

# A Cool Treat in a Warm Paradise

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## 1 | Introduction

### 1 | 1 Background

Barbados; a tropical nation at the edge of the Eastern Caribbean. Though small in size (with an area of approximately 166 square miles), it makes up for its small size with its big waves of heat. Despite its heat, thousands of tourists visit Barbados for its tropical climate, white sandy beaches & scrumptious delicacies annually.

With this in mind, an aspiring entrepreneur has decided to open a shop to sell ice cream to tourists and locals alike with unique Barbadian flavours like tamarind, Mount Gay Rum, Mauby, etc.

### 1 | 2 Problem

An aspiring entrepreneur is interested in opening an ice cream shop in the small island nation of Barbados. This project aims to determine the best parish to open an ice cream shop based on population size and nearby competition.

## 2 | Data Acquisition & Cleaning

### 2 | 1 Data Sources

The main source of data comes from the [Parishes of Barbados](#) Wikipedia page (this was the only information available for analysis). The table containing the information of the 11 parishes of Barbados was scraped using the **BeautifulSoup** library and analyzed. We chose this particular table mainly for its **Parish (short name)**, **Capitals** and **Population (Census 2010)** columns.

- **Parish (short name)** - This column contains the names of the eleven parishes of Barbados. These names will also work in tandem with the Foursquare location data.
- **Capitals** - This column contains the capital of each parish.
- **Population (Census 2010)** - This column contains the population of Barbados per parish from the year 2010.

### 2 | 2 Data Cleaning

The raw data is a **pandas** dataframe consisting of 12 rows and 8 columns (*see Fig. 2.1*).

Nr.	Parish	Official Long Name	Capitals	Land Area	Population (2010 Census)	Density	Historic Vestry
1	Christ Church	The Parish of Christ Church[6]	Oistins	57	54,336	868.4	Lead church of the Parish.
2	St. Andrew	The Parish of Saint Andrew[7]	Greenland	36	5,139	145.9	Lead church of the Parish.
3	St. George	The Parish of Saint George	Bulkeley	44	19,767	406.1	None
4	St. James	The Parish of Saint James[7]	Holetown	31	28,498	733.6	None
5	St. John	The Parish of Saint John	Four Roads	34	8,963	261.0	Lead church of the Parish.
6	St. Joseph	The Parish of Saint Joseph[7]	Bathsheba	26	6,620	261.7	Lead church of the Parish.
7	St. Lucy	The Parish of Saint Lucy[7]	Crab Hill	36	9,758	259.1	None
8	St. Michael	The Parish of Saint Michael[7]	Bridgetown	39	88,529	2,145.7	None
9	St. Peter	The Parish of Saint Peter	Speightstown	34	11,300	314.7	Lead church of the Parish.
10	St. Philip	The Parish of Saint Philip[7]	Crane	60	30,662	342.3	None
11	St. Thomas	The Parish of Saint Thomas	Hillaby	34	14,249	340.9	None
Barbados	Bridgetown	432	277,821	580.1	♦	None	None

**Fig. 2.1** Raw dataframe containing the Parishes of Barbados

The columns (**Nr.**, **Official Long Name**, **Land Area**, **Density**, **Historic Vestry**) and the bottom row have been deleted (*see Fig. 2.2*).

	Parish	Capitals	Population (2010 Census)
0	Christ Church	Oistins	54,336
1	St. Andrew	Greenland	5,139
2	St. George	Bulkeley	19,767
3	St. James	Holetown	28,498
4	St. John	Four Roads	8,963
5	St. Joseph	Bathsheba	6,620
6	St. Lucy	Crab Hill	9,758
7	St. Michael	Bridgetown	88,529
8	St. Peter	Speightstown	11,300
9	St. Philip	Crane	30,662
10	St. Thomas	Hillaby	14,249

*Fig 2.2 Unnessecary columns and row deleted*

Next, the coordinates of each parish were retrieved using the **Nominatim** library and then placed into its own dataframe (*see Fig. 2.3*).

	Latitude	Longitude
0	13.150033	-59.525030
1	13.248905	-59.575714
2	13.146904	-59.547892
3	13.187890	-59.628104
4	13.157913	-59.504316
5	13.197636	-59.545423
6	13.304229	-59.614320
7	13.118029	-59.600986
8	13.261403	-59.619967
9	13.150033	-59.525030
10	13.179373	-59.586824

*Fig. 2.3 Dataframe containing the coordinates of each parish*

Finally, the two dataframes were merged into one dataframe (*see Fig. 2.4*).

