1. Task 1:

Assumptions:

1- Unlimited number of taxis
2- Disregarding rides without passengers
3- Ignoring temporal aspects
4- Capacity limitation=1

d_{rk} = distance from node r to node k

p_{i} = pick up point passenger i

d_{i} = drop off point passenger i

Minimum total travel distance= $\sum_{i=1}^{n} d_{p(i)d(i)}$= 110319.18 km

2. Task 2:

Assumptions:

1- Unlimited number of taxis
2- Disregarding rides without passengers
3- Ignoring temporal aspects
4- Capacity limitation=2

Parameters:

r = set of all nodes

n = set of all passengers

i = index of passenger

d_{rk} = distance from node r to node k

p_{i} = pick up point passenger i

d_{i} = drop off point passenger i

Decision Variables:

$x_{\mathrm{ij}} = \begin{cases} 1 & \text{if taxi goes from pickup point of passenger i to pickup point of passenger j} \\ 0 & \text{otherwise} \end{cases}$

$m_{\mathrm{ij}} = \begin{cases} 1 & \text{if taxi drops off passenger i befor passenger j} \\ 0 & \text{otherwise} \end{cases}$

$n_{\mathrm{ij}} = \begin{cases} 1 & \text{if taxi drops off passenger i after passenger j} \\ 0 & \text{otherwise} \end{cases}$

$f_{\mathrm{i}} = \begin{cases} 1 & \text{if taxi goes direct from pickup i to drop off i with just one passenger} \\ 0 & \text{otherwise} \end{cases}$

Objective:

$$\min z = \sum_{j=1}^{n} \sum_{i=1}^{n} d_{p(i)p(j)} x_{ij} + \sum_{j=1}^{n} \sum_{i=1}^{n} (d_{p(j)d(i)} + d_{d(i)d(j)}) \, m_{ij} + \sum_{j=1}^{n} \sum_{i=1}^{n} (d_{p(j)d(j)} + d_{d(j)d(i)}) \, n_{ij} + \sum_{i=1}^{n} d_{p(i)d(i)} f_i$$

Subject to:

$(\forall i, j) \; m_{\mathrm{i}} + n_{\mathrm{j}} = x_{\mathrm{ij}}$

$(\forall i) \; \sum_{j \neq i} x_{ij} + \sum_{j \neq i} x_{ji} + f_{\mathrm{i}} = 1$