**Normalization**

**Now we have already got the weight of each aspect; however, to analysis the three factors together, we need to normalize them so that they will have the same unit. Followings are our considering steps and normalized results:**

**We decide to give a mark (between 0 and 1) to each factor in every situation, which carries different number and kinds of drones as well as medicines. Details of the principles to give the marks are below.**

**Amount of medical supply:**

As we calculated, the five hospitals need 7 MED1, 2 MED2 and 4 MED3 per day. We define this one-day’s medical demand as a supply unit. For ensuring the basic medical demand during the first many days after the disaster, we decide to supply at least 120 supply units. (which are enough for four months). In our marking system, a scheme which has 120 supply units is worth 0.6 marks; when the amount of medical supply approaches infinity, the scheme worth 1 mark. To achieve these two criterions, we give a marking function:

f(D)= D/(D+80), (D>=120)

Minimum time to complete medical supply delivery:

We can know the function of time is:

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For the speed of the fastest drone is 79km/h (63.2km/h with cargo bay) and the speed of the slowest drone is 60km/h (48km/h with cargo bay), assume that distance is 7km(the Type D Drones’ furthest flight with cargo bay), a round-turn for this two drones cost 式子2. The percentage difference is 4.998%; thus, we can regard the time for different types of drones is roughly same.

When we only have one drone, we can take 1042 units of medicines; thus, if we add a drone, the impact of ΣZi is much larger than the decrement in M. We decide to ignore the tiny change of M.

In our greedy algorithm (we will introduce its details in Part Six), we adjust our plan by adding one drone per time and compare it with the former condition. Adding one drone will not influence the average of all drones’ payload capability when there are more than 10 drones; thus, we can reasonable assume the average of the drones’ payload capability does not change.

Finally, we can get T 正比于 1/飞机数目N.

The full one mark of this factor is given by the following situation:

With carrying 120 supply units of medicines (which ensure the medical supply) in the three cargo containers and three Type H Drones, the rest room is full of Type D Drones (which has the smallest volume of shipping container).

(Nmax=(3\*(19\*12+3)\*(W)\*(H)-3\*(vol(TypeH))-120\*(vol(MED))) /vol(Type D))

To calculate other conditions’ marks, we simply use the number of the drones to divide the largest number Nmax.

G(n)= n / Nmax

Reconnaissance ability:

It is obvious that if we add a drone, the reconnaissance ability will be higher. A drone which can fly further is able to detect more area and roads, which shows it has a higher reconnaissance ability. However, the drone’s flying time is limited, the reconnaissance ability should not be exactly proportional to the area which it can reach. We regard it roughly be proportional to the sum of all drone’s max flying distance. (\*the max distance of each kind of drone is shown below.)

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The full one mark of this factor is given by the following situation:

With carrying 120 supply units of medicines (which ensure the medical supply) in the three cargo containers and three Type H Drones, the rest room is full of Type B Drones (which has the largest ratio of flight distance to its volume of shipping container). This situation has the largest sum of all drone’s max flying distance.

(Dmax=(3\*(19\*12+3)\*(W)\*(H)-3\*(vol(TypeH))-120\*(vol(MED))) /vol(Type B) \* (79\*40/60)

To calculate other conditions’ marks, we simply use the sum of all drone’s max flying distance in that situation to divide the largest sum to get the mark:

h(x[n]) = sum(x[i].distance)/ Dmax