In order to reconcile the dilemma between the shortest path, which means the lowest time, and the widespread route?, which refers to no crashing, we apply a multi-purpose programming to devise the correspondence of each drone from the dragon to Chinese map. We introduce the cosine value of the angle of two vectors to measure and quantify how widespread the route is.

Within the range from 0 degree to 180 degree, the closer the cosine value of the vector angle to 1 is, the nearer the two vectors are. In light of the range of the cosine function defined in 0 degree to 180 degree, from -1 to 1, we can reach the conclusion that the greater the cosine value is, the near they are.

We set a reference point, which is the center of the target pattern (76, 57, 112.5), Chinese map, to generate the relative vectors of each coordinate. We calculate the vectors from the point to each coordinate of the drones in the two patterns. The transformation technique are shown as below

Then we calculate the cosine value of each vectors in the dragon and each vectors in the map. Here are the formulas

As mention prior, we also calculate the Euclidean distance between each two coordinates as a preparation to the multi-purpose programming.

We number the drones in the Ferris wheel from 1 to 477. Here we define as the distance between the drone in the dragon and drone in the map, as well as as the cosine vector angle between the drone in the dragon and drone in the map. Then we define to judge the following situation: if the drone in the dragon matches the drone in the map, then we define. Otherwise, we define .

Considering the first goal, we define function Z, the minimum total distance, as one of our target function. We define function W, the maximum total cosine vector angle, as another target function.

In a similar way, the functions are subject to

Combining the two function in to one function, we define *λ1* as the weight of the first function and similarly *λ2* as the weight of the second function. Hence we have

Since the two conditions are equally important to the final consequence, we attach the two functions to equal weight, which means .

We also apply LINGO to run the multi-purpose binary integer programming, the details of the code are in the attachment. Nevertheless, due to limited time, we fail to collect the final data of the program.