Decision Algorithm

Formula

- Expected unfulfilled demand of node $\mathbf{u}$ at time $\mathbf{t}$ when vehicle number $\mathbf{y}$ in vector $\mathbf{I}$ arrives

Let $\mathbf{A_u}: \mathbb{R}_0^+ \times \mathbb{N} \times (\mathbb{R}_0^+ \times \mathbb{R}_0^+)^n \to \mathbb{R}_0^+$ where $\Delta t = l_i - l_{i-1}$ such that

$$A_u(t, y, \bar{I}) = \max\left(0, D_u(t + l_1) - X_u + \sum_{i=2}^{y}\left(r_u \Delta t + \int_0^{\Delta t} R_u(T)dT - b_{i-1}\right)\right)$$

- Decreasing unfulfilled demand rate of node $\mathbf{u}$ at time $\mathbf{t}$ caused by vehicle number $\mathbf{y}$ in vector $\mathbf{I}$

Let $\mathbf{f_u}: \mathbb{R}_0^+ \times \mathbb{N} \times (\mathbb{R}_0^+ \times \mathbb{R}_0^+)^n \to \mathbb{R}_0^+$ where $K = A_u(t, y, \bar{I}_u)$ such that

$$f_u(t, y, \bar{I}) = \frac{K^2 - \max^2(0, K - b_y)}{l_y + 1}$$

- Sum of total decreasing unfulfilled demand rate

Let $\mathbf{P^*}: \mathbb{R}_0^+ \to \mathbb{R}_0^+$ such that

$$P^*(t) = \sum_{u \in V} \sum_{i=1}^{|I_u|} f_u(t, i, I_u)$$

Pseudo code

```
INPUT    A Valid Test case
OUTPUT   A Distribution Strategy

    FIND all pair shortest path in graph
    WHILE incident occurs
        Update transportation state
        Receive donations
        SORT donations by their utility values in descending order
        FOR each donation in list
            Assign feasible destination which maximize P*(t)
        END FOR
        Update transportation state
    END WHILE
```

(D)APSP Algorithm

Dijkstra's Algorithm

```
DIJKSTRA(G, w, s)
INITIALIZE-SINGLE-SOURCE(G, s)
S = ∅
Q = G.V
while Q ≠ ∅
    u = EXTRACT-MIN(Q)
    S = S ∪ {u}
    for each vertex v ∈ G.Adj[u]
        RELAX(u, v, w)
```

Floyd-Warshall Algorithm

FLOYD-WARSHALL(W)

$n \leftarrow rows[W]$

$D^{(0)} \leftarrow W$

for $k \leftarrow 1$ **to** n

  do for $i \leftarrow 1$ **to** n

    do for $j \leftarrow 1$ **to** n

      $d_{ij}^{(k)} \leftarrow min(d_{ij}^{(k-1)}, d_{ik}^{(k-1)} + d_{kj}^{(k-1)})$

return $D^{(n)}$