

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

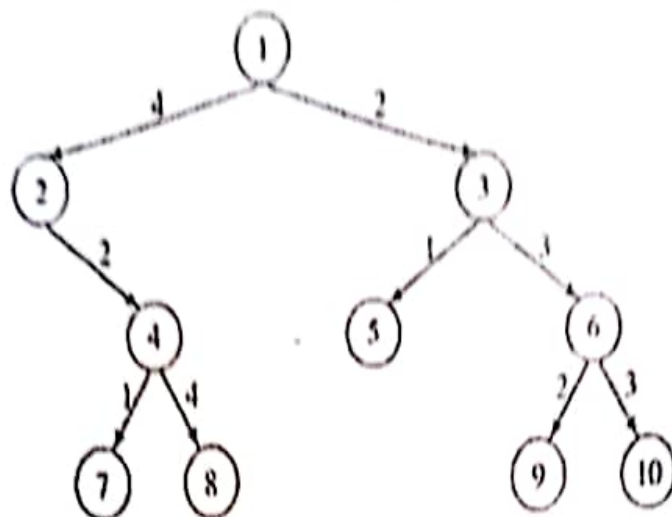
1. a) What is the need for algorithm analysis? How would you perceive the best, worst and average case complexities? Give an example, along with a suitable graph. 7
- b) Explain the master's method for solving the recurrence relations. 8
Solve the following recurrence relations using the master's method.
 - i. $T(n) = 3T(n/2) + n$
 - ii. $T(n) = 2T(n/4) + \sqrt{n}$
2. a) Briefly explain the Queue data structure. Write an algorithm to add an element from the circular queue and compute the complexity of your algorithm. 7
- b) Briefly explain the binary search tree. Write an algorithm to remove an element from the binary search tree and compute the complexity of your algorithm. 8
3. a) What is the difference between fractional knapsack and 0/1 knapsack. 7
Consider the following 7 items and the knapsack has a capacity of 15.
Find an optimal solution using fractional knapsack.

Object(O)	1	2	3	4	5	6	7
Profits(P)	10	5	15	7	6	18	3
Weights(w)	2	3	5	7	1	4	1

- b) Consider the set of given jobs as shown. Find a sequence of jobs, which will give maximum profit.

Jobs	J1	J2	J3	J4	J5	J6
Deadlines	5	3	3	2	4	2
Profits	200	180	190	300	120	100

4. a) What is the real-life application of tree vertex splitting problem? For $\delta = 5$, add a booster to the following tree.



- b) Explain the optimal merge pattern algorithm used for merging multiple sorted sequences. How does it minimize the total number of comparisons and improve efficiency? 8
5. a) Discuss the similarities and differences between divide and conquer, greedy method and dynamic programming. How do these approaches differ in their problem-solving strategies and efficiency? 7
- b) Explain "Principle of Optimality" in dynamic programming. Let $X = \text{moon}$ and $Y = \text{spoon}$. Find the minimum cost required to transform X into Y , if each insertion and deletion takes 1 unit and change takes 2 units of time. 8
6. a) Design a three-stage system with device types D1, D2 and D3. The costs are \$30, \$15, and \$20 respectively. The cost of the system is to be no more than \$105. The reliability of each device is 0.9, 0.8, 0.5 respectively 8
- b) Define the articulation point and bi-connected component of the graph. Write an algorithm to determine biconnected components in a graph with a suitable example. 7
7. Write short notes on: (Any two) 2x5
- Graph Coloring Problem
 - Sum of subset problem
 - Strassen's Matrix Multiplication

POKHARA UNIVERSITY

Semester : Spring

Year : 2023

Level: Bachelor

Programme: BE

Course: Analysis and Design of Algorithm

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

- a) What are the measures that we use to measure the efficiency of an algorithm? Write an algorithm to find the largest number from an array of numbers and discuss its best and worst case. 7
- b) Briefly explain the binary search tree. Write an algorithm to add an element from the binary search tree and compute the complexity of your algorithm. 8
- a) Briefly explain a circular queue. Write an algorithm to add and remove an element from the circular queue and compute the complexity of your algorithm. 7
- b) Consider the following tasks with their deadlines and profits. Schedule the tasks in such a way that they produce maximum profit after being executed – 8

