Project 1: Fixed Charge Facility Location

Project 1: Model Development and Python Implementation

- Part 1: Integer programming model submission due **Wednesday 22 September in class**
- Part 2: Python implementation of model due **Tuesday 28 September at 11:59pm**

Ground Rules:

- This is an individual project
- You may ask me for help, your textbook/notes, or Google but cite your sources.
- Late submissions will be deducted 5% for each hour late.
- Final grade for project 1 will be 50% of your part 1 grade and 50% of your part 2 grade.

1 The Problem

The Guinness Brewery Company has two breweries (Dublin-B and Kilarny) and three markets (Dublin-M, Galway, and Cork). They have three warehouse locations (Kilgore, Sligo, and Galway), but don't necessarily have to use all of them. 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. If they use a warehouse, each one has a monthly operating cost, as well as a maximum capacity. Each brewery has a monthly supply, and each market has a monthly demand shown below.

	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
Galway (W)	15	20	16	5	12
Dublin-B (B)	—	—	18	—	—

Brewery	Supply
Dublin-B	700
Kilarny	800

Market	Demand
Dublin-M	600
Galway	500
Cork	300

Warehouse	Cost	Capacity
Kilgore	240	400
Sligo	450	800
Galway	320	600

They want to meet all demand at minimum cost.

Part 1: Concrete and Abstract Models

a. Draw a model of the network.

b. Write a concrete model to solve the Guiness fixed-charge transportation problem. *Hint: Begin with a standard minimum-cost network flow model with three warehouses, then modify the model as needed to accomodate the warehouse cost, capacities, and logical constraints.*

c. Convert the concrete model to parameterized form.

d. Submit the network diagram and both models (either online or in class).

Part 2: Python implementation

a. Implement and solve the Guinness problem in Python. It will help you in your coding to look at the project 1 helper file posted on blackboard.

b. Print the solution in a neat, clear format. In addition to the total cost, the printed solution should include which warehouse(s) to open and how many cases to ship along each of the network arcs.

c. Submit your Jupyter notebook with all output displayed.