National Taiwan University
Department of Electrical Engineering
Algorithms, Fall 2019

Handout #28
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Sample Solutions to Quiz #4

1. (12)

   Since there is a link between each pair of stations, there are totally $O(n^2)$ channels. Let every station be a vertex and each channel be an edge. To find the maximum total bandwidth, we can multiply all the bandwidth values by -1 as the edge costs and then apply Prim's algorithm to find the $n-1$ channels with minimum cost. It takes $O(n^2 \lg n)$ time.

2. (15)

   Since there is an equality constraint in this linear-programming system, we can divide it into two inequality constraints.

   $$x_2 - x_3 = 8 \Rightarrow \begin{cases} x_2 - x_3 \leq 8, \\ x_3 - x_2 \leq -8. \end{cases}$$

   Figure 1 shows the constraint graph of this linear-programming system. There is a negative cycle $< x_1, x_2, x_3, x_4, x_1 >$ (red) in the graph. Therefore, there is **no feasible solution** for this system.

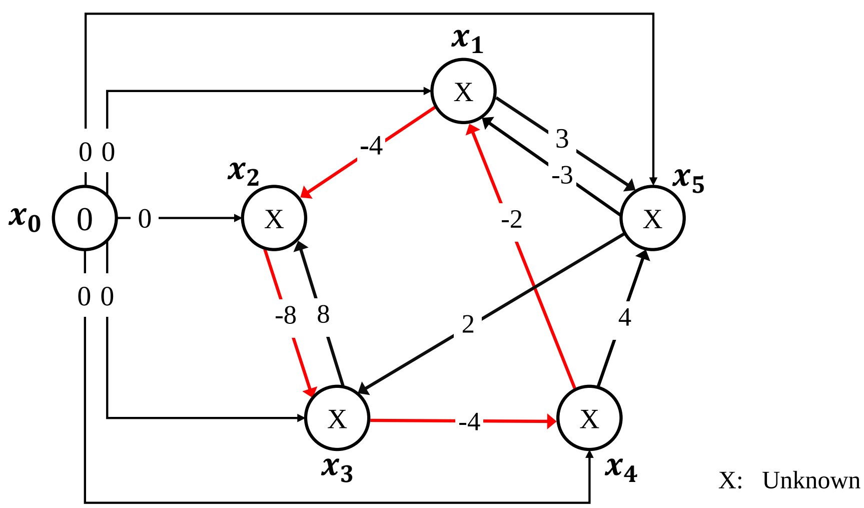

Figure 1: The constraint graph for Problem 2.

3. (12)

   $$d_{ij}^{(k)} = \max\left(d_{ij}^{(k-1)}, \min(d_{ik}^{(k-1)}, d_{kj}^{(k-1)})\right)$$

4. (6)