Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No. .....

MCA–203

M. C. A. (Second Semester) EXAMINATION, June, 2008

DATA STRUCTURES

(MCA—203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Question paper is divided into *five* Units. Attempt *one* question from each Unit. All questions carry equal marks.

Unit—I

1. (a) List and explain the applications of stack in computers. 10

   (b) Translate the following infix expression into its equivalent postfix forms : 2 each

   (i) A * (B + D)/E − F * (G + H/K)

   (ii) (A + B ↑ D)/(E − F) + G

   (iii) A && B | | C | | ! (C > D)

   (iv) ((A + B)/D) ↑ ((E − F) * G)

   (v) A ↑ B ↑ C * D

P. T. O.

Or

2. (a) What is a priority queue ? What are the different ways of maintaining a priority queue in memory ? 10

   (b) What is the significance of linked implementation of stack ? Write insertion and deletion algorithm for this data structure. 10

Unit – II

3. (a) Write an algorithm to concatentate two given linear lists. 10

   (b) What is doubly linked list ? Compare doubly linked list and singly linked list. Write deletion algorithm for doubly linked list. 10

Or

4. (a) How polynomials can be represented by linked list ? Write an algorithm to add *two* polynomials with *two* variables. 10

   (b) Write steps/procedure to remove duplicate information from a linked list. 10

Unit – III

5. (a) Define the following terms. Also give examples of each : 10

   (i) Complete binary tree

   (ii) Extended binary tree

   (iii) Strictly binary tree

   (iv) Expression tree

   (b) Prove that the total number of edges in a complete binary tree with n terminal nodes is $2(n-1)$. 10

Or

6. (a) Write non-recursive preorder traversal algorithm for binary tree. Traverse the following binary tree in preorder. 10

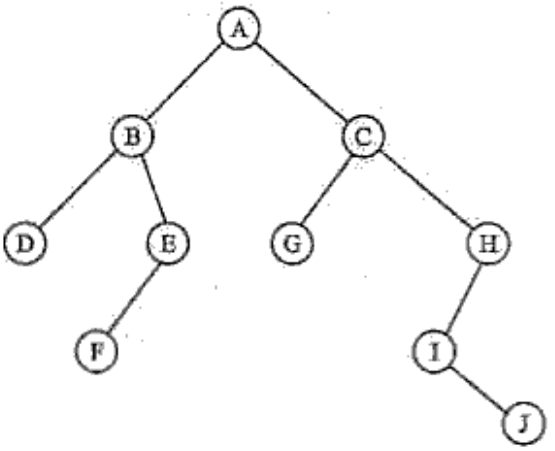

Fig. 1

(b) What are the applications of tree data structure ? Explain. 10

Unit–IV

7. (a) Explain the following search techniques with examples : 10

(i) indexed sequential search

(ii) interpolation search

(b) Write insertion sort algorithm. Using this method arrange the following list in ascending order : 10

25, 15, 30, 9, 99, 20, 26

Or

8. (a) Explain Heap sort procedure with proper example. 10

(b) Write some collision resolution techniques. Also explain chaining. 10

P. T. O.

Unit—V

9. (a) Which are the *three* commonly used representations of graph ? Give examples to explain each. 10

(b) What is Dijkstra's Algorithm ? Using this algorithm find the shortest paths from source A to all the other vertices. 10

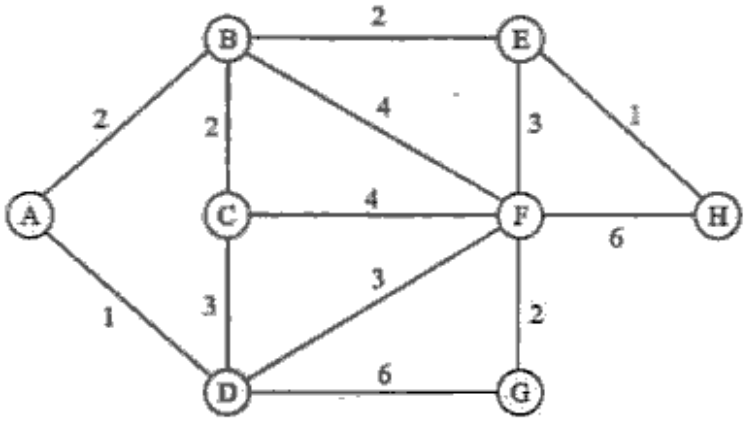

Fig. 2

Or

10. (a) Define the term AVL tree. Write about various rotations performed to balance an AVL tree. Construct an AVL search tree by inserting the following elements into an empty AVL tree : 10

