Task 1

Data:

S	The set of all suppliers
P	The set of all plants

Decision variables:

X_{ij}	*The decision variable representing amount of biomass to transport between i and j*	$i \in S \quad j \in P$
SC_i	The supply capacity of any given supplier	$i \in S$
PC_j	The capacity of any given plant	$j \in P$
TP_{ij}	The cost of transportation between i and j, given in $ per Mg per kilometer of biomass. The total cost of a trip is thus $C_{ij} * X_{ij}$	$i \in S \quad j \in P$
D	The total demand, which is 500,000,000 liters of bio-ethanol, requires 2,155,172 Mg of biomass	
L	The cost of loading and unloading a truck, given as a constant 10000	
I_j	The investment cost for each plant	$j \in P$
B_j	A binary variable that represents whether or not we've invested in a plant	$B \in \{0,1\} \quad j \in P$
Y_j	The conversion capacity of each plant	$j \in P$
R	The constant conversion rate of bioethanol per Mg of biomass, which is 232 liters/Mg.	

Objective function:

$$Minimize\ Z = \sum_{i \in S} \sum_{j \in P} (TP_{ij} * X_{ij}) + \sum_{j \in P} (I_j * B_j)$$

Constraint to:

$\sum_{i \in S} \sum_{j \in P} X_{ij} \geq D$ *The sum of flow between all i's and j's meets the production goal*

$\sum_{i \in S} \sum_{j \in P} X_{ij} \leq SC_i$ *The sum of the outgoing flow from each supplier is less than or equal to its available supply*

$\sum_{j \in P} \sum_{i \in S} X_{ij} \leq PC_j$ *The sum of incoming flow to each plant is less than or equal to its capacity*

$\sum_{i \in S} \sum_{j \in P} X_{ij} = \sum_{j \in P} \sum_{i \in S} X_{ij}$ *The sum of outgoing flow from all suppliers equals the ingoing flow to all plants*