	Parish	Capitals	Population (2010 Census)	Latitude	Longitude
0	Christ Church	Oistins	54,336	13.150033	-59.525030
1	St. Andrew	Greenland	5,139	13.248905	-59.575714
2	St. George	Bulkeley	19,767	13.146904	-59.547892
3	St. James	Holetown	28,498	13.187890	-59.628104
4	St. John	Four Roads	8,963	13.157913	-59.504316
5	St. Joseph	Bathsheba	6,620	13.197636	-59.545423
6	St. Lucy	Crab Hill	9,758	13.304229	-59.614320
7	St. Michael	Bridgetown	88,529	13.118029	-59.600986
8	St. Peter	Speightstown	11,300	13.261403	-59.619967
9	St. Philip	Crane	30,662	13.150033	-59.525030
10	St. Thomas	Hillaby	14,249	13.179373	-59.586824

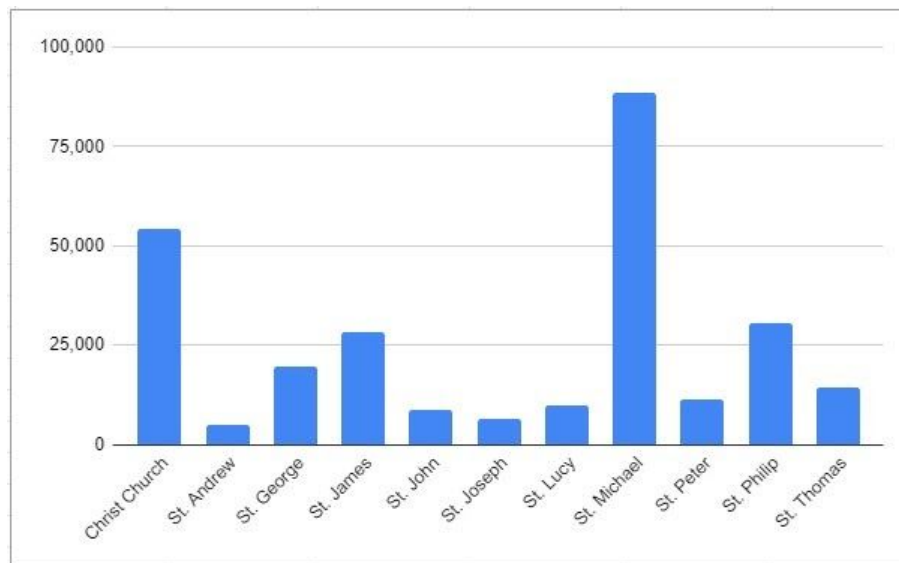
***Fig 2.4 The final dataframe***

### 3 | Methodology

#### 3 | 1 Exploratory Analysis

##### 3 | 1 | 1 Population Distribution by Parish (2010)

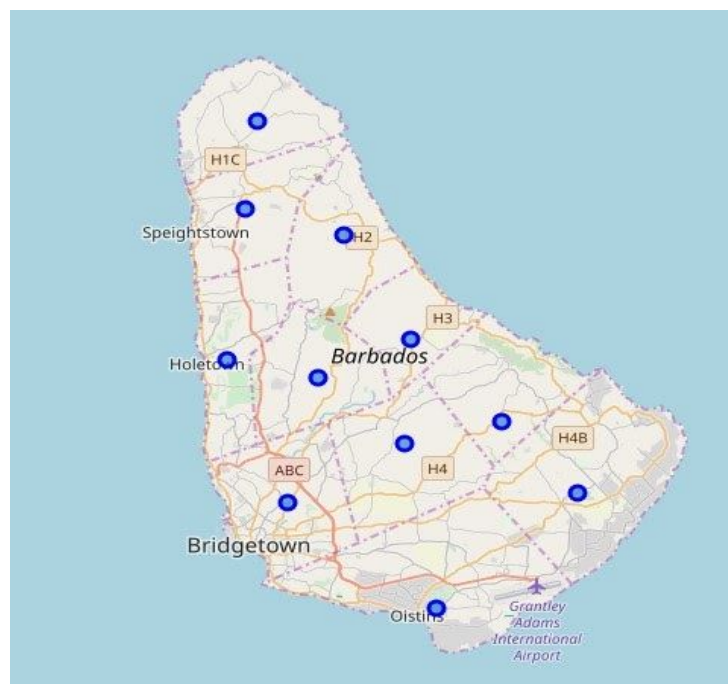
Looking at the population distribution, it is clear that St. Michael has the highest population of the 11 parishes (at 88,529), followed by Christ Church (with 54,336) and the lowest populated parish being St. Andrew (at 5,139) (*see Fig. 3.1*).



