INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Department of Computer Science and Engineering
Mid Spring Semester Examination, 2015-16

Date: 23-Feb-16 **Time: 9am–11am**
No. of Students: 44 **Full Marks: 60**

Subject: Computational Geometry (CS60064)

Instructions: *(1) Answer all the questions.*
(2) The part of each question must be together. Otherwise they will not be evaluated.

1. (a) Develop an algorithm that will place sufficient number of cameras to guard a simple polygon with n vertices such that every interior point of the polygon will be visible from at least one camera.

   (b) It is known that the vertex guard art gallery problem for polygons with or without holes is NP-hard. Develop an approximation algorithm for this problem.

   (c) Compare the number of guards required in the above two algorithms and comment on the goodness.

   Marks: 5+6+4=15

2. (a) Given a set of n points in the plane. Develop a randomized incremental algorithm to find the closed circular disk of minimum radius that encloses all of these points.

   (b) Let us assume $CH(n)$ is the convex hull computed from a set of n points in the plane and q is the set of hull points. Prove or Disprove that your designed algorithm in the above step can be applied on q points rather than n points. Analyse the computational complexity for such a modified algorithm where convex hull is computed as pre-processing of your randomized incremental algorithm.

   Marks: 6+12=18

3. (a) Define a linear programming problem.

   (b) Develop a deterministic incremental algorithm to solve 2-dimension linear programming problem. Analyse its complexity.

   Marks: 2+10=12

P.T.O.

4. Prove or Disprove the followings:

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

(b) Every simple polygon with n vertices has a triangulation consisting of $(n\text{-}2)$ diagonals and $(n\text{-}3)$ triangles.

(c) Given two points (x_1,y_1) and (x_2,y_2), the point (x,y) is on the line determined by (x_1,y_1) and (x_2,y_2) if and only if there is a real number t such that

$$x=(1-t)x_1+tx_2 \quad \text{and}$$
$$y=(1-t)y_1+ty_2 \quad .$$

Marks: 5+5+5=15