**Introduction**

In accordance with New York State laws, the New York City Police Department reports reported crime and offense data. The law categories are summarized into three law categories: felony, misdemeanor and violation, which are further subdivided into broad crime and offense categories such as Murder, Rape, Robbery and etc. Please refer to NYPD website[[1]](#footnote-1) for detailed info about the data collection.

In our project, we choose data of seven major felony offenses of five boroughs of New York City in 2019. There are 77 observations with 8 variables including Precinct, reported incidents of Murder & Non Negl. Manslaughter, Rape, Robbery, Felony Assault, Grand Larceny and Grand Larceny of Motor Vehicle. We labeled boroughs as M= Manhattan, X = Bronx, K = Brooklyn, Q = Queens, S = Staten Island. Using this dataset, we conducted MAOVA analysis, Discriminant analysis, PCA and Factor analysis to evaluate the difference of five boroughs in terms of felony offenses.

**MANOVA**

As five boroughs of New York City have different in terms of populations, GDP, density and etc., we expected that the reported incidents would different across boroughs. Therefore, before applying other analysis, we conducted a MANOVA test to access whether five boroughs are significantly different in terms of those seven felony offenses. In the MANOVA test, p = 7 (seven felony offenses), k = 5 (five boroughs of New York City).

As p-values are smaller than 0.05, all four MANOVA tests reject , including Wilk’s test, Roy’s test, Phillai’s test, and Lawley-Hotelling test. We concluded that five boroughs are significantly different in terms of seven major felony offenses, which aligned with our expectations. Among five boroughs of New York City, people always make comparison between Brooklyn and Queens, and keep saying that Bronx has a lowest community security. To test whether Brooklyn is different from Queens in terms of felony, and whether Bronx is different from the other 4 boroughs, we further conduct two contrast tests. According to the test results, we fail to reject the null hypothesis of the test Brooklyn vs Queens, indicating that there is no significant difference between these two boroughs. However, we reject the null hypothesis of Bronx being same as other four boroughs. Detailed test statistics could be found in **Appendix A.**

**Appendix A MANOVA test**

A screenshot of a cell phone

Description automatically generated

**Contrast: Brooklyn vs. Queens**

A screenshot of a cell phone

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**Contrast: Bronx vs. the other 4 Boroughs**

A screenshot of a cell phone

Description automatically generated

**SAS Code**

**DATA** NYC\_Felony;

INFILE 'MV.DAT';

INPUT Borough $ Precinct Murder Rape Robbery Assault Burglary Larceny LarcenyOfAutomotives;

**PROC** **GLM**;

CLASS Borough;

MODEL Murder Rape Robbery Assault Burglary Larceny LarcenyOfAutomotives = Borough;

MANOVA H=Borough/PRINTE PRINTH;

CONTRAST 'Brooklyn vs. Queens'

Borough **0** **0** **1** -**1** **0**;

CONTRAST 'Bronx vs. the other 4 Boroughs'

Borough -**1** **4** -**1** -**1** -**1**;

MANOVA H=Borough/PRINTE PRINTH;

**RUN**;

1. https://www1.nyc.gov/site/nypd/stats/crime-statistics/historical.page [↑](#footnote-ref-1)