S. No.	1	2	3	4	5
Jobs	J1	J2	J3	J4	J5
Deadlines	2	2	1	3	4
Profits	20	60	40	100	80

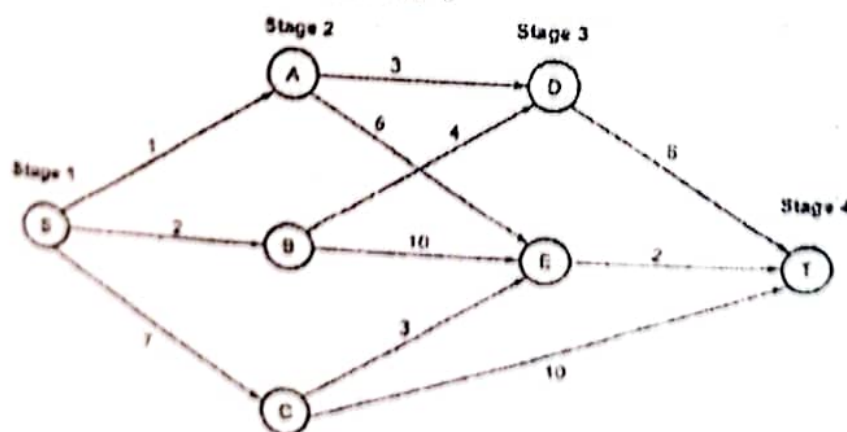
3. a) What is the difference between a fractional knapsack and a 0/1 knapsack? Consider the following 5 items and the knapsack has a capacity of 60. Find an optimal solution to the knapsack problem. 7

Objects	11	12	13	14	15
Profits	30	20	100	90	160
Weights	5	10	20	30	40

- b) Write an algorithm to find minimum and maximum elements among n elements and analyze its complexity.
4. a) Compare divide and conquer, greedy method, dynamic programming and Backtracking approach of problem solving? Explain with examples.
- b) Explain "Principle of Optimality" in dynamic programming. Let X =sunday and Y =saturday. Find the minimum cost required to transform X into Y , if each insertion and deletion takes 1 unit and change takes 2 units of time.
5. a) What is the optimal binary search tree? Using a dynamic approach, build an optimal binary tree for the given values.

Keys	10	20	30	40
Frequency	4	2	6	3

- b) Define the articulation point and bi-connected component of the graph. Write an algorithm to determine biconnected components in a graph with a suitable example
6. a) What do you mean by graph coloring problem? How this problem could be solved with the help of Backtracking algorithm, explain with algorithm.
- b) Find the shortest path in the following multistage graph using dynamic programming from vertex S to T



7. Write short notes on: (Any two)

- Tree vertex Splitting
- BFS and DFS
- Hamiltonian Cycle

2×5

POKHARA UNIVERSITY

Semester: Fall

Level: Bachelor

Programme: BE

Course: Analysis and Design of Algorithm

Year : 2022

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

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Attempt all the questions.

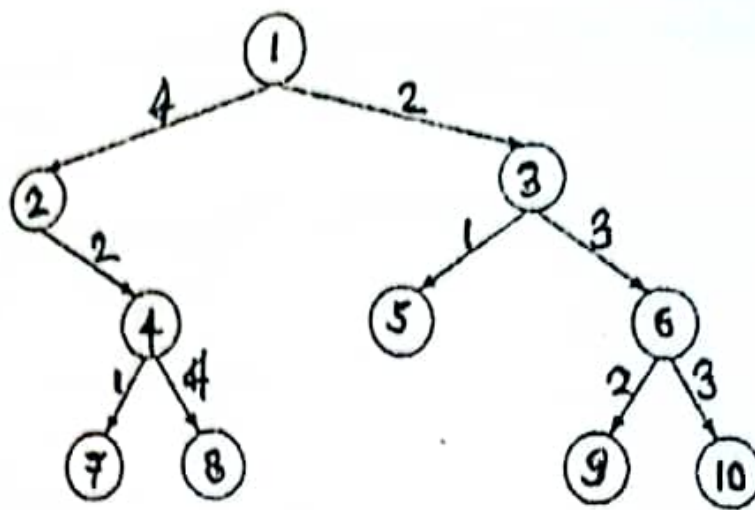
- a) Define algorithm. Why is analysis of algorithms necessary? Explain asymptotic notations BigO, Big Θ and Big Ω 8
- b) Define Binary Search Tree. Write an algorithm to search an element in the binary search tree and find the time and space complexity of your algorithm. 7
- a) What is the difference between fractional knapsack and 0/1 knapsack. 8
- Consider the following 7 items and the knapsack has capacity of 15. Find an optimal solution using fractional knapsack.

Objects	1	2	3	4	5	6	7
Profits	10	5	15	7	6	18	3
Weights	2	3	5	7	1	4	1

- b) Consider the set of given jobs as shown. Find a sequence of jobs, which will give maximum profit 7

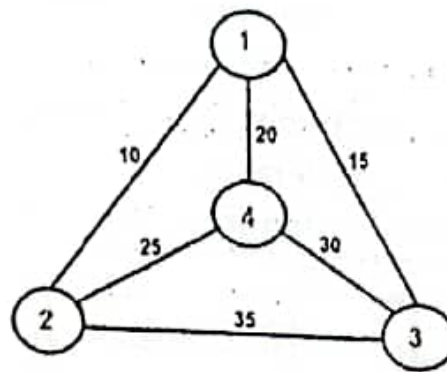
Jobs	J1	J2	J3	J4	J5	J6
Deadlines	5	3	3	2	4	2
Profits	200	180	190	300	120	100

