CSE 5311.004 Fall 2005

Exercise Set Week 11

1. Compute the Prefix function by the KMP algorithm for the pattern:

   A B C A B D C D B A

2. Give an example of a string and a pattern which represents the "best case" for the KMP algorithm, i.e. the algorithm will run in the fastest possible manner for such a problem instance.
3. Give an example of a string and a pattern which represents the "worst case" for the KMP algorithm, i.e. the algorithm will run in the slowest possible manner for such a problem instance.
4. The input is two strings of characters $A = a_1\ a_2\ \ldots\ a_n$ and $B = b_1\ b_2\ \ldots\ b_n$. Design an O(n) algorithm to determine whether B is a *cyclic shift* of A. In other words, the algorithm should determine whether there exists an index k, $1 \leq k \leq n$ such that $a_i = b_{k+i} \bmod n$, for all i, $1 \leq i \leq n$.
5. Given a non-convex polygon, design an O(n)-time algorithm to find the smallest convex polygon that contains it.
6. Given a convex polygon, design an O(n)-time algorithm to find the pair of vertices that the furthest from each other.
7. "Triangulating" a polygon is the process of adding new line segments such that (a) the line segments connect original vertices of the polygon (b) these new segments are completely inside the interior of the polygon and do not intersect each other, and (c) they break up the interior of the polygon into a collection of triangles.
   a. Given an n-vertex non-convex polygon, how many internal segments are needed to triangulate it?
   b. Give an algorithm to triangulate a non-convex polygon. What is the running time of your algorithm?
8. Given two non-overlapping convex polygons with m and n vertices respectively, show how to compute the convex hull of all the m+n points in O(m+n) time.