2, 10, 3, 9, 4, 8, 7, 5, 6

(b) Compare B-tree with B +-tree. 10

Total No. of Questions : 10] [Total No. of Printed Pages : 4

MCA–203

M. C. A. (Second Semester)
EXAMINATION, June, 2007
DATA STRUCTURE
(MCA–203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt *one* question from each Unit. All questions carry equal marks.

Unit–I

1. (a) What is recursion ? Solve Tower of Hanoi problem by using recursion. 10

   (b) What is the procedure for calculating the address of any two-dimensional array ? Explain with the help of an example. 10

2. (a) Explain briefly an array, structure and array of structures. If an array B [11] [8] is stored as columnwise and B [2] [2] is stored at 1024 and B [3] [3] at 1084, find the addresses of B [5] [3] and B [1] [1]. 10

   (b) Write an algorithm to find the VALUE of an Arithmetic expression P into postfix notations : 10

   $$P = (3 \uparrow 2 * 5)/(3 * 2 - 3) + 5$$

P. T. O.

Unit – II

3. (a) Draw the picture representation of a polynomial function P (x) using linked list : 10

$$P(x) = 2x^8 - 5x^7 - 3x^2 + 4$$

(b) Write an algorithm to delete the First Node N from a linked list which contain the given ITEM of information. 10

4. (a) Explain the memory representation of a doubly linked list. 10

(b) Explain the following : 10

(i) To represent linked list using array

(ii) Sparse matrices

Unit – III

5. (a) Explain the memory representation of a binary tree with suitable example. 10

(b) What are basic differences between complete binary tree and almost complete binary tree ? Construct the binary tree with general tree. 10

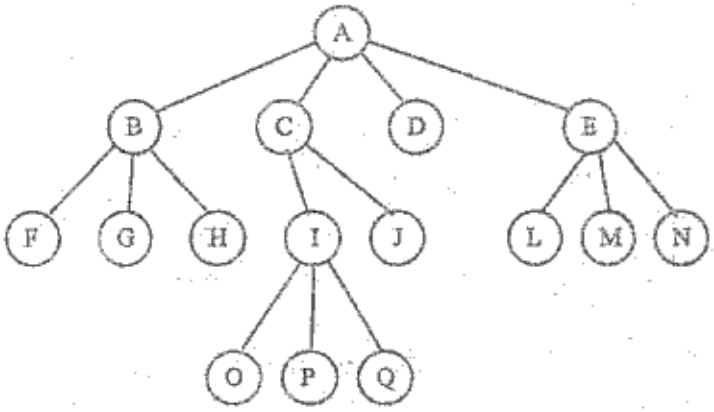

Fig. 1

6. (a) Show that maximum number of nodes in a binary tree of height '*h*' is $2^{h+1} - 1$, $h \geq 0$. 10

(b) Construct a Binary Tree T with Nine Nodes and the Inorder and Preorder Traversal of T yields the following sequences of nodes : 10

INORDER : E, A, C, K, F, H, D, B, G

PREORDER : F, A, E, K, C, D, H, G, B

Unit–IV

7. (a) Write the procedure for shell sort. Explain with suitable example. 10

(b) Write the algorithm for Merge Sort and also prove that the worst case complexity is O ($n \log n$). 10

8. (a) Explain Hasing Procedure. Give *four* advantages of a chained hash table over open addressing. 10

(b) What are the differences between Sequential Search and Binary Search ? Write an algorithm for binary search on linear array. 10

Unit–V

9. (a) What is Minimum Cost Spanning Tree ? An undirected graph G is given below. Convert into the Minimum Cost Spanning Tree by using Kruskal's Algorithm. 10

