Registration No. : | | | | | | | | | | |

Total number of printed pages – 4

B. Tech
BE 2106

Second Semester Back Examination – 2015

DATA STRUCTURE USING C

BRANCH(S) : AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, EC, EEE, EIE, ELECTRICAL, ETC, FAT, IEE, IT, MANUFACT, MANUTECH, MECH, MINERAL, MINING, MM, MME, PLASTIC, TEXTILE

QUESTION CODE : M 123

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

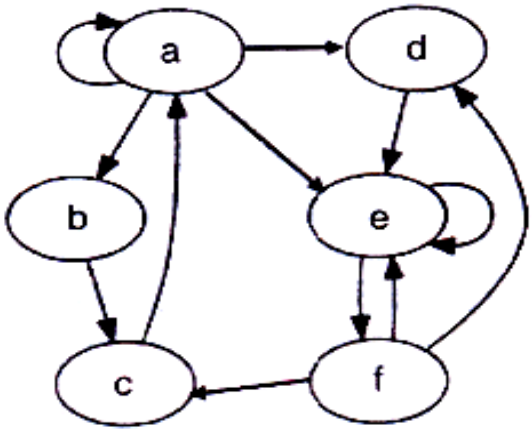
1. Answer the following questions : 2×10

(a) How does the chaining method differ from the linear probing method of collusion handling ? Which method is better and why ?

(b) The following postfix expression with single digit operands is evaluated using a stack : 8 2 3 ^ / 2 3 * + 5 1 * – (Note that ^ is the exponentiation operator). What are the top three elements of the stack after the first * is evaluated ?

(c) Consider the two binary operators '↑' and '↓' with the precedence of ↓ being lower than the operator ↑. Operator ↑ is right associative while operator ↓ is left associative. Draw the expression tree for the expression: (7 ↓ 3 ↑ 4 ↑ 3↓ 2).

(d) Consider the following directed graph. Calculate the degree of each vertex. Also find its adjacency matrix representation.



(e) What is an abstract data type (ADT) ? How is it different from the regular (built-in) data types ?

(f) The initial configuration of the queue is a, b, c, d ('a' is the front element). You are required to reverse this configuration (i.e. to make this configuration d, c, b, a) with the help of a stack. What is the minimum number of "insert" and "delete" operations required in total (consider 'push' as a kind of insert operation and 'pop' as a kind of delete operation) ? Justify.

(g) Consider the following nested representation of binary trees : (X Y Z) indicates Y and Z are the left and right sub stress, respectively, of node X. Note that Y and Z may be NULL, or further nested. Which of the following represents a valid binary tree? Justify your answer.

(i) (1 2 (4 5 6 7))

(ii) (1 (2 3 4) 5 6) 7)

(iii) (1 (2 3 4)(5 6 7))

(iv) (1 (2 3 NULL) (4 5))

(h) What is a "Dequeue" ? What are the various types of "Dequeues" ?

(i) Consider the following sequence of integers : 8,22,7,9,31,19,5,13. How many swaps are required to sort these in ascending order by using quick sort ? Assume 8 as the pivot element.

(j) The following numbers are inserted into an empty binary search tree in the given order : 10, 1, 3, 5, 15, 12, 16. Construct the binary search tree. What is the height of the final binary search tree ?

2. (a) Write an algorithm that traverses a double linked list and deletes the node that contains the first occurrence of a given integer. 5

(b) What is a circular queue ? Why is it better than normal queue ? Write 'C' functions to implement the 'insert' and 'delete' operations on a circular queue. 5

3. (a) Given the following pre-order and post-order traversal results of a binary tree. Construct the binary tree. 5

Pre-order traversal result: A B D G H K C E F

Post-order traversal result: G K H D B E F C A

(b) A "min heap" is an almost complete binary tree with the property that each non-leaf node in the tree is less than or equal to its children. Given an almost complete binary tree write an algorithm **"BuildMinHeap"** that will convert the almost complete binary tree to a min heap. Also calculate the worst case running time of this algorithm. 5

4. (a) Write an algorithm to convert an infix expression to a prefix expression by using a stack. Also provide the steps to convert the following infix expression to its prefix equivalent by using a stack. 5

A + B * C * (M * N ^ P + T) – G + H

(b) Two arrays of integers 'A' and 'B' are given below : 5

A: 47, 3, 66, 32, 56, 92

B: 3, 47, 66, 32, 56, 92

The array 'A' is an unsorted array. The array 'B' is a partially sorted array after applying two passes of a sorting algorithm on 'A'. Which sorting algorithm is being used (bubble, selection, or insertion) ? Justify your answer.

5. (a) Two linked lists 'A' and 'B' contains the following polynomials :

A : $9x^6 + 3y^3 + 10x^2 + y + 3$

B : $14x^4 + 6y^3 + 4x^2 + y^2$

Write a function **add()** to add these polynomials and print the resulting linked list. 5

(b) A two dimensional array A[36][20] is represented in column-measure order in memory. Assuming that the matrix is of floating point type and its base address is at 4900, calculate the address of the element A[17][19]. What would be the address of the same element if the matrix is represented in row-measure order ? 5

6. (a) Write a complete program using C to create a stack using linked list and perform the following operations : 5

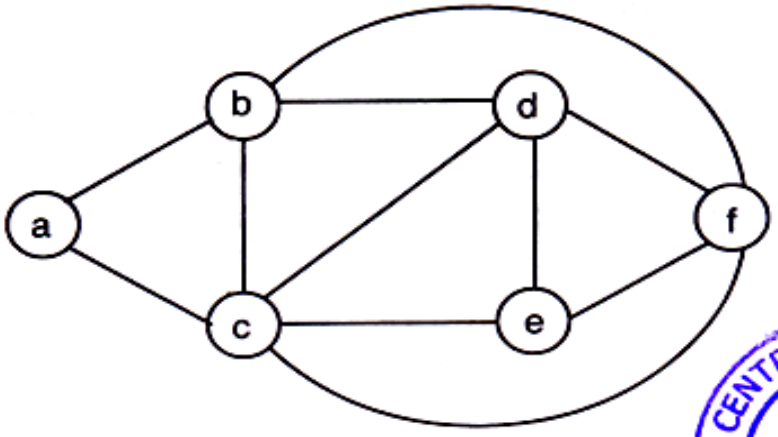
(i) push

(ii) pop

(iii) sort (the top should contain the maximum element)

(b) Insert the characters of the string K R H C S N Y T J M into a hash table of size 10. Use the hash function **H(x) = (AlphaPosition (x) + 1) mod 10** and linear probing to resolve collisions. The function "AlphaPosition" returns the alphabetical position of an alphabet. e.g. AlphaPosition (C) = 3. Which insertions cause collisions ? Display the final hash table. 5

7. (a) Write an algorithm for the depth-first-traversal of a graph. Show in steps the depth-first-traversal result for the following graph : 5



(b) What is an AVL tree ? How is it better than a binary search tree ? Create an AVL tree using the following node values : 5

55, 66, 77, 15, 11, 33, 22, 35, 25, 44, 88, 99

8 Write short notes on any **two** : 5 × 2

(a) Expression trees

(b) Binary search

(c) Warshall's algorithm.
