Department of Computer Science & Engineering,
Motilal Nehru National Institute of Technology, Allahabad.
Mid Semester Examination
September-2017
MCA-III Semester

Subject: Analysis of Algorithms | **Paper code: CA-3304**
Duration: 90 Minutes | **Max. Marks: 20**

Note: **Attempt all questions. Make assumptions wherever necessary and quote it.**

Q1. Solve the following using Master Theorems: ***[1×2=2 Marks]***

(a) $T(n) = 16T\left(\frac{n}{4}\right) + n!$

(b) $T(n) = 3T\left(\frac{n}{3}\right) + \frac{n}{2}$

Q2. Find upper bound for $n^4 + 100n^2 + 50$ ***[1 Marks]***

Q3. Find the complexity of the below function: ***[2 Marks]***

```
function(int n){
 for (int i=0; i<n; i++)
    for(int j=i; j<i*i; j++)
       if(j%i==0){
       for(int k=0; k<j; k++)
          print("*")
   }
}
```

Q4. Write down the Quick sort and Merge sort pseudocode and give the complexity analysis with help of some example. ***[4 Marks]***

Q5. Prove that the complexity of heap sort is $O(nlogn)$. ***[4 Marks]***

Q6. Show that selection (using RANDOMIZED-SELECT algorithm) in expected linear time is $O(n)$. ***[3 Marks]***

Q7. Consider the array A={26, 17, 41, 14, 21, 30, 47, 10, 16, 19, 21, 28, 38, 7, 12, 14, 20, 35, 39, 3}. Create RED-BLACK tree with one more attributes its size of node. Retrieve 17^{th} smallest element in the RED-BLACK tree. ***[4 Marks]***