Fall 1999 **CMSC 651: Homework 4** Samir Khuller

Due in class: November 10.

(1) Given a graph $G = (V, E)$ an **edge cover** is a subset S of edges in G such that all the vertices of G are "covered" by S. (Each vertex in G has at least one edge from S incident on it.) You may assume that there are no vertices of zero degree in G. Design a polynomial time algorithm to find a minimum edge cover.

(2) Given a bipartite graph $G = (V, U, E)$ and a function b that maps vertices to non-negative integers, design a polynomial algorithm to find a subgraph of G in which vertex v has degree exactly $b(v)$ by reducing this to the network flow problem.

(3) Design a polynomial time algorithm for the "Quickest Path" problem. You have a directed network, with two special vertices s and t. Each edge e has a positive capacity $c(e)$ and a positive delay $d(e)$. The time to ship σ units of data from s to t on path P is $\sum_{e \in P} d(e) + \frac{\sigma}{C}$ where $C = \min_{e \in P} c(e)$. Design a polynomial time algorithm to find the path that will minimize the shipping time? You should also give an argument that shows why your method finds the quickest path.

(4) Problem 27.2-8 (pg 600)

(5) Problem 27.3-5 (pg 604)