

Department of Mathematics
SA 405 - Advanced Mathematical Programming
Quiz 2 Alt

Name: _____

Delicious Donuts makes donuts in Annapolis and Baltimore and ships them to the neighboring towns for the costs given in the table below.

	Transportation Costs			
	Bowie	Laurel	Odenton	Ocean City
Baltimore	15	20	27	17
Annapolis	20	19	30	16

The donut shops in Baltimore and Annapolis have supplies of 700 and 400 donuts, respectively. Likewise, Bowie, Laurel, Odenton, and Ocean City have demands of 100, 300, 400, and 200, respectively. They want to meet demand at as low of a cost as possible.

1. (25 points) Draw the network diagram for this problem. Be sure to indicate the supply/demand of each node.

2. For the next questions, consider the following sets and variables:

Sets

Let N be the set of nodes

Let E be the set of edges

Variables

Let $x_{i,j}$ be the flow along edge (i, j) for all $(i, j) \in E$.

(a) (20 points) With these decision variables, write the (concrete) objective function for this model.

(b) (15 points) With these decision variables, write the (concrete) flow balance constraint for Annapolis.

(c) (20 points) With these sets and decision variables, write the (parameterized) balance of flow constraints for this model. Be sure to clearly define any new sets, variables, or parameters used.

3. (20 points) Suppose that $I = \{1, 2, 3\}$ and $J = \{A, B, C\}$. Expand the following set of constraints so that they are written with no index sets (i.e., convert these constraints from parameterized to concrete form).

$$\sum_{j \in J} r_j x_{i,j} \geq u_i \text{ for all } i \in I$$