Disparities in the police department with respect to incentives and disciplinary actions

<u>Group name</u>: The Game of Drones

<u>Group members</u>: Azizakhon Mirsaidova, Preetham Pareddy, Srik Gorthy

Overview

Both incentives and disciplinary actions are a form of feedback which officers receive depending on their performance and how they conduct themselves. Ideally officers with good performance and behaviour must receive awards and officers with bad behaviour or misconduct must be disciplined. This is a system that is present not just in the department but in all environments like schools, offices etc. Such feedback is important as it rewards good performance and punishes bad behaviour. But if this system is not completely fair and is biased towards officers of certain race or gender then the whole point of feedback is defeated. Good performing officers will be demotivated if they are not given awards because of their race. Officers who have bad behaviour will continue to keep doing so because they are not being disciplined, because of the bias towards their race. This will reduce the overall quality of policing. Hence we wanted to use the CPDB data to first test whether such bias is happening in the department so that we can bring awareness to this which helps us take a step towards possible solutions like increasing the diversity, or holding certain checks so that this doesn't happen. We have found through our previous checkpoints that this is indeed happening. This checkpoint helps us go deeper into this analysis with the help of graph analytics.

Question 1. Are there disparities in police award nominations?

In this checkpoint, we provide evidence of the racial disparity in award nominations by analyzing a metric of internal recognition in Chicago Police Departments, which is the awards. We have decided to analyze awards rather than promotions because promotions are much rarer and therefore resulting in less data.

From the previous checkpoints, in particular, 2 and 3, we found that there is an inequality in the proportion of awards distributed among black and hispanic officers compared to their white counterparts. We aim to go

deeper into this by analyzing the requesters of the awards with awardees to test if there is any racial bias involved when requesters nominate other officers for awards.

We constructed the dataset by joining the *data_award* and *data_officer*. To get the district information, we joined the *data_policebeat*, *data_area*, and *police_unit*. As graph property encompasses vertices and edges. Here are table details:

- Our vertex query includes the requester id, requester's full name and the number of awards.
- Our edge query includes police officer id (awardee) for source, requester id for destination and the number of awards for relationship.

Analysis and Findings

[Link to Colab Notebook](#)

We selected 6 districts in which the awards differences between the races was highest, in order to reduce the complexity of networks and also to decrease the time taken for pre-processing. For this purpose we used the same metric *award_disproportion* as we have used in checkpoint 3. This metric is normalized for the population and lies between -1,1. Negative being the officers of that race are getting less than their respective population proportion, positive being the vice versa. These 6 districts were narrowed down for further analysis.

In all the 6 districts, 3 were majority white departments (Near West, Morgan Park, Jefferson Park) and 3 were majority black (Wentworth, Calumet, Gresham). The table below shows this in much more detail:

District_Number_Name	Race	Percentage
12TH DISTRICT - NEAR WEST	White	43.34%
12TH DISTRICT - NEAR WEST	Hispanic	41.36%
12TH DISTRICT - NEAR WEST	Black	13.31%
12TH DISTRICT - NEAR WEST	Asian/Pacific	1.98%
16TH DISTRICT - JEFFERSON PARK	White	74.92%
16TH DISTRICT - JEFFERSON PARK	Hispanic	16.61%
16TH DISTRICT - JEFFERSON PARK	Asian/Pacific	5.02%
16TH DISTRICT - JEFFERSON PARK	Black	3.45%
22ND DISTRICT - MORGAN PARK	White	60.67%
22ND DISTRICT - MORGAN PARK	Black	27.33%
22ND DISTRICT - MORGAN PARK	Hispanic	11.33%
22ND DISTRICT - MORGAN PARK	Native American/AI	0.67%
2ND DISTRICT - WENTWORTH	Black	67.97%
2ND DISTRICT - WENTWORTH	White	17.27%
2ND DISTRICT - WENTWORTH	Hispanic	11.70%
2ND DISTRICT - WENTWORTH	Asian/Pacific	2.79%
2ND DISTRICT - WENTWORTH	Native American/AI	0.28%
5TH DISTRICT - CALUMET	Black	55.68%
5TH DISTRICT - CALUMET	White	34.07%
5TH DISTRICT - CALUMET	Hispanic	9.14%
5TH DISTRICT - CALUMET	Asian/Pacific	1.11%
6TH DISTRICT - GRESHAM	Black	46.33%
6TH DISTRICT - GRESHAM	White	30.13%
6TH DISTRICT - GRESHAM	Hispanic	21.77%
6TH DISTRICT - GRESHAM	Asian/Pacific	1.77%

Table 1: Police department population percentage by race

But in all these districts, white officers have requested the highest number of awards and the white requesters are more than the other races.

