data of size n. **(5 Marks)**

```
A(n)
{
     if(n<=1)
return 1;
     else
return A(√n);,
}
```

a) Write the recurrence relation. (1 Marks)

b) Solve the recurrence relation using master method to compute the time complexity. (2 Marks)

c) In the given recurrence code, the termination condition is indicated in *if* condition. In case n indicates the size of the array in the recurrence call and an array of that size is passed in the recurrence function, then what should be the correct and precise termination condition. Explain with proper justification (2 Mark)

2. What is the time complexity of following code snippet? Assume initial value of A and B to be '1'. **(5 Marks)**

```
while (B <= n)
  {
    A++;
    B += A;
  }
printf("%d",B);
```

3. Answer the following question precisely with explanation. **(6 Marks)**

   a. Consider a sufficiently large array provided for sorting using the Quick Sort algorithm. Determine the minimum and maximum number of elements that can be correctly positioned after three iterations.
   b. What will be the number of comparisons required in the worst case when using the merge sort algorithm to merge two sorted lists of sizes k and r respectively?

4. Assume that a *selection* algorithm in worst case takes 30 seconds to find k^{th} smallest element in an array of size 75. What is the approximate maximum input size of an array in which the k^{th} smallest element can be computed in 5 minutes? **(4 Marks)**

5. Differentiate between procedure and Algorithm? What is analysis of algorithm and why we need it? **(2+2=4 Marks)**

6. Determine the time complexity of the given recurrence relation by recursively expanding the recurrence function through substitution. **(6 Marks)**

$$T(n) = T(2n/3) + 1$$