Q c.s 2001

FIFTH SEMESTER B.E. (COMPUTER SCIENCE AND ENGINEERING/
INFORMATION SCIENCE AND ENGINEERING) DEGREE
EXAMINATION, MARCH 2001

ANALYSIS AND DESIGN OF ALGORITHMS

Maximum : 100 Marks

Time : Three Hours

Answer any **five** *questions.*
All questions carry equal marks.

1. (a) Define precisely the terms–time complexity and space complexity.   (4 marks)

   (b) Briefly explain the notations of Bigot's" and asymptotic growth rate.   (6 marks)

   (c) Solve the recurrence relations :

   $$T(n) = aT\left(\frac{n}{c}\right) + bn \quad \text{for } n > 1$$
   $$= b \qquad\qquad \text{for } n = 1$$

   (10 marks)

2. (a) Briefly explain the depth first search of a graph and illustrate it on the graph shown in Figure 1 below. Show the tree and back edges.
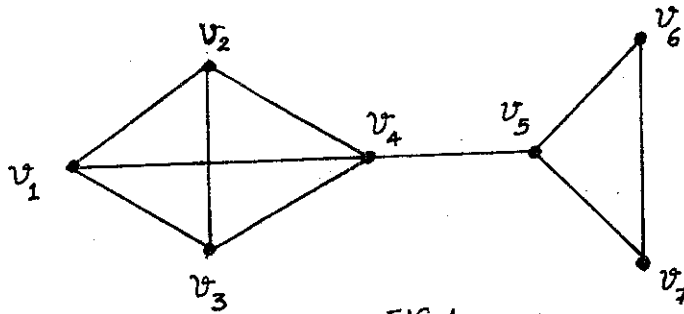

FIG. 1.

   (10 marks)

   (b) Briefly explain an algorithm to find connected components of a graph with an example.

   (10 marks)

3. (a) Briefly explain the "greedy strategy".   (8 marks)

   (b) Explain the primis algorithm to construct a minimum cost spanning tree and give its time complexity.

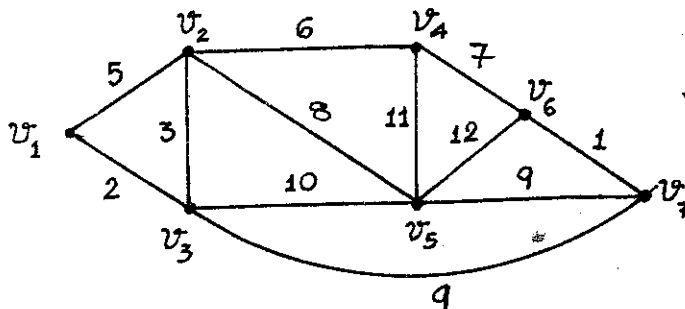   Illustrate the algorithm on the graph below shown in Fig. 2.

FIG. 1.

   (12 marks)
   Turn over

4. (a) Explain the merge sort and obtain its time and space complexities. (1

   (b) Show that no. of comparisons needed to sort n elements is $\Omega(n \log n)$. (8

5. (a) Give an algorithm to obtain an optimal order of multiplying a chain of matri (10

   (b) Explain an algorithm to solve all pair shortest path problem and give its time cor (10

6. (a) Briefly explain the method of backtracking and illustrate it on O/I knapsack p (12

   (b) Give an algorithm to obtain the maximum clique of a graph. (8

7. (a) Briefly explain the method of "branch and bound". (8

   (b) Give a method for obtaining a "bound" in travelling salesman problem. Illustra the matrix below :

	v_1	v_2	v_3	v_4
v_1	∞	-5	3	8
v_2	4	∞	6	5
v_3	-2	8	∞	10
v_4	8	13	14	∞

Show the matrix after the edge (v_3, v_2) is selected and compute the bound i resulting matrix.

(14 r

8. (a) Briefly explain the concepts of polynomial reducibility and NP-completeness.

