Homework #3
Introduction to Algorithms/Algorithms 1
600.363/463

Due on: Friday, March 30, 11:59 a.m. (NOON)

Where to submit: On blackboard, under student assessment
Late submissions: will NOT be accepted

Format: Please start each problem (1 through 14) on a new page.
Please type your answers; handwritten assignments will not be accepted.
Note that: NUMBERED EXERCISES AND PROBLEM REFER TO THE
COURSE TEXTBOOK (CLRS, 3rd Edition.)

March 9, 2012

1   Adjacency Matrix

Let G be an unweighted undirected graph with adjacency matrix M, and let M_1 be
a product of the matrix by itself. i.e. $M_1 = M \times M$

- What does M_1 represent?

- What will happen if we will multiply M by itself k times?

2 Cycles

Design an algorithm that checks whether or not an undirected graph contains a cycle.

3 Exercise 9.3-3

4 Exercise 9.3-8

5 Problem 9-2

6 Exercise 22.2-4

7 Exercise 22.2-5

8 Exercise 22.2-8 (Optional)

9 Problem 22-1

10 BFS/DFS

Explain why BFS cannot be used to perform the topological sort. Explain why DFS cannot be used to find a shortest path.

11 Disjoint Sets

We know that the data structure for disjoint sets (Chapter 21) can be implemented in such a way that m operations over n elements take $m\ \alpha(n)$ time where $\alpha(n)$ is the function from Chapter 21.4. Can we derive a similar bound for heaps? Explain your answer.

12 MST

Why does Kruskal's algorithm work slower then $O(E\ \alpha(E))$? Why do we need two different algorithms for the MST?