BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MCA
BRANCH: MCA

SEMESTER : III
SESSION : MO/16

SUBJECT: MCA3005 FUNDAMENTALS OF COMPUTER ALGORITHMS

TIME: 03:00

FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
6. Nothing should be written on front or back of the question paper except tick marking.

Q.1(a) Define Big-Oh (O) notation. Show that log(n)=O(n). [6]

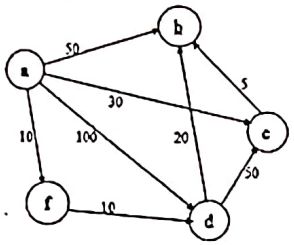
Q.1(b) What is time complexity and space complexity? Find the time complexity for $f(n) = \sum_{k=1}^{n} k^2$. [6]

Q.2(a) Use the recursion-tree method to determine a guess for the recurrence relation: [6]

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

Q.2(b) What is amortized analysis? Explain with an example the aggregate method for finding the amortized cost of each operations. [6]

Q.3(a) Using Dijkstra's algorithm for the single-source shortest path, find the shortest path of the given weighted digraph with complete path tracing from the source node (here a). [6]



Q.3(b) Write the Prim's algorithm for finding minimum-cost spanning tree and calculate its time complexity. [6]

Q.4(a) Analyze Strassen's matrix multiplication algorithm using divide-and-conquer method. [4]

Q.4(b) Using pseudo-median (median of median), select the 20th smallest number from a following set of 45 random numbers: 99, 70, 35, 82, 22, 11, 78, 18, 29, 64, 41, 15, 99, 97, 79, 82, 13, 70, 77, 17, 25, 70, 77, 31, 77, 37, 10, 76, 54, 4, 11, 49, 81, 49, 89, 84, 29, 38, 11, 30, 98, 8, 14, 65, 58. [8]

[P.T.O.]

Q.5(a) Find the minimum cost of computing the chained-matrix product P=A*B*C*D*E*F for the fully parenthesization using dynamic program approach. The dimensions of the six matrices are given as follows: A(30x35), B(35x15), C(15x5), D(5x10), E(10x20), and F (20x25). [9]

Q.5(b) Write notes on principle of optimality [3]

Q.6(a) Use branch-and-bound to solve the assignment problems with the following cost matrices: [6]

	1	2	3	4
a	94	1	54	68
b	74	10	88	82
c	62	88	8	76
d	11	74	81	21

Q.6(b) Differentiate between breadth-first search and depth-first search. [6]

Q.7(a) Write notes on different classes of probabilistic (randomized) algorithm. [6]

Q.7(b) With example discuss factorizing large integers in probabilistic algorithm paradigm. [6]

*****25/11/16******M

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(SHORT SEMESTER EXAMINATION)

CLASS : BE
BRANCH : CSE

SEMESTER : SS/2015
SESSION : 2014-15

SUBJECT : CS6101 DESIGN & ANALYSIS OF COMPUTER ALGORITHMS

TIME : 3 HOURS

FULL MARKS : 100

INSTRUCTION :
1. The question paper contains 7 questions each of 20 marks and total 140 marks.
2. Candidates may attempt for all questions.
3. In those cases where the marks obtained exceed 100 marks, the excess will be ignored.
4. The missing data, if any, may be assumed suitably.
5. Before attempting the question paper, be sure that you have got the correct question paper.
6. Tables/Data hand book/Graph Paper etc. to be supplied to the candidates in the examination hall.

Q1. (a) What is A priori analysis? [4]
(b) Find the complexity for the following functions in terms of Theta and small Oh: [6]
$f(n) = 8n^3 + 8n - 2$
(c) Write an algorithm for "Matrix Multiplication" & derive its time complexity. [10]

Q2. (a) Solve the following recurrence by iterative method. [4]
$T(n) = T(n/2) + n$ and $T(1)=2$
(b) Is 4 way Merge Sort (where the array is divided into 4 parts and then merged) better than normal merge sort? Justify. [6]
(c) Derive time complexity of Quick Sort in Average case and Worst case. [10]

Q3. (a) What are the strength and limitations of the greedy approach? [4]
(b) Find the MST and Minimum cost of the following graph by Prim's approach. [6]

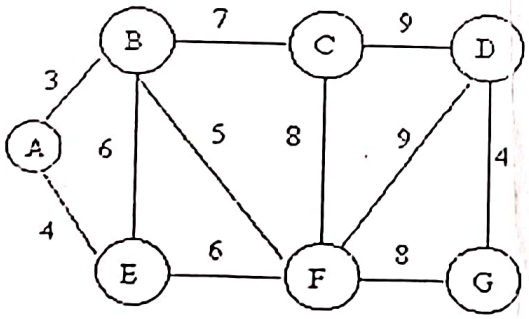


Figure -1

(c) Compare and contrast between Prim's Approach with Krushkal for finding MST. [10]