(10 n

   (b) Explain an approximate algorithm for Vertex cover problem. (10 n

\ S

CS/IS5T1

Reg. No. ☐☐☐☐☐☐☐☐☐☐

Fifth Semester B.E. Degree Examination, January / February 2003

Computer/Information Science & Engineering
Analysis and Design of Algorithms

Time: 3 hrs.]

[Max.Marks : 100

Note: Answer any FIVE full questions.

1. (a) Define space and time complexity of a program. Discuss about various components of space complexity. (10 Marks)

   (b) What is meant by asymptotic notation ? Explain the various notations used in analysing algorithms. Give two examples for each. (10 Marks)

2. (a) Explain the three ways of representing graphs. Discuss about the space and time complexities of those representations. (10 Marks)

   (b) Explain depth first search method. Develop C^{++} code for finding a path between two vertices in a graph using DFS. (10 Marks)

3. (a) What is meant by greedy criterion? Suggest an algorithm for single source shortest path problem. Discuss about selection of data structures and time complexities. (10 Marks)

   (b) Show how minimum spanning tree is found using Kruskal's algorithm. Using the same, find the minimum spanning tree for the following graph. .
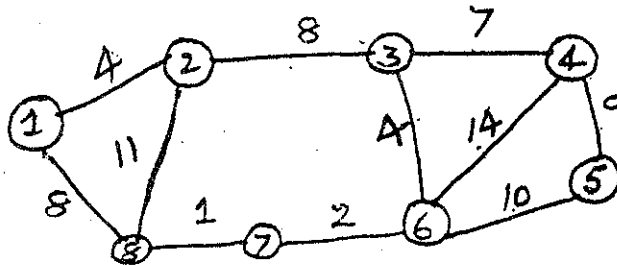
(10 Marks)

4. (a) Explain how divide and conquer technique is used in solving defective chess board problem. Develop an algorithm for the same. (10 Marks)

   (b) Explain Merge Sort algorithm with an example. Obtain its time complexity. (10 Marks)

5. (a) Solve the following multiplication chain problem and show the sequence of multiplication. (10 Marks)
   Number of matrices $q = 5, r = (10, 5, 1, 10, 2, 10)$

   (b) Give an algorithm to compute all pair shortest paths in a digraph and illustrate the same taking a suitable example. (10 Marks)

6. (a) Explain the method of back tracking and illustrate it on container loading problem.
(10 Marks)

(b) Explain Branch and bound algorithm to solve max clique problem. (10 Marks)

7. (a) Define NP-Hard and NP- complete problems with examples. What is meant by reducibility ?
(10 Marks)

(b) What is an approximation algorithm ? Give an approximation algorithm for vertex cover problem.
(10 Marks)

8. Write detailed note on :

a) Quick sort method

b) Operation count and step count

c) Bipartite cover problem

d) Strassen's multiplication method

(4×5=20 Marks)

** * **

USN

Fifth Semester B.E. Degree Examination, July/August 2003

Computer/Information Science & Engineering

Analysis and Design of Algorithms

Time: 3 hrs.] [Max.Marks : 100

Note: **Answer any FIVE full questions.**

1. (a) Define space complexity and time complexity. Give reasons for measuring the space complexity and time complexity. (10 Marks)

   (b) Write recursive and non-recursive functions to compute factorial of n, where, n is a positive integer. Compare space requirement of the two functions. (10 Marks)

2. (a) Explain the representation schemes used for representing graphs and digraphs. For the following graph given in Fig. 2(a) obtain the adjacency matrix with diagonal eliminated, packed adjacency matrix and linked adjacency matrix. (10 Marks)
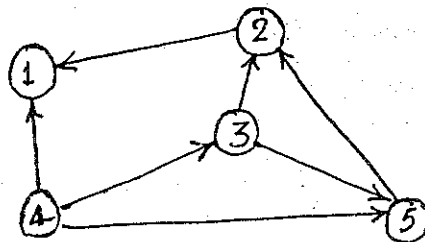

Fig. 2 (a)

   (b) Explain Breadth-first search and depth-first-search methods. Write algorithms for each of them. (10 Marks)

