

Appendix A:

The following represents the Python code to parse average daily station activity in Houston.

This same methodology was replicated in both Austin and San Antonio datasets as well.

```
import csv
import json
import geocoder
from datetime import datetime
from os import path
data_path = ("HoustonBikeShareData")
data_files = os.listdir(data_path)

def mapLocations():
    import re
    fileName = "locationMap.pkl"
    if path.exists(fileName):
        df = pd.read_pickle(fileName)
    else:
        with open("scraped_locations.txt") as f:
            text = f.read()
            points = re.findall(r"LatLng\((.*?)\)", text)
            names = re.findall(r"<h5>(.*?)</h5>", text)
            data = [[name, point, latlng2geo(point)] for name, point in zip(names, points)]
            df = pd.DataFrame(data=data, columns=['Location', 'LatLng', 'postcode'])
            df.to_pickle("locationMap.pkl")
    df.set_index(["Location"])
    return df

def read_data():
    dfs = []
    for file in data_files:
        dfs.append(pd.read_csv(path.join(data_path, file), encoding='latin1'))
    df = pd.concat(dfs)
    del df["UserProgramName"], df["TripProgramName"], df["LocalProgramFlag"],
df["UserCity"], \
df["UserState"], df["MembershipType"], df["TripOver30Mins"], df["UserCountry"],
df["BikeType"], \
df["AdjustmentFlag"], df["AdjustedDurationMins"]
df = df[df["UserRole"] != "Maintenance"]
df["CheckoutTime"] = df["CheckoutDateLocal"] + " " + df["CheckoutTimeLocal"]
df["CheckoutTime"] = pd.to_datetime(df["CheckoutTime"])
df["ReturnTime"] = df["ReturnDateLocal"] + " " + df["ReturnTimeLocal"]
```

```

df["ReturnTime"] = pd.to_datetime(df["ReturnTime"])
location = mapLocations()
df = df[df["CheckoutKioskName"].isin(location["Location"])]
df=df[df["ReturnKioskName"].isin(location["Location"])]
return df
def latlng2geo(latlng):
    return geocoder.google(latlng, method="reverse").postal
bike = read_data()
checkout = bike["CheckoutKioskName"].value_counts()
checkin = bike["ReturnKioskName"].value_counts()
total = checkout + checkin
bike['Date'] = pd.to_datetime(bike['CheckoutDateLocal'])
date = bike['Date']
opening = bike['Date'].groupby(bike['CheckoutKioskName']).min()
closing = bike['Date'].groupby(bike['CheckoutKioskName']).max()
import datetime
daysinop0 = closing - opening

```

Appendix B:

Table B1: Kernel Density Function by Indicator

Indicator	Kernel Density Method	Search Radius	Raster Output Cell	Austin	San Antonio	Houston
Population by Census		400				
Block Group (CBG)	Point Centroid	meters	50 meters	X	X	X
Housing Units per CBG	Point Centroid	400	50 meters	X	X	X
Non-SOV Commuter		400				
Mode Count per CBG	Point Centroid	meters	50 meters	X	X	X
Ratio of Renters to		400				
Home Owners by CBG	Point Centroid	meters	50 meters	X	X	X
Employment Density	Point Centroid	400	50 meters	X	X	X
Restaurant Density	Point	meters	50 meters	X	-	-
Length of High Comfort		1600				
Bikeways	Line	meters	50 meters	X	X	X
Length of High or		1600				
Medium Comfort		400				
Bikeways	Line	meters	50 meters	X	X	X
Length of Sidewalk	Line	meters	50 meters	X	X	-
Parkland Area	Point Centroid	meters	50 meters	X	X	X
Major Road Length	Line	400	50 meters	X	X	X

		meters	400			
Minor Road Length	Line	meters	50 meters	X	X	X
Transit Route Density	Line	meters	50 meters	X	-	X
Walkscore	n/a	n/a	n/a	-	-	-
Transitscore	n/a	n/a	n/a	-	-	-
Bikescore	n/a	n/a	n/a	-	-	-