So at least in the districts with the most difference in awards between races, white officers are requesting more awards than others, irrespective of the majority population in the department of that district. Table 2 shows the exact numbers for this.

	district	majority	requester_race	awards_requested_count
0	12TH DISTRICT - NEAR WEST	White	Asian/Pacific	21
1	12TH DISTRICT - NEAR WEST	White	Black	168
2	12TH DISTRICT - NEAR WEST	White	Hispanic	1607
3	12TH DISTRICT - NEAR WEST	White	White	4186
4	16TH DISTRICT - JEFFERSON PARK	White	Asian/Pacific	573
5	16TH DISTRICT - JEFFERSON PARK	White	Black	120
6	16TH DISTRICT - JEFFERSON PARK	White	Hispanic	163
7	16TH DISTRICT - JEFFERSON PARK	White	White	5086
8	22ND DISTRICT - MORGAN PARK	White	Black	451
9	22ND DISTRICT - MORGAN PARK	White	Hispanic	108
10	22ND DISTRICT - MORGAN PARK	White	White	6153
11	2ND DISTRICT - WENTWORTH	Black	Asian/Pacific	11
12	2ND DISTRICT - WENTWORTH	Black	Black	849
13	2ND DISTRICT - WENTWORTH	Black	Hispanic	144
14	2ND DISTRICT - WENTWORTH	Black	White	2211
15	5TH DISTRICT - CALUMET	Black	Asian/Pacific	6
16	5TH DISTRICT - CALUMET	Black	Black	1955
17	5TH DISTRICT - CALUMET	Black	Hispanic	589
18	5TH DISTRICT - CALUMET	Black	White	3377
19	6TH DISTRICT - GRESHAM	Black	Asian/Pacific	73
20	6TH DISTRICT - GRESHAM	Black	Black	2009
21	6TH DISTRICT - GRESHAM	Black	Hispanic	1021
22	6TH DISTRICT - GRESHAM	Black	White	4045

Table 2: Sample table about the number of requester awards per requester race in selected six districts

To further understand the behavior of the requesters, we graphed the vertices which show the top twenty award requesters based on the number of awards represented in table 3. We investigated whom these requesters mostly requested the awards for and what is the proportional distribution of awards among racial makeup of awardees by exploring requesters' race, ranking, district, and distribution of the awards they have requested. Analysis of this relationship helps us identify the network in the following analysis.

```
+-------+------------------+-----------+
|     id|requester_full_name|award_count|
+-------+------------------+-----------+
|15728.0|       RobertLarson|       1287|
|25976.0|       KevinSellers|       1131|
|24849.0|         DavidRucci|       1072|
|30907.0|       MargitWillis|        767|
| 9963.0|   GregoryGilfillan|        635|
| 6736.0|       ArshellDennis|       608|
|19163.0|        KeithMilmine|        595|
|18702.0|        VictorMedina|        589|
|26777.0|        TimothySmith|        579|
| 1072.0|   HootanBahmandeji|        575|
|21710.0|        PhilipPaluch|        572|
|31199.0|         RobertWoods|        565|
|16733.0|           JoseLule|         561|
| 5063.0|    TerrenceCollins|         559|
|11152.0|        PaulHagemann|        540|
|26641.0|       GregorySloyan|        529|
|25799.0|       AnthonySchulz|        524|
|12195.0|     ReginaHightower|        516|
|19351.0|        JosephMolina|        472|
|23979.0|        ThereseRiley|        458|
+-------+------------------+-----------+
```

Table 3: Vertices Table

Furthermore, it's essential to understand the network of the award requesters and awardees. Thus, we graphed the edge table to represent the relationship between the award requesters and awardees, as shown in table 4. An interesting pattern we found was that a few of the connections on the top of the sorted list comprise officers requesting awards for themselves. This can be seen from table 4 where "src" and "dst" are the same id. For example, two officers with the most connections, 21309 and 15728 identified as white mostly nominated themselves.

```
+-----+-------+------------+
|  src|    dst|relationship|
+-----+-------+------------+
|21309|21309.0|         132|
|15728|15728.0|         104|
| 2463|15728.0|          95|
|25799|25799.0|          77|
|17351|15728.0|          70|
| 7167|19163.0|          69|
|32383|18721.0|          63|
|  933|19855.0|          62|
|20053|25030.0|          62|
| 2849|19163.0|          62|
|13273|13273.0|          61|
| 2068|14124.0|          61|
|30884|30884.0|          60|
|22269|30884.0|          59|
|25578|25578.0|          56|
| 2981|19163.0|          56|
|29408|19163.0|          55|
|14124|14124.0|          55|
|12691|26641.0|          54|
|20475| 3387.0|          53|
+-----+-------+------------+
```

