Due via Blackboard 9/7 at 2200.

In what follows, replace YOURLASTNAME *with your last name. For example, the first file MIDN Smith would save would be:*

```
Smith_guinness_mcf.mod
```

To be completed for class on Thursday 8/31/17. DO NOT SUBMIT VIA BLACKBOARD. Wait until the due date for the overall assignment, and submit all files at that time.

1. Obtain the data `Guinness.xlsx` from Blackboard. For the given data, use GUSEK to formulate and solve the minimum cost flow problem, i.e., **do not model the fixed costs for opening warehouses**. Solve the problem to optimality and save the file as YOURLASTNAME_guinness_mcf.mod.

Submit your THREE model files and your text-based answer to number 3 below via Blackboard by the due date.

1. Save your previous model file as YOURLASTNAME_guinness_fl_weak.mod. Add in the fixed charge constraints and objective sum to the model. Be sure to define your warehouse $OPEN_j$ variables as binary. You will also need to define a new set W for warehouses, and a new parameter $capacity_j$, which specifies the maximum capacity of warehouse j. Also, when adding in the fixed charge constraints, use the formulation:

$$\sum_{\{i|(i,j)\in A\}} X_{ij} \leq capacity_j OPEN_j, \text{ for all } j \in \mathcal{W}.$$

   Solve the model.

2. Save your previous worksheet as YOURLASTNAME_guinness_fl_strong.mod. Remove the weak version of the fixed charge constraints you added in Step 1 above. Be sure to define a new set $\mathcal{B}$ for breweries. Add a strong version of the fixed charge constraints as follows

$$X_{ij} \leq capacity_j OPEN_j, \text{ for all } i \in \mathcal{B} \text{ and } j \in \mathcal{W}.$$

   Solve the model.

3. Compare the solution times for the two models, and describe in complete sentences why you think one model is faster than the other.