Q4. (a) Write the condition for placing the N_Queens in a chess board. [4]
(b) Propose an algorithm for finding factorial using dynamic programming. Discuss its complexity. [6]
(c) Solve the TSP problem of cost matrix given in Figure 2 using dynamic programming. [10]

	a	B	c	d	e
a	–	3	1	5	4
b	3	–	6	7	3
c	4	6	–	4	2
d	5	7	4	–	6
e	2	8	2	3	–

PTO

Q5. (a) Differentiate between Backtracking and Branch & bound. [4]
(b) Write an algorithm for n-queens problem using backtracking. [6]
(c) Let w={5,7,10,12,15,18,10} and m=35. Find all possible subsets of w that sum to m. Draw the state space tree for it. [10]

Q6. (a) Discuss the problem of text matching with an example. [4]
(b) Solve the 0/1 knapsack problem by Least Cost branch & bound method: n=5, (p1,p2,.....,p5)=(10,18, 6, 20, 15), (w1, w2, ...,w5)=(4, 6, 3, 4, 5), and m=16. [6]
(c) Write the algorithm for job sequencing with deadlines and analyse its complexity. [10]

Q7. (a) What do you mean by NP and NP- complete? [4]
(b) What is reducibility? Explain with an example. [6]
(c) Is TSP is a NP problem? Justify your answer. [10]

*****24.06.15*****

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE
BRANCH: CSE

SEMESTER : III
SESSION : MO/15

SUBJECT: CS6101-DESIGN AND ANALYSIS OF COMPUTER ALGORITHM

TIME: 03:00

FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What is the asymptotic time-complexity of the following pseudo-code fragment in terms of *n*: [2]

```
For i = 1 to n do
  For j = i to n do
    For k = 1 to 3 do
        Count++;
```

(b) Solve the recurrence using master's theorem T(n)=T(n/2) + n [4]
(c) Design and write two different algorithms for generating random permutation of given set of numbers and analysis their relative efficiencies (Time). [6]

Q.2(a) Let A[1.....n] be a sorted array of n distinct integers, proposed a divide and conquer algorithm that can find an index i such that A[t]=i (if it exists) with running complexity O(lgn). [2]
(b) Design an algorithm for finding second largest from a set of n inputs and find its time complexity. [4]
(c) Write a 3 way merge sort algorithm and analyze it's time complexity by setting up the corresponding recurrence relation. [6]

Q.3(a) Find the minimum retrieval time for a sequential tape of having {S1,S2,S3}={5,10,3}. [2]
(b) Write the general method for greedy algorithm and analyze it's time complexity. [4]
(c) Proposed an algorithm for finding MST of a graph and find it's time complexity. [6]

Q.4(a) Solve the following *0-1 Knapsack* problem using *dynamic programming* algorithm. [2]
The optimum profit table must have rows according to the following object-order.
{O1 (5Kg, 120Rs), O2(3, 150), O4(8, 270),O5(6,100),O6(2,170)}, Knapsack=8Kg.
(b) What is back tracking? Explain with an example. [4]
(c) The following is the cost matrix for a graph, find the optimal tour for Travelling sales man and explain this thoroughly. [6]

0	10	15	20
5	0	9	10
6	13	0	12
8	8	9	0

Q.5(a) List the elements of dynamic programming. [2]
(b) Find an optimal parenthesization of matrix chain product whose sequence of dimension is (5X10,10X3,3X12,12X4,4X50). [4]
(c) Write the algorithm for memorized matrix chain. [6]

Q.6(a) What are branch and bound and how it is helpful in algorithm design? [2]
(b) Write an algorithm for string matching. [4]
(c) Write the algorithm for sum of subsets and analyze it's time complexity. [6]

Q.7(a) What do you mean by non-deterministic algorithms? [2]
(b) Design a circuit which is satisfiable. [4]
(c) Prove that circuit satisfiable problem is NP Complete. [6]

******26/11/15******E

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MCA
BRANCH: MCA

SEMESTER : III
SESSION : MO/18

SUBJECT: MCA3005 FUNDAMENTAL OF COMPUTER ALGORITHMS

TIME: 3.00 HOURS

FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Distinguish between algorithm and pseudocode? Describe the difference between average and worst-case analysis of an algorithm with an example? [6]

Q.1(b) What do you mean by conditional asymptotic notation? Discuss asymptotic notation with several parameters? [6]

Q.2(a) What is amortized analysis of algorithm and explain how is it different from asymptotic analysis? [6]

Q.2(b) What do you mean by performance analysis? Explain recursive functions algorithm analysis with an example? [6]

Q.3(a) Find the optimal solution to the knapsack instance n = 7 objects and the capacity of knapsack m = 15. The profits and weights of the objects are (P1, P2, P3, P4, P5, P6, P7) = (10, 5, 15, 7, 6, 18, 3) (W1, W2, W3, W4, W5, W6, W7) = (2, 3, 5, 7, 1, 4, 1). [6]

