

**FIFTH SEMESTER EXAMINATION-2005
DESIGN & ANALYSIS OF ALGORITHM**

Full Marks-70

Time: 3 Hours

The figures in the right hand margin indicate marks.
Answer six questions including Question No.1 which is compulsory.

1. Answer the following questions

[2x10]

- (a) What do you mean by time complexity and space complexity of an algorithm? Suppose it is known that the running time of one algorithm is $O(N \log N)$ and that the running time of another algorithm is $O(N^3)$. What does this say about the relative performance of algorithm ?
- (b) What is the purpose of Big Oh notation? Arrange the following function into increasing order: $n \log n$, $(\log n)^3$, 2^n , $\log n$.
- (c) What is W notation? Compare order of growth of $n!$ and 2^n
- (d) On what input data does QUICK SORT algorithm for sorting exhibit its worst-case behavior? Justify with example of a elements.
- (e) Define and differentiate between NP and NP complete problems with examples.
- (f) Is the running time of Merge sort depends on the value of the keys in the input file? Explain your answer.
- (g) In Kruskal's method for finding a minimum spanning tree, how does the algorithm know when the addition of an edge will generate cycle?
- (h) What is the minimum number of keys that must be moved during a "remove the largest" operation in a max-heap? Use a heap of size 15 to explain your answer.
- (i) Solve the following recurrence relation

$T(n) = n$; if $n=0$ or $n=1$
$T(n)=5T(n-1) - 6T(n-2)$; otherwise
- (j) Show that the following equations are correct ?

$n! = O(n^n)$
$33n + 4n = \Omega(n^2)$

2.

- (a) Develop a Huffman code for the input string "a fast runner need never be afraid of the dark" Explain how the greedy-choice property used in this algorithm? [5]
- (b) Write an algorithm for merge sort. Show that running time is $O(n \log n)$ [5]

3.

- (a) Explain the process of Heap sort. Write an algorithm to construct a min heap. Construct max-heap from the following list. Sketch the heap after deleting 76. What is the time complexity of the whole process?
{21,6,56,61,44,7,9,76,75,32,34,4,49} [5]

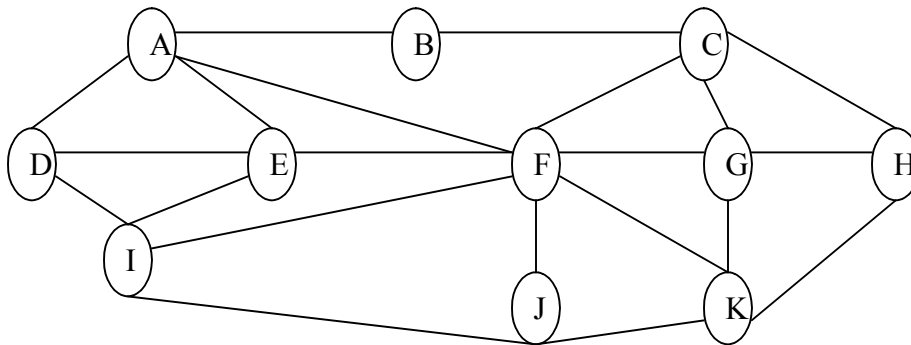
- (b) What is the principle of Optimality that is used in Dynamic Programming paradigm? Explain with an example how **use of table** is found to be efficient instead of using recursion? [5]

4.

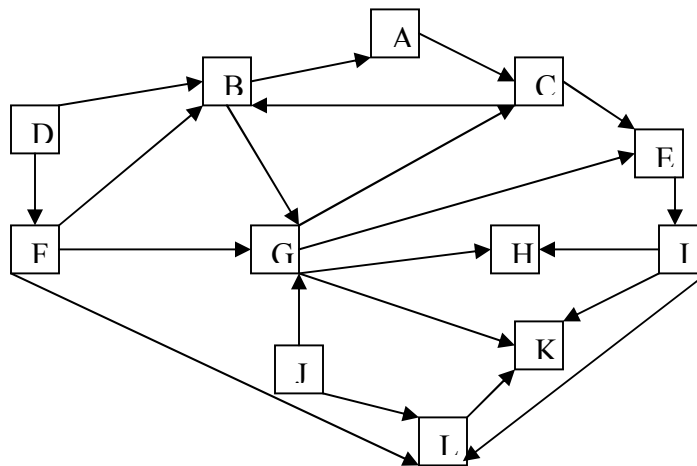
- (a) Give the algorithm of Binary search. Explain how it functions? Show that the algorithm is of same order for both average and worst case is $O(\log n)$ [5]

(b) Define lower bound a problem. What is the difference between worst case lower bound and average case lower bound? Find out the lower bound of heap sort algorithm. [5]

5. (a) Show how to use dynamic programming to compute the longest common subsequence between the two strings “**bbabbaaab**”? What is the complexity of the LCS finding algorithm? [5]
 (b) Explain the principle of ordering Matrix multiplication in the light of dynamic programming. Show that the number of ways that n matrices can be multiplied is of $O(4^n/n^{3/2})$. Hence find an optimal way to find product ABCD of matrices A (30X1), B(1X 40), C (40X10), D(10X25). [5]
6. (a) What do you mean by greedy choice property? Suggest a greedy algorithm to solve 0/1 knapsack problem. Comment on data structure to be used for implementation What is a average case time complexity of your greedy algorithm? [5]
 (b) Find a minimum spanning tree for a given graph using Kruskal’s algorithms. What is the time complexity of this algorithms? Explain the reason why Kruskal’s algorithm always yields optimal spanning tree. [5]



7. (a) Write an algorithm to perform DFS on a grap. Find out the path from A to L using DFS. What is the complexity of your algorithm? Does this algorithm always yields optimal solution? [5]



(b) What is the basic objective of Robin Crap pattern matching algorithm? Write the Robin Crap patern-matching algorithm and explain the use of rolling hash function? What is the worst case running time of Robin Crap search? [5]

8. (a) How the Greedy paradigm of Algorithm differs from that of DYNAMIC PROGRAMMING? What is single Source Shortest Path Problem? Suggest the greedy algorithm to find shortest paths from the designated vertex start to all of the other vertices in a connected weighted, n vertex graph. [5]
- (b) Define and differentiate between P.NP and NP-complete problems with examples.Explain why input size is an important consideration for algorithm comple. [5]