

Department of Computer Sc. & Engineering, NIT Jamshedpur
Laboratory Assignment Autumn Semester 2020

Course: CS1304 Design and Analysis of Algorithms

Class: B. Tech, CSE, 3rd Semester

Instructions:

- (i) Use C or C++ programming language for solving the problems.
- (ii) The program should run without error for all possible input values and should handle the illegal input values without generating run-time error and getting terminated.
- (iii) Large numbers of input values (such as a 3 x 4 or larger size matrix taken as input) should be taken from input text files.

Set-1 (Submission deadline 31st Aug 2020)

1. Implement a function to convert an infix arithmetic expression involving the operators +, -, /, *, (,) and single digit constant integer operands to postfix expression. Assume usual precedence of operators in the order of /, *, + and -. Parentheses () are used to override the precedence of operators.
2. Implement a function to read an arithmetic expression (as given in the previous problem) from the command line and display the computed value of the expression.

Set-2 (Submission deadline 10th Sept 2020)

3. Implement the preorder traversal algorithm for binary trees without using recursion.
4. Implement the functions createTree(), deleteTree(), insertItem(), deleteItem(), searchItem(), deleteTree() for AVL trees, i.e. the balanced binary search trees.

Set-3 (Submission deadline 15th Sept 2020)

1. Implement the (i) insertion sort, (ii) bubble sort, (iii) selection sort, (iv) shell sort, (v) quick sort, (vi) merge sort, (vii) heap sort, (viii) radix sort, (ix) counting sort, (x) bucket sort, (xi) radix exchange sort, and (xii) address calculation sort.

Set-4 (Submission deadline 25th Sept 2020)

2. Implement Dijkstra's algorithm for the shortest path problem.
3. Implement Prim's algorithm for the minimum spanning tree problem.
4. Implement Kruskal's algorithm for the minimum spanning tree problem.
5. Implement DFS algorithms for graphs. Your function should be able to identify all the tree edges, back edges, forward edges and cross edges.
6. Write a function to identify the largest and smallest cycles in a given directed or undirected graph.

Set-5 (Submission deadline 10th Oct 2020)

7. Implement Bellman Ford algorithm for the shortest path problem.
8. Implement dynamic programming algorithm for the shortest path problem.
9. Implement the 0/1 knapsack problem using the dynamic programming.
10. Implement the 0/1 knapsack problem using the backtracking method.
11. Implement the n-queens problem using the backtracking method.
12. Implement the 15-puzzle problem using the branch and bound method.

Set-6 (Submission deadline 25th Oct 2020)

13. Implement the coin changing problem using the greedy method.
14. Write a function to implement the job sequencing with deadline problem in which each job has integer deadline and unit processing time.
15. Implement the graph coloring problem using the backtracking method.
16. Write functions to identify all the strongly connected components, biconnected components, articulation points and bridges in a given directed graph.
17. Write a function to perform topological sort on a given directed graph.
18. Write a function to implement the travelling sales person problem. Prepare the table of running time for graphs containing 10, 20, 40, 60 and 100 nodes and draw graph problem-size versus execution time.

Set-7 (Submission deadline 10th Nov 2020)

19. Write a program for determining whether a graph with n vertices and e edges contains a clique of size m ($m \leq n$). Check for what values of n , e , and m your program gives output in reasonable time.
20. Write a program for determining whether there exists a Hamiltonian cycle in a graph with n vertices and e edges.
21. Write a program for determining whether a graph with n vertices and e edges is a bipartite graph.

Project: Develop a Java based software JEES using GUI interface to process the result of JEE main. Student details should be taken as input when student registers themselves for the examination. JEES assigns them a six character unique Roll number in sequence that also reflects their category Gen or Resv. Roll number serves the purpose of the primary key of a student's record to identify student uniquely. Marks are filled by

the office staff. Student can view their result themselves. Students belong to Gen and Resv categories. Merit serial is made based on total score, if total marks are equal then on Math marks score, then on Phy marks score if Total as well as Math marks of two students are also same.

(Project completion deadline: 31st Oct 2020)

-----END-----