Table B2: Average Kernel Density Value by Indicator

Indicator	Austin	San Antonio	Houston
Population	1940.7	1188.4	2154.5
Housing Units	1159.3	608.7	1279.6
Employment	17856.4	6370.1	15673.8
Major Road	6.3	11.2	4.7
Minor Road	13.6	11.2	12.5
Sidewalk	15.6	10.3	n/a
Park Area	0.1	5.3	14.0
High-Comfort Bikeway	1.9	1.1	1.1
High-Medium Comfort Bikeway	6.0	1.8	1.4
Non-SOV Commuter	326.6	159.4	328.9
Owner-Renter Ratio	40.3	20.2	10.2
Transit Routes	72.4	n/a	8.6
Walkscore	85.4	66.7	80.1
Transitscore	62.9	65.2	79.8
Bikescore	92.8	69.3	74.5
Restaurants	94.4	n/a	n/a

Appendix C:

The following tables represent the univariate Pearson's R correlations among independent and dependent variables used to inform the stepwise regression.

Variable	Rest_dens	ANY_dist	Zkr_dist	Aust_dist	Conv_dist	APL_dist	Conv_dist	Cap_dist	bikescore	transitscore	walkscore	empdensSLD	coahc2k2	coahc2k1	parkareake	coasidewal	minordens	arterialsid	cmstrouted	hraticorek	popdens	nonsovdens	houders	AVG_ACT_DAILY
Rest_dens	1.0000	-0.4027	0.0301	-0.3231	-0.6353	-0.3227	-0.6298	-0.4297	0.1641	0.4336	0.5286	0.6734	0.0342	0.4358	-0.2843	0.4989	0.3665	0.6987	0.5519	-0.1400	-0.0027	0.1381	0.5758	0.2169
ANY_dist	-0.4027	1.0000	0.6390	0.7701	0.5989	0.8636	0.7977	0.6727	-0.0892	-0.3830	-0.0521	-0.8979	-0.3984	-0.8620	-0.1434	-0.2300	-0.1813	-0.5738	-0.8804	0.1870	0.1479	0.0640	-0.5746	-0.3815
Zkr_dist	0.0301	0.6390	1.0000	0.6226	-0.1179	0.7042	0.1799	0.0232	0.3805	-0.0241	0.4249	-0.1380	-0.6859	-0.3486	-0.7340	0.4125	0.4391	0.1513	0.1630	0.1695	0.2229	0.3109	-0.3010	-0.4748
Aust_dist	-0.3231	0.7701	0.6226	1.0000	0.5605	0.3223	0.7028	0.3569	-0.2941	-0.5487	-0.2075	-0.5062	-0.0388	-0.5629	-0.1099	-0.0374	0.2088	-0.2865	-0.3111	0.4213	0.3009	0.2375	-0.6863	-0.5282
Conv_dist	-0.6353	0.5989	-0.1179	0.5605	1.0000	0.5274	0.9274	0.7282	-0.5921	-0.7214	-0.6409	-0.7446	0.0295	-0.5254	0.5479	-0.7165	-0.5381	-0.8276	-0.7586	0.3078	0.1350	-0.0615	-0.8189	-0.1622
APL_dist	-0.3227	0.7042	0.3223	0.3223	0.5274	1.0000	0.7864	0.5452	-0.2718	-0.6437	-0.2226	-0.6408	-0.6427	-0.7499	-0.1375	-0.1892	0.0474	-0.4164	-0.4231	0.2614	0.1914	0.1099	-0.7017	-0.4313
Conv_dist	-0.6298	0.7977	0.1799	0.7028	0.9274	0.7864	1.0000	0.8651	-0.5188	-0.8465	-0.5867	-0.8936	-0.1523	-0.7376	0.3815	-0.7126	-0.4916	-0.8603	-0.8466	0.2011	0.0772	-0.1232	-0.7270	-0.1553
Cap_dist	-0.4297	0.6727	0.0232	0.3569	0.7282	0.5452	0.8651	1.0000	-0.4593	-0.8468	-0.4876	-0.8084	0.1615	-0.6320	0.4880	-0.8678	-0.7296	-0.8884	-0.9116	-0.1612	-0.2052	-0.4027	-0.5147	-0.1099
bikescore	0.1641	-0.0892	0.3805	-0.2941	-0.5921	-0.2718	-0.5188	-0.4593	1.0000	0.7163	0.8576	0.4113	0.0449	0.4256	-0.6927	0.5570	0.2792	0.4865	0.5508	-0.6220	0.1295	0.3190	0.3575	0.0073
