Network Algorithms: Exercise 8
Reductions

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1 (Local) Reductions (25 + 25 + 25 = 75 points)

Many problems can be seen as—more or less obvious—variants of others and therefore can be solved by clever use of the same algorithms. In this exercise you may use the algorithms derived in the lecture as subroutines.

a) The edge coloring problem is defined as follows: Given a graph $G = (V, E)$, assign each edge $e \in E$ a color $c(e)$ such that no two adjacent edges (i.e., edges sharing a node) have the same color! As usual, the problem should be solved not only fast, but also using a small number of different colors. Give a $2\Delta - 1$ edge coloring algorithm running in $O(\log n)$ time!

b) Given a graph $G = (V, E)$, a *dominating set* is a subset $D \subseteq V$ such that each node either is in D or has a neighbor in D. The *minimum dominating set* problem is to find a dominating set of minimum cardinality. Give a 3/2-approximation algorithm for this problem on rings which takes $O(\log^* n)$ time!

c) A family of graphs of *bounded independence* is a set of graphs where nodes have at most a constant number C of independent (i.e., mutually non-adjacent) neighbors. Give a C-approximation algorithm to the minimum dominating set problem on graphs of bounded independence running in $O(\log n)$ time!