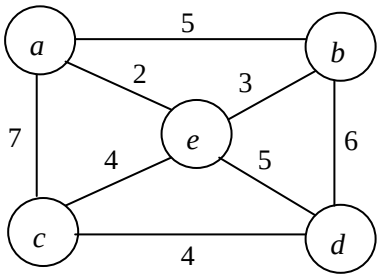
Spring 2017

CS3230 Tutorial (Greedy Techniques; week of 20 March)

1. Mixing Milk.
   Help Merry Milk Makers get the milk they need in the cheapest possible manner. The Merry Milk Makers company has several farmers from which they may buy milk, and each one has a (potentially) different price at which they sell to the milk packing plant. Moreover, as a cow can only produce so much milk a day, the farmers only have so much milk to sell per day, M_i. Each day, Merry Milk Makers can purchase an integral amount of milk from each farmer, less than or equal to the farmer's limit. Given the Merry Milk Makers' daily requirement of milk, N, along with the cost per gallon and amount of available milk for each farmer, calculate the minimum amount of money that it takes to fulfill the Merry Milk Makers' requirements. Note: The total milk produced per day by the farmers will be sufficient to meet the demands of the Merry Milk Makers.

2. Job Scheduling (textbook page 313).
   Consider the problem of scheduling n jobs of known durations $t_1, t_2, \ldots, t_n$ for execution by a single processor. The jobs can be executed in any order, one job at a time. You want to find a schedule that minimizes the total time spent by all the jobs in the system. (The time spent by one job in the system is the sum of the time spent by this job in waiting plus the time spent on its execution.) Design a greedy algorithm for this problem. Does the greedy algorithm always yield an optimal solution?

3. Apply Prim's algorithm to the following graph. Include in the priority queue all the vertices not already in the tree.



4. Indicate whether the following statements are true or false: (textbook p. 322)
   a. If e is a minimum-weight edge in a connected weighted graph, it must be among edges of at least one minimum spanning tree of the graph.
   b. If e is a minimum-weight edge in a connected weighted graph, it must be among edges of each minimum spanning tree of the graph.
   c. If edge weights of a connected weighted graph are all distinct, the graph must have exactly one minimum spanning tree.
   d. If edge weights of a connected weighted graph are not all distinct, the graph must have more than one minimum spanning tree.