INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date: __-____-14 FN/AN Time: 2 Hrs **Full Marks: 60 Deptt: Computer Sc. & Engg.**
No. of Students: 86 **Mid Spring Semester Examination, 2013-14**
Subject No: CS60064 **Subject Name: Computational Geometry**

Instruction: Answer all the questions.

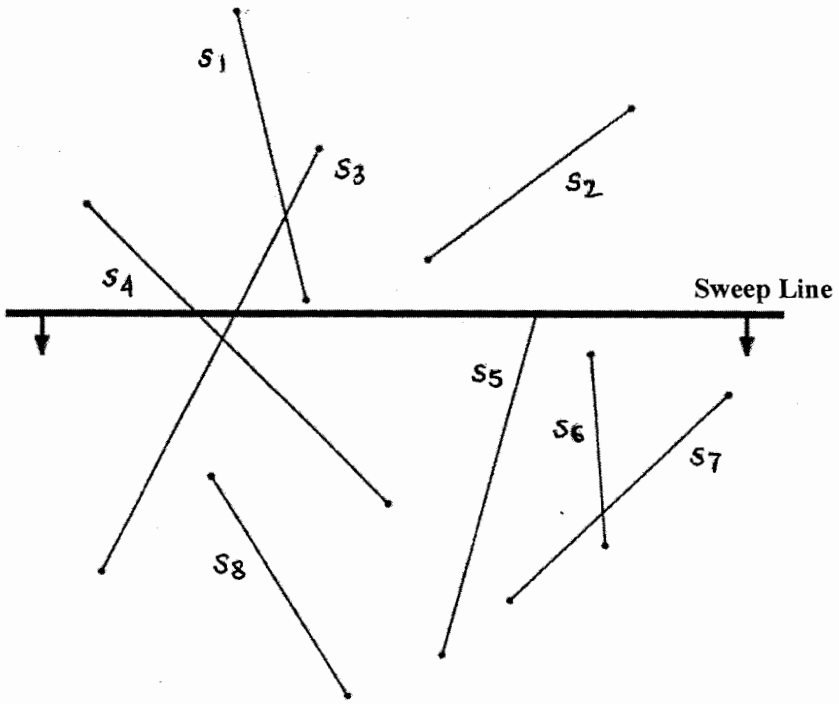
---

1. a) Describe Graham Scan algorithm for computing convex hull of a set of points in the 2-dimensional space. [6+5+(2+2)=15]

   b) Analyse the complexity of the above mentioned algorithm assuming that the input points are already in sorted order.

   c) What is output sensitivity of an algorithm? Elaborate on the output sensitiveness of the above algorithm.

2. a) Let us assume that a plane sweep algorithm is running to identify the intersection points of eight line segments as given in the following figure, where *i-th* line segment is marked as S_i. The sweep line (thick horizontal line in the figure) is moving from top to bottom. Draw the status structure using a proper data structure for the following status to speed up the computation. Name the data structure and discuss the goodness of your data structure. [(6+1+2)+6=15]



   b) Analyse the time complexity of the Plane Sweep algorithm for the line segment intersection.

3. a) Prove that for a given simple polygon with n vertices, there exists a guarding set with at most $\lfloor n/3 \rfloor$ guards. [7+8=15]

b) Discuss about the difficulty of minimum vertex guard art gallery problem. What is the plausible solution?

4. Prove or Disprove the followings: [5+5+5=15]

a) $\Omega(n \log n)$ is a lower bound on the running time of any Convex Hull algorithm.

b) r guards are occasionally necessary and always sufficient to see the interior of a n-gon of $r \geq 1$ reflex vertices.

c) The lower bound on triangulating a monotone polygon is $\Omega(n \log n)$.