3. a) What is the real-life application of tree vertex splitting problem? For $\delta = 5$, add booster to the following tree. 8



7

- b) Explain and analyze the Floyd's Warshall algorithm for all pair shortest path problem. Trace the algorithm with suitable example
4. a) Find the cost of travelling from vertex one to rest of the vertex for a sales man having minimum cost, travelling all the cities. 8



- b) What do you mean by an articulation point in a network? What is the effect of deleting it in communication networks? When we say that a graph is bi-connected. What does it mean? Explain with a neat diagram. 7
5. a) What is the backtracking method for problem solving? Explain how you solve the 8-queen problem using the backtracking method. 7
- b) Write an algorithm for finding minimum and maximum elements in array. Also find its complexity. 8
6. a) Write an Algorithm for push and pop operation of stack. Also analyze the complexity. 8
- b) Explain Multistage graph problem with suitable example. 7
7. Write short notes on: (Any two) 2x5
- a) String Editing Problem
- b) Sum of Subset Problem
- c) BFS and DFS

POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Analysis and Design of Algorithm

Semester: Spring

Year : 2021

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

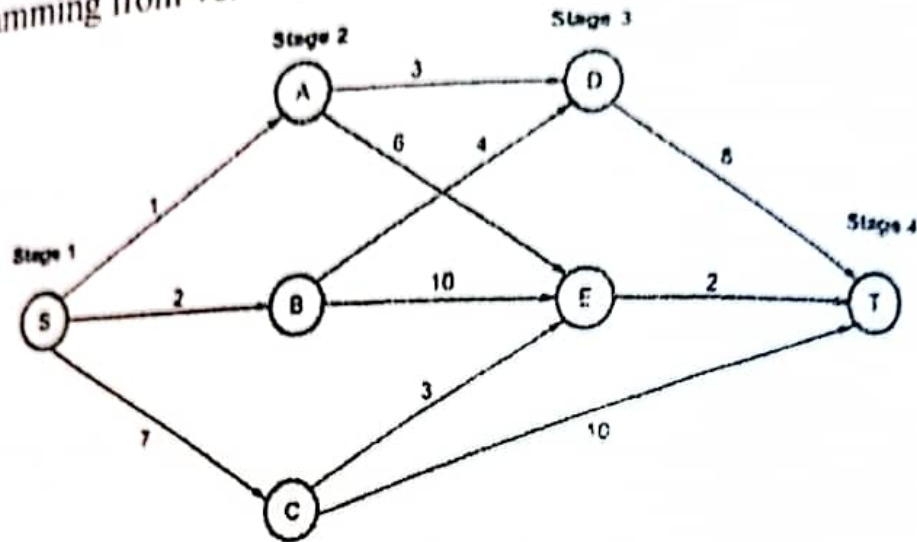
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Attempt all the questions.

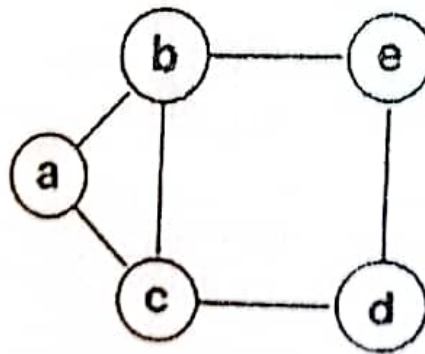
- a) Why do you need the algorithm analysis? Explain the best, worst and average case complexities with suitable example. 8
- b) Explain the master method for solving the recurrence relations. Solve the following recurrence relations using this method. 7
 - i. $T(n) = 3T(n/2) + n$
 - ii. $T(n) = 2T(n/4) + \sqrt{n}$
- a) Explain Binary Search Tree (BST)? Write an algorithm to insert an element to the binary search tree and find the time complexity of your algorithm. 7
- b) Briefly explain the Queue data structure. Write an algorithm to add and remove an element from the circular queue and compute the complexity of your algorithm. 8
- a) Consider five items along with their respective weights and profit values 7
 - Items $I = \langle 11, 12, 13, 14, 15 \rangle$
 - Weights $w = \langle 5, 10, 20, 30, 40 \rangle$
 - profit value $v = \langle 30, 20, 100, 90, 160 \rangle$The Knapsack has capacity $W=60$. Find an optimal solution to the Knapsack Problem
- b) Explain how you use the divide and conquer approach to solve Strassen's Matrix Multiplication. 8
- a) Write an algorithm for quick-sort and trace out the algorithm for the following array $A[] = \{ 16, 7, 15, 14, 18, 25, 55, 32 \}$. 8

- b) Briefly explain the dynamic programming method for problem solving. What is the basic difference between Dynamic programming and Greedy method?
5. a) Find the shortest path in the following multistage graph using dynamic programming from vertex S to T.



Multistage graph

- b) Define spanning tree. Generate spanning tree for graph below using both BFS and DFS method.