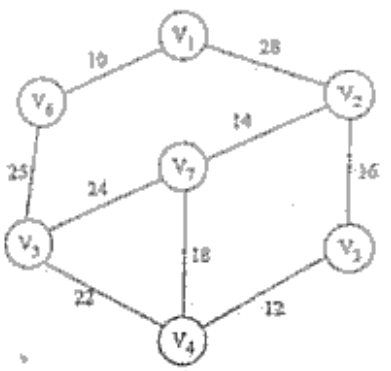

Fig. 2

P. T. O.

(b) Write an Algorithm to insert the element into the B-tree. 10

10. (a) Write the Algorithm for Breadth First Graph Traversals. Also prove the time complexity is : 10

$$T(n, e) = \theta(n^2)$$

(b) Construct the AVL search-tree from the given set of item values : 10

H, I, J, B, A, E, C, F

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–203(O)

M. C. A. (Second Semester) EXAMINATION, May/June, 2006

(Old Scheme)

DATA STRUCTURE

[MCA–203 (O)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) How will you implement several stacks and queues with in single array ? 10

   (b) Write an algorithm to search a node in linked list. 10

2. (a) Let *a* be the set of integers. Give recursive algorithm to compute the maximum and minimum elements of array. 10

   (b) Transform each of the following expressions to prefix and postfix : 10

   (i) A + B * C – D

   (ii) (A + B) * (C – D)/E * F

   (iii) A – B/(C * D)

P. T. O.

3. (a) Write algorithms for the following in a deque : 12

(i) Remove left element of deque

(ii) Remove right element of deque

(iii) Insert an element to left of deque

(iv) Insert an element to right of deque

(b) How will you declare doubly linked list in C language ? What are its main features ? 8

4. (a) What is the difference between internal and external sorting ? Sort the following array using heap sort : 14

42, 73, 10, 64, 23, 57, 93, 35, 98, 96

Also write algorithm for heap sort.

(b) Explain Hashing. Explain various collision handling methods. 6

5. (a) Write an algorithm to search in a B-Tree. 10

(b) Explain sequential search, binary search, index sequential search and interpolation search. 10

6. (a) Explain the following terms : 12

(i) Indegree of graph

(ii) Outdegree of graph

(iii) Weighted graph

(iv) Adjacency matrix

(v) Adjacency list

(vi) Complete graph

(b) Explain Dijkstra's algorithm for shortest path in graph with example. 8

7. (a) Explain B^+ trees. Compare with B trees. 8

(b) What do you mean by forest ? How will you convert forest into trees ? 8

(c) Explain AVL trees. 4

8. Write short notes on any *four* of the following : 20

(i) Applications of stacks

(ii) Complete binary tree

(iii) String processing

(iv) Selection sort

(v) Merge sort

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–203(N)

M. C. A. (Second Semester) EXAMINATION, May/June, 2006

(New Scheme)

DATA STRUCTURES

[MCA–203 (N)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Obtain a data representation for mapping a stack S and a queue Q into a single array V (1 : *n*). Write algorithms to add and delete elements from these two data objects. 10

   (b) Explain the term 'Recursion'. How is stack useful in recursion ? Write a recursive function to calculate the product of two integers. 10

2. (a) Transform each of the following expressions to prefix and postfix form : 10

   (i) A + (B * C – (D/E ^ F) * G) * H

   (ii) (A + B) * (C – D)^ E * F

   (iii) (A + B) * D + E/(F + A * D) + C

P. T. O.

(iv) $(A + B) * (C \wedge (D - E) + F) - G$

(v) $A \wedge - B + C$

(b) Write algorithms to implement a queue using circular linked list having *one* external pointer. 10

3. (a) What are the different ways to represent linked list in memory ? Explain by giving proper examples. Also write the advantages and disadvantages of each type. 10

(b) Write algorithms to perform the following : 10

(i) Invert a linked list pointed at by X

(ii) Concatenate two linked lists producing a third one.