transitscore	0.4336	-0.3830	-0.0521	-0.5487	-0.7214	-0.6437	-0.8465	-0.8468	0.7163	1.0000	0.6457	0.7967	0.0768	0.6274	-0.9521	0.7103	0.4193	0.7174	0.8613	0.1795	0.2763	0.4723	0.6895	0.0205
walkscore	0.5286	-0.0521	0.4249	-0.2075	-0.6409	-0.2226	-0.5687	-0.4876	0.8576	0.6457	1.0000	0.5197	-0.0841	0.4002	-0.7576	0.6800	0.4884	0.6209	0.5781	-0.0207	0.1396	0.3601	0.4460	-0.1046
empdensSLD	0.5734	-0.6979	-0.1380	-0.5962	-0.1146	-0.6408	-0.8936	-0.8084	0.4113	0.7967	0.5197	1.0000	0.1432	0.7362	-0.3192	0.7233	0.4884	0.3011	0.8467	-0.1608	-0.0850	0.1409	0.6844	0.0873
coahc2k2	0.0342	-0.3486	-0.6859	-0.6388	-0.0266	-0.6427	-0.1523	0.1615	0.0449	0.0759	-0.0841	0.1432	1.0000	0.5545	0.5813	-0.4196	0.6687	-0.1386	-0.1719	-0.3433	-0.3631	-0.3859	0.3255	0.6037
coahc2k1	0.4358	-0.8620	-0.3486	-0.5629	-0.5254	-0.7499	-0.7376	-0.6320	0.4096	0.6274	0.4002	0.7362	0.5545	1.0000	0.0087	0.4824	0.1759	0.6813	0.6133	-0.1872	-0.1806	-0.0163	0.5195	0.2607
parkareake	-0.2843	-0.1434	0.7340	-0.1099	0.5479	-0.1375	-0.3815	0.4880	-0.8927	-0.8261	-0.7016	-0.3192	0.6813	0.0087	1.0000	-0.7894	0.6616	-0.5296	0.5689	-0.2015	-0.3407	-0.5201	-0.2287	0.3778
coasidewal	0.4989	-0.3300	0.4125	-0.0374	-0.7165	-0.1892	-0.7126	-0.8678	0.5570	0.7103	0.6800	0.7233	-0.4196	0.4824	-0.7394	1.0000	0.8804	0.9002	0.8749	-0.1818	0.2470	0.4730	0.3627	-0.3073
minordens	0.3665	-0.1813	0.4391	0.2088	-0.5381	0.0474	-0.4916	-0.7296	0.2792	0.4193	0.4884	0.4884	-0.6687	0.1759	-0.6616	0.8804	1.0000	0.7516	0.6759	0.1528	0.2024	0.3769	0.1235	-0.4073
arterialsid	0.6687	-0.5738	0.1513	-0.2865	-0.8276	-0.4164	-0.8603	-0.8684	0.4865	0.7174	0.6209	0.9011	-0.1386	0.6813	-0.5095	0.9002	0.7516	1.0000	0.9178	-0.0595	-0.0241	0.2220	0.4835	-0.0315
cmstrouted	0.5519	-0.8804	0.1630	-0.3111	-0.7976	-0.4231	-0.8466	-0.9116	0.6506	0.8513	0.8781	0.8457	-0.1719	0.6133	-0.5859	0.8749	0.6779	0.9178	1.0000	0.1191	0.2023	0.4092	0.5191	-0.0307
hraticorek	-0.1400	0.1870	0.1695	0.4212	0.3078	0.0141	0.2011	-0.1612	0.0220	0.1795	-0.0207	-0.1608	-0.3433	-0.1872	-0.2015	0.1618	0.1526	-0.0265	0.1191	1.0000	0.9388	0.8895	-0.0187	0.2972
popdens	-0.0027	0.1479	0.2229	0.3009	0.1350	0.1914	0.0772	-0.2082	0.1295	0.2793	0.1396	-0.0850	-0.3631	-0.1806	-0.3407	0.2470	0.2024	-0.0241	0.2023	0.9388	1.0000	0.9486	0.1843	-0.2476
nonsovdens	0.1381	0.0640	0.3109	0.2375	-0.0615	0.1009	-0.1232	-0.4027	0.3190	0.4723	0.3601	0.1409	-0.3859	-0.0163	-0.5201	0.4730	0.3769	0.2220	0.4092	0.8895	0.9486	1.0000	0.3036	-0.2884
houders	0.5758	-0.5746	-0.3010	-0.6863	-0.6189	-0.7017	-0.7270	-0.5147	0.3575	0.6895	0.4460	0.5005	0.5135	-0.2397	0.3627	0.1235	0.4835	-0.0187	0.1843	0.3006	1.0000	0.3006	0.0000	0.2970
AVG_ACT_DAILY	0.2169	-0.3815	-0.4748	-0.5282	-0.1822	-0.4313	-0.1933	0.1099	0.0073	0.0205	-0.1046	0.0873	0.6037	0.2607	0.3778	-0.3073	-0.4073	-0.0315	0.0307	-0.2973	-0.2476	-0.2884	0.2970	1.0000