Table 4: Edge Table

This led us to find the actual number of officers who are requesting for themselves in each of the 6 districts. The below image gives the total self nominations for officers race wise. It shows that the number of black officers who nominate themselves is less than the corresponding number of white officers who nominate themselves in 2 out of 3 black majority districts and

all the 3 white majority districts. This occurrence signals us with the question, why are black officers requesting less for themselves (even in the majority black districts)?

```
district                          requester_race
12TH DISTRICT - NEAR WEST         Hispanic           24
                                  White             327
16TH DISTRICT - JEFFERSON PARK    Asian/Pacific       1
                                  Hispanic           19
                                  White             364
22ND DISTRICT - MORGAN PARK       Black               4
                                  Hispanic            5
                                  White             242
2ND DISTRICT - WENTWORTH          Black              67
                                  Hispanic            1
                                  White               3
5TH DISTRICT - CALUMET            Asian/Pacific       1
                                  Black              54
                                  Hispanic           22
                                  White             257
6TH DISTRICT - GRESHAM            Black              66
                                  Hispanic            9
                                  White             245
```

Table 5: The racial makeup of officers who are requesting awards for themselves

PageRank

We assume that award requesters asking for the majority of the awards have a legitimate power in the department and authority in making decisions. By understanding those requesters and their awardee relationship, we can understand whether their action causes a racial disparity in the department or supports diversity and inclusion. Therefore, we plot the network graph with GraphX pagerank algorithm that provides rough estimates about the importance of the node. The significant importance given to the highest award count requesters in particular, Timothy Smith, Gregory Gilfillan, Hootan Bahmandeji, Philip Paluch, and Nicola Zoda which are illustrated as outliers in figure 1.
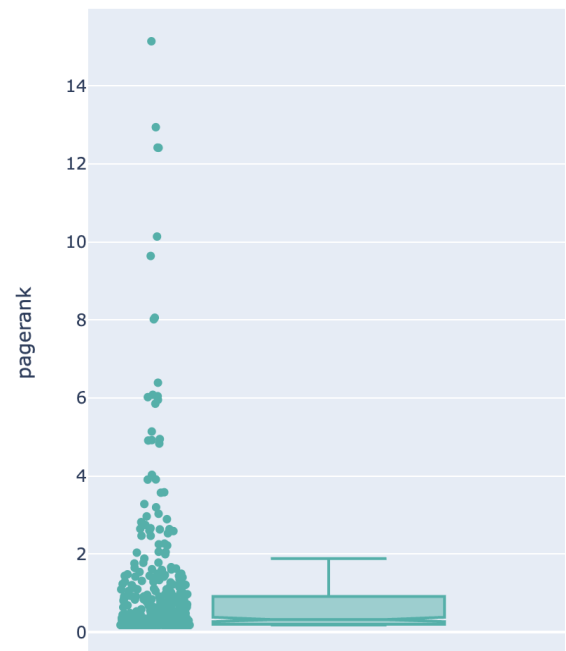

Figure 1: Page Rank

The box plot is an interactive visual that provides further information about the requesters. Hover over parameter contains detailed information about the requester's id, their full name and page rank.

