Problem:

1. Given a $p \times q$ matrix of reals, row sums α_i, and column sums β_j.

2. We can round any matrix entry a up or down (i.e., to $\lceil a \rceil$ or to $\lfloor a \rfloor$).

3. Round entries as well as row and column sums so that sums are consistent in the rounded matrix.

			Row Sum
3.1	6.8	7.3	17.2
9.6	2.4	0.7	12.7
3.6	1.2	6.5	11.3
Col Sum 16.3	10.4	14.5	

Solution:

1. Node i for row i, and node j' for column j. Two additional nodes s and t.

2. Edge (i, j') for each matrix entry D_{ij}. Edge (s, i) for row-sum i; edge (j', t) for column sum j.

3. Lower and upper bounds for (i, j') correspond to rounding down and rounding up D_{ij}.
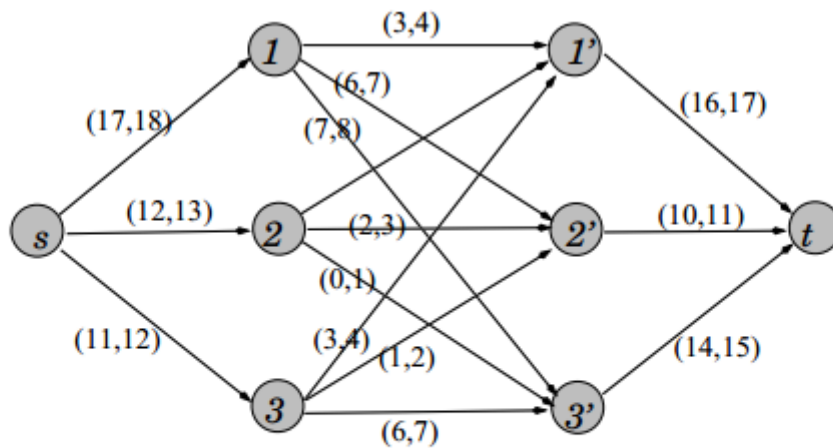
4. Consisten matrix rounding if and only feasible flow in the network.

Alternative example:

3.14	6.8	7.3	17.24
9.6	2.4	0.7	12.7
3.6	1.2	6.5	11.3
16.34	10.4	14.5	

Original Data

3	7	7	17
10	2	1	13
3	1	7	11
16	10	15	

Possible Rounding

Max Flow formulation

3.14	6.8	7.3	17.24
9.6	2.4	0.7	12.7
3.6	1.2	6.5	11.3
16.34	10.4	14.5	

Row **Column**

3, 4

17, 18

12, 13

11, 12

16, 17

10, 11

14, 15

∞

Lower bound **Upper bound**