6. a) Define articulation point and bi-connected component of the graph? Write the algorithm for finding articulation point in the graph with suitable example.
- b) Explain about the complexity classes P, NP and NP complete with suitable examples.
7. Write short notes on: (Any two)
- a) Travelling Salesman Problem
- b) Optimal Storage on Tapes Problem.
- c) Graph Colouring Problem

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What is algorithm analysis? Why it is necessary to analyze the algorithm? 8

Input: n

Output: nth Fibonacci number.

Algorithm: assume a as first(previous) and b as second(current) numbers

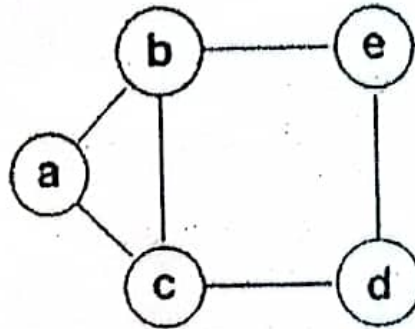
```
fib(n)
{
  a = 0, b = 1, f = 1 ;
  for(i = 2 ; i <= n ; i++)
  {
    f = a + b ; a = b ; b = f ;
  }
  return f ;
}
```

Compute the Time and space complexity of this algorithm. 7

- b) Briefly explain a stack data structure. Write algorithm to add and remove an element from the stack and compute the complexity of your algorithm
2. a) What do you mean by greedy method of problem solving? Explain optimal storage on tapes problem. Find the optimal storage of files on magnetic tape if $n=3$ and $(l_1, l_2, l_3) = (5, 10, 3)$
- b) Consider a set of given jobs as shown. Find a sequence of jobs, which will be completed within their deadlines and will give maximum profit.
- | Job | J1 | J2 | J3 | J4 | J5 |
|-----|----|----|----|----|----|
| | | | | | |

Deadline	2	1	3	2	1
Profit	60	100	20	40	20

3. a) Devise a divide and conquer algorithm for finding minimum and maximum element among a set of given elements. Write recurrence relation for your algorithm and give its big-O estimate.
- b) What are the characteristics of problem that can be solved by using dynamic programming Algorithm? Give the recursive definition of solving 0/1 knapsack problem. Trace the algorithm for $w = \{9, 7, 9, 7, 9\}$, $v = \{5, 1, 5, 3, 3\}$ and knapsack of capacity 8.
4. a) Explain and analyze the Floyd's warshall algorithm for all pair shortest path problem. Trace the algorithm with suitable example.
- b) Define spanning tree. Generate spanning tree for graph below using both BFS and DFS method.



5. a) What is the Backtracking method of problem solving? Explain how you solve the 8-queen problem using the backtracking method.
- b) Define articulation point and bi-connected component of the graph? Write the algorithm for finding articulation point in the graph with suitable example.
6. a) Solve the following recurrence relation using iterative substitution method. $T(n) = T(n/2) + n$
- b) Write an algorithm for merge sort and find its time complexity.
7. Write short notes on: (Any two)
 - a) Binary search tree
 - b) Graph Colouring Problem
 - c) Quick sort

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2020

Programme: BE

Full Marks: 100

Course: Analysis and Design of Algorithm

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

- a) What is algorithm analysis? Why it is necessary to analyze the algorithm? Explain big O, big θ and big Ω notation for performance analysis of algorithm. 8
- b) Explain the master method for solving the recurrence relations. Solve the following recurrence relations using this method. 7
- i.) $T(n) = 3T(n/2) + n$
- ii.) $T(n) = 2T(n/4) + \sqrt{n}$
- a) Briefly explain a stack data structure. Write algorithm to add and remove an element from the stack and compute the complexity of your algorithm. 8
- b) Explain a min Heap. Write an algorithm to delete an element from a min Heap and find its time complexity. 7
- a) Write the Iterative algorithm and Divide and conquer algorithm for MAX and MIN finding problem and explain which algorithm is efficient and why? 7
- b) What is randomized quick sort? In which case randomized quick sort is appropriate? Sort the following sequence of numbers using Quick sort: 15, 10, 13, 9, 12, and 17. Find the worst case complexity of quick sort. 8
- a) What is the basic different between Divide and conquer, Greedy method, Dynamic programming and Backtracking approach of Problem solving? Explain with example. 7
- b) Explain the "Principle of Optimality" in dynamic programming. Write the algorithm and define how multistage graph problem can be solved using dynamic programming. 8

5. a) Compare knapsack problem and 0/1 knapsack problem. Explain how 0/1 knapsack problem can be solved using dynamic programming. Compare the solution approach, with problem solved using greedy approach. 7
- b) Explain how can you implement breadth first search using queue? Write the algorithm for BFS and analyze its time and space complexity. 8
6. a) Define articulation point and bi-connected component of the graph? Write the algorithm for finding articulation point in the graph with suitable example. 8
- b) What is backtracking technique in problem solving? Explain how can you solved 8-queens problem using backtracking? 7
7. Write short notes on: (Any two) 2x5
- a) Job sequencing with deadline
 - b) TSP
 - c) Graph colouring problem