4. (a) What do you understand by Thread binary trees ? Explain one-way and two-way threading of a binary tree traversed in inorder. Write inorder traversal algorithm for TBT. 10

(b) Write an algorithm to convert a forest into a binary tree. Using your procedure convert the following forest into a binary tree. 10

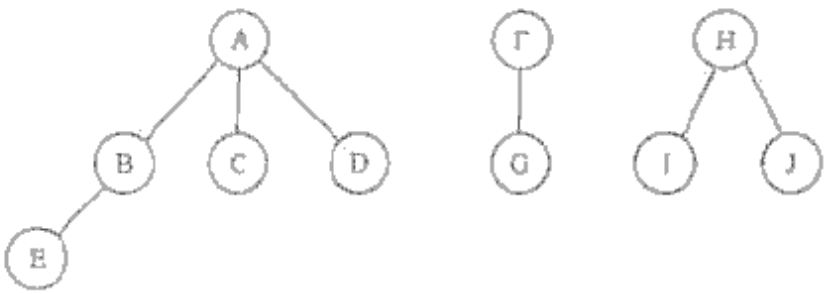

Fig. 1

5. (a) Write recursive functions : 5, 5

* to create an exact copy of a given tree
* to check whether the two binary trees are equivalent or not.

(b) Create a binary search tree and a heap of the following data : 5, 5

42, 23, 74, 11, 65, 58, 94, 36, 99, 85

6. (a) Explain about the following searching methods by giving examples : 8

* binary search

* indexed sequential search

(b) Write quick sort algorithm. Using quick sort technique sort the following array in ascending order : 12

25, 57, 48, 37, 12, 92, 86, 33, 50, 42

7. (a) What do you understand by hashing ? Describe any *four* hashing functions with suitable example. 10

(b) What is minimum spanning tree ? Write Kruskal's algorithm to find the minimum cost spanning tree of any graph. Using this algorithm find the minimum spanning tree of the following graph. 10

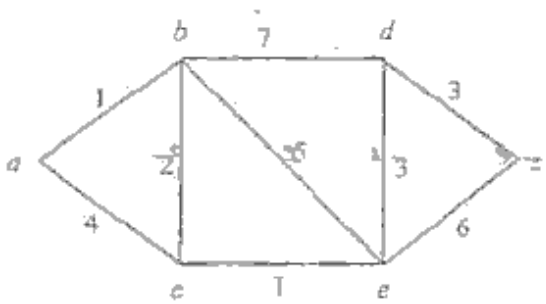

Fig. 2

8. (a) What are the properties of a B-tree ? Construct a B-tree of order 5 using the following data : 10

2, 7, 9, 12, 30, 15, 18, 25, 13, 4, 6, 8, 11, 32, 35, 31, 33, 34

(b) What is B +- Tree ? Write the differences between B-trees and B +-trees 10

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–203

M. C. A. (Second Semester)
EXAMINATION, Dec., 2005
DATA STRUCTURES
(MCA – 203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) A square matrix is said to be symmetric if $a(i,j) = a(j,i)$ for i and j. Such a symmetric square matrix may be stored in an array of half the size of the matrix in terms of number of elements :

   (i) Derive the formula for index of one dimensional array in terms of indices of symmetric square matrix for the above storage scheme. 8

   (ii) Write an algorithm to print the sum of each column of the above matrix stored as one dimensional array. 8

   (b) Define Recursion with the help of example. 4

2. (a) Define stack. Describe an algorithm to convert an infix expression to postfix expression. 10

P. T. O.

(b) Describe circular queue. Write algorithms to add and delete an item from circular queue. 10

3. (a) Given a pointer P, to a node in a doubly linked list, write algorithms to insert a node after the node pointed to by P, and to delete the node before the node pointed to by P, Handle the conditions when P pointing to first or last node of the list. 10

(b) Suggest a suitable node structure to represent polynomials using linked list. Create a linked list using your structure for the following polynomial : 10

$$x^7 y^2 - 100yz^6 + 6xyz + 20x + 40$$

4. (a) What is a heap ? How can a heap be used to represent a priority queue ? Discuss how to perform the operations of item insertion and removal in heaps used to represent priority queues. 10

(b) What is tree traversal ? Write recursive algorithm for various types of traversal. Explain with the help of an example. 10

5. (a) Discuss the advantages and disadvantages of a threaded storage representation for binary tree. 6

