Dynamic Programming Assignments

April 24, 2014

Problem 1: Weighted Staged Directed Graph:WSDG

In a weighted staged directed graph G, we want to search the shortest path from start node s to the terminal node e.

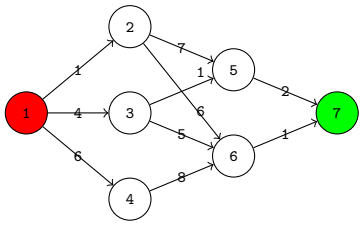

Figure 1: A weighted staged directed graph

1. Defined that $g(i)$ is the shortest distance from start node s to the node i in a WSDG. Write out the recursive equation.

2. Write out the pseudo codes to calculate the shortest distance $g(i)$ using your recursive equation.

Problem 2: Knapsack problem

The knapsack problem is a problem in combinatorial optimization: Given a set of items, each with a mass and a value, determine the number of each

item to include in a collection so that the total weight is less than or equal to a given limit and the total value is as large as possible.

Let there be n items, z_1 to z_n where z_i has a value p_i and weight w_i. x_i is the number of copies of the item z_i. The maximum weight that we can carry in the bag is c. It is common to assume that all values and weights are nonnegative.

The task of knapsack problem is to determine the values of x_i so that

$$\max \sum_{i=1}^{n} x_i * p_i \tag{1}$$

$$\textbf{Subjects to:} \sum_{i=1}^{n} x_i * w_i \leq c \tag{2}$$

1. 0/1 knapsack problem in which x_i must be zero or one. Show that the problem holds the principle of optimization(optimal substructure).

2. 0/1/2 knapsack problem in which x_i must be zero, one or two. Define the optimal value function of the problem and derive corresponding recursive equation.