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2019

Programme: BE

Full Marks: 100

Course: Analysis and Design of Algorithm

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What do you mean by performance analysis of algorithms? Explain space and time complexity of an algorithm using an example. 7
- b) Design an algorithm to find all the common elements in two sorted lists of numbers. For example, for the lists 2, 5, 5, 5 and 2, 2, 3, 5, 5, 7, the output should be 2, 5, 5. What is the maximum number of comparisons your algorithm makes if the lengths of the two given lists are m and n , respectively? 8
2. a) Briefly explain a Queue data structure. Write algorithm to add and remove an element from the circular queue and compute the complexity of your algorithm. 8
- b) Define Binary trees. Write algorithm to insert and delete a node in the binary tree. 7
3. a) Compare divide and conquer, greedy method and dynamic programming as general method of problem solving, in terms of completeness and optimality. 8
- b) Explain how you use divide and conquer approach to solve Strassen's Matrix Multiplication. 7
4. a) Explain how greedy approach is useful to find the solution to fractional knapsack problem. 8
- b) Explain the "Principle of Optimality" in dynamic programming with suitable example. 7
5. a) Apply Dynamic programming to multiply the following chain of matrices: M_1 , M_2 , M_3 and M_4 with respective, dimensions (5×10) , (10×3) , (3×7) , (7×15) ? 8
- b) Explain BFS and DFS as Graph Traversal Techniques with examples and analyze their performance in terms of time, space, completeness and optimality. 7
6. a) What do you mean by approximation algorithm? Write the algorithm for approximate the vertex cover of a connected graph with example. 8

- b) What is Backtracking method of problem solving? Explain how you solve 8-queen problem using backtracking method. 7
7. Write short notes on: (Any two) 2x5
- a) Tree vertex splitting problem
 - b) TSP
 - c) Hamiltonian Cycle

Candidates are required to give their answers in their own words as far as practicable

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Differentiate between deterministic and non-deterministic algorithm. Explain big O, big Φ and Ω notation for performance analysis of algorithm. 8
- b) Explain the recursion tree method for solving the recurrence relations. Solve the following recurrence relations using this method. $T(n) = T(n/3) + T(2n/3) + n$ 7
2. a) Explain Binary search tree. Write an algorithm to delete an element from BST and find its time complexity. 7
- b) Briefly explain a stack data structure. Write algorithm to add and remove an element from the stack and compute the complexity of your algorithm. 8
3. a) Write an algorithm for merge-sort and find its time complexity. Trace out the algorithm for the following array $A[] = \{ 16, 7, 15, 14, 18, 25, 55, 32 \}$. 8
- b) Explain binary search technique using divide and conquer method of problem solving and analyze its time complexity. 7
4. a) Explain Strassen's algorithm for matrix multiplication and analyze it. Also verify the correctness of this algorithm. 8
- b) What is the basic different between Divide and conquer, Greedy method, Dynamic programming and Backtracking approach of problem solving? Explain with example. 7
5. a) Discuss the 0/1 knapsack problem and how this problem can be solved? Explain the algorithm. 7
- b) Explain Dijkstra's algorithm for computing the single source shortest path in a graph with suitable example. 8

6. a) Define articulation point and bi-connected component of the graph? 8
Write the algorithm for finding articulation point in the graph with suitable example.
- b) Explain about the complexity classes P, NP and NP complete with 7
suitable examples.
7. Write short notes on: (Any two) 2×5
- a) Minimum Cost Spanning Tree
 - b) Optical Merge Pattern
 - c) String Editing Problem

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2018

Programme: BE

Full Marks: 100

Course: Analysis and Design of Algorithm

Pass Marks: 45

Time : 3hrs.

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Attempt all the questions.

1. a) Explain the term Big-oh, Big-omega and Big-theta. Show that a function $f=3n^2+4n+7$ is big theta of n^2 . 8
- b) In each of the following situations, indicate whether $f = O(g)$, or $f = \Omega(g)$, or both (in which case $f = \Theta(g)$). 7

	$f(n)$	$g(n)$
(a)	$n - 100$	$n - 200$
(b)	$n^{\frac{1}{2}}$	$n^{\frac{2}{3}}$
(c)	$\log 2n$	$\log 3n$
(d)	$10 \log n$	$\log n^2$
(e)	$n!$	2^n

2. a) Briefly explain a circular queue. Write algorithm to add and remove an element from the circular queue and compute the complexity of your algorithm. 7
- b) Briefly explain a link list data structure. Write algorithm to add and remove an element from the link list and compute the complexity of your algorithm. 8
3. a) Write an algorithm for bubble sort and trace out the algorithm for bubble sort with suitable example. 7
- b) Discuss how Strassen's method can perform matrix multiplication of two $n \times n$ matrix in $O(n^{\log_2 7})$. 8
4. a) Explain prim's algorithm for computing the MST of a given graph and analyze it. Also verify the correctness of this algorithm. 8
- b) Briefly explain the dynamic programming method for problem solving. What is the basic difference between Dynamic programming 7

and Greedy method?

