Printed Pages : 3   **CS – 042**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1045 | **Roll No.**

B. Tech.

(SEM. VIII) EXAMINATION, 2006-07

COMPUTATIONAL GEOMETRY

Time : 3 Hours]   *[Total Marks : 100*

Note :   (1)   *Attempt **all** questions.*

(2)   *All questions carry **equal** marks.*

(3)   *Assume suitable data wherever **necessary**.*

1   Attempt any **two** parts :
(a)   Differentiate between :
(i)   Classical and computational geometry
(ii)   Plane and 3D line
(iii) Convex and concave in context of computational geometry.
(b)   With help of a suitable example explain the impact of model of computation on complexity of a geometric operation.
(c)   Discuss, two fields of application of computational geometry highlighting why classical geometry can't be applied in such fields ?

2   Attempt any **two** parts :
(a)   Contrast chain and slab methods for location of a point in a planar subdivision highlighting data structure employed and computational complexity.

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(b) (i) Consider a triangle ABC described by vectors $\overrightarrow{AB}$, $\overrightarrow{BC}$ and $\overrightarrow{AC}$. Explain how to derive equation of a plane containing this triangle with the information supplied. If the above information is not sufficient, what more information would be required.
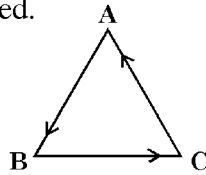

Fig. 1

(ii) For triangle in part (i) develop an algorithm to indicate if a point P is internal or external. For an external point the algorithm must be able to tell the side with respect to plane containing triangle.

(c) Discuss, in brief, one dimensional range searching problem. Explain how this can be extended to multidimensional range searching.

3 Attempt any **two** parts :

(a) (i) Define convex hull. Determine convex hall, if any, for the following figures (you must indicate how you arrived at the solution)
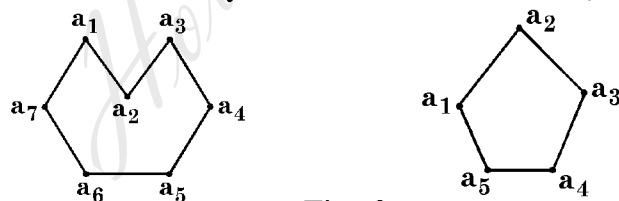

Fig. 2

(ii) Discuss in brief two applications of convex hull.

(b) Discuss quick hull technique with help of a suitable example.

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(c) Explain Jarvis's march for convex hull with help of a suitable example.

4 Attempt any **two** parts :

(a) Discuss hidden line problem and an algorithm for the same.

(b) Contrast 'Divide and conquer approach' with 'Locus approach'.

(c) Write short notes on :
  (i) Voronoi diagram
  (ii) Hidden surface problem.

5 Attempt any **two** parts :

(a) Discuss significance of rectangle in the field of computational geometry.

(b) Derive an algorithm to determine bounding rectangle of an arbitrary shape. Apply the algorithm to following shape and comment on computational complexity.
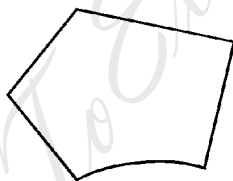

Fig. 3

(c) Define union and intersection of a set of rectangles. Determine mathematically perimeter of union and intersection of two rectangles. Assume that these rectangles lie in same plane and are not making an angle i.e., aligned as shown below
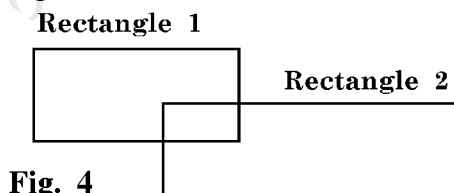(Figure)

Rectangle 1

Rectangle 2

Fig. 4