3. (a) Explain optimization problems with examples. (5 Marks)

   (b) What is meant by topological sorting? Suggest a greedy algorithm for the same. Trace its working with a suitable example. (10 Marks)

   (c) Explain prim's algorithm to determine minimum spanning tree. (5 Marks)

4. (a) Given

   $$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

   Find the product of two matrices A & B using strassen's method. (10 Marks)

   (b) Write a non-recursive C/C^{++} program to find minimum and maximum of a given list of 'n' numbers, using divide and conquer technique. (10 Marks)

5. (a) Explain variable bit scheme method of image compression with an example.

(10 Marks)

(b) Discuss the divide and conquer solution for 'closest pair of points' problem with an example.

(10 Marks)

6. (a) Explain backtracking method of designing algorithms with an example.

(5 Marks)

(b) Draw the solution space tree for a 4-object 0/1 knapsack problem. (5 Marks)

(c) Compare and contrast the two backtracking solutions of container loading problem with examples.

(10 Marks)

7. (a) Explain FIFO branch and bound and least cost branch and bound methods.

(10 Marks)

(b) Explain the concept of polynomial reducibility and N-P completeness.

(10 Marks)

8. Write short notes on :

a) Quick sort

b) Branch and bound method of Max clique

c) Noncrossing subset of nets

d) Component folding

(5×4=20 Marks)

** * **

CS/IS5T1

USN ⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜

Fifth Semester B.E. Degree Examination, July/August 2003

Computer/Information Science & Engineering

Analysis and Design of Algorithms

Time: 3 hrs.]

[Max.Marks : 100

Note: *Answer any FIVE full questions.*

1. (a) Define space complexity and time complexity. Give reasons for measuring the space complexity and time complexity.   (10 Marks)

   (b) Write recursive and non-recursive functions to compute factorial of n, where, n is a positive integer. Compare space requirement of the two functions.   (10 Marks)

2. (a) Explain the representation schemes used for representing graphs and diagraphs. For the following graph given in Fig. 2(a) obtain the adjacency matrix with diagonal eliminated, packed adjacency matrix and linked adjacency matrix.   (10 Marks)
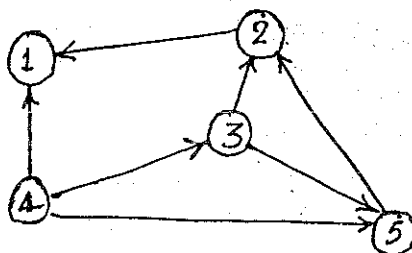

Fig. 2 (a)

   (b) Explain Breadth-first search and depth-first-search methods. Write algorithms for each of them.   (10 Marks)

3. (a) Explain optimization problems with examples.   (5 Marks)

   (b) What is meant by topological sorting? Suggest a greedy algorithm for the same. Trace its working with a suitable example.   (10 Marks)

   (c) Explain prim's algorithm to determine minimum spanning tree.   (5 Marks)

4. (a) Given

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

   Find the product of two matrices A & B using strassen's method.   (10 Marks)

   (b) Write a non-recursive C/C^{++} program to find minimum and maximum of a given list of 'n' numbers, using divide and conquer technique.   (10 Marks)

5. (a) Explain variable bit scheme method of image compression with an example.

(10 Marks)

(b) Discuss the divide and conquer solution for 'closest pair of points' problem with an example.

(10 Marks)

6. (a) Explain backtracking method of designing algorithms with an example.

(5 Marks)

(b) Draw the solution space tree for a 4-object 0/1 knapsack problem. (5 Marks)

(c) Compare and contrast the two backtracking solutions of container loading problem with examples.

(10 Marks)

7. (a) Explain FIFO branch and bound and least cost branch and bound methods.

(10 Marks)

(b) Explain the concept of polynomial reducibility and N-P completeness.

