Cs545 — Homework #3
Binomial heaps, Fibonacci heaps, string matching and closest pair
Due 10/25/06

1. Prove item (3) of Lemma 19.1 (there are exactly $\binom{k}{i}$ nodes at depth i at B_k)
2. Problem 19-2 from CLRS (second Edition).
3. Question 20.2-1 from CLRS
4. Question 20.2-4 from CLRS.
5. Question 20.2-5 from CLRS.
6. Question 20.4-1 from CLRS.
7. (This question has more than one solution, and basically the question's purpose is to trigger you to seek nice solutions.

   Let P be an $m \times m$ boolean matrix, and T be an $n \times n$ boolean matrix, where m is much smaller than n. Each element in these matrices is either 0 or 1. Suggest an algorithm that checks if there are values s_1, s_2 such that

   $$P[i_1, i_2] = T[i_1 + s_1, i_2 + s_2] \ ,$$

   for every pair of integers i_1, i_2 such that $1 \leq i_1 \leq m$ and $1 \leq i_2 \leq m$.
8. Given points p, q, r, the triangle determined by pqr is the triangle whose vertices are p, q, r. The *perimeter* of this triangle is the sum of lengthes of its edges.

   Let S be a set of n points in the plane. Suggest an algorithm whose **expected** running time is $O(n)$, and finds the triangle determined by 3 points of S, and its perimeter is no larger than the perimeter of any triangle determined by triple of points of S. What is the worst case running time of this algorithm ?