(b) Show that the maximum number of nodes in a binary tree of height H is $2^{H+1} - 1$. 7

(c) What is forest ? Explain how forest is converted to tree. 7

6. (a) Write quick-sort algorithm for sorting. What is the average case and worst case time complexity of quick-sort ? Trace the quick-sort algorithm for the following data : 12

1, 2, 3, 6, 5, 4, 7, 8, 9, 12, 11, 10

(b) Explain the working of Binary Search. Compare the performance of Binary search and Sequential search. 8

7. (a) Define a Graph. Explain its different representation in memory using suitable example. 10

(b) Write any minimum spanning tree algorithm for graphs. Explain its working with suitable example. 10

8. Write short notes on any *two* of the following : 10 each

(a) B-Tree

(b) Hashing

(c) Dynamic Memory Management

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–203

M. C. A. (Second Semester) EXAMINATION, Dec., 2004

DATA STRUCTURES

(MCA – 203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks. Make suitable examples and references wherever necessary.

1. (a) How the conversion of INFIX expression to POSTFIX expression takes place using a stack ? Write an algorithm to convert an INFIX expression into POSTFIX expression. 10

   (b) Convert the following INFIX expression into POSTFIX expression with the help of the algorithm :

   $$A + (B * C - (D \mid E \uparrow F) * G) * H$$ 10

2. (a) Write algorithms to insert and delete an element in a circular queue. 10

   (b) Briefly describe the concept and use of doubly linked list. Write an algorithm to delete a node of doubly linked list. 10

P. T. O.

3. (a) How does a circular header linked list differs than a linear linked list ? Write a procedure to insert a new node into a circular beader linked list. 10

(b) Write a non-recursive algorithm for in order traversal of a binary tree. 10

4. (a) What is meant by binary search tree ? Write an algorithm to delete a node from a binary search tree. Include all possibilities. 10

(b) Create a binary expression tree for the following expression and write its pre-order and post order traversals : 10

$$-A++ \quad +--B+D++ \quad +--C-E++$$

5. (a) Discuss the worst case time complexity of selection sort algorithm. Write an algorithm for insertion sort method, then analyse its time complexity in worst case with selection sort method. 10

(b) Discuss the application of data structure graph. What are the most commonly used graph representation methods ? How do we select a particular representation ? Discuss. 10

6. (a) Prove that Prim's algorithm finds a minimum cost spanning tree for every connected, undirected graph. 10

(b) Define AVL tree. Consider the following list of elements :

3, 5, 11, 8, 4, 1, 12, 7, 2, 6

Describe and construct an AVL tree for these elements. 10

7. (a) Differentiate Binary search tree, AVL tree and m-way tree with the help of suitable examples. 10

   (b) Draw a B-tree of order-5 for the following data items :

   D H K Z B P Q E A S W T C L N Y M 10

8. Write short notes on any *four* of the following : 20

   (i) Interpolation search

   (ii) Shortest path algorithm

   (iii) Heap

   (iv) Circular linked list

   (v) Linked stack

   (vi) Time-complexity of algorithm

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–203

M. C. A. (Second Semester) EXAMINATION, June, 2004

DATA STRUCTURES

(MCA – 203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks. Make suitable examples and references wherever necessary.

1. (a) Describe any *three* applications of stack. Differentiate array, stack and queue with the help of suitable examples. Write an algorithm to evaluate a postfix expression. 10

   (b) Evaluate the following postfix expression with the help of algorithm : 10

   3 5 + 6 4 − * 4 1 − 2 ↑ +

2. (a) Describe data structure queue and its importance in Computer Science. Briefly describe different implementations of queue. 10

   (b) What do you understand by Linked queue ? Write preudo-codes for insertion and deletions operations on a linked queue. 10

P. T. O.

3. (a) Describe the advantages of linked list over array. How linked list is implemented using array ? Write the algorithms to getnode and releasenode in context to the storage area created using array. 10

(b) A doubly linked list is created in ascending order of elements. How can the elements of doubly-linked list be displayed in descending order ? Write the algorithm for the method. 10

