PURBANCHAL UNIVERSITY
2022

B.E. (Computer)/Fifth Semester/Final
Time: 03:00 hrs. Full Marks: 80 /Pass Marks: 32
BEG371CO: Algorithm Analysis & Design *(New Course)*

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

The figures in the margin indicate full marks.

Answer EIGHT questions. 8×10=80

1. Define algorithm and explain how an algorithm can be designed efficiently.

2. Define asymptotic notation. List different asymptotic notations used in representation of an algorithm. Explain Big O-notation briefly.

3. Design an algorithm for Quick Sort and compute the time complexity for your algorithm.

4. Explain Convex Hull briefly along with examples

5. Differcnitiate between NP-hard and NP-complete problem. Explan with example.

6. What is branch and bound techinique? Explain how 0/1 knapsack problem can be solved using branch and bound technique.

7. Explain general method for greedy algorithm. Explain the prim's algorithm for finding MST and analyse its complexcity.

8. State travelling salesperson problem and with the help of an example show how it can be solved using dynamic programming.

9. Write short notes on any TWO: 4+4

   (a) Recursive algorithm (b) 8-Queen Problem

   (c) Dijkstra's algorithm (d) Hamiltonian cycle.

PURBANCHAL UNIVERSITY
2021

B.E. (Computer)/Fifth Semester   Full Marks: 80 /Pass Marks: 32

Time: 03:00 hrs.

BEG371CO: Algorithm Analysis & Design (New Course)

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

The figures in the margin indicate full marks.

Answer EIGHT questions.   **8×10=80**

1(a) What are the major characteristics of good algorithm? Describe different cases used to analyze the quality of an algorithm.   3+3

(b) Define Recurrence relation. Using substitution method solve the following recurrence relation. $T(n)=4T(n/2)+n^2$, $n>1$.   1+3

2. Using the Divide and Conquer strategy, design an algorithm for Merge-sort and analyze its time complexity. Compare Merge sort with quick sort in terms of time and space complexity.   6+4

3. Explain the concept of space and time complexity with appropriate example. Describe the concept of volker matrix multiplication method with its benefits.   5+5

4. Write any two characteristics of Greedy Algorithms. Write an algorithm for solving fractional Knapsack problem and also use it find the optimal solution to the Knapsack instance, n= 4, m=5 $(w_1, w_2, w_3, w_4) = (2, 1, 3, 2)$ and $(P1, P2, P3, P4) = (12, 10, 10, 15)$.   2+8

5. Define planar graph. Explain the concept of Convex Hull in 2D. Describe dijkstra's algorithm with example.   1+4+5

6. Defien shortest path and tree. Explain and analyse travelling salesperson problem of the given graph: 1+1+8

Contd. ...
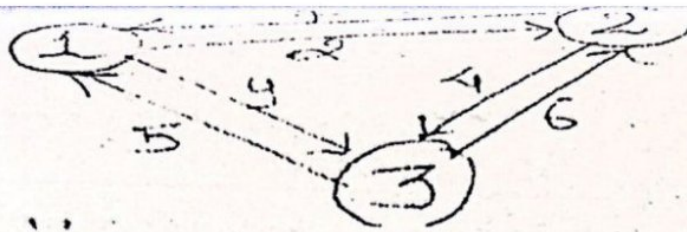
7. Compare the iterative and recursive algorithm for Backtracking method. Write algorithm, to place 8-queen's in non-attacking position on 8 × 8 chess-board. Also draw its state space search tree. 3+7

8. What is Branch and Bound Method, how is it different from Backtracking? Explain, with the help of an example, how 0/1 Knapsack problem can be solved using Branch and Bound technique. 3+7

9. Explain about class P, class NP, NP-Hard and NP complete with suitable examples. Discuss about The Satisfiability Problem for chromatic number. 7+3

PURBANCHAL UNIVERSITY
2019

B.E. (Computer)/Fifth Semester.

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32.

BEG371CO: Algorithm Analysis & Design (New Course)

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

The figures in the margin indicate full marks.

Answer EIGHT questions.

8×10=80

1(a) Define worst case, best case and average case of algorithm analysis.

