Name: .....

ISyE 3103 Introduction to Supply Chain Modeling: Logistics
Summer 2012
Quiz 3
July 20, 2012

Instructions

1. There are 2 pages and 20 points.
2. No books, notes, computers, calculators, cell phones, or other electronic equipment allowed.
3. Do your own work.
4. Show all calculations.

Traveling Salesman Tours

The following table gives the travel costs between city pairs. Note that travel is allowed in either direction with the same travel cost.

Edge costs	A	B	C	D	E	F	G	H	J
A	0	41	15	24	31	43	57	62	70
B	41	0	29	64	59	27	62	72	64
C	15	29	0	25	37	41	63	72	83
D	24	64	25	0	28	53	36	82	51
E	31	59	37	28	0	17	26	52	32
F	43	27	41	53	17	0	37	42	83
G	57	62	63	36	26	37	0	46	57
H	62	72	72	82	52	42	46	0	30
J	70	64	83	51	32	83	57	30	0

1. Use an algorithm to determine the minimum spanning tree (MST) on the network. Neatly draw your minimum spanning tree, and report the cost $C(\text{MST})$ of the minimum spanning tree.
   Answer: The MST has the following edges: (A, C), (E, F), (A, D), (E, G), (B, F), (D, E), (H, J), (E, J). $C(\text{MST}) = 199$.

2. What is the triangle inequality on a network with edge costs $c_{i,j}$ on the edges (i, j)?
   Answer: For any 3 nodes i, j, k, it holds that $c_{i,k} \leq c_{i,j} + c_{j,k}$.

3. Suppose that the triangle inequality holds on the network above (for this quiz, you do not have to verify that the triangle inequality holds). Give a lower bound and an upper bound based on the minimum spanning tree (MST) for the optimal cost $C(\text{TSP}^*)$ of a traveling salesman tour in the network.
   Answer: $C(\text{MST}) \leq C(\text{TSP}^*) \leq 2C(\text{MST})$.

4. Use the Twice-Around-Minimum-Spanning-Tree heuristic to construct a traveling salesman tour. Start your walk at node A, and whenever you have a choice of direction to go in next, always take the cheapest of the edges among which you can choose next. Write down your walk, and report the cost of the walk. Then write down your traveling salesman tour, and its total cost.
   Answer: The Walk is $ACADEFBFEGEJHJEDA$. $C(\text{WALK}) = 398$.
   The Twice-Around-MST tour is $ACDEFBGJHA$. $C(\text{Twice-Around-MST tour}) = 323$.