4. (a) Describe the following with the help of example : 10

(i) Parse tree and DOS tree

(ii) Strictly binary tree

(iii) Fully binary tree

(iv) Binary expression tree

(b) Draw a binary expression tree for the following expression : 10

$$A * B + C - D * E + F * G/H$$

5. (a) What is the advantage of binary search tree data structure ? How binary search tree is constructed ? Write an algorithm to insert a node into a binary search tree. 10

(b) Consider the following list of 10 test scores :

84, 76, 71, 90, 95, 86, 98, 93, 60, 87

Explain the method of sorting these test scores using quick sort. Write an algorithm for the method and analyse its worst and average case time complexities. 10

6. (a) Define a graph and a multigraph. Describe and write Kruskal's minimum cost spanning tree algorithm. 10

(b) Describe depth first search or Breadth first search method of traversing a graph. 10

7. (a) What is height balanced binary tree ? How is it constructed ? Describe. 10

(b) Describe the method of constructing B-tree. Draw a B-tree of order-5 for the following data items : 10

a g f b k d h m j e s i r x c l n t u p

8. Write short notes on any *four* of the following : 20

(i) Hashing

(ii) String processing applications

(iii) Dijkstra algorithm

(iv) Internal Sorting

(v) B^+ tree

(vi) Threaded Binary tree

Total No. of Questions : 8] [Total No. of Printed Pages : 2

MCA–204

M. C. A. (Second Semester) EXAMINATION, June, 2004

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. Each question carries equal marks.

1. (a) Show that the convergence of Newton-Raphson formula is quadratic.

   (b) Find any real root of $x^3 = x + y$ upto six digits using Newton-Raphson formula.

2. (a) Describe iterative method of roots of equation with convergence condition.

   (b) Find a root (near 1) of the following equation using iterative method (upto six digits) :

$$x^3 + 2x^2 + 10x - 20 = 0$$

3. (a) Explain Round-off, truncation and relative errors by choosing suitable example.

   (b) Given :

$$A_n = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots \frac{1}{2n-1}$$

   Compute A_n correct to three digits.

P. T. O.

4. (a) Describe the Gauss-elimination method.

   (b) Solve the following equation by Gauss-elimination method :

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 2 & 1 \\ 1 & 2 & 2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$$

5. (a) What is meant by ill-conditioning system ?

   (b) Solve the following system by the Gauss-Seidal method :

$$\begin{bmatrix} 10 & -5 & -2 \\ -4 & 10 & -3 \\ -1 & -6 & 10 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \\ 3 \end{bmatrix}$$

6. (a) Derive Simpson's $\left(\frac{3}{8}\right)$ rule.

   (b) Apply the Simpson's (3/8) rule to evalute the following integral (for six digits) :

$$\int_{1\cdot0}^{1\cdot30} \sqrt{x} \cdot dx$$

7. (a) Derive the (fourth order) Runge-Kutta formula.

   (b) Apply the Runge-Kutta formula to solve the following equation :

$$y' = \frac{1}{2}(1 + x)y^2, \quad y(0) = 1$$

8. Write short notes on any *two* of the following :

   (a) Regula-falsi method of roots finding

   (b) Gauss-Legendre integration formula

   (c) Interpolation for unequal spacing

6650

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–203

M. C. A. (Second Semester) EXAMINATION, Dec., 2003

DATA STRUCTURES

(MCA – 203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) What is an upper triangular matrix ? How is it stored in memory ? In an upper triangular matrix with n rows find the total number of non-zero terms and also obtain the accessing function.

   (b) Transform the following expression to prefix and post fix form :

   $$(A + B) * D + E/(F + A * D) + C$$

2. (a) Let P be a pointer to a circularly linked list. Show how this list may be used as a queue ? Write algorithms to add and delete elements from this queue.

   (b) Write a program that contains two functions INVERT and COPY.INVERT inverts a given singly linked list with Pointer LIST. COPY makes a copy of this list.

P. T. O.

3. (a) What are the properties of a well-defined recursive procedure ? Write a recursive algorithm for binary search.

   (b) Define the following by giving examples :

   (i) Complete binary tree

   (ii) Full binary tree

   (iii) Height balanced tree

   (iv) Weight balanced tree

4. (a) Explain tree traversal. Write iterative algorithm for preorder traversal of a binary tree.