3

(b) Make a tight big-0 analysis of following code

7

```
void main()
{
int m, n, I, j, a[], b[], c[];
printf (''Enter value of m and n");
scanf("%d%", &m; &n);
for(i=0; i<n; i ++)
{
a[i] = i;
b[i] =i * i :
c[i] = - i ;
}
for (i=0;j<m;j++)
{
printf("%d it %d it %d in", a(j), c(j);
}
}
```

2. What is minimum spanning tree? Write the execution trace of following graph to construct minimum panning tree by Prim's algorithm. 3+7
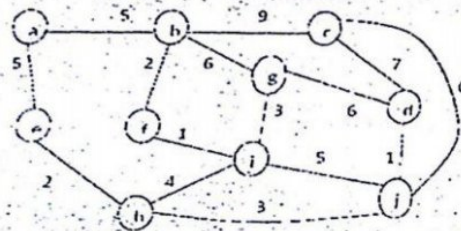
3. Define approximation algorithm. Explain Graham's Scan algorithm to compute convex hull. 2+8

4. What is divide and conquer technique? Using this technique. Write an algorithm of quick sort then analyse it. 3+7

5. What is left turn and right turn? Discuss "class P", "Class NP", and "NP completeness". 2+8

a) What do you mean by recurrence relation? 2

Give the jobs sequencing algorithm with deadlines. You have given 5 jobs with profit pi and deadlines di as

job i = {1,2,3,4,5}
pi= {20,10,5,15,1}
di= {2,1,3,2,3}

Find the optimal job list that can be executed in sequence with their deadlines so as to maximize the profits. 8

7. Explain and analyse the Floyd's Warshall algorithm for all pairs shortest path problem. Trace the algorithm for the following graphs.
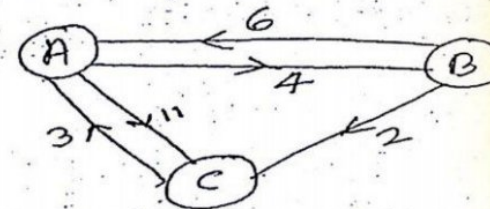
8. What is Backtracking? With the help of an algorithm, explain how 8-queen problem is solved? 2+8

9. Define branch and bound. Explain multi-stage graph with an example. 3+7

PURBANCHAL UNIVERSITY
2018

B.E. (Computer)/Fifth Semester

Time: 03:00 hrs.   Full Marks: 80 /Pass Marks: 32

BEG371CO: Algorithm Analysis & Design (New Course)

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

The figures in the margin indicate full marks.

Answer EIGHT questions.   8×10=80

1. Compare optimization problems and decision problems. Elaborate on Asymptotic Notations with examples.   4+6

2. Using the step count method analyze the time complexity when two m×n matrices are added. Derive Big Oh notation for given relation: $T(n)=2T(n/2)+3n^2$, $T(1)=11$ and $n=2^k$ 4+6

3. How divide and conquer method is used to solve a problem? Explain convex hull problem using Divide and Conquer method.   4+6

4. Write down general method of greedy technique. Find optimal schedules for following tasks with given deadlines and penalties in terms of weight.   4+6

Task	1	2	3	4	5	6
W_i	20	15	25	10	5	30
d_i	2	4	3	1	5	6

5. Differentiate between Divide and conquer method and Dynamic Programming method. Explain a multistage graph problem based on dynamic programming with example.   4+6

6. What is all pair shortest path problem? Solve TSP problem to find optimal path using Dynamic Programming method for a graph with cost matrix as follow: 4+6

Contd. ...

$$\begin{bmatrix} 0 & 20 & 15 & 10 \\ 6 & 0 & 2 & 6 \\ 5 & 12 & 0 & 15 \\ 7 & 10 & 9 & 0 \end{bmatrix}$$

7. Write down solution state space tree for 4 queen problem with explicit and implicit constraints to solve using backtracking method.

