Model Answer
B.Tech. (Fourth Semester) Examination 2013
(Information Technology)
Data Structure and Programming Methodology (IT2202)

Note: The paper consists of two sections. Section A and Section B. Section A is compulsory. In Section B attempt any one question from each unit.

Section A

Q.1 - Objective type Questions. (10×1=10)

a) Which of the following data structure store the homogeneous data elements?
   1. Arrays
   2. Records
   3. Pointers
   4. None of the above

ANS – Arrays

b) When new data are to be inserted into a data structure, but there is no available space, this situation is usually called
   1. Underflow
   2. Overflow
   3. House full
   4. Saturated

ANS – Overflow

c) A data structure where elements can be added or removed at either end but not in the middle
   1. Linked lists
   2. Stacks
   3. Queues
   4. Deque

ANS – Deque

d) Which of the following name does not relate to stacks?
   1. FIFO lists
   2. LIFO list
   3. FILO list
   4. Push-down lists

ANS – FIFO List
e) Which of the following sorting algorithm is of divide-and-conquer type?
   1. Selection sort
   2. Quick sort
   3. Merge sort
   4. Both B & C

ANS – Both B & C

f) In a graph if e=[u, v], Then u and v are called
   1. End points of e
   2. adjacent nodes
   3. neighbors
   4. all of above

ANS – all of above

g) Which of the following ways below is a pre order traversal?
   1. Root->left sub tree-> right sub tree
   2. Root->right sub tree-> left sub tree
   3. right sub tree-> left sub tree->Root
   4. left sub tree-> right sub tree->Root

ANS – Root->left sub tree-> right sub tree

h) Which of the following linked list below have last node of the list pointing to the first node?
   1. Circular doubly linked list
   2. Circular linked list
   3. Circular singly linked list
   4. Doubly linked list

ANS – Circular Singly Linked list

i) BFS stands for …Breadth First Search…….

j) For any level r of a tree T can have at most ….. $2^r$….. nodes

Q.2 - Short answer Type. (5×2=10)

a> what is data structure?
Ans – Data structure is a way for structuring data i.e. way of storing data in a computer so that it can be used efficiently.

b> Write any four attributes of entity EMPLOYEE?
Ans – Name, Date of birth, Sex, Designation etc.

c> what is binary search tree?
Ans – A tree T is called BST if each node N of T has the following property – The value at N is greater than every value in the left sub tree of N and is less than every value in the right sub tree of N.

d> what is a balance factor?
Ans – Balance factor = Height of left sub tree – Height of right sub tree.

e> what is Deque?
Ans – A Deque is a liner list in which elements can be added or removed at either end but not in the middle.
Section B
Note: Attempt any one question from each unit. Each question carries 8 marks.

Unit 1
Q. 3- Arrange the list of elements in ascending order using quick sort – 44,33,11,55,77,90,40,60,99,22,88,66 ? After each step write the value of left pointer l, right pointer r and LOC and also draw the current scenario after each step? [8]
Ans -

two pointer l & r (left & right boundaries)

Assign loc = l where pivot = A[loc]

44

Loc 88 11 55 77 90 40 60 99 22 88

left

pivot = A[loc] = 44

Scan r from r to l of comparing each element

with pivot element & stopping at first one which

is less than 44, so 22.

Swap 22, 44

loc = 1

Loc 88 11 55 77 90 40 60 99 22 88

reset loc = 1

Loc 88 11 55 77 90 40 60 99 22 88

Swap 40, 44

loc = 1

Loc 88 11 33 40 77 90 44 60 99 55 88 66

r = 1, l = 2

Loc 88 11 33 40 77 90 44 60 99 55 88 66

r = 1, l = 2

Loc 88 11 33 40 77 90 44 60 99 55 88 66

So 44 is your partition ele. & you divide the list

into 2 sublists.

(22 33 40 44) 44 (90 77 60 99 55 88 66)

\[ p = l \]

\[ p = p+1 \]

\[ p = p-1 \]

\[ \text{apply the same process recursively on both sublists.} \]
OR

Q. 4 - Explain the Merging operation in details? Explain with the help of example? [8]

Ans -

\[ \text{Merging} \equiv (\text{Combining}) \]

- Suppose \( A \) is a sorted list with \( n \) elements and \( B \) is a sorted list with \( m \) elements.
  - Merging combines the elements of \( A \) and \( B \) into a single sorted list \( C \) with \( n + m \) elements is called merging.
  - We must always keep track of the locations of the smallest element of \( A \) and the smallest element of \( B \). Let \( NA \) and \( NB \) denote these locations respectively. Also let \( PTR \) denote the location in \( C \) to be filled.
  - So initially we set \( NA = 1 \), \( NB = 1 \) and \( PTR = 1 \). At each step of algo we compare \( A[NA] \) and \( B[NB] \) & assign the smaller element to \( C[PTR] \).
  - Then we increment \( PTR \) by setting \( PTR = PTR+1 \) and we either increment \( NA \) by setting \( NA = NA+1 \) or increment \( NB = NB+1 \) according to whether the new element in \( C \) has come from \( A \) or from \( B \).
  - If \( NA > n \) then remaining ele\ of \( B \) are assigned to \( C \) or if \( NB > m \) then the remaining elements of \( A \) are assigned to \( C \).

