

IEEM 101 Industrial Engineering and Modern Logistics

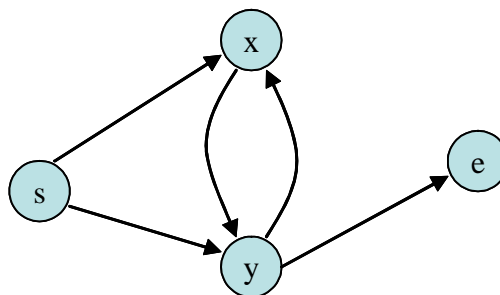
Fall 03, Assignment 4

Due: Fri, Nov 28. Max Score: 25 points

Q1. [*Shortest paths*] An individual who lives in Ridgewood, New Jersey, and works in Whippany, New Jersey, seeks a car route that will minimize the morning driving time. This person has recorded driving times (in minutes) along major highways between different intermediate cities; these data are shown in table below. A blank entry signifies that no major highway directly links the corresponding points. Determine the best communicating route for this individual.

	Ridgewood (R)	Clifton (C)	Orange (O)	Troy Hills (T)	Parsippany (P)	Whippany (W)
Ridgewood (R)	...	18	...	32	...	...
Clifton (C)	18	...	12	28	...	...
Orange (O)	...	12	...	17	...	32
Troy Hills (T)	32	28	17	...	4	17
Parsippany (P)	...	...	...	4	...	11
Whippany (W)	...	...	32	17	11	...

Q2 (a). Dijkstra's algorithm requires that all edges must have a positive weight. Using the graph below, assign weights to the edges to demonstrate that when some edge has a negative weight, then Dijkstra's algorithm will fail. (Add extra edges if required).



Q2 (b). Trying to remove the above limitation, Mr. NotDijkstra suggested the following approach when the graph $G(V, E)$ has some negative weights.

NotDijkstra's Algorithm

- Step 1. From all the weights, find the minimum one; let the minimum-weight(E) = m .
- Step 2. Add $|m|$ to the weight of each edge: in other words, $\text{weight}(e) \leftarrow \text{weight}(e) + |m|$.
- Step 3. The converted graph has all non-negative weights; apply Dijkstra's algorithm to it.

NotDijkstra claims that the shortest path using his algorithm is the shortest path on the original graph. Do you agree ? [Give reason].

Q3. [CPM/PERT] An industrial project has the following data:

Activity	Immediate Predecessor(s)	Duration (Weeks)
A	-	5
B	-	5
C	B	2
D	A,C	2
E	A,C	3
F	A,C	1
G	B	2
H	B	7
I	E	13
J	E,D	6
K	F,G,H	4
L	H	5
M	J,K,L	5

I and M are the terminal activities of the project.

(a) Develop a network diagram and find the critical path.

(b) Identify each activity that has some slack in its start time.

Q4. [Inventory: continuous review] The Edison Electronics Warehouse stocks tool kits for personal computers. One of the popular kits, “Basics”, has annual demand of 10,000. The ordering costs are \$150.00 and the carrying costs are 25% of the unit price. The price quotation from the supplier is given below. Find the EOQ and optimal T.

Order quantity	Price per unit
1 to 899	\$15.50
900 to 1499	\$14.00
1500+	\$13.50

Q5. A baking company distributes bread to grocery stores daily. The company’s cost for the bread is \$0.80 per loaf. The company sells the bread to the stores for \$1.20 per loaf sold, provided that it is disposed of as fresh bread (sold on the day it is baked). Bread not sold is returned to the company. All bread that is unsold at the end of the day is sold at discount to a local orphanage at \$0.6 per loaf. The cost due to a shortage is estimated to be \$0.80 per loaf. The daily demand has a *uniform distribution* between 1,000 and 2,000 loaves. Find the optimal daily number of loaves that the manufacturer should produce.