4+6

8. Define NP hard and NP complete. Show that CLIQUE is NP complete.

5+5

9. Write down steps of least cost search method to solve TSP problem. Solve O/I Knapsack problem using Branch and Bouding method for item: <11, 12, 13>, <w1, w2, w3> : <5, 4, 3> and <v1, v2, v3> : <6, 5, 4>

4+6

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PURBANCHAL UNIVERSITY
2016

B.E. (Computer)/Fifth Semester/Final
Time: 03:00 hrs.   Full Marks: 80 /Pass Marks: 32
BEG373CO: Operating System (New Course)

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

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer EIGHT questions.   8×10=80

1. What is an operating system? Discuss briefly about the evolution of operating system.   2+8

2. Define process and its different states. What are the various operations on a semaphore? Solve the produce-consumer problem using semaphore.   2+4+4

3. Compute average waiting times using FCFS, Priority (lowest no. represents highest priority) and Round Robin (quantum= 1ms) scheduling algorithm for the following set of processes. Assume that all processes have arrived at time 0 in the order P1, P2, P3, P4 and P5.   3+3+4

Process	Burst Time(ms)	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

4. What are the necessary conditions for a deadlock? Briefly explain "Banker's Algorithm".   4+6

5. Consider that there are total 10 magnetic tapes. There are four processes in the system, in which process p1 may need maximum of 4-tapes, p2 may need maximum of 3, p3 may need maximum of 5 and p4 may need maximum of 7 tape drives. The matrix is as follows: 10

PURBANCHAL UNIVERSITY
2016

B.E. (Computer)/Fifth Semester
Time: 03:00 hrs.   Full Marks: 80 /Pass Marks: 32
BEG371CO: Algorithm Analysis & Design (New Course)

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

The figures in the margin indicate full marks.

Answer EIGHT questions.   8×10=80

1. What do you mean by asymptotic notation? Define and explain the notation Big Oh, theta and omega notation. Find the best case, worst case and average case running time for Binary Search algorithm.   1+5+4

2. Define multistage graph. Explain knapsack problem in context of Backtracking.   2+8

3. Define greedy paradigm. Explain the concept of job sequencing with illustration. You have given 5 jobs with profit "pi" and deadline "di" as:

   job = {1,2,3,4,5}
   pi = {20,10,5,15,1}
   di = {2,1,3,2,3}

   Find the optimal job list that can be executed in sequence with their deadlines so as to maximize the profits.   2+8

4. Discuss algorithm analysis. Explain time complexity and space complexity.   3+7
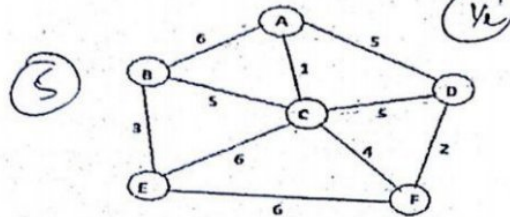
5. What is graph? Explain shortest path algorithm and its application with Dijkstra's Algorithm.   2+8

6. What is Divide and Conquer technique? Using this technique, write an algorithm of quick sort and then analyze it.   3+7

(2)

7. Sketch the Prim's algorithm for computing Minimum Spanning Tree (MST) of a graph and analyze its complexity. Find the MST for the following graph.　　10

8. Explain about Class P, Class NP and NP complete with suitable example.　　10

9. What is the concept of dynamic Programming? Find the longest common subsequence (LCS) between "XMJYAUZ" and "MZJAWXU".　　3+7

10. Write short notes on:　　5+5
    (a) Travelling Salesman problem
    (b) Convex Hull

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(2)

Process	Max. Need	Allocated
P1	4	2
P2	3	2
P3	5	3
P4	7	1

Find the safe sequence if the system is in safe

6. What are the advantages of dynamic memory partitioning fixed memory partitioning. Use LRU page replacement algo in the following reference string having three frames calculate the no. of page faults:

　　0 1 2 3 0 1 2 3 0 1 2 3 4 5 6 7

7. Discuss disk scheduling algorithm in brief.

8(a) Define soft real time and firm real time
  (b) Why is Android Operating System popular? Discuss.

9. Write short notes on any TWO:
   (a) Classical IPC Problem-Dining Philosopher
   (b) DMA
   (c) Process Control Block (PBC)

B.E. (Computer)/Fifth Semester/ *Final*

Time: 03:00 hrs.   Full Marks: 80 / Pass Marks: 32

BEG371CO: Algorithm Analysis & Design *(New Course)*

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

The figures in the margin indicate full marks.

