

1. (60pts) Let $T, N > 0$ be given integers, $s, t \in \{1, 2, \dots, T\}$ and $i, j \in \{1, 2, \dots, N\}$.

Count how many additions and comparisons in each of the following operations. [20 pts $\times$ 3]

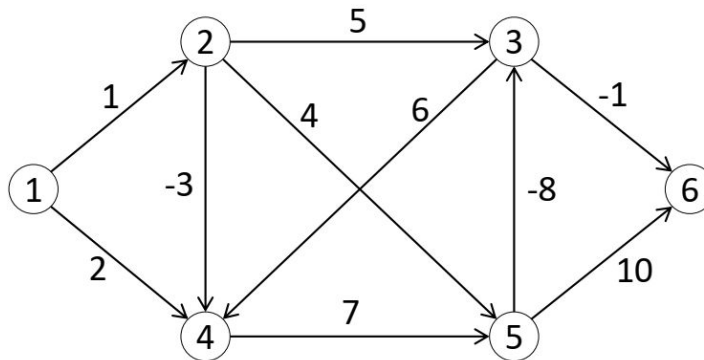
$$(a) \sum_{t=1}^T \sum_{s < t} (a_t + a_s)$$

$$(b) \max_i \left\{ \sum_{t=1}^T \sum_{s < t} \min\{a_{it}, a_{is}\} \right\}$$

$$(c) \sum_{j=1}^N \max_{i < j} \left\{ \sum_{t=1}^T \sum_{s < t} \min\{a_{it}, a_{is}\} \right\}$$

2. (40pts) Given the following directed graph with six nodes and ten arcs (the length of each arc

is marked on the arc):



- Write the node-node adjacency matrix A . [5pts]
- Write the node-arc incidence matrix B . [5pts]
- How many cycles are embedded in the figure? **Identify all of them.** [10pts]
- Use a shortest path algorithm you learned in class to find one shortest path from node 1 to each other node. [10pts]. (Eye inspection doesn't count!)
- Find the second shortest path from node 1 to node 6. [10pts]

