IE 432: Quantitative Risk Management
Project Stage 1

Fall 2023

Due: December 4th

For this project assignment, you should form groups of 3 people.

In course project, we consider Stochastic Server Location Problem (SSLP). Below, you can find a brief description of SSLP.

Stochastic Server Location Problem (SSLP)

We consider a set of customer buildings in a metropolitan area for which a service provider is interested in installing optical fibers and switching equipment in the most profitable manner. Due to the uncertainty regarding the customer base for high speed services, telecommunication providers often adopt a very conservative approach to capital investment, leading to potential losses in revenue. Such problems are common in practice and can be formulated as the SSLP.

The essence of the SSLP may be described as follows. Suppose that we place a server at location $j \in J$ where J is the set of possible server locations. The fixed cost of locating a server at location $j \in J$ is c_j. A server can provide enough capacity to serve up to u amount of resource to clients. There is also a shortage cost (penalty) q_{j0} for each unit of demand that remains unserved among the clients assigned to server j. As far as operational considerations are concerned, we allow only one server to be installed at each location and each client can only be served by one server.

The revenue generated by serving client $i \in I$ from location $j \in J$, is denoted q_{ij} where I is the set of clients. If client i is served by a server at location j, it uses d_{ij} units of resource from the server. However, we know that some clients may not always exist at a given time,

that is, presence of clients is subject to uncertainty. Let S be the set of all possible scenarios and p_s be the probability associated with scenario $s \in S$. Also let $h_{is} = 1$ if client i is present in scenario $s \in S$ and 0, otherwise. Note that for a given scenario s, if $h_{is} = 1$ and the client i is assigned to a server located at j, client i has a demand of d_{ij} from the server located at j. If $h_{is} = 0$, then the client has no demand for scenario $s \in S$.

Note that we first decide locations of servers, then observe existing customers and finally decide on client-server assignments.

SSLP is to choose locations of servers and client-server assignments that minimize the total expected operating cost subject to the given constraints.

Construct a **linear** model to solve SSLP and explain the statements of constraints clearly. Define your variables indicating that whether they are first or second stage variables.

What to hand in:

In a pdf document:

(a) List the group members names and IDs.

(b) Mathematical formulation. Explanation of parameters and decision variables, objective function and constraints.