Ex:-

1. \( A = [1, 3, 5, 7] \quad B = [2, 4, 6, 8, 9, 10] \)
   \( C = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10] \)

2. \( A = [2, 4, 6, 8, 9, 10] \quad B = [1, 3, 5, 7] \)
   \( C = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10] \)

3. \( A = [1, 2, 3] \quad B = [4, 5, 6, 7] \)
   \( C = [1, 2, 3, 4, 5, 6, 7] \)
Unit 2

Q. 5 - Evaluate the following postfix notation using stack [5, 6, 2, +, *, 12, 4, /, -] and also write the algorithm for evaluation of a postfix expression? [8]

Ans –

Evaluation of a postfix expression:
This algo finds the value of an arithmetic expression P written in postfix notation:
1. Add a right parenthesis “)” at the end of P.
2. Scan P from L→R & repeats step 3 & 4 for each ele. of P until the sentinel “)” is encountered.
3. If an operand is encountered, put it on STACK.
4. If an operator @ is encountered then:
   (a) Remove the two top elements of STACK, where A is the top ele. & B is the next to top ele.
   (b) Evaluate B @ A
   (c) Place the result of (b) back on STACK.
5. Set value equal to the top ele. on STACK.

Step 1 → 5 6 2 + * 12 4 / -
Q. 6 - What is linked list? Write an algorithm for inserting an ITEM in the beginning of the linked list? [8]

Ans - Linked list is a liner collection of data elements called nodes, where each node contains a reference to the next node in the list called Link. In addition, each node contains a unit of data called the Info.

Algorithm for inserting at beginning of a list: -

```
INSFIRST (INFO, LINK, START, AVAIL, ITEM)
1. IF AVAIL = NULL THEN WRITE OVERFLOW & EXIT.
2. SET NEW = AVAIL AND AVAIL = LINK (AVAIL).
3. SET INFO [NEW] = ITEM
4. SET LINK [NEW] = START
5. SET START = NEW
6. EXIT.
```

Q. 7 - What is binary tree? Draw the binary tree from given PRE – GBQACKFPDERH and IN – QBKCFAGPEDHR Order Traversal. [8]

Ans - A binary tree is made of nodes, where each node contains a "left" pointer, a "right" pointer, and a data element. The "root" pointer points to the topmost node in the tree. The left and right pointers recursively point to smaller "subtrees" on either side. A null pointer represents a binary tree with no elements -- the empty tree. The formal recursive definition is: a binary tree is either empty (represented by a null pointer), or is made of a single node, where the left and right pointers (recursive definition ahead) each point to a binary tree.
OR

Q. 8 – For the given Binary Search Tree T, perform the following sequence of operations –

Ans -

Ans 8 $\rightarrow$ delete 44 $\rightarrow$

delete 75 $\rightarrow$

if we use in order successor then op is

if we use in order predecessor then op is
Unit 4

Q. 9 - Write an algorithm to traverse the graph using Breadth First Search? [8]

Ans –

algo. (BFS) : –
1. Initialize all nodes to the ready state (status 1)
2. Put the starting node A in QUEUE B, change its status to the waiting state (status 2)
3. Repeat step 4 & 5 until QUEUE is empty
4. Remove the front node N of QUEUE process N and change the status of N to the processed state (state 3)
5. Add to the rear of QUEUE all the neighbors of N that are in the steady state (status 1)
6. Exit

OR

Q. 10 – What is Adjacency Matrix? Draw the Adjacency Matrix of the following graph – [8]

Ans –

adjacency matrix : –
Suppose G is a simple directed graph with m nodes & suppose v1, v2 – vm are nodes. Then the adjacency matrix A = (aij) of the graph G is the mxm matrix defined as follows:

\[ a_{ij} = \begin{cases} 
1 & \text{if } v_i \text{ is adjacent to } v_j \\
0 & \text{otherwise}
\end{cases} \]

Matrix which contains only 0 & 1 is called a bit matrix or boolean matrix.
Unit 5

Q. 11 - Explain the data storage and management technique? [8]

Ans – In this question very briefly explain data storage process and management and explain any one method of storage management.

OR

Q. 12 - Write a short note on file organization? [8]

Ans –

File organization is the methodology which is applied to structured computer files. Files contain computer records which can be documents or information which is stored in a certain way for later retrieval. File organization refers primarily to the logical arrangement of data (which can itself be organized in a system of records with correlation between the fields/columns) in a file system. It should not be confused with the physical storage of the file in some types of storage media. There are certain basic types of computer file, which can include files stored as blocks of data and streams of data, where the information streams out of the file while it is being read until the end of the file is encountered.

We will look at two components of file organization here:

1. The way the internal file structure is arranged and
2. The external file as it is presented to the O/S or program that calls it. Here we will also examine the concept of file extensions.

We will examine various ways that files can be stored and organized. Files are presented to the application as a stream of bytes and then an EOF (end of file) condition.
Techniques of File Organization

The three techniques of file organization are
1. Sequential
2. Indexed Sequential
3. Direct file organization

..........................................................End of Solution.........................................................