(10 Marks)

8. Write short notes on :

a) Quick sort

b) Branch and bound method of Max clique

c) Noncrossing subset of nets

d) Component folding

(5×4=20 Marks)

** * **

CS/IS5T1

USN ☐☐☐☐☐☐☐☐☐☐

Fifth Semester B.E. Degree Examination, July/August 2004
Computer/Information Science & Engineering
Analysis and Design of Algorithms

Time: 3 hrs.]

[Max.Marks : 100

Note: *Answer any FIVE full questions.*

1. (a) Define Big On, omega and theta notations used in analyzing algorithm.

   (6 Marks)

   (b) Design an algorithm to find max and min in a given set of numbers. Find its asymptoic time complexity.

   (6 Marks)

   (c) Write an algorithm for rank sorting. Explain its working with an example.

   (8 Marks)

2. (a) Prove that every n-vertex connected undirected graph contains at least $n - 1$ edges, $n \geq 2$.

   (6 Marks)

   (b) For the graph given below

   i)   Obtain a breadth first search spanning tree

   ii) Obtain a depth first search spanning tree

   both starting from vertex 1 and also 3.
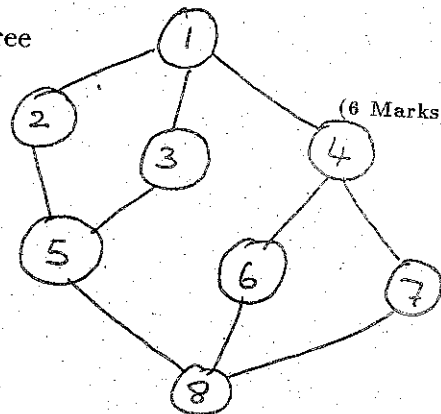
   (6 Marks)

Fig 2(b).

   (b) Write the Add, Delete and Indegree functions in C^{++} for cost adjacency matrix for weighted directed graphs.

   (8 Marks)

3. (a) Write an algorithm for topological sorting and explain.

   (6 Marks)

   (b) What is a Bipasatite graph ? Given

   $$S = \{S_1, S_2, S_3, S_4, S_5\}$$
 $$U = \{4, 5, 6....15\}$$
   $$S_1 = \{4, 6, 7, 8, 9, 13\} \quad S_2 = \{4, 5, 6, 8\}$$
   $$S_3 = \{8, 10, 12, 14, 15\} \quad S_4 = \{5, 6, 8, 12, 14, 15\}$$
   $$S_5 = \{4, 9, 10, 11\}$$

   Find the minimum cover.

   (6 Marks)

(c) Write Kruskal's algorithm for minimum cost spanning tree and explain with an example.   (8 Marks)

4. (a) How "Divide and Conquer" can be applied to multiply two square matrices ? Explain.   (6 Marks)

(b) With a Pseudo code explain merge sort algorithm.   (6 Marks)

(c) When do we compute lower complexity of an algorithm ? Show the decision tree for insertion sort with $n = 3$.   (8 Marks)

5. (a) Explain dynamic programming method desiging algorithm taking 0/1 knapsack problem as an example.   (10 Marks)

(b) Give a recursive algorithm for matrix multiplication chains.   (10 Marks)

6. (a) Explain backtracking in the context of TSP. Apply backtracking to TSP for the following graph:
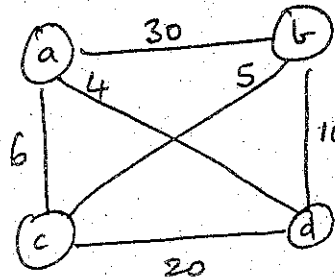
(10 Marks)

(b) Define max clique problem and show backtracking method for a maxclique problem.   (10 Marks)

7. (a) Give an algorithm for container loading problem using FIFO Branch bound method.   (10 Marks)

(b) Write note on complexity class NP.   (10 Marks)

8. (a) With an example, explain approximate vertex cover problem. Give its algorithm.   (10 Marks)

(b) Write short notes on :
   i)   Solving Recurrance Equation   (5 Marks)
   ii) Linked list representation of ADT.   (5 Marks)

** * **