

## CISC-868 FALL 2011

### HOMEWORK 8

These questions come from *Discrete and Computational Geometry* by Satyan Devadoss and Joseph O' Rourke.

- Exercise 5.15:** What is the Minkowski sum of two squares whose sides are parallel? Describe the sum when the side lengths of the squares are  $a$  and  $b$ .
- Exercise 5.16:** Describe the Minkowski sum of a regular polygon with  $n$  vertices (of side length  $a$ ) and a regular polygon with  $m$  vertices (of side length  $b$ ).
- Exercise 5.18:** Suppose the infinite plane is filled with unit square obstacles, with corners  $(i-1, j-1)$  and  $(i+1, j+1)$  for all even integers  $i$  and  $j$ . (a) If  $R$  is a disk of radius  $r$ , what is the largest value of  $r$  that permits  $R$  to move between any pair of lattice points whose coordinates are odd integers? (b) What is the largest value of  $r$  that permits  $R$  to be placed somewhere in this environment without overlapping any obstacles?
- Exercise 5.41:** Show that the hedge in the preceding sentence – potentially larger – is necessary by constructing a curve  $C$  with a point  $x$  in  $C$  such that  $\rho(x)$  is arbitrarily small, even if the curvature of  $C$  in a neighbourhood of  $x$  is zero.
- Exercise 5.44:** Prove that if a disk is tangent to  $C$  at a smooth point  $x$  in  $C$  and has radius less than or equal to  $\rho(x)$ , then the disk contains no points of  $C$  in its interior.