The Page Rank relationship includes both "direct relationship" which means requesters nominated for themselves and "indirect relationship" as a means to request for others which is illustrated in figure 2.
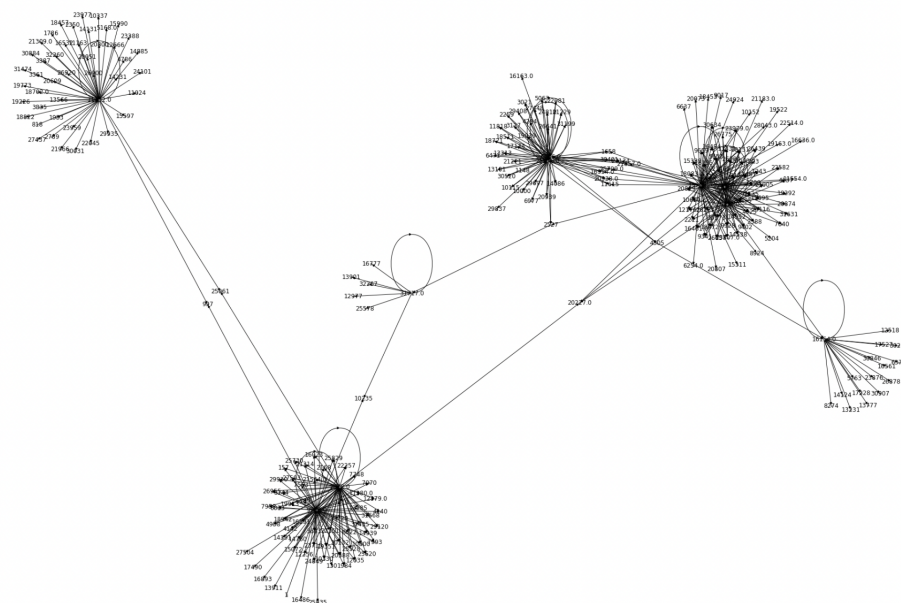

Figure 2: Page Rank network for 10 nodes

Label Propagation

The figure 2 gives us the hint that there are networks of the people that are requesting for each other and between the groups. In order to determine the community of those requesters and awardees, we computed the label propagation which detects the communities based on the vertices and edges. The figure 3 shows the clusters of the groups (label) illustrated in various colors to distinguish the difference in group and their assembly. For example, most requesters are grouped in labels "214748364800" including 77 requesters, "936302870528" with 76 requesters, "575525617664" with 64 requesters and "223338299393" gathering 52 requesters.
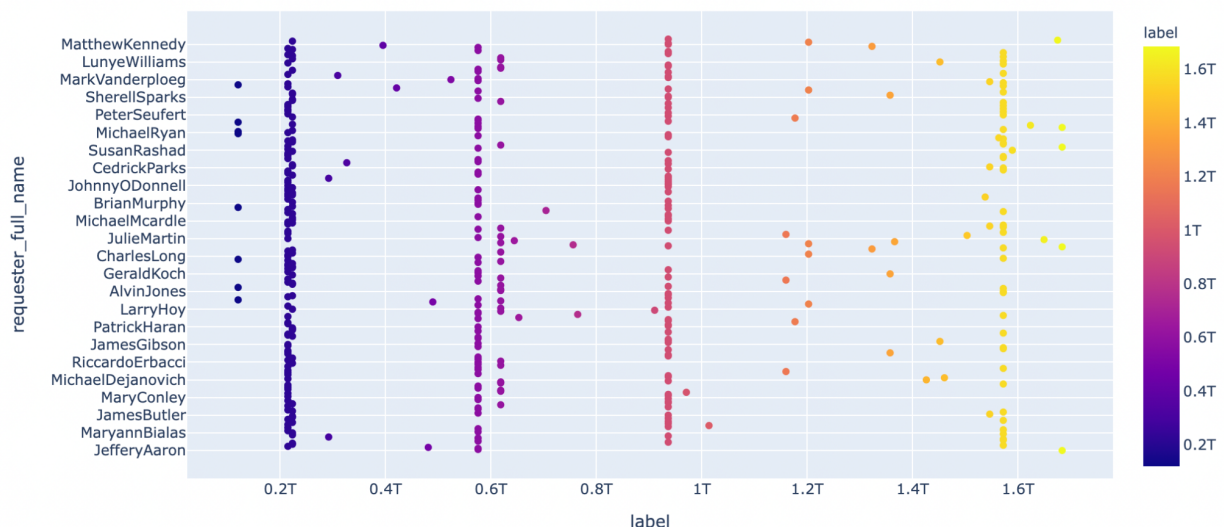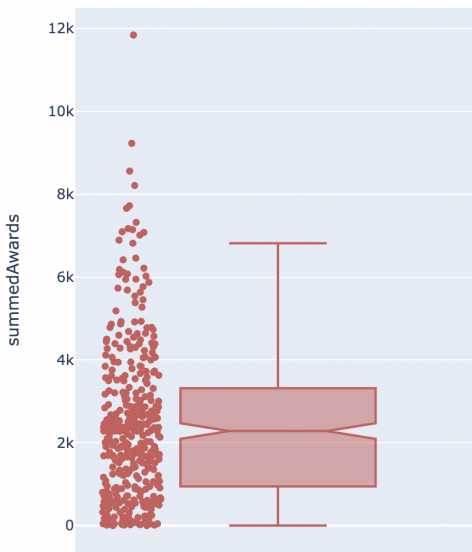
Figure 3: Label Propagation

