

Shri G. S. Institute of Technology and Science
Department Of Computer Engineering
CO 3463: Design and Analysis of Algorithms
Lab Assignment # 03

Marks: 10 points

Submission Date: 19 February 2017@23:59

Demo Date: 20 February 2017 - 24 February 2017

Late Submission: Not allowed

No copying allowed. If found then students involved in copying will fail in this course.

Note: For the each program, draw a graph between the size of inputs and computational time required by yours program.

- Q. 13.** Suppose x is array of positive integers of size n , and y is another array of positive integers of size m . These two array represents the n -digits and m -digits long integers. Write a program to find the multiplication of x and y .
- Q. 14.** Given a list of n rectangles, Design an algorithm that computes their upper envelope. A rectangle is represented by a triplet $(L;H;R)$ where L, R are the X -coordinates of the left and right sides respectively, and H is the height. (The Y -coordinate of the bottom side of all rectangles is the same.) The output should be an alternating sequence of X and Y coordinates of the upper envelope. Write a program for yours algorithm. Also analyze the running time of your algorithm. To get full credit, your solution should be better than $O(n^2)$.
- Q. 15.** Consider the modified binary search algorithm so that it splits the input not into two sets of almost-equal sizes, but into three sets of sizes approximately one-third. Write down the recurrence for this ternary search algorithm and find the asymptotic complexity of this algorithm. Also write a program and verified it.
- Q. 16.** Consider another variation of the binary search algorithm so that it splits the input not only into two sets of almost equal sizes, but into two sets of sizes approximately one-third and two-thirds. Write down the recurrence for this search algorithm and find the asymptotic complexity of this algorithm. Also write a program and verified it.
- Q. 17.** Write a program and also analyze a divide and conquer MAXMIN algorithm that find minimum and maximum of given list of n integers.
- Q. 18.** A set of points in the plane, $\{p_1 = (x_1; y_1); p_2 = (x_2; y_2); : : : ; p_n = (x_n; y_n)\}$ are given, write a program to find the closest pair of points: that is, the pair $p_i \neq p_j$ for which the distance between p_i and p_j , that is, $\sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$; is minimized.
- Q. 19.** Suppose S is array of positive integers of size n is given. Write a program to find the maximum jump from an earlier index(i) to a later index(j), where $i \leq j$. For example, if the array is $[40; 20; 0; 0; 0; 1; 3; 3; 0; 0; 9; 21]$, then the maximum jump is 21, which happens between the index at 2 and index at 11. More formally, the problem is to compute: $\text{Max}\{ (S_j - S_i) \mid 0 \leq i \leq j \leq |S| \}$
- Q. 20.** Write a program to find the approximate n^{th} Fibonacci number in $O(\log n)$ time.
- Q. 21.** An element of a sequence of length n is called a majority element if it appears in the sequence strictly more than $n/2$ times. Write a program to find the majority element from the given list of n integers.
- Q. 22.** Write a program using divide and conquer techniques for yours own one problem to improve the time complexity of the problem.