Guinness Assignment

The Guinness Brewery Company has two breweries (Dublin-B and Kilarny) and three markets (Dublin-M, Galway, and Cork). They have two warehouse locations (Kilgore and Sligo), but don't necessarily have to use both. They have transportation costs (dollars/case) for moving cases of beer from brewery to warehouse, and from warehouse to market (see the table below). Note that it is possible to transport cases directly from the brewery to the market in Dublin (Dublin-B to Dublin-M). Otherwise, the cases must visit a warehouse before being transported to a market. Each warehouse has a monthly operating cost, as well as a maximum capacity. Each brewery has a monthly supply, and each market has a monthly demand.

	Transportation Costs				
	DublinB (B)	Kilarny (B)	Dublin-M (M)	Galway (M)	Cork (M)
Kilgore (W)	15	10	16	12	11
Sligo (W)	20	25	21	9	28
Dublin-B (B)	—	—	18	—	—

Brewery	Supply
Dublin-B	400
Kilarny	500

Market	Demand
Dublin-M	500
Galway	200
Cork	100

Warehouse	Cost	Capacity
Kilgore	240	400
Sligo	450	800

1 Minimum-Cost Network Flow Model:

a. Write a model on paper to minimize Guinness's total monthly transportation cost, ignoring monthly warehouse costs. *Hint: Draw the network. There is a neat way to turn the warehouse capacities into edge capacities by adding a dummy edge and node for each warehouse.*

b. Implement this first model in GMPL. Try running with and without the "integer" requirement on the decision variables. Do you get the same solution? Does one solve faster?

2 Fixed-Charge Model:

a. Update your written model to incorporate warehouse costs. Include both the strong and weak forcing constraints for the binary variables (but clearly indicate that we need only one type or the other, not both).

b. Implement your new model in GMPL. Run the model using the weak forcing constraints. Record the solution and solve time. Do the process again using the strong forcing constraints.

   (a) Do both models yield the same solution? Does one solve faster?

   (b) Now run both versions again, but remove the integer and binary requirements on the decision variables. Record the solutions and run times.

      i. Do you get the same solution as the integer/binary version?

      ii. Do you get the same solution as each other?

      iii. Which is faster: running the model with or without integer/binary requirements?