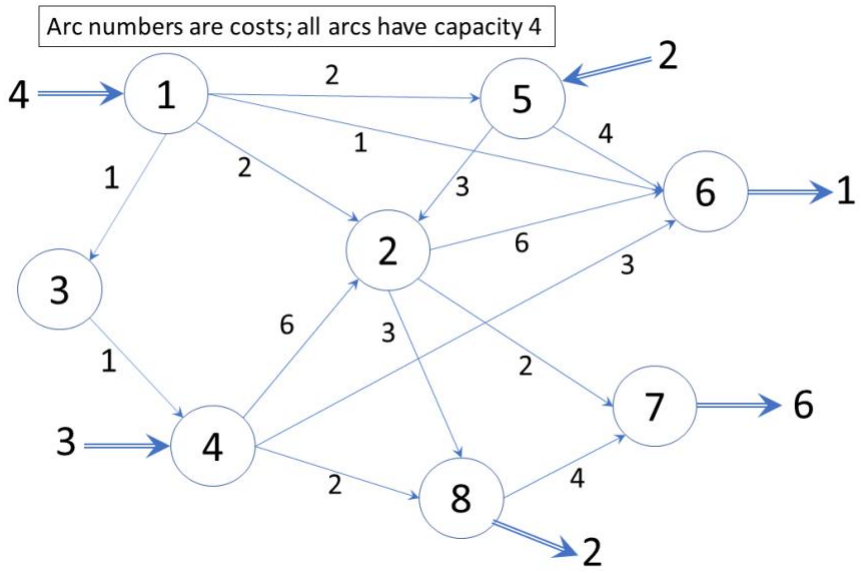
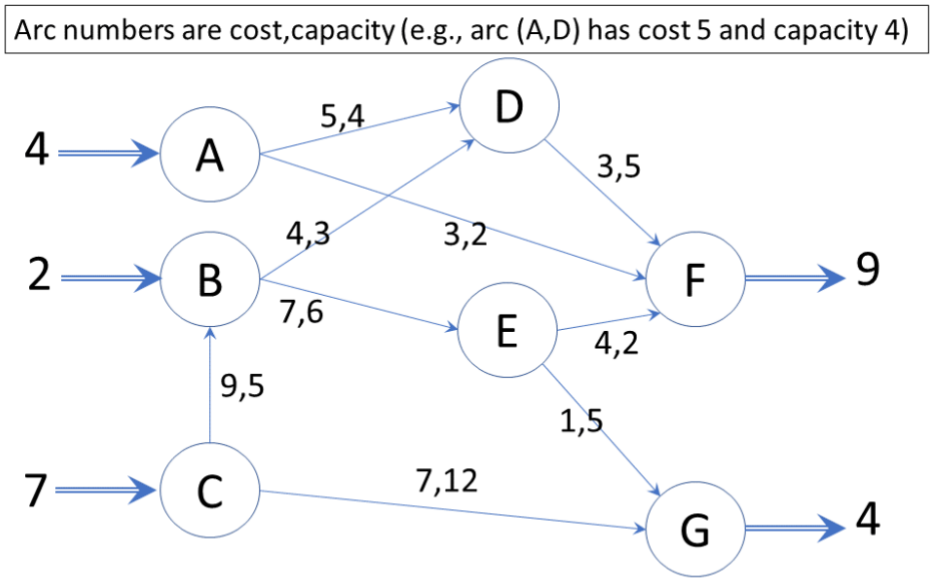
Exercises - Section 2: Lecture 10 – Network Model - Questions

For each of the following network pictures, write the optimization model mathematically and in gurobipy, and solve the gurobipy model.

1.



2.



For each of the following situations, draw the appropriate network model picture.

3. A television news channel has reporters stationed around the world in the capitals of various countries. As important news areas change, they need to reposition their reporters to cover the hot stories.

   Based on last week's stories and this week's stories, the news director has determined that they have 3 reporters too many in Kyiv (the capital of Ukraine) and 2 reporters too many in Jerusalem (the capital of Israel). On the other hand, they need 4 more reporters in Washington, D.C. (the capital of the United States) and 1 more reporter in Lagos (the capital of Nigeria). The number of reporters in Baghdad (the capital of Iraq) and Wellington (the capital of New Zealand) does not need to be changed.

   The news network has agreements with various airlines to provide inexpensive seats on last-minute flights between certain pairs of cities. The news director wants to use only those inexpensive flights, so flights are only available between the following cities: Kyiv to Baghdad ($200 per seat), Baghdad to Washington ($300), Jerusalem to Washington ($300), Jerusalem to Wellington ($800), Lagos to Washington ($100), Wellington to Lagos ($400), Washington to Kyiv ($200), Kyiv to Lagos ($500). There are two seats available on each flight.

4. A home-building company builds houses in three cities (A, B, and C). The company buys raw materials in two other (lower-priced) cities D and E and trucks them either directly to cities A, B,

and C where they are building, or through another city F along the way to A, B, and C. Because of variations in trucking costs, it is sometimes less expensive to truck from D or E to F and then from F to A, B, or C, than it is to truck directly from D and E to A, B, and C.

In a certain week, the company believes it will need amounts d_A, d_B, and d_C of raw materials in cities A, B, and C; and plans to purchase amounts s_D and s_E in cities D and E. The cost of trucking raw materials from any city i to any city j is denoted by c_{ij}, and at most u_{ij} raw materials can be sent from city i to city j.

The company wants to minimize its trucking cost of getting all of its purchased raw materials to the cities where it is building houses. Draw this scenario as a network problem.

For the following situation, draw the appropriate assignment model network picture, write the optimization model mathematically and in gurobipy, and solve the gurobipy model.

5. An automobile manufacturer produces cars in Detroit and Dallas. The Detroit plant produces 6500 cars, and the Dallas plant produces 5500 cars. Cars must be shipped to three cities. Los Angeles must receive 5000 cars, Atlanta must receive 4000 cars, and St. Louis must receive 3000 cars. Cars may also be shipped through Memphis and Denver. The cost of shipping a car between cities is given in the table below. At most 2000 cars may be sent directly from any one city to any other city.

	To Los Angeles	**To Atlanta**	**To St. Louis**	**To Denver**	**To Memphis**
From Detroit	$800	$600	$300	$300	$200
From Dallas	$500	$200	$200	$400	$200
From Denver	$300	$800	$500	---	$500
From Memphis	$800	$100	$100	$500	---

The manufacturer wants to find the least-expensive way to ship all of the cars.

Draw this scenario as a network problem, write the model mathematically and in gurobipy, and solve the gurobipy model.

NOTES:

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