Total No. of printed pages = 3

SUBJECT CODE: CSE024101

Roll No. of candidate | | | | | | | | | | |

2017

End Semester M. Tech in CSE Examination

1st Semester

Algorithm and Complexity Analysis

Full Marks- 70 Pass Marks-21 Time- 3 hours

The figures in the margin indicate full marks.

PART – A

Q.1. Answer all questions: **16 x 1 = 16**

a)What is time complexity of fun()?

```
int fun(int n)
{ int count = 0;
  for (int i = n; i > 0; i /= 2)
  for (int j = 0; j < i; j++)
  count += 1;
  return count;
}
```

b) Arrange the following function in the increasing order of asymptotic complexity

$f1(n) = 2^n$

$f2(n) = n^{3/2}$

$f3(n) = nLogn$

$f4(n) = n^{Logn}$

c) What is the best time complexity of bubble sort?

d) Does The following statement is a valid one log(n!) = (n log n).?

e) What does it mean when we say that an algorithm X is asymptotically more efficient than Y?

f) Which of sorting algorithms has the lowest worst-case complexity?

g) Consider the following three claims.

a. $(n + k)^m = (n^m)$, where k and m are constants

b. $2^{(n+1)} = 0(2^n)$

c. $2^{(2n+1)} = 0(2^n)$

Which of these claims are correct?

h) Two matrices M1 and M2 are to be stored in arrays A and B respectively. Each array can be stored either in row-major or column-major order in contiguous memory locations. How time complexity of an algorithm to compute M1 × M2 is very with storing scheme.
i) When a problem in NP is NP-complete?
j) Which algorithm design technique is used in find optimal solution for Fractional Knapsack Problem and why?
k) Prove that **$o((g(n))\cap\omega(g(n))$** is an empty set.
l) What is asymptotic tight upper bound?
m) What is the relation between asymptotic notation small o and small ω ?
n) Is **$2^{n+1}= O(2^n)$** ?
o) An algorithm of complexity **$\theta(\log n)$** takes eight unit time to run an input size n=12. Estimate the instance that can be produced in 56 unit time?
p) What are the possible solution techniques for sorting problems?

PART – B

Q.2.Answer all questions: **4 x 3.5= 14**

a) Show that for any real constants **a** and **b,** where b>0 **$(n+b)^b= \theta(n^b)$**
b) Can divide and concur technique be used to solve matrix manipulation problem? Discuss
c) Which data structure for representation of graphs you will choose for space efficiency in solving MST problem and why?
d) What is reducibility in NP problems?

PART – C

Each question carries 10 marks.

Q3. Draw the recursion tree for **$T(n)= 4T\lfloor n/2 \rfloor + cn$** , where c is a constant and provided a tight asymptotic bound on its solution , Verify your bound by substitution method.

OR

Use the master method to give tight asymptotic bounds for the following recurrences.

a. **$T(n)=4T(n/2) +n$**
b. **$T(n)=4T(n/2) +n^2$**
c. **$T(n)=4T(n/2) +n^3$**

Q4. Can any recurrence problems be solved using dynamic programing technique? Write pseudo code for Fibonacci series in using dynamic programming technique and prove that it's better than recursive one.

OR

How Greedy algorithm provide optimal solution for single source shortest path problem. Explain using Bellman –Ford algorithm.

Q5. What are P and NP problems? Proper coloring of graph vertex is a P or NP problem? Explain with proper reason.

OR

What is NP hard and NP complete problems? Prove that Travelling Salesman is NP complete Problem.

Q6. What is the running time of BFS if its input graph is represented by an adjacency matrix and the algorithm is modified to handle this type of input? Explain with an example.

OR

Use Krushkal algorithm to find the minimum spanning tree for the following Graph. What will be the running time of the algorithm for this graph? Is there any change in running time will occur if we change graph representation structure? Explain.