

# CENG 773 – Computational Geometry

## Midterm Exam 25/11/2011

**NAME SURNAME, ID:**

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**Duration:** 90 minutes

**About the exam questions:**

- The points assigned for each question are shown in parentheses next to the question number.

This exam consists of 5 pages including this page. Check that you have them all.

**GOOD LUCK!**

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**Question 1**

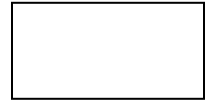
**Question 2**

**Question 3**

**Question 4**

**Total:**

**1** (25 points)



Describe a plane sweep algorithm to find the closest pair of a set of  $n$  points in 2D space in  $O(n \log n)$  time.

2

(30 points)



(a) (20 pts) Given the vertex and half edge records of a doubly connected edge list that represents a subdivision of the plane, describe an algorithm to find the number of faces of the subdivision including the unbounded face. What is the time complexity of your algorithm?

(b) (10 pts) Draw an example doubly connected edge list for which  $Twin(Prev(Twin(e)))$  is different from  $Next(e)$ .

3

(30 points)



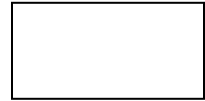
(a) (20 pts)

Prove or disprove: The dual graph of the triangulation of a monotone polygon is always a chain, that is, any node in this graph has degree at most two.

(b) (10 pts)

Draw an example  $y$ -monotone polygon whose triangulation **has** to include a segment which connects two vertices from the same chain. A  $y$ -monotone polygon is composed of a left chain and a right chain connected at the top and bottom vertices. Assume that there are no horizontal edges.

**4** (15 points)



Given a polygon  $P$  in the plane and a 2-dimensional mold for  $P$ , for which a specific edge of the polygon is selected as the *top* edge. Describe a linear time algorithm that decides whether  $P$  can be removed from the mold by a single translation.