Q.3(b) Discuss the single-source shortest paths algorithm with suitable example? [6]

Q.4(a) Write divide and conquer recursive quick sort algorithm and analyze the algorithm for average time complexity? [6]

Q.4(b) What is the difference linear search and binary search? Explain recursive binary search algorithm with suitable examples? [6]

Q.5(a) Explain how matrix chain multiplication problem can be solved using dynamic programming with suitable example? [6]

Q.5(b) Describe the dynamic 0/1 knapsack problem? [6]

Q.6(a) Discuss the 4-queens' problem? Draw the portion of the state space tree for n = 4 queens using backtracking algorithm? [6]

Q.6(b) Compare BFS and DFS algorithm with an example graph and denotes its time complexity? [6]

Q.7(a) What is the difference between expected and average time? Discuss monte carlo probabilistic algorithms? [6]

Q.7(b) Discuss numerical probabilistic algorithms? [6]

:::::30/11/2018:::::M

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(SHORT SEMESTER EXAMINATION)

CLASS : IMSC — SEMESTER : SS/2015
BRANCH : ALL — SESSION : 2014-15

SUBJECT : CS6101 DESIGN & ANALYSIS OF COMPUTER ALGORITHMS

TIME : 3 HOURS — FULL MARKS : 100

INSTRUCTION :
1. The question paper contains 7 questions each of 20 marks and total 140 marks.
2. Candidates may attempt for all questions.
3. In those cases where the marks obtained exceed 100 marks, the excess will be ignored.
4. The missing data, if any, may be assumed suitably.
5. Before attempting the question paper, be sure that you have got the correct question paper.
6. Tables/Data hand book/Graph Paper etc. to be supplied to the candidates in the examination hall.

Q1. (a) Define Big Oh and Small Oh. [4]
(b) What do you mean by best, average and worst case time complexity? Explain with suitable example. [6]
(c) Write the insertion/selection sort algorithm. Then derive its time-complexity using any standard approach. [10]

Q2. (a) Derive the asymptotic time complexity: $T(n) = 2T(n/2) + 2n$. [4]
(b) Derive the average case time complexity of quick sort. [6]
(c) Consider a modification of binary search where the instruction "mid = (low+high)/2" is replaced by "mid= (low+high)/4". Will this algorithm be able to perform searching properly? Find the time complexity of the algorithm. Is it better than normal binary search? Explain. [10]

Q3. (a) What are the limitations of Greedy technique? [4]
(b) Find the MST and Minimum cost of the following graph by Kruskal's approach. [6]

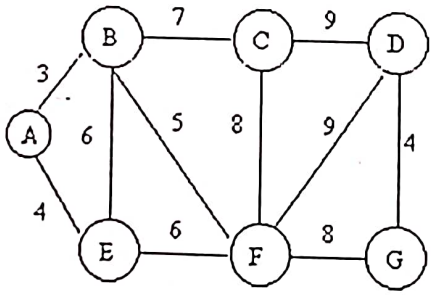


Figure 1

(C) Prove the optimality of Prim's method for obtaining minimum cost spanning tree. [10]

Q4. (a) What is memorization in dynamic programming? Give example. [4]
(b) Consider the following instance of the knapsack problem: 5 elements, their cost/value =(10, 15, 20, 10, 18), weight=(2, 5, 5, 4, 3) and maximum capacity =12. Solve the problem using dynamic programming approach. [6]
(c) Solve the TSP problem of cost matrix given in figure 2 using dynamic programming. [10]

Figure 2

	a	b	c	d	e
a	–	3	1	5	3
b	2	–	4	3	5
c	1	6	–	7	6
d	3	4	5	–	1
e	4	2	7	3	–

Q5. (a) Differentiate Backtracking and Branch & bound. [4]
(b) Write the algorithm to solve n-queens problem using backtracking. [6]
(c) Let w={3, 5, 6, 7, 10, 12, 14} and m=25. Use the backtracking based algorithm to find all possible subsets of w that sum to m. Draw the state space tree for it. [10]

Q6. (a) Is it possible to have LIFO branch and bound? How to implement it? [4]
(b) Apply Least Cost branch and bound to solve the 0/1 Knapsack problem: [6]
(weight, cost) of 4 elements as: (7 42), (4, 40), (3, 12), (5, 25); and Knapsack capacity = 12.
(c) Solve the TSP problem given in Figure 2 of Q.No. 4(c) using branch and bound. [10]

Q7. (a) Give example of polynomial, non polynomial and non-deterministic polynomial algorithms. [4]
(b) Define NP, NP Hard and NP Complete. Then find the relationship among these. [6]
(c) Write a non-deterministic algorithm for sorting. Discuss its time-complexity and compare it with deterministic algorithms. [10]

*****19.06.15*****