Big Brother Is
(really in need of your help in)
Watching You!

The year is 2084 and the security situation is as grim as ever:

An overabundance of "jaywalkers" endangers the safety of law-abiding drivers throughout Gotham City. The municipal government is finally ready to deal with this problem decisively and hires you to design a surveillance plan for the entire borough of Manhattan.

The Mayor is adamant that all surveillance should be conducted by Micro Unmanned Aerial Vehicles (MAVs) alone. City Hall has a binding contract with "Batman & Robin Unlimited", a conglomerate manufacturing overpriced and antiquated quadrotor mini-helicopters, similar to those that emerged 73 years earlier. But unlike the mini-helicopter drones of 2011, the current MAVs are relatively robust both indoors & outdoors, can fly up to 5 hours without need to recharge or refuel, and require no human being to monitor each of them – instead, a sophisticated computerized controller can be programmed to follow any patrol strategy of your choice.

The Mayor actually needs four (4) different plans for deploying these MAVs,
but he'll be grateful for anything you can prepare on such a short notice.

Gotta watch them: no geographic point in the city should remain unobserved from the air for more than 15 minutes in a row. How many MAVs will you need to guarantee this?

Plan for contingencies: Note that any flight plan involving frequent sharp turns will require more frequent recharging/refueling stops. Moreover, these outdated MAVs are not very reliable and a significant proportion of them might be briefly grounded for repairs, interrupting their patrol activities throughout the day. Despite this, all areas of the city should remain regularly observed (even if somewhat less often). An ideal plan will accomplish this even without reprogramming the remaining drones. What kind of surveillance coverage will your plan provide if 30% of your drones become unusable?

All areas are equal, but some are more equal than the others: Some parts of the city have a higher density of jaywalkers; e.g., the neighborhood of Gotham University and the financial district are particularly dangerous for drivers. Such areas should be observed at least once in each 5 minute interval. On the other hand, Gotham Central Park has only a few roads passing through it, and there is no need to observe it more than once in 20 minutes. How many MAVs will you need to provide the requested variable level of coverage?

Everyone is equal in the eyes of the drones: The troublemakers from Gotham Jaywalking Liberties Union complain that you & all other municipal employees involved in programming the drones have an unfair advantage: even if you don't know the current position of all MAVs, your insider knowledge (of the surveillance strategy/schedule & the current number of operational drones) may be used to craft a significantly less drone-observable jaywalking path through the city. If necessary, modify your plan to assuage these fears. How many drones will you need to provide a comparable surveillance coverage under the new plan?

Good luck & have fun!   **The drivers of Gotham thank you for your vigilance!**