Exercise - TiclanSugar Supply Chain Network

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TiclanSugar inc. is an enterprise that is specialized in sugar refining. The production process is as follows. At the beginning of each month, TiclanSugar receives raw sugar (retrieved from sugar cane) at its refinery plants in Montreal, Canada. The acquisition costs of the raw sugar, as well as its available quantities vary from month to month. The raw sugar is then refined in the refinery plants, producing refined sugar through a series of operations (such as cleaning of the raw sugar, crystalization), which takes the entire month. The refinery plant has a monthly capacity of 500 tons, that is, it can transform up to 500 tons of raw sugar into refined sugar per month. The corresponding refining costs are about 30$ per ton.

Each month, TiclanSugar has the possibility of storing up to 1,000 tons of the acquired raw sugar in a warehouse in case it is not directly processed in the refinery plant. The storing costs are 20$ per ton and per month. At the end of each month, the refined sugar is sold to a client (a supermarket chain) in the greater region of Montreal. The minimum amount of refined sugar that TiclanSugar has to provide to the client is 200 tons per month. The maximum amount of refined sugar the client would buy, as well as the selling price for each ton, varies at each month. The following table summarizes, for each month, the acquisition price of raw sugar, the maximum availability of raw sugar, the selling price of refined sugar and the maximum number of tons TiclanSugar can sell to the client:

Month	Price of raw sugar ($/ton)	Maximum availability of raw sugar (tons)	Selling price of refined sugar ($/ton)	Maximum client demand (tons)
1	150	600	200	700
2	200	900	200	800
3	250	850	400	450
4	300	750	400	550

Suppose that the company can produce one ton of refined sugar from one ton of raw sugar. Draw the minimum cost-flow network model that illustrates the planning problem of TiclanSugar for the next four months. Remember: such a network model is composed of nodes and arcs. Arcs may have costs and minimum/maximum amounts of flow that can be “routed” on them.