Answer EIGHT questions.   8×10=80

1(a) Describe briefly how the divide-and-conquer strategy is used for designing efficient algorithms.   4

(b) Using divide-and-conque strategy, design an algorithm for binary search and compute its time complexity for the worst case.   6

2(a) What is dynamic programming? How does it differ from greedy strategy?   2+2

(b) Find minimum-cost path from s to t in the given multistage graph using either forward or backward approach.   6
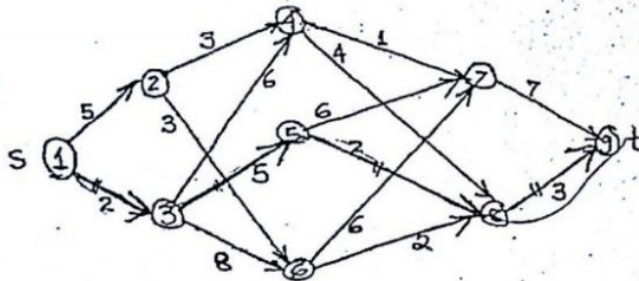

3(a) Give the algorithm for greedy strategies for the Knapsack problem.   4

(b) Using greedy strategy, find an optimal solution to the knapsack instance n=7, m=15, $(p_1, p_2, ..., p_7)$ = (10, 5, 15, 7, 6, 18, 3), and $(w_1, w_2, ..., w_7)$ = (2, 3, 5, 7, 1, 4, 1), where n represents the number of objects, m the knapsack capacity, P_i the profit per unit weight of object i, and w_i the weight of object i.   6

Contd. ...

4. Define algorithm. Express the asymptotic notation using big O of f(n) defined as follows: 2+8

$f(n)=10n^2+4n+4$

5(a) Using Kruskal's algorithm, find the minimum-cost spanning tree for the given graph. Show all stages in the algorithm. 6
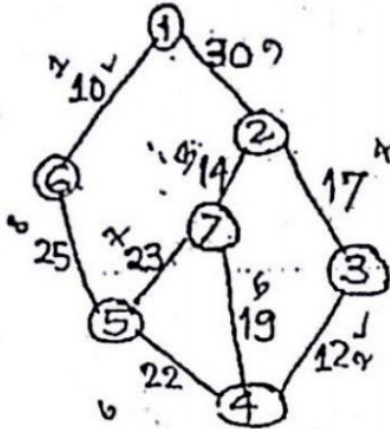
(b) Discuss about graph coloring problem. 4

6. What is 8-Queens problem? What algorithm design strategy would you adopt to solve this problem? Develop an algorithm for it. 3+1+6

7. Describe briefly the branch-and-bound strategy of algorithm design. Mention a few types of problems that can be solved by using this strategy. 6+4

8. Describe NP-complete problems in detail. Why is it important to know about such problems? 7+3

9(a) Using divide-and-conquer design strategy, develop an algorithm to sort a list of numbers with the help of quick sort sorting technique. 5

(b) Discuss about travelling sales person problem and its solution in the light of dynamic programming. 5

10. Write short notes on: 5+5
(a) Space complexity
(b) Ω asymptotic notation

PURBANCHAL UNIVERSITY
2014

B.E. (Computer)/Fifth Semester
Time: 03:00 hrs.   Full Marks: 80 /Pass Marks: 32
BEG371CO: Algorithm Analysis & Design (New Course)

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

The figures in the margin indicate full marks.

Answer FIVE questions.

                                                    5×16=80

(a) Define Algorithm. Explain recursive algorithm to compute factorial of an integer.
                                                    8

(b) What do you mean by asymptotic notation? Define and explain the notion Big 0 with example. Explain divide and conquer technique.
                                                    4+4

(a) Obtain a recurrence relation to calculate computing time of quick sort. For the following set of numbers search the no. 14 using binary search algorithm and show all the steps: 5, 9, 12, 14, 58, 61, 101, 106.
                                                    4+4

(b) Write and explain the concept of Merge sort and calculate the time complexity of this.
                                                    8

(a) Explain the general concept of greedy method, with its control abstraction.
                                                    8

(b) Identify the difference between Prim's and Kruskal's algorithm. Obtain a minimum cost spanning tree using prim's algorithm from the following graph.
                                                    2+6
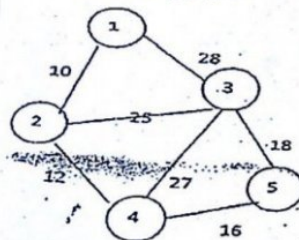
                                                    Contd. ...