***Fig. 3.1 Population Distribution by Parish (2010)***

### 3 | 1 | 2 Map of Barbados

There are eleven parishes in Barbados. A map was generated using the **Folium** library displaying a node for each parish(see Fig 3.2).



***Fig. 3.2 Map of Barbados***

### 3 | 1 | 3 Venues in Each Parish using Foursquare Data

After connecting to Foursquare, a function called **getNearbyVenues** was created to retrieve the venues in each parish and input the data into a new dataframe (*see Fig. 3.3*).

	Parish	Parish Latitude	Parish Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Christ Church	13.06667	-59.53333	Enterprise/Miami Beach	13.060394	-59.539852	Beach
1	Christ Church	13.06667	-59.53333	Oistins Fish Fry	13.063553	-59.542639	Seafood Restaurant
2	Christ Church	13.06667	-59.53333	Pat's Place	13.063469	-59.542630	Caribbean Restaurant
3	Christ Church	13.06667	-59.53333	Fred's Bar	13.063560	-59.542452	Caribbean Restaurant
4	Christ Church	13.06667	-59.53333	Mr. Delicious Snack Bar	13.078572	-59.528693	Food Truck
5	Christ Church	13.06667	-59.53333	Cafe Luna	13.059421	-59.538004	Restaurant
6	Christ Church	13.06667	-59.53333	chillin & grillin	13.063441	-59.542947	Seafood Restaurant
7	Christ Church	13.06667	-59.53333	Oistins Fish Market	13.063556	-59.542722	Fish Market
8	Christ Church	13.06667	-59.53333	Oistins Bay Garden	13.063511	-59.542559	Other Nightlife
9	Christ Church	13.06667	-59.53333	Uncle George's Fish Net Grill	13.063589	-59.542981	Seafood Restaurant

***Fig. 3.3 Venues in Each Parish***

### 3 | 1 | 4 Ice Cream Shop Venues

The data pulled from Foursquare only returned 2 ice cream shops, because of this, data had to manually typed into a .csv file from information found on Google Map and read into a dataframe using the **panda.read\_csv** function (*see Fig. 3.4*).

	Parish	Parish Latitude	Parish Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Christ Church	13.066670	-59.533330	Chefette	13.074406	-59.588523	Ice Cream Shop
1	St. James	13.187890	-59.628104	Chefette	13.200587	-59.615367	Ice Cream Shop
2	St. Philip	13.122874	-59.469571	Chefette	13.117160	-59.476180	Ice Cream Shop
3	St. Michael	13.118029	-59.600986	Chefette	13.117091	-59.617039	Ice Cream Shop
4	St. Michael	13.118029	-59.600986	Chefette	13.096970	-59.615466	Ice Cream Shop
5	St. Thomas	13.179373	-59.586824	Chefette	13.154219	-59.611567	Ice Cream Shop
6	St. George	13.146904	-59.547892	Chefette	13.129086	-59.569922	Ice Cream Shop
7	Christ Church	13.066670	-59.533330	Chefette	13.080162	-59.487813	Ice Cream Shop
8	St. James	13.187890	-59.628104	Chillz Delight Treats	13.162094	-59.636862	Ice Cream Shop
9	Christ Church	13.066670	-59.533330	Cafe de Paris	13.065909	-59.563326	Ice Cream Shop
10	Christ Church	13.066670	-59.533330	Magnolia Chocolatier	13.075704	-59.539721	Ice Cream Shop

***Fig. 3.4 Manually scraped Ice Cream Shop data***

The manually scraped dataframe was then concatenated with the data retrieved from Foursquare containing information of the ice cream shops of Barbados (*see Fig. 3.5*).