Figure C1: Austin, TX Pearson's R bivariate correlation table.

Correlation Coefficients Matrix														
Variable	houdens	nonsovdens	popdens2	SLDempdens2	cosaroaddens	sidewalkdens	parkclipdens2	hmcndens	bikelanedens	hcbikedensclip	walkscore	TransitScore	Bikescore	daily_act
houdens	1.0000	0.8059	0.7618	0.5670	0.6147	0.5791	-0.3354	-0.3475	0.5449	-0.6287	0.7949	0.5877	0.4139	-0.2262
nonsovdens	0.8059	1.0000	0.8221	0.2979	0.4225	0.4558	-0.0981	0.0078	0.3999	-0.2612	0.5898	0.3522	0.4810	-0.2157
popdens2	0.7618	0.8221	1.0000	0.0362	0.1824	0.1847	-0.2626	-0.3092	0.0582	-0.2730	0.3848	0.1139	0.2230	-0.0625
SLDempdens2	0.5670	0.2979	0.0362	1.0000	0.8074	0.6985	-0.1259	-0.0830	0.8176	-0.6135	0.7287	0.8534	0.3146	-0.2115
cosaroaddens	0.6147	0.4225	0.1824	0.8074	1.0000	0.9513	-0.2270	-0.1347	0.7832	-0.6263	0.7753	0.7185	0.3763	-0.2799
sidewalkdens	0.5791	0.4558	0.1847	0.6985	0.9513	1.0000	-0.2074	-0.0675	0.7445	-0.5412	0.7212	0.6129	0.3891	-0.2848
parkclipdens2	-0.3354	-0.0981	-0.2626	-0.1259	-0.2270	-0.2074	1.0000	0.7413	-0.2610	0.7420	-0.2553	-0.1943	-0.1236	0.0013
hmcndens	-0.3475	0.0078	-0.3092	-0.0830	-0.1347	-0.0675	0.7413	1.0000	0.0308	0.7415	-0.2133	-0.1054	0.1609	-0.0764
bikelanedens	0.5449	0.3999	0.0582	0.8176	0.7832	0.7445	-0.2610	0.0308	1.0000	-0.6474	0.7444	0.8163	0.4406	-0.2876
hcbikedensclip	-0.6287	-0.2612	-0.2730	-0.6135	-0.6263	-0.5412	0.7420	0.7415	-0.6474	1.0000	-0.6605	-0.6286	-0.1729	0.1333
walkscore	0.7949	0.5898	0.3848	0.7287	0.7753	0.7212	-0.2553	-0.2133	0.7444	-0.6605	1.0000	0.7770	0.6322	-0.3019
TransitScore	0.5877	0.3522	0.1139	0.8534	0.7185	0.6129	-0.1943	-0.1054	0.8163	-0.6286	0.7770	1.0000	0.4675	-0.3015
Bikescore	0.4139	0.4810	0.2230	0.3146	0.3763	0.3891	-0.1236	0.1609	0.4406	-0.1729	0.6322	0.4675	1.0000	-0.2002
daily_act	-0.2262	-0.2157	-0.0625	-0.2115	-0.2799	-0.2848	0.0013	-0.0764	-0.2876	0.1333	-0.3019	-0.3015	-0.2002	1.0000

