Exercise - IntelliMoto Production Network

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The company IntelliMoto-Inc. is the market leader for high-performance car motors. Their new motor series for autonomous vehicles are highly in demand. The company just signed a contract with the company AutonoDrive, which is currently expanding their production lines for autonomous vehicles. The contract requires IntelliMoto-Inc. to deliver 370 motors within the next 5 months, spread over the 5 months as indicated in the following table:

Month 1	Month 2	Month 3	Month 4	Month 5
70	40	110	100	50

To make sure that IntelliMoto-Inc. will be able to deliver these quantities of motors, the company talked to one of its sub-contractors, the company M&M inc., which could provide some of the motors required by the contract. In this case, M&M inc. would make available a part of their monthly production capacity throughout the 5-months period of the contract. The following table summarizes the production capacity (in number of motors) at M&M inc., as well as the production costs per unit (1,000$ per unit) for the considered planning period:

Month	IntelliMoto-Inc. Capacity	IntelliMoto-Inc. Cost per unit	M&M inc. Capacity	M&M inc. Cost per unit
1	40	10	50	9
2	40	8	60	10
3	40	11	40	12
4	40	8	40	7
5	40	7	60	10

Note that IntelliMoto-Inc. has to pay transportation costs of 65$ for each motor produced at M&M inc. IntelliMoto inc. can also store motors in a warehouse for a monthly storing costs of 50$ per motor. The maximum storage capacity is 60 motors per month. At the beginning of month 1, IntelliMoto has already 40 motors in its storage. After month 5, the company would like to have exactly 20 motors in storage.

(a) Draw a minimum cost-flow network model to represent the planning problem that IntelliMoto inc. would like to solve.

(b) IntelliMoto-Inc. has the possibility to renegotiate the contract with AutonoDrive. After renegotiation, the new contract specifies that the deliveries of the 370 motors can be spread over the 5 months as it best fits the planning of IntelliMoto inc. However, the company may not deliver more than 140 motors at any given month. How should the previous network model be modified in order to account for this new situation?