5. a) How can dynamic programming technique be applied to The Travelling salesman problem? 7
b) Explain Dijkstra's algorithm for computing the single source shortest path in a graph with suitable example. 8
6. a) Write an algorithm to determine biconnected components in a graph. 7
b) Let $w = \{5, 7, 10, 12, 15, 18, 20\}$ and $m = 35$. Use Backtracking algorithm to systematically search the solution space to find few possible subsets of w that sum to m . Also, draw a portion of the tree diagram that shows the organization of state space. 8
7. Write short notes on: (Any two) 2x5
 - a) Binary Search Tree
 - b) Knapsack 0/1 problem
 - c) Graph Coloring Problem

Candidates are required to give their answers in their own words as far as practicable.

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Attempt all the questions.

1. a) What do you mean by Best case, Worst case and average case complexity of an Algorithm? 7

Given the following pseudo code for finding the minimum and maximum elements of an array, (where all the elements are distinct)

Find minimum and Maximum ($x[]$, N)

/* $x[]$ is the input array of size N */

```
{
    min = max = x[0]
    for i := 1 to N - 1 :
        if x[i] < min:
            min = x[i]
        else if x[i] > max:
            max = x[i]
    end for
}
```

What would be the best case and worst case complexity for the above algorithm? Explain.

- b) Explain the Master's method for solving the recurrence relations. Give an example of a recurrence relation where Master's method cannot be applied. Solve the following recurrence relations using Master's method. 8

i. $T(n) = 2T(n/4) + \sqrt{n}$

ii. $T(n) = 3T(n/2) + n$

iii. $T(n) = 4T(n/3) + n^2$

2. a) Explain a MaxHeap Data Structure. Give an example where such a data structure may be used. Write the algorithm to delete the max Element from a MaxHeap and analyse its time complexity. 8

- b) Describe Queue Abstract data structure. Discuss the time complexity of various operations allowed on a circular queue.
3. a) Write, in pseudocode, the algorithm for quick-sort and trace each steps of the algorithm on following array, $A[] = \{ 16, 7, 15, 14, 18, 25, 55, 32 \}$.
 b) You are given a problem of finding the value of x^N using only multiplications and additions where x and N are supplied by user at runtime. How would you apply divide and conquer strategy to find the value of x^N using minimum number of multiplication?
- You should be able to do better than multiplying $x * x * \dots * x$ $N-1$ times. Find the complexity of your algorithm.
4. a) Describe the Binary search algorithm and analyze it's time complexity.
 b) State the 0/1 knapsack problem and explain why greedy algorithm does not give optimal solution for this problem. Give an algorithm to solve this problem optimally.
5. a) Explain Dijkstra's algorithm for computing the single source shortest path in a graph with suitable example.
 b) Describe an algorithm for computing the Minimum Spanning Tree (MST) of a given graph. Analysis its time complexity. Also, verify its correctness.
6. a) Define graphs, complete graphs, bipartite graphs, planar graphs and trees. Describe different binary tree traversal techniques.
 b) State the Hamiltonian graph problem and show that backtracking can be used to solve it.
7. Write short notes on: (Any two)
 a) Tree vertex splitting problem
 b) TSP
 c) Sets and Disjoint Set Union master's

2x5

Level: Bachelor

Semester: Spring

Year : 2017

Programme: BE

Full Marks: 100

Course: Analysis and Design of Algorithm

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What are the measures that we take to measure the efficiency of an algorithm? Write an algorithm to find an element from an array and discuss about its best and worst case while finding an element. 8
 - b) Define aggregate method of amortized analysis with suitable example. 7
 2. a) Find the run time using recurrence tree method and by master method $T(n) = T(n/4) + T(n/2) + cn^2$ 8
 - b) Consider an array $a[]$ of n numbers that has $n/2$ distinct elements and $n/2$ copies of another element. The problem is to identify the repeated element. Any deterministic algorithm needs at least $n/2 + 2$ time, so how could you improve the efficiency by using randomized algorithm in this case. 7
 3. a) Find the time and space complexity for following algorithm to find Greatest common Divisor (GCD) 8
- Inputs: Two numbers a and b
 Output: G.C.D. of a and b
 Algorithm: assume (for simplicity) $a > b >= 0$
- ```

gcd(a,b)
{
 While(b!=0)
 {
 d=a/b;
 temp=b;
 b=a-b*d;
 a=temp;
 }
 return a;
}

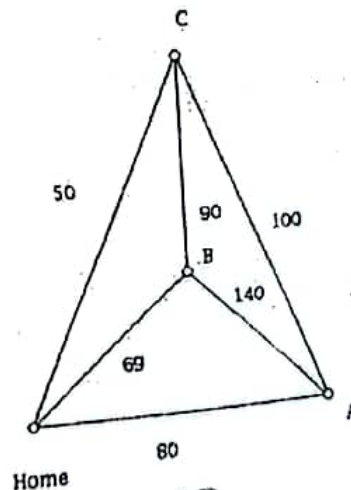
```