	Parish	Parish Latitude	Parish Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
266	St. Michael	13.118029	-59.600986	Chilly Moos Ice Cream Treatery	13.075227	-59.589527	Ice Cream Shop
241	St. Michael	13.118029	-59.600986	Chefette	13.091495	-59.585205	Ice Cream Shop
0	Christ Church	13.066670	-59.533330	Chefette	13.074406	-59.588523	Ice Cream Shop
1	St. James	13.187890	-59.628104	Chefette	13.200587	-59.615367	Ice Cream Shop
2	St. Philip	13.122874	-59.469571	Chefette	13.117160	-59.476180	Ice Cream Shop
3	St. Michael	13.118029	-59.600986	Chefette	13.117091	-59.617039	Ice Cream Shop
4	St. Michael	13.118029	-59.600986	Chefette	13.096970	-59.615466	Ice Cream Shop
5	St. Thomas	13.179373	-59.586824	Chefette	13.154219	-59.611567	Ice Cream Shop
6	St. George	13.146904	-59.547892	Chefette	13.129086	-59.569922	Ice Cream Shop
7	Christ Church	13.066670	-59.533330	Chefette	13.080162	-59.487813	Ice Cream Shop
8	St. James	13.187890	-59.628104	Chillz Delight Treats	13.162094	-59.636862	Ice Cream Shop
9	Christ Church	13.066670	-59.533330	Cafe de Paris	13.065909	-59.563326	Ice Cream Shop
10	Christ Church	13.066670	-59.533330	Magnolia Chocolatier	13.075704	-59.539721	Ice Cream Shop

***Fig. 3.5 Final Ice Cream Shop Data Concatenated***

The final ice cream shop dataframe was then concatenated with the accumulated dataframe retrieved from Foursquare. This dataframe was then cleaned (*see Fig. 3.6*).

	Parish	Parish Latitude	Parish Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Christ Church	13.066670	-59.533330	Enterprise/Miami Beach	13.060394	-59.539852	Beach
1	Christ Church	13.066670	-59.533330	Oistins Fish Fry	13.063553	-59.542639	Seafood Restaurant
2	Christ Church	13.066670	-59.533330	Pat's Place	13.063469	-59.542630	Caribbean Restaurant
3	Christ Church	13.066670	-59.533330	Fred's Bar	13.063560	-59.542452	Caribbean Restaurant
4	Christ Church	13.066670	-59.533330	Mr. Delicious Snack Bar	13.078572	-59.528693	Food Truck
...	...	...	...	...	...	...	...
6	St. George	13.146904	-59.547892	Chefette	13.129086	-59.569922	Ice Cream Shop
7	Christ Church	13.066670	-59.533330	Chefette	13.080162	-59.487813	Ice Cream Shop
8	St. James	13.187890	-59.628104	Chillz Delight Treats	13.162094	-59.636862	Ice Cream Shop
9	Christ Church	13.066670	-59.533330	Cafe de Paris	13.065909	-59.563326	Ice Cream Shop
10	Christ Church	13.066670	-59.533330	Magnolia Chocolatier	13.075704	-59.539721	Ice Cream Shop

***Fig. 3.6 Final Data Accumulated with Ice Cream Shop Data***

### 3 | 2 Modelling

It was decided that a K-Means Cluster algorithm would be used to categorize the data by the amount of ice cream shops within each parish.



First, the data was one hot encoded with the **pandas.get\_dummies** function and normalized using the **mean** attribute grouping by each parish (see Fig. 3.7).

	Parish	Airport Terminal	American Restaurant	Art Gallery	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Automotive Shop	BBQ Joint	Bakery	...	Spa	Sports Bar	Steakhouse	Supermarket
0	Christ Church	0.010101	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010101	0.000000	...	0.000000	0.010101	0.010101	0.03030
1	St. Andrew	0.000000	0.000000	0.000000	0.000000	0.000000	0.100000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00000
2	St. George	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.066667	0.133333	...	0.000000	0.000000	0.000000	0.00000
3	St. James	0.000000	0.028986	0.000000	0.014493	0.014493	0.000000	0.000000	0.000000	0.014493	...	0.000000	0.000000	0.000000	0.02898
4	St. John	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.125000	0.000000	...	0.000000	0.000000	0.000000	0.00000
5	St. Joseph	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.050000	0.000000	...	0.000000	0.000000	0.000000	0.00000
6	St. Lucy	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00000
7	St. Michael	0.000000	0.009615	0.000000	0.000000	0.019231	0.000000	0.009615	0.019231	0.038462	...	0.000000	0.019231	0.000000	0.01923
8	St. Peter	0.000000	0.000000	0.033333	0.000000	0.000000	0.033333	0.000000	0.000000	0.033333	...	0.033333	0.000000	0.000000	0.00000
9	St. Philip	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.03846
10	St. Thomas	0.000000	0.046512	0.000000	0.023256	0.000000	0.000000	0.000000	0.000000	0.023256	...	0.000000	0.023256	0.000000	0.04651

**Fig. 3.7 Data Normalized for Clustering**

The data needed for clustering was then isolated from normalized dataframe (see Fig. 3.8).

