You and your team are hire as a consultant for a company that provides air surveillance within a city. The company is planning to introduce to the city surveillance service a fleet of drones that will be constantly in the air providing real time imaging of what is going on around the urban. After losing its power, drones must go back to a charging facility that can be place at any neighborhood center of the city. One charging facility can only serve one drone. The city is divided by neighborhoods and a drone can cover a circular area of a radius of $5\ mi$

The project manager in charge of the fleet introduction will want to assess:

a. Initially, how many drones should he display to cover all neighborhoods and where should he locate the charging facilities.

b. Because drones will have a charging time where they will not be performing surveillance the police chief wants to be cover the neighborhoods with more than one drone. For this, the manager is interested in assessing on this first scenario how many neighborhoods are covered at least by two drones.

c. How many drones does he need to display to guarantee that at least 2 drones will be serving each neighborhood?

d. How many drones does he need to display to guarantee that at least 3 drones will be serving each neighborhood?
e. How many drones does he need to display to guarantee that at least 4 drones will be serving each neighborhood?
f. Now you can choose among 3 types of drones. Each type will have a different cost (drone plus charging facility) and a different coverage capacity as shown below.

Drone Model	Coverage Radius (miles)	Cost ($/year-unit)
IRQN-2B	5	5,000.00
PELJC-TYE2	10	50,000.00
CAZD-OR3000	50	100,000.00

Run b, c, d, and e for each model (you already did it for IRQN-2B).

g. Now create a formulation that takes into account all of the models at the same time. In order to guarantee that at least 3 drones will be serving each neighborhood at a **minimum**

investment cost. How many drones of each type should your team buy and where should you place the charging facilities of each drone?

h. The police chief wants to increase the number of drones covering the most dangerous neighborhoods. Specifically, she wants to have at least 4 drones covering the top 3 most dangerous neighborhoods; then she wants at least 3 drones covering the next 2 (4^{th} and 5^{th}) most dangerous neighborhoods; at least 2 drones covering the remaining neighborhoods until the top 10 is completed. And for the rest she only wants at least 1 drone. Where and how many drones does your team needs to place the charging facilities to minimize the total investment cost?

The location of each neighborhood center along with its population and number of crimes last year are given bellow:

Latitude	Longitud	Population	Crimes
35.9405	-78.89870115	4721	453
36.05952	-78.90548911	987	768
35.02536	-77.93633527	2085	368
34.91341	-81.461978	4007	566
36.47482	-79.59491191	818	602
35.36636	-80.10327313	2895	932
36.61737	-76.96518275	1552	595
35.96485	-77.85138376	4531	237
35.3553	-81.07188523	4212	554
35.95009	-78.98072471	4871	96
35.30805	-78.78536946	3450	766
35.41166	-79.56319961	2618	434
36.75454	-78.83257233	5000	358
36.46565	-78.95642837	3175	829
35.17293	-78.85543841	1797	835
36.73573	-79.58559494	1429	483
35.88996	-80.65308117	4013	615
36.35274	-78.71235081	1684	933
36.39771	-76.27821844	4994	474
35.45436	-79.49948708	2731	675
36.60613	-79.89409166	4767	682
35.47372	-77.79994467	4080	929
35.87726	-77.05774268	2134	842
36.17111	-76.58442876	1183	153
37.49959	-78.63937056	3880	750
36.62883	-77.7553535	890	298
35.06429	-78.91134421	3395	179
34.90717	-78.29861561	3585	824
34.94897	-78.82959221	2204	663
35.42296	-79.05687759	4915	338
36.49349	-79.22128678	4141	270