- b) Find the minimum edit distance to transform the string  $X = \text{aabab}$  into  $Y = \text{babb}$ .
4. a) Compare Divide and conquer and Dynamic Programming approaches of algorithm design with examples.
- b) State the 0/1 knapsack problem. Suppose  $n=4$  and  $W=16$  and we have following.

| i | $P_i$ | $W_i$ | $P_i/W_i$ |
|---|-------|-------|-----------|
| 1 | \$40  | 2     | \$20      |
| 2 | \$30  | 5     | \$6       |
| 3 | \$50  | 10    | \$5       |
| 4 | \$10  | 5     | \$2       |

5. a) Explain the graph traversal techniques of BFS and DFS with help of algorithm.
- b) Solve the following Travelling Salesman Problem starting from Home using greedy approach.



OR

- Explain backtracking algorithm and write down the Backtracking algorithm for N-queen problem.
6. a) What do you mean by graph coloring problem how this problem could be solved with the help of Backtracking algorithm, explain with algorithm.
- b) Differentiate between P, NP, NP-hard and NP-complete with an example of each.
7. Write short notes on: (Any two)
- Hamiltonian Cycle
  - Optimal merge pattern
  - Las Vegas Algorithm



# POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Analysis and Design of Algorithm

Semester: Fall

Year : 2016

Full Marks: 100

Pass Marks: 45

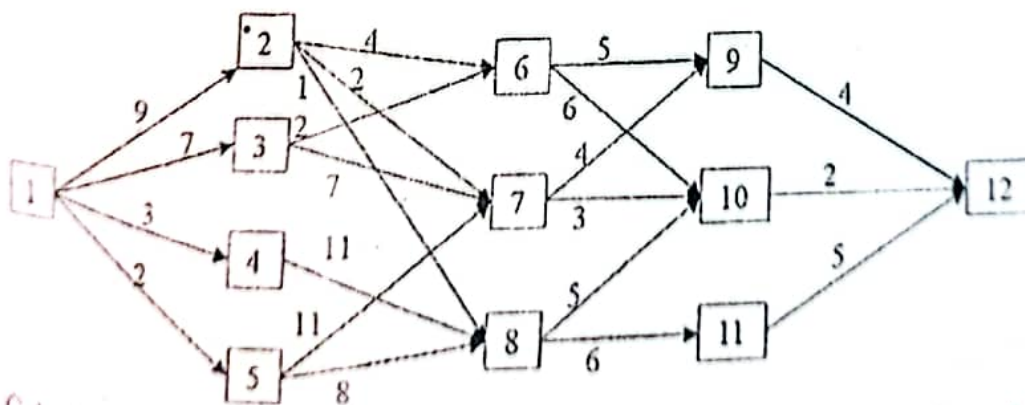
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

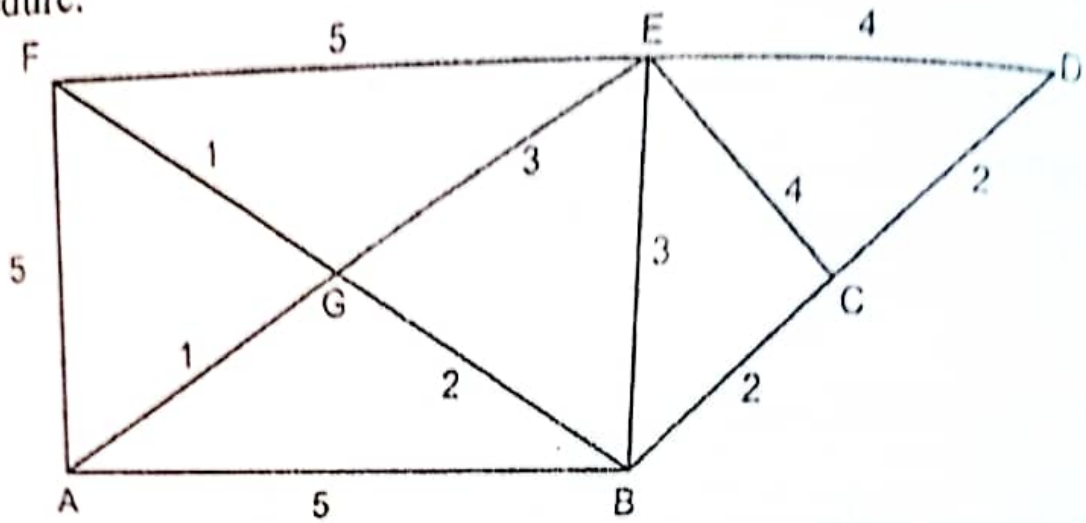
- a) Why iteration and recursion is used in an algorithm. Explain its use. 7
- b) Write an algorithm to insert and delete an item from binary tree. Also compare these operations in terms of their time and space complexity. 8
- a) Can greed approach be optimal always? Provide an example to support your answer (in terms of time/space usage). 8
- b) Why is it necessary to have auxiliary array  $b[\text{low}:\text{high}]$  in function Merge for MergeSort? Give example that shows why in place merging is inefficient. 7
- a) Explain job sequencing algorithm. Provide an analysis of tree vertex splitting. 8
- b) 7



Calculate shortest distance and path from 1 to 12 using backward approach.