(2)

4(a) What do you mean by dynamic programming? Obtain a multistage graph for 3 resources and 2 projects.   2+6

(b) Write and explain the concept of all pairs shortest path approach What do you mean by backtracking? Explain its general concept.
                                                    4+4

5(a) Define and explain the concept of State space tree. Obtain a state space tree for 4-queens problem.
                                                    8

(b) Explain the difference between depth first and breadth search technique with example
                                                    8

6(a) What do you mean by NP-Hard and NP complete problem? Explain their difference.
                                                    8

(b) Define and explain decision algorithm, optimization problem and optimization algorithm.
                                                    8

PURBANCHAL UNIVERSITY
2013

B.E. (Computer)/Fifth Semester/Final
Full Marks: 80 /Pass Marks: 32
Time: 03:00 hrs.
BEG371CO: Algorithm Analysis & Design (New Course)

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

The figures in the margin indicate full marks.

Group A
2×12=24

Answer TWO questions.

1(a) What is time complexity? Develop an efficient algorithm for finding the sum of n numbers. Draw step table for this algorithm and find out its time complexity using big O asymptotic notation.
2+2+2+2

(b) Define algorithm. What are the criteria that all algorithms must satisfy?
1+3

2(a) Describe in brief how the divide-and-conquer strategy is used for designing efficient algorithms.
4

(b) Using divide-and-conquer strategy, design an algorithm for merge sort sorting technique. Compute its time complexity.
6+2

3(a) Give the algorithm for greedy strategies for the Knapsack Problem.
5

(b) Using greedy strategy, find an optimal solution to the Knapsack instance n=3, m=20, (p_1, p_2, p_3)=(25, 24, 15) and (w_1, w_2, w_3)=18, 15, 10), where n represents the number of objects, m the Knapsack capacity, P_i the profit per unit weight of object i, and w_i the weight of object.
7

Group B
8×7=56
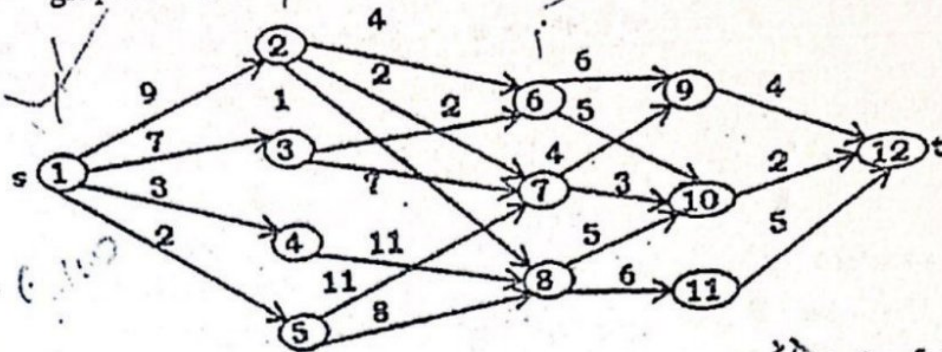
Answer EIGHT questions.

4. What is dynamic programming? How does it differ from greedy strategy?
4+3

5. Find a minimum-cost path from s to t in the given multistage graph using either forward or backward approach: 7

6. Express the asymptotic notations using big O and Ω of f(n) defined as follows: f(n)= 100n+6. 4+3

7. Using the Prism's algorithm, find the minimum-cost spanning tree for the given graph. Show all stages of the algorithm. 7
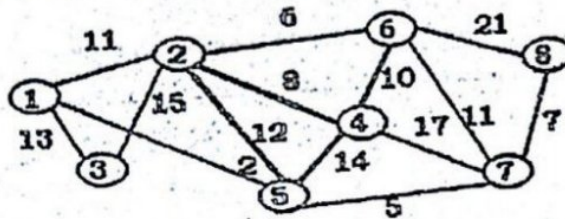
8. What is backtracking algorithm design techniques? Give a backtrack solution to the 8-queens problem. 3+4

9. Describe briefly the branch-and-bound strategy of algorithm design. Mention a few types of problems that can be solved using this strategy. Knapsack & Traveling Salesperson 4+3

10. What are NP-hard and NP-complete problems? Discuss. 7

11. Using divide-and-conquer design strategy, develop an algorithm to sort a list of numbers with the help of selection sort sorting technique. 7

). Write short note on any TWO: 2×3.5=7
(a) Dijkstra's algorithm
(b) Graph colouring
(c) Performance measurement