Figure C2: San Antonio, TX Pearson's R bivariate correlation table.

Correlation Coefficients Matrix															
Variable	localbusdeen	Parkdens2miles	majorroaddens	colparkdens	hcbikedens	hcmcbikedens	houdens	nonsovdens	popdens	minorroaddens	empdensSLD	walkscore	transitscore	bikescore	avg_daily
localbusdeen	1.0000	-0.3386	0.5383	-0.2082	0.2514	-0.2549	-0.6023	-0.5441	-0.7053	0.1956	0.9613	0.1389	0.2659	0.1655	0.1590
Parkdens2miles	-0.3386	1.0000	-0.1986	0.8720	0.5366	0.5749	0.1477	-0.0768	0.0769	-0.6597	-0.3504	-0.1965	-0.0123	0.0490	0.1073
majorroaddens	0.5383	-0.1986	1.0000	-0.2339	0.2191	-0.1389	-0.3245	-0.2073	-0.4331	-0.0616	0.4450	0.3426	0.4216	0.3384	0.3989
colparkdens	-0.2082	0.8720	-0.2339	1.0000	0.6525	0.6301	-0.0839	-0.2330	-0.1016	-0.7333	-0.1625	-0.3598	-0.1176	-0.0831	0.0715
hcbikedens	0.2514	0.5366	0.2191	0.6525	1.0000	0.7017	-0.5244	-0.5657	-0.4354	-0.8267	0.2923	-0.0362	0.1676	0.0478	0.2557
hcmcbikedens	-0.2549	0.5749	-0.1389	0.6301	0.7017	1.0000	-0.1586	-0.1378	0.0352	-0.8267	-0.1347	-0.1273	0.0636	-0.1504	0.0722
houdens	-0.6023	0.1477	-0.3245	-0.0839	-0.5244	-0.1586	1.0000	0.8708	0.8968	0.3098	-0.6535	0.0509	-0.1488	-0.1380	-0.1109
nonsovdens	-0.5441	-0.0768	-0.2073	-0.2330	-0.5657	-0.1378	0.8708	1.0000	0.8046	0.3701	-0.5660	0.0524	-0.0732	-0.1191	-0.2386
popdens	-0.7053	0.0769	-0.4331	-0.1016	-0.4354	0.0352	0.8968	0.8046	1.0000	0.1440	-0.7170	0.0609	-0.1239	-0.1930	-0.2088
minorroaddens	0.1956	-0.6597	-0.0616	-0.7333	-0.8267	-0.8267	0.3098	0.3701	0.1440	1.0000	0.1369	0.0757	-0.0615	-0.0186	-0.2625
empdensSLD	0.9613	-0.3504	0.4450	-0.1625	0.2923	-0.1347	-0.6535	-0.5660	-0.7170	0.1369	1.0000	0.0729	0.2454	0.0965	0.1291
walkscore	0.1389	-0.1965	0.3426	-0.3598	-0.0362	-0.1273	0.0509	0.0524	0.0609	0.0757	0.0729	1.0000	0.5324	0.1836	0.1250
transitscore	0.2659	-0.0123	0.4216	-0.1176	0.1676	0.0636	-0.1488	-0.0732	-0.1239	-0.0615	0.2454	0.5324	1.0000	0.2256	0.0339
bikescore	0.1655	0.0490	0.3384	-0.0831	0.0478	-0.1504	-0.1380	-0.1191	-0.1930	-0.0186	0.0965	0.1836	0.2256	1.0000	-0.0339
avg_daily	0.1590	0.1073	0.3989	0.0715	0.2557	0.0722	-0.1109	-0.2386	-0.2088	-0.2625	0.1291	0.1250	0.0339	-0.0339	1.0000