   (b) For the following binary tree write in order, preorder and post order traversal.

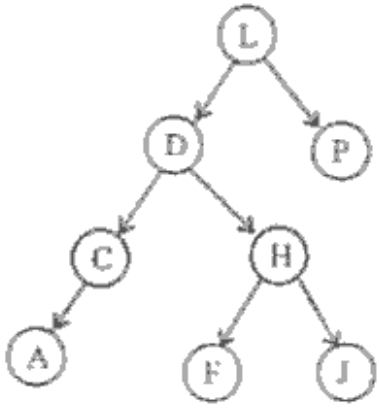

Fig. 1

5. (a) What is a forest ? Write different steps to convert the following forest into a binary tree.

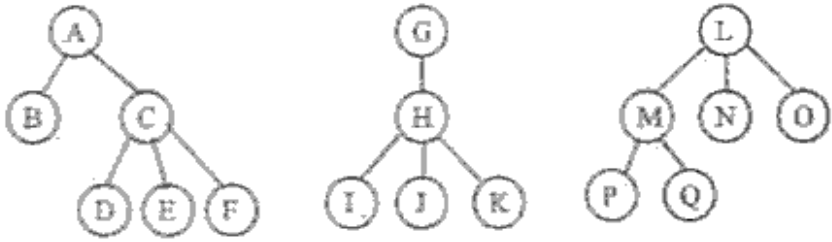

Fig. 2

(b) What are Threaded Binary Trees ? Write a program to traverse a threaded binary in inorder.

6. (a) Compare sequential, indexed sequential and interpolation search.

(b) What is Hashing ? Write the significance of hashing function and explain any *two* of them.

7. (a) Write an algorithm for quick sort. Find its efficiency. Arrange the following array in ascending order using quick sort :

25, 57, 48, 37, 12, 92, 86, 33

(b) Explain shell sort with the help of an example.

8. (a) Write Dijkstra's shortest path algorithm. Using this algorithm find the shortest path between A and H.

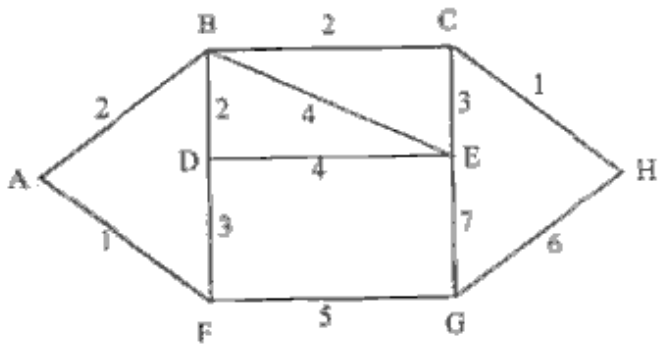

Fig. 3

(b) Define AVL trees. Discuss its insertion operation. To maintain an AVL tree what necessary steps should be followed ?

Total No. of Questions : 8] [Total No. of Printed Pages : 2

MCA–203

M. C. A. (Second Semester) EXAMINATION, June, 2002

DATA STRUCTURE

(MCA – 203)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Write algorithms for operation on a queue.
   (b) How the conversion of an infix expression to post-fix takes place using a stack ?

2. (a) How a linked queue can be implemented ?
   (b) Write an algorithm to insert a node in a Doubly linked list.

3. (a) How linked list can be implemented using arrays ?
   (b) Write an algorithm for non-recursive implementation of pre-order traversal of a Binary Tree.

4. (a) Discuss the various representations of a Binary Tree.
   (b) Compare sequential search with indexed sequential search.

P. T. O.

5. (a) What are different Hashing schemes ?
   (b) What are different techniques for collision resolution ?

6. Explain along with algorithm (any *two*) :
   (a) Quick sort
   (b) Merge sort
   (c) Bubble sort
   (d) Heap sort

7. (a) Discuss the various graph traversal schemes.
   (b) What is a B^+ – tree ? Compare it with B-tree.

8. Write short notes on any *three* of the following :
   (a) Shortest path Algorithm
   (b) AVL Tree
   (c) Threaded Binary Tree
   (d) Heap