

Linear Optimization Assignment

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We are given adjacency matrix representations of two flow networks. Each edge (i, j) is a directed edge from i to j . The capacity of each edge is given in the adjacency matrices. Node S represents the source and node T represents the sink in both the networks. Note that each capacity is an integer. Both the flow networks satisfy following properties

- Conservation of flow at each node except Source (i.e., Total incoming flow at a node must equal total outgoing flow at the node).
- For each edge, any flow respects the capacity constraint of the edge.

The assignment tasks are as follows

- Write a code for Simplex method(any variant) from scratch. (8 Marks)
- Formulate LPs for the flow-networks 1 and 2 to find out the maximum flow from S to T . (3 Marks)
- Take the Duals of each LP which corresponds to $S - T$ Min-Cut in the respective network. (4 Marks)
- Write a code to solve all the LP's(you formed) by simplex method (you coded). (2 Marks)
- Write the codes in AMPL to solve the LP's (you formed). Show that min-cut is equal to max-flow (i.e, a LP and its dual have same optimal). Also Show that the solution you obtained by solving the LP are integral (Flow through each edge is an Integer). (3 Marks)

Network 1	S	A	B	C	D	T
S	0	16	13	0	0	0
A	0	0	10	12	0	0
B	0	4	0	0	14	0
C	0	0	9	0	0	20
D	0	0	0	7	0	7
T	0	0	0	0	0	0

Network 2	S	A	B	C	D	E	F	G	H	I	J	T
S	0	11	15	10	0	0	0	0	0	0	0	0
A	0	0	0	0	0	18	4	0	0	0	0	0
B	0	3	8	5	0	0	0	0	0	0	0	0
C	0	0	0	0	6	0	0	3	11	0	0	0
D	0	0	0	4	0	0	0	17	6	0	0	0
E	0	0	0	0	3	16	0	0	0	13	0	0
F	0	12	0	0	4	0	0	0	0	0	0	21
G	0	0	0	0	0	0	0	0	4	9	4	3
H	0	0	0	0	0	0	0	4	0	0	5	4
I	0	0	0	0	0	0	0	0	0	0	7	9
J	0	0	0	0	0	0	0	0	2	0	0	15
T	0	0	0	0	0	0	0	0	0	0	0	0

What you need to submit:

- The complete submission should include: (a) the report (in PDF format), (b) the source code(s).
- They should be compressed into one zip file (YourFullName_StudentID.zip).