Figure C3: Houston, TX Pearson's R bivariate correlation table.

Limitations of Analysis:

Census Block groups did not provide the granularity of data required for this analysis. As such, kernel density function was employed to create an artificially interpolated variation among station values. These values represent a statistical best guess of the value of the indicator at this particular pixel, but this could differ widely from block to block in a real urban environment. Secondly, not all independent variable datasets were able to be acquired in all three cities. Thirdly, due to data accessibility constraints, the data analyzed is from different time periods and spans for each of the three cities. A fuller dataset drawn from equivalent time frames would provide for a better comparative analysis while bolstering the explanatory power of the regression analysis. This is the first study of this kind performed focusing on recreation-oriented small to medium sized bike-share system in the cities with such minimal bicycle commute shares. An interesting follow-up study might include employing a similar methodology to correlate tourism-related factors with bike-share system usage.

Appendix D:

Table D1: Dependent Variable Descriptive Statistics

	Dependent Variable	N	Max	Min	Mean	S.D.	Median
Austin	Daily Avg. Station Activity (All Days)	55	42.2	3.8	19.0	10.7	17.1
	Daily Avg. Station Activity (Weekend)	55	69.1	4.2	23.0	14.7	18.9
	Daily Avg. Station Activity (Weekday)	55	27	3.1	11.7	6	10.6
San Antonio	Daily Avg. Station Activity (All Days)	55	42	2.3	13.1	8.8	10.8
	Daily Avg. Station Activity (Weekend)	55	64.8	3.1	18.4	13.3	15.3
	Daily Avg. Station Activity (Weekday)	55	30.7	4.3	12.2	56	10.5
Houston	Daily Avg. Station Activity (All Days)	33	86.8	1.4	18.4	18.7	11.3
	Daily Avg. Station Activity (Weekend)	33	126.1	4.2	27.3	28.8	15.5
	Daily Avg. Station Activity (Weekday)	33	12.2	1.6	4.4	2.9	3.4

