Solutions for Homework #1, CS 540, Spring 2012

Problem 1.

(a)

		13	7	8
		14	6	9
			5	10
		1	4	11
		2	3	12

(b)

6/7	9/11	14/15	19/18	
5/6		21/19	17/17	
4/5	7/9	11/13	16/16	
3/4	2/2	1	15/15	20/19
13/14	10/12	8/10	12/14	18/18

(c)

		8/0	7/1	
			6/2	
	3/3	1/2	5/3	
		2/3	4/4	

(d)

10/6		14/6	12/6	
8/6	11/6	13/6	9/6	
6/6	3/4	1/2	7/6	
	5/6	2/4	4/6	

Problem 2.

a) 4
b) The states at depth k form a square rotated 45 degrees to the grid with each side having k states, so the answer is 4k.
c) Without repeated state checking, tree-search BFS expands exponentially many nodes. ((4^(x+y+1) – 1)/3) – 1 or O(4^(x+y)).
d) There are quadratically many states within the square for depth x+y, so the answer is 2(x+y)(x+y+1) – 1 or O((x+y)^2).
e) Yes, it is admissible because it is the Manhattan distance and this is the minimum distance.
f) All nodes in the rectangle defined by (0, 0) and (x, y) are candidates for the optimal path, and there are quadratically many of them, all of which may be expanded by A* in the worst case. So, the answer is the same as (d).
g) Yes, it remains admissible because removing links may cause detours along longer paths, requiring more steps, so h is an underestimate.
h) No, because non-local links can possibly reduce the actual path length to something less than the Manhattan distance.