Assignment 2

Graph coloring and its application

Due: August 14, 2009 (Friday)

Part 1 **(10)**

Define a data type to represent simple undirected graphs.

Part 2 **(30)**

Write a function that, given a graph G, returns the list of the vertices of G, sorted with respect to the degrees of the vertices.

Part 3 **(30)**

Write a function that, given a graph G, produces a greedy coloring of the vertices of G by the Welsh–Powell algorithm. Vertices of higher degrees are colored earlier than the vertices of lower degrees. A vertex v is given the color with the smallest number, not used by any of the neighbors of v, that have already been colored. If necessary, a new color is to be created.

Part 4 **(30)**

Suppose that you are the manager of a car-rental company. You are given a list of rental requests for the next month. Each request consists of a date and a duration when a car is needed by a client. Naturally, a single car cannot serve two requests that overlap in time. Your aim is to serve all the requests by using as few cars as possible. Map this problem to a graph-coloring problem, and run the above greedy coloring algorithm on this graph. Report a chart of car usage serving the clients' requests.

Submit a single C/C++ file solving all the above parts. The file must contain your name and roll number.

Remark: Computing an optimal coloring of a graph is, in general, a difficult computational problem. For the car-scheduling problem, however, the greedy algorithm is known to supply an optimal solution.