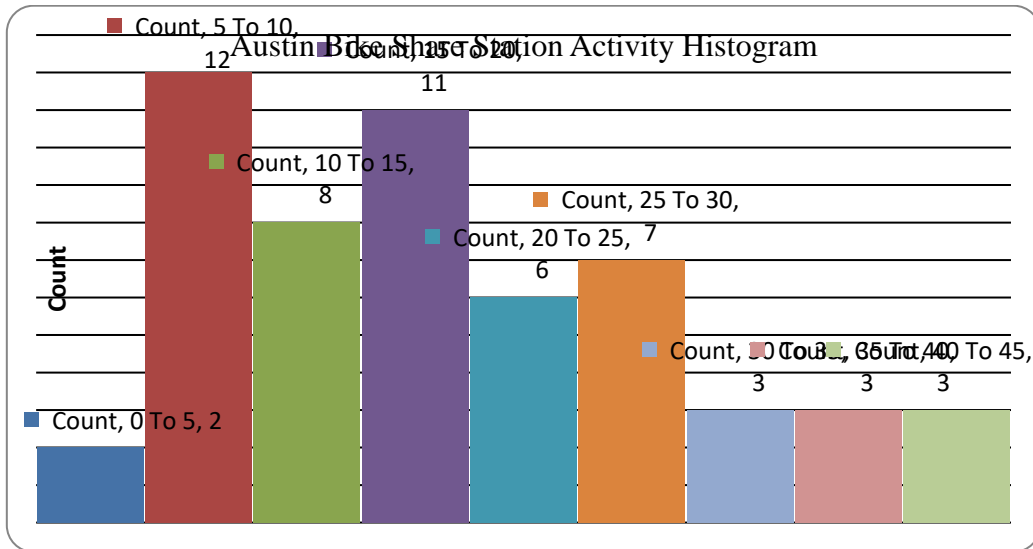


Figure D1: Austin Bike Share Station Activity Histogram

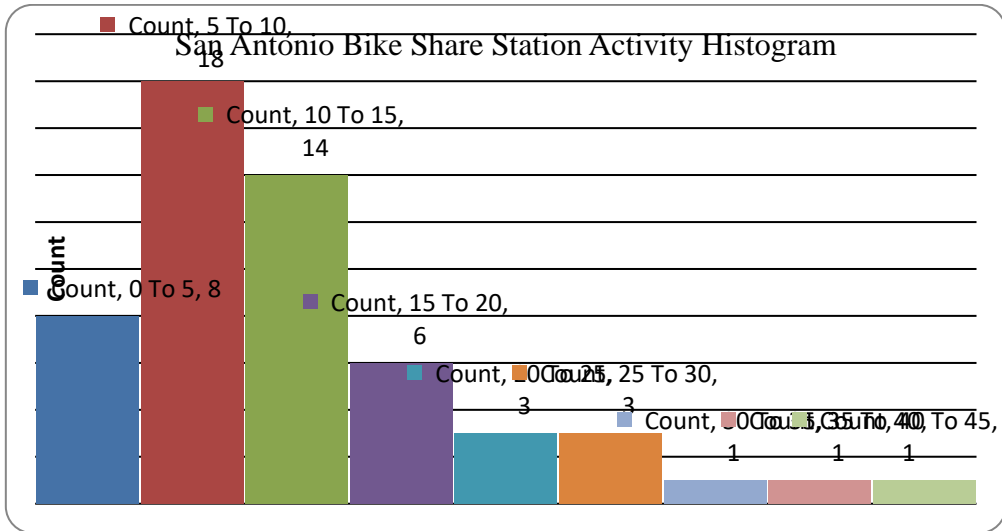


Figure D2: San Antonio Bike Share Station Activity Histogram

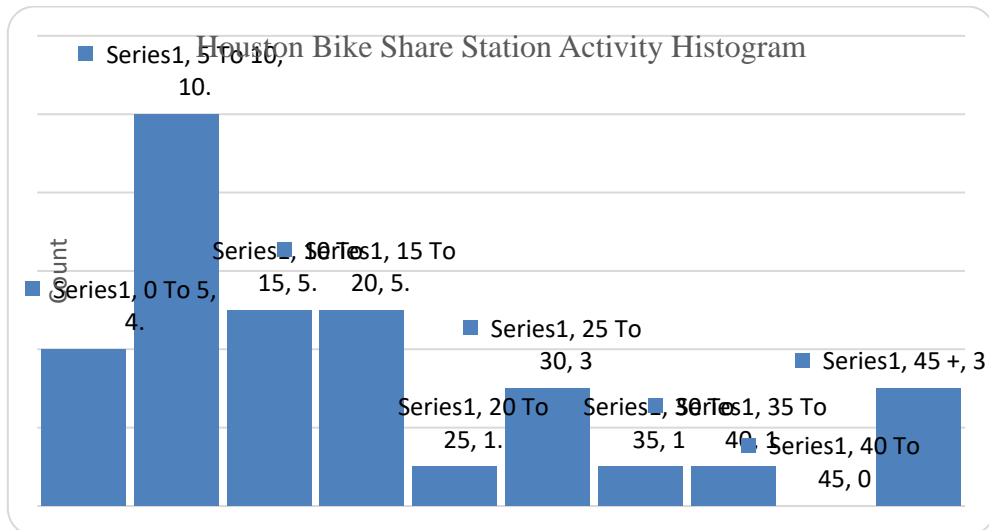


Figure D3: Houston Bike Share Station Activity Histogram