Ain Shams University
Faculty of Computer & Information Science
Subject: Computational Geometry
Exam: (Midterm) 23/3/2019
Year: (2nd term) 4th

Examiner: Dr. Mohammed Marey
Offering Dept.: Scientific Computing
Academic year: 2018-2019
Dept. Scientific Computing
Duration: 3 hours

Answer the following three questions: (Total marks: 10)

1st Question (35%)

A. Triangulate Polygon-C in **Fig. POLYGON** using modified subtracting ear algorithm.
- What is the data structure?
- Explain the preprocessing step
- Explain what is performed in each step of the loop and the modification done after removing an ear.
- Apply the subtracting ear algorithm to triangulate polygon-C.

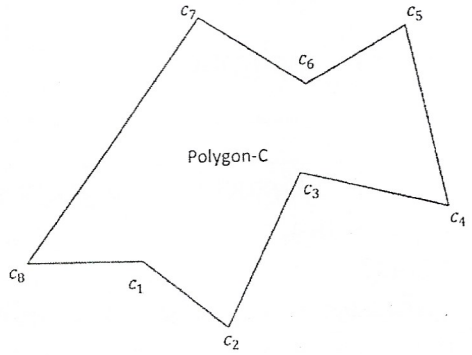

Fig. POLYGON

B. Use the subtracting ear algorithm to triangulate the region bounded by polygon-B and Polygon-A in **Fig. NESTED**.

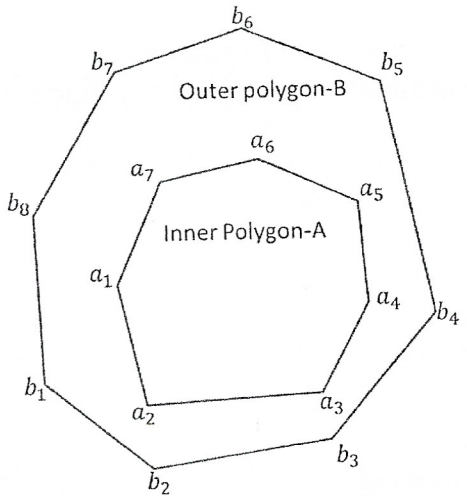

Fig. NESTED

C. Define the Art Gallery Problem. Then find the minimum number of guards required to guard the region bounded by polygon-B and Polygon-A in **Fig. NESTED**?
[Use the triangulation obtained from B to]

2nd Question (30%)

A. Let C be a set of circles of equal radiuses given in **Fig. CIRCLES**. Assume that center of each circle is given and no two centers have the same x-coordinate. Propose an efficient algorithm to find the convex hull of the set C. What are the types of the data structure used? Discuss the time complexity.

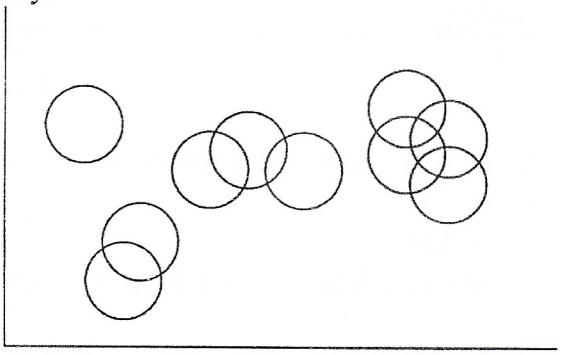

Fig. CIRCLES

B. Define Quad tree and explain one of its application.

3rd Question (35%)

A. In sweep line algorithm for finding the intersection of a given set of segments
1. Explain the complexity of the algorithm.
2. What are the three types of events?
3. What is the data structure required for sweep line status and the events?

B. When applying **FINDINTERSECTIONS** algorithm we may reach the following configurations **Fig. INTERSECTIONS (a) and Fig. INTERSECTIONS (b).** For each situation:
1. What is the status of the variables before the event?
2. What is the status of the variables after the event?
3. What are the required modifications of the sweep-line status and for the event queue?

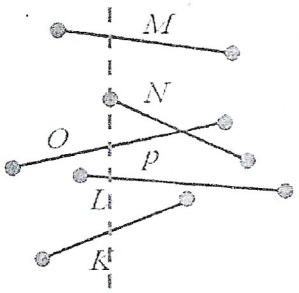

Fig. INTERSECTIONS (a)

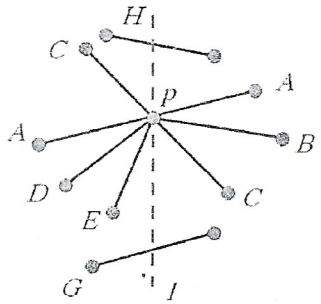

Fig. INTERSECTIONS (b)

Good Luck

Dr. Mohammed Marey