- a) What is dynamic programming? Explain the finding method of longest common subsequence. 7
- b) Write an algorithm for tree traversal and discuss their complexity. 8
- a) For the given graph, perform an operation to generate a minimum 8

spanning tree. Also calculate the time and space complexity of the procedure.



- b) Write an algorithm for depth first search and discuss the complexity. 7
6. a) Suppose you need an array to store list of students where you need to do frequent search for student. Which data structure would you choose, stack or dictionary? Support your answer in terms of time and space usage. 7
- b) Why is backtracking used? Apply backtracking to sum of subsets problem. 8
7. Write short notes on: (Any two) 2×5
  - a) Significance of space and time complexity
  - b) Optimal merge pattern
  - c) TSP.

सुमन सेतनवी सप्लायर्स एण्ड प्रोटेक्टर्स सर्विस  
बालकुवाही, लखितपुर १८३१२९९२९२  
NCIT College

Level: Bachelor  
Programme: BE

Course: Analysis and Design of Algorithm

POKHARA UNIVERSITY

Semester: Spring

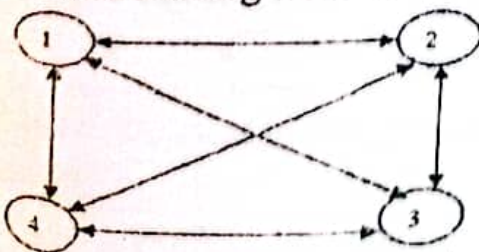
Year : 2015  
Full Marks: 100  
Pass Marks: 45  
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

- a) What do you mean by an Algorithm? Explain Las Vegas algorithm with an example. 8
- b) Define Big O, Big  $\Omega$  and Big  $\Theta$ . Why is performance analysis of algorithm important? 7
- a) Briefly explain circular queue? Write down the algorithm to insert and delete an item from an circular queue. 7
- b) Write algorithms to insert and delete elements to and from a dictionary. 8
- a) How is merge sort different from quick sort? Compare both the sorting techniques on its running time on different instances. 8
- b) Provide the algorithm for Strassen's matrix multiplication. Explain each step with an example. 7
- a) How does greedy method help in problem solving? Compare and contrast 0-1 Knapsack and fractional Knapsack problems in terms of their performances. 8
- b) Consider the following directed graph where four cities 1-4 are give along with the travelling cost. Find the minimum cost of travelling all the cities starting from 1. 5



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

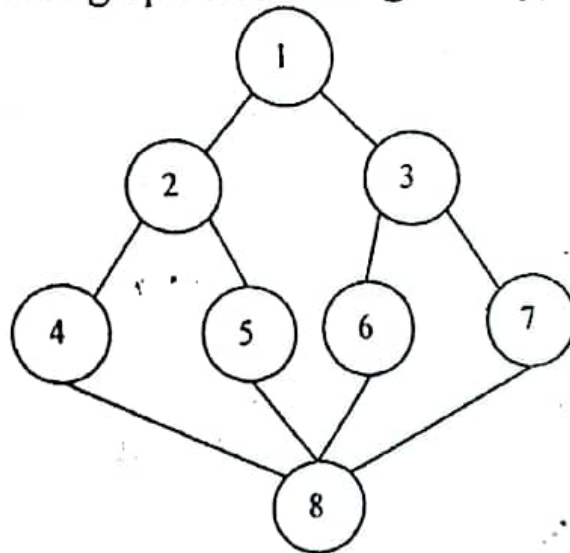


5. a) Find optimal solution to 0-1 knap sack problem where number of element  $n=4$  and the size of knapsack=5 for following items using dynamic programming.

|                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|
| 1. $W=2$<br>$V=3$ | 2. $W=3$<br>$V=4$ | 3. $W=4$<br>$V=5$ | 4. $W=5$<br>$V=6$ |
|-------------------|-------------------|-------------------|-------------------|

- b) Describe Dynamic programming approach of problem solving. How can we use it to allocate 'r' number of resources to 'n' number of projects?

6. a) Differentiate depth first search and breadth first search. Generate spanning tree for graph below using both approach.



- b) Explain backtracking algorithm and write down the Backtracking algorithm for N-queen problem.

7. Write short notes on: (Any two)

- Bi-connected components
- Hamiltonian cycle
- Tree vertex splitting
- BFS v.s. DFS