We need further information to conclude on what gathers these requesters together to the same group (label). For instance, these people can be connected because they are in the same districts. While we don't have enough features to identify the similar characteristics of those requesters, we can calculate their connected vertices and edges and distinguish their importance among their neighbors by using AggregateMessages. The figure 4 describes the distribution of the summed awards.

Figure 4: Aggregated Awards

Question 1 Conclusion

This report analyzes the racial disparities in award nominations among 6 Chicago Police Departments. Through our investigation, we find the followings:

1. White award requesters (supervisors) are less likely to nominate black officers than white or Hispanic officers.
2. White officers are requesting more awards than others, irrespective of the majority population in the department of that district.
3. In the 6 districts, black officers are requesting less awards for themselves than their counterparts.
4. There is suggestive evidence of implicit preferences towards in-group members: white officers are more likely to nominate officers in their associated groups.

All things considered, these findings suggest that simply increasing the diversity of the police departments may not be the only solution. Rather, police departments should center their attention on providing equal chances to all officers in getting recognition and provide opportunities for career advancement which eventually leads to quality policing.

Question 2

Is the disparity in disciplinary actions taken against internal and external complaints based on racial makeup of the district due to the relationship between alleged officers and investigators?

Using Student's t-Test, we proved in Checkpoint 3 that there are disparities between disciplinary actions taken against internal and external complaints based on the racial makeup of the police district. In Checkpoint 4, we want to find out if these disparities arise due to the relationships between investigators and misconduct alleged officers. If true, it is likely that there is racial bias within the investigators being a factor in the aforementioned disparities.

Tables Used
- Columns "id", "race" from the table data_officer
- Columns "officer_id", "allegation_id" from the tabledata_officerallegation
- Columns "officer_id" from the tabletrr_trr
- Columns "investigator_id" from the tabledata_investigatorallegation

Analysis and Findings
Link to Colab Workbook

To start, we first wanted to see if any race officers are disproportionately alleged to have been in misconduct complaints. As shown in Table 6, 50% of the top 20 highly alleged officers were White, 35% of them were Black, and the rest 15% were Hispanic. Additionally, as shown in Table 7, the racial makeup of the police officers in the CPD is 49% are White, 25% were Hispanic and 21% of the officers were Black. There aren't many differences in these percentages(White: 50% High Misconduct Officers - 49% Officers, Hispanic: 15% High Misconduct Officers - 25% Officers, Black: 35% High Misconduct Officers - 21% Officers). This lack of significant differences in the makeups show that the problem is not straightforward.

As we infer from the above paragraph that the disparities aren't blatantly due to the race of the officers, we would move to see if the relationship between misconduct-alleged officer and respective investigator being a factor for the disparities.

```
|   id|off_race|allegation_count|
+-----+--------+----------------+
| 8562|   White|             175|
|21837|   Black|             137|
|17816|   White|             136|
| 8138|   Black|             132|
|21468|   White|             127|
|31631|   White|             121|
|29033|   White|             117|
|32166|   Black|             110|
| 4807|   Black|             109|
|32164|   Black|             106|
|31119|   White|             106|
| 2015|   White|             102|
|32265|   White|             102|
|10890|   Black|             102|
| 3897|   White|             100|
|11634|   White|              97|
|23265|Hispanic|              96|
|25306|Hispanic|              94|
|16567|Hispanic|              93|
|17041|   Black|              93|
```

Table 6: Highest misconduct alleged officers and their races

Race	# Officers	% Officers
White	3711	49.00%
Hispanic	1940	25.62%
Black	1648	21.76%
Asian/Pacific	253	3.34%
Native American/Alaskan Native	19	0.25%
Unknown	2	0.03%
Grand Total	7573	100.00%

