1 Variable arrangement

The *decision variables* are arranged in the following manner:

$$[u, v, w, \bar{w}, x_0, x, \bar{x}, y_0, y, \bar{y}, z]$$

The lengths of these depends on the the variables (i, j, l, r, s, t). Here are the dependencies:

$$u \rightarrow l, r, s, t \tag{1}$$
$$v \rightarrow i, r, s, t \tag{2}$$
$$w, \bar{w} \rightarrow i, r \tag{3}$$
$$x_0 \rightarrow i, j, s, t \tag{4}$$
$$x, \bar{x} \rightarrow i, j, r, s, t \tag{5}$$
$$y_0 \rightarrow i, s, t \tag{6}$$
$$y, \bar{y} \rightarrow i, r, s, t \tag{7}$$
$$z \rightarrow i, r, s, t \tag{8}$$
$$d_0 \rightarrow l, t \tag{9}$$
$$d \rightarrow l, r, t \tag{10}$$

The total length of the coefficient array for the equations is $(lrst + irst + 2ir + ijst + 2ijrst + ist + 2irst + irst)$. Assuming the lengths of each as 3, we have $(81+81+9+9+81+243+243+27+81+81+81+9+27) = 1053$ elements in the coefficient array. Depending on the numbers, this vector can be extremely large.

The decision variables will be arranged in the order of (i, j, l, r, s, t). for u with 2 elements each (l, r, s, t), it'll be

$$\begin{aligned}
&[u^1_{1,1}(1), u^2_{1,1}(1), u^1_{2,1}(1), u^2_{2,1}(1), u^1_{1,2}(1), u^2_{1,2}(1), u^1_{2,2}(1), u^2_{2,2}(1), && (11)\\
&u^1_{1,1}(2), u^2_{1,1}(2), u^1_{2,1}(2), u^2_{2,1}(2), u^1_{1,2}(2), u^2_{1,2}(2), u^1_{2,2}(2), u^2_{2,2}(2),\\
&v^1_{1,1}(1), v^2_{1,1}(1), v^1_{2,1}(1), v^2_{2,1}(1), v^1_{1,2}(1), v^2_{1,2}(1), v^1_{2,2}(1), v^2_{2,2}(1), && (12)\\
&v^1_{1,1}(2), v^2_{1,1}(2), v^1_{2,1}(2), v^2_{2,1}(2), v^1_{1,2}(2), v^2_{1,2}(2), v^1_{2,2}(2), v^2_{2,2}(2),\\
&w^1_1, w^2_1, w^1_2, w^2_2, \bar{w}^1_1 \ldots\ldots\ldots\ldots\ldots\ldots]
\end{aligned}$$

A matlab function will resolve the position of each decision variable given the values (i, j, l, r, s, t) in the coefficient vector.

2 Example

Considering equation 10 from the original text:
$y^i_{0,s}(1) = 0$
The coefficient vector for the first equation $y^1_{0,1}(1) = 0$ will look like: [000000...01000..00000]where the single 1 is the 748^{th} position in the coefficient vector. The next iteration of eqn 10 is $y^2_{0,1}(1) = 0$ which will look like [000000...00100..00000] while this time, the 1 is in 749^{th}position in the vector (Considering all lengths are 3).

3 Summary

What exactly are we finding?
Reserve of the resources and what amount to be placed at which location.

3.1 Locations

We have our first variable N which is the number of locations. each of these locations are called i. each i has a set of nearby location set called ε_i. We call each of nearby locations j.

Right now we know **i, j, N,** ε and we know what they are. in the example, N = 8. each ε_i is also 8. Moving on..

Possible Conflict: each i should be on ε_i list as first priority. But, there's the table where C, D has themselves listed lower than others. How is this possible. Also there are no A's

Next thing on list is p_{ij} which is preference score (ascending) of city j judging from city i. r_{ij} is response time / transfer time of resources from j to i.

This means, p_{ij} will determine the ε_i. we will deal with response time r_{ij} later.

Concern: if this ε_i is not the same list of cities for every city? If it is, then there is no need to call for additional j. If not, and it is variable, we need to write a subroutine to generate viable list of j for each i.

3.2 Resources

There are few different types. each one of them needs specialist and other general members. In example there are 3 types. Theres a teeny tiny component of setup time for the resources too.

R is the number of resource *types*. in example R = 3. α_r, β_r are number of specialists and generalists required for each of type-r equipment. s_r is the setup time for type-r equipment. Obviously this should be independent of number of equipments.