	Parish	Ice Cream Shop
0	Christ Church	0.040404
1	St. Andrew	0.000000
2	St. George	0.066667
3	St. James	0.028986
4	St. John	0.000000
5	St. Joseph	0.000000
6	St. Lucy	0.000000
7	St. Michael	0.048077
8	St. Peter	0.000000
9	St. Philip	0.038462
10	St. Thomas	0.023256

**Fig. 3.8 Ice Cream Shop Data Normalized per Parish**

With a cluster size of 5, the cluster labels were generated and along with the dataframe in *Fig. 3.8*, was added to the dataframe in *Fig. 2.4* (see *Fig. 3.9*).

	Parish	Capitals	Population (2010 Census)	Latitude	Longitude	Cluster Labels	Ice Cream Shop
0	Christ Church	Oistins	54,336	13.066670	-59.533330	1	0.040404
1	St. Andrew	Greenland	5,139	13.248905	-59.575714	0	0.000000
2	St. George	Bulkeley	19,767	13.146904	-59.547892	2	0.066667
3	St. James	Holetown	28,498	13.187890	-59.628104	3	0.028986
4	St. John	Four Roads	8,963	13.157913	-59.504316	0	0.000000
5	St. Joseph	Bathsheba	6,620	13.197636	-59.545423	0	0.000000
6	St. Lucy	Crab Hill	9,758	13.304229	-59.614320	0	0.000000
7	St. Michael	Bridgetown	88,529	13.118029	-59.600986	4	0.048077
8	St. Peter	Speightstown	11,300	13.261403	-59.619967	0	0.000000
9	St. Philip	Crane	30,662	13.122874	-59.469571	1	0.038462
10	St. Thomas	Hillaby	14,249	13.179373	-59.586824	3	0.023256

***Fig. 3.9 Dataframe Ready for Clustering***

The data was inputted onto a **Folium** map of Barbados for final analysis (see *Fig 3.1.0*).



***Fig. 3.1.0 Clustered Map of Barbados***

## 4 | Results

The results show that Greenland, Four Roads, Bathsheba, Crab Hill and Speightstown (the capitals of St. Andrew, St. John, St. Joseph, St. Lucy and St. Peter respectively) have no competition in terms of ice cream shops (*see Fig. 4.1*)

	Capitals	Cluster Labels	Ice Cream Shop
1	Greenland	0	0.0
4	Four Roads	0	0.0
5	Bathsheba	0	0.0
6	Crab Hill	0	0.0
8	Speightstown	0	0.0

***Fig 4.1 Cluster 1 Results***

Holetown and Hillaby (capitals of St. James and St. Thomas respectively) have relatively low competition (*see Fig. 4.2*).

	Capitals	Cluster Labels	Ice Cream Shop
3	Holetown	3	0.028986
10	Hillaby	3	0.023256

***Fig. 4.2 Cluster 4 Results***

Oistins, Crane and Bridgetown (capitals of Christ Church, St. Philip and St. Michael) all have somewhat high competition (*see Fig. 4.3 & 4.4*).

	Capitals	Cluster Labels	Ice Cream Shop
0	Oistins	1	0.040404
9	Crane	1	0.038462

***Fig. 4.3 Cluster 2 Results***

	Capitals	Cluster Labels	Ice Cream Shop
7	Bridgetown	4	0.048077

***Fig. 4.4 Cluster 5 Results***

Finally, the results show that Bulkeley, St. George has the highest amount of competition for ice cream shops in Barbados (*see Fig. 4.5*).

	Capitals	Cluster Labels	Ice Cream Shop
2	Bulkeley	2	0.066667

***Fig. 4.5 Cluster 3 Results***

## 5 | Discussion

The aim of this project is to find which Barbadian parish is the best place to open an ice cream shop. This project took into consideration population size and nearby competition within each parish; important factors to keep in mind when opening a new business.

Taking the results into consideration, three parishes to consider opening an ice cream shop would be St. Philip, St. James & Christ Church. Though St. Philip and Christ Church both have moderately high competition, having some competition indicates an established market and demand. They also have the 3rd and 2nd highest populations respectively in Barbados. St. James has a relatively high population while also having relatively low competition, which makes it a worthy candidate as well.

Though St. Andrew, St. John, St. Joseph, St. Lucy and St. Peter all have no competition, they also have the lowest populations in the country. The absence of competition in tandem with the low population numbers may indicate that these parishes are on riskier side of the spectrum.

## 6 | Conclusion

This project was put together to assist an aspiring entrepreneur in making their decision as to which parish of Barbados is the best place to open an ice cream shop. Through K-Means clustering, we were able to classify and examine each parish as well as compare each parish strength and weaknesses.