Table 7: Racial Makeup of the CPD Officers

We plotted the officer-investigator pairs in Figure 4 below. We can see that most of these pairs are scattered across and not dense. However, at the center, we can see from the same figure that there are few networks of officer-investigator pairs which happen quite frequently.
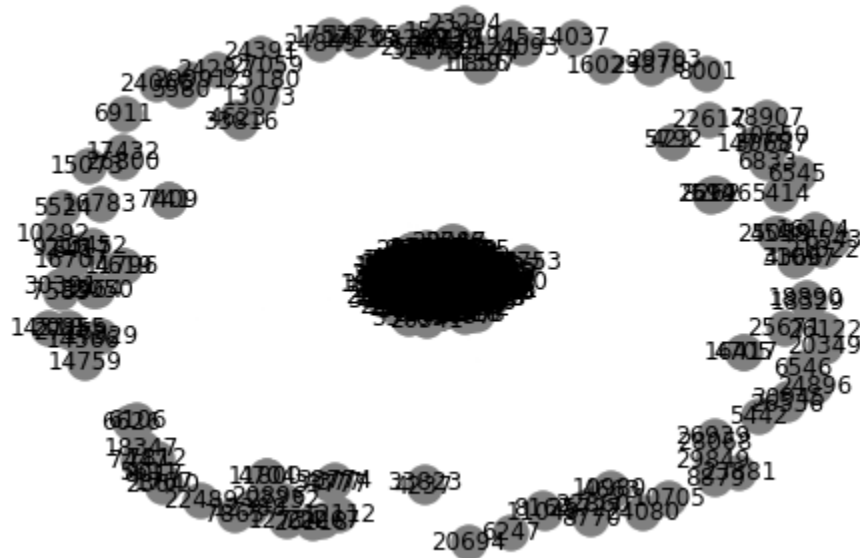
Figure 4: Investigator - Misconduct Alleged Officer Network

The top of these aforementioned dense relationships are shown in Table 8.

src	dst	relationship
2538	32166	24
3886	23841	24
3886	8562	23
2538	12478	21
1718	27415	20
3886	3454	20
3278	2725	20
2151	17041	19
1718	32016	19
1718	21098	19
2376	25898	19
3255	11266	18
2970	21887	17
3278	32164	17
1718	32172	17
3886	18076	17
3836	8386	17
3836	8620	16
2970	3764	16
2970	31853	16

Table 8: Investigator(src) - Misconduct Alleged Officer(dst) pair and their frequency

The pairs are basically formed predominantly between white officers and investigators, i.e. 9 relationships with over 10 misconduct allegations, whereas the number is low for Black, i.e. 4 relationships with over 10 misconduct allegations and all others 0. This shows that when white officers are in charge of the investigations things are expanding to multiple repeated allegations.

```
+-----+--------+
|   id|inDegree|
+-----+--------+
| 3764|     108|
|16385|      98|
| 8138|      88|
|25799|      87|
|17372|      87|
|11190|      87|
| 3808|      86|
| 3897|      85|
| 8562|      85|
|31631|      84|
|32265|      83|
|12074|      82|
|21468|      81|
|15228|      80|
| 9309|      79|
| 4118|      79|
|31882|      74|
| 5193|      74|
|17647|      74|
|25963|      73|
+-----+--------+
```

Some officers have a high indegree, i.e, most of the repeated allegations are caused by these officers shown in Table 9.

Additionally, there are common officers between Table 9(High misconduct having officers) and Table 9(dst column with investigator-officer pairs), for example, officer_ids 3764, 8562. These officers' repeated allegations patterns could be a factor in the disparity in the way internal and external complaints are handled. If we consider these officers being part of a network, external complaints are not given the proper attention causing the offending pattern to repeat over-and-over-again.

Table 9: High Indegree officers

Question 2 Conclusion

1. There is no blatant disparity in the misconduct officers with respect to the racial makeup of the CPD
2. Most of the investigator-officer pairs are disparate. However, some of them are close and could be potential cause of the disparity in disciplinary actions
3. Some officers are highly likely to be associated with investigators and thus are likely suspects for repeat alleged offending patterns, probably causing the disparity in the way internal and external complaints are handled

Final Conclusion

As we have stated before, incentives and disciplinary actions hold an important place in the working of any organization, police departments included. And a bias in these systems could affect the quality of policing. In the above two questions, we have investigated the possible reasons for this bias through:
- Awardee - Requestor relationships
- Officer with alleged misconduct - investigator relationships

Our analysis showed that there is indeed a bias among the requestors who are nominating officers for the awards and among the investigators who are investigating the disciplinary complaints against the officers. The findings are given in more detail in the respective conclusions of each section. Now that we found these factors, we can think of possible ways to curb the bias in incentives and punishments of officer in the CPD.