R 599

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2005.

Second Semester

Computer Science and Engineering

CS 1151 — DATA STRUCTURES

(Common to B.Tech. — Information Technology and First Semester in Part-Time B.E. — Computer Science — Regulations 2005)

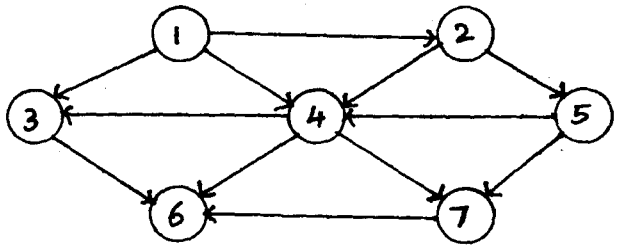
(Regulations 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define an algorithm.
2. Given two variables a and b, exchange the values assigned to them.
3. What is an abstract data type (ADT)?
4. Convert the infix expression $a + b * c + (d * c + f) * g$ to its equivalent postfix expression.
5. Show that the maximum number of nodes in a binary tree of height H is $2^{H+1} - 1$.
6. Define a hash function.
7. What is the average number of inversion in an array of N distinct numbers?
8. What is the average number of comparisons used to heapsort a randomized permutation of N distinct items?
9. Write down the adjacency matrix of the graph



10. What is the NP-complete problem?

PART B — ($5 \times 16 = 80$ marks)

11. (i) Write down the algorithm binary search for searching x from an array $a[1, n]$ and give the stepwise execution for an array (10, 12, 20, 23, 27, 30, 31, 39, 42, 44, 45, 49, 57, 63, 70) to search $x = 44$. (10)

(ii) The exponential growth constant e is characterized by the expression $e = \frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \ldots$ Device an algorithm to compute e to n terms. (6

12. (a) (i) Write routines to pop and push onto a stalk using link implementation.

(ii) Using circularly linked list, write routines to implement ad two polynomials.

Or

(b) A degree is a data structure consisting of a list of item, on wh following operation are possible :

Push (X, D) : Insert item X on the front end of degree D

Pop (D) : Remove the front item from degree D and ret

Inject (X, D) : Insert item X on the rear end of degree D

Eject (D) : Remove the rear item from degree D and return it.

Write routines to support the degree that take $O(1)$ time per opera

13. (a) (i) How do you insert an element into an AVL tree? 5

(ii) Write routines to find and to insert an element in a separate chaining hash table (8)

Or

(b) (i) Write a function to generate the AVL tree of height H with fe nodes. What is the running time of your function? (8)

(ii) Write a function to perform Delete Min in a binary heap. (8)

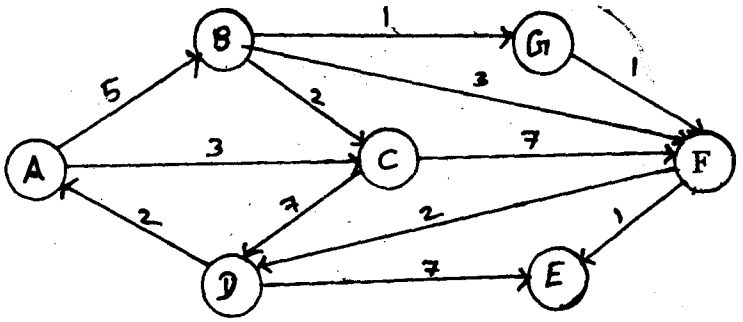
14. (a) Write down the quick sort algorithm and give its worst case, best case and average case analysis.

Or

(b) (i) Show that the resulting running shellsort on the input 9, 8, 7, 6, 5, 4, 3, 2, 1 using the increments {1, 3, 7}. (8)

(ii) What is external sorting? Give the polyphase merging strategy with three tapes T_1, T_2 and T_3. (8)

15. (a) Find the shortest path from A to all other vertices for the graph in the following graph.



Or

(b) What is topological sort? Write down the pseudocode to perform topological sort and apply the same to the following graph.