

City of Akron, Ohio Library Location Report

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1. Introduction/Business Problem

The City of Akron, Ohio has determined that they have the resources to build a new library, however first they must decide where to build it.

The city council would like for this new library to be built in an area that is within city limits, relatively far from existing libraries, and ideally in an area that would benefit from the services that a library would provide (ie. access to technology, ability to borrow books for free, job training, etc.). Determining which areas would benefit most from these services should be based on poverty rate, access to technology, and educational attainment depending on which data is available.

The local government only has the money to build one new library, so it would like to find the location which would benefit citizens of Akron as much as possible.

2. Data

For this project, Data was sourced from the Foursquare API and from the U.S. Census through the U.S. Census API(from the 5-year American Community Survey 2018). The Foursquare API was used to determine the current location of existing Akron public libraries, which was used to determine which parts of Akron are furthest from a public library. U.S. census data was used to determine the Unemployment rate, income levels, and educational attainment of citizens in the census tracts which are not near a public library to determine which area would benefit the most from the services a library could offer. In addition, Novatim and OpenStreetMap will be used to find a Geojson file of the limits of Akron.

3. Methodology

- a. Determining library locations and creating first folium map with city borders

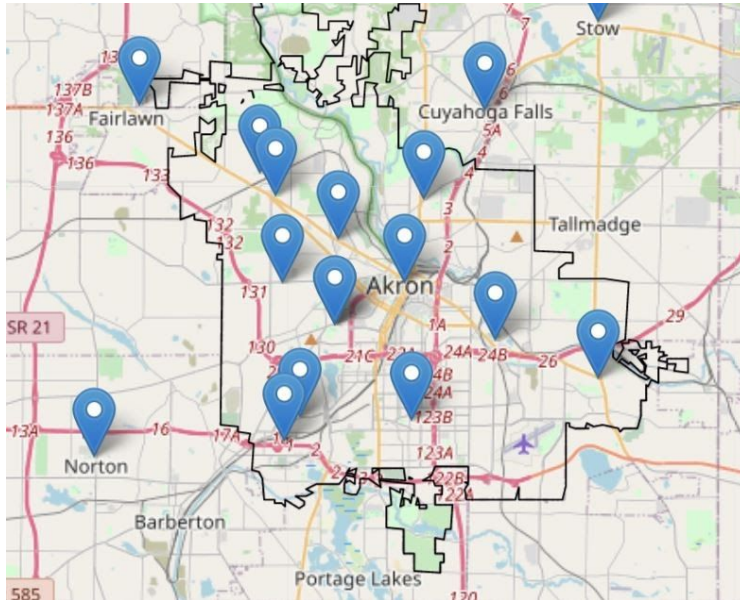
First, I added my credentials for Foursquare which I then used to request all libraries in and around Akron, Ohio.

```
Out[2]: [{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]}],
'venue': {'id': '4b43e4d9f964a52068ed25e3',
'name': 'Akron-Summit County Public Library: Main Branch',
'location': {'address': '60 S High St',
'crossStreet': 'at E Market',
'lat': 41.08336493528707,
'lng': -81.51683941671816,
'labeledLatLngs': [{'label': 'display',
'lat': 41.08336493528707,
'lng': -81.51683941671816}]},
'postalCode': '44326',
'cc': 'US',
'city': 'Akron',
'state': 'OH',
'country': 'United States',
'formattedAddress': ['60 S High St (at E Market)',
'Akron, OH 44326',
'United States']},
'categories': [{'id': '4bf58dd8d48988d12f941735',
```

I then normalized this data into a pandas dataframe before removing all columns which were not relevant to my project (I kept latitude, longitude, and name). I then removed the few items on the list which did not correspond to public libraries or which were actually a store (Library Shop on Main) and reset the index before renaming the columns of the dataframe so they would be easier to reference later.

	latitude	longitude	name
0	41.083365	-81.516839	Akron-Summit County Public Library: Main Branch
1	41.134771	-81.485502	Cuyahoga Falls Library
2	41.115915	-81.574477	Northwest Akron Branch Library (ASCPL)
3	41.054888	-81.440852	Akron Summit County Library - Ellet Branch
4	41.160995	-81.440889	Stow Munroe Falls Public Library
5	41.136310	-81.621572	Akron-Summit County Public Library - Fairlawn/...
6	41.241590	-81.443457	Hudson Library & Historical Society
7	41.314069	-81.626122	Cuyahoga County Public Library - Brecksville B...
8	41.331228	-81.721279	Cuyahoga County Public Library - North Royalto...
9	41.042591	-81.514704	Firestone Park Library
10	41.239848	-81.817134	Medina County District Library - Brunswick Branch

I then used Folium to create a map centered on Akron with a zoom of 11 with a marker at the location of each library before using a geojson file of the borders of Akron (from Novatim) to add Akron's city limits to the map.



b. Finding the coordinates of each Census Tract in Akron

Next, I created a list of all census tracts (from data.census.gov) which are at least partially in Akron (census tracts do not exactly line up with city borders) before finding another data.census.gov dataset which provided me with the coordinates of every census tract in Ohio. I used the FIPS code of each tract to filter out all tracts which were not in the same county that Akron is in. I then converted all FIPS codes to be in the same format as the census tract numbers before making a dataframe with all the numbers of each census tract in Akron and their coordinates.

	latitude	longitude	fips number
0	41.0903877	-81.5058552	5011.00
1	41.0683703	-81.5140053	5017.00
2	41.0688191	-81.5429231	5018.00
3	41.0656521	-81.5326908	5019.00
4	41.1091563	-81.499983	5021.01
5	41.1097084	-81.478352	5021.02

c. Determining the distance between each Census Tract and the closest library in kilometers

Next, I used the Haversine distance formula to determine the distance between the center of each census tract and every library. I then created an algorithm which selected the distance to the closest library for each census tract in Kilometers. I added these distances to my pandas dataframe with census numbers and coordinates before ordering the table by distance to the closest library and made a dataframe with only the five furthest from the nearest library.

	latitude	longitude	fips number	km to library
123	41.1828813	-81.5530077	5329.01	7.660222
124	41.1771447	-81.5109597	5329.02	5.171389
130	41.0808405	-81.6157451	5334.00	4.264885
52	41.1491105	-81.5566533	5080.00	3.981595
96	41.0204442	-81.4387054	5311.01	3.834180

d. Requesting and formatting data for the five Census Tracts which are furthest from the nearest library and creating pandas dataframes to display them

I then requested data using the Census API on the rate of high school graduation by 25, broadband internet access, and the percent of residents below the poverty line. I selected the relevant data which I then formatted into lists before creating a separate pandas dataframe for each metric and the census tract number in addition to adding a table with the distance to the nearest library in kilometers.

4. Results

(Note- all census tracts will be referred to by their index number which is consistent across tables)

a. Distance to the nearest library

Census Tract	Distance to Library in Kilometers
0	532901 7.660222
1	532902 5.171389
2	533400 4.264885
3	508000 3.981595
4	531101 3.834180

As can be seen from the dataframe, census tract zero is over two kilometers farther from the nearest library than the second closest library, with about 3.8 kilometers from the nearest library being the lowest distance of the tracts being considered. Based upon this metric, it would seem to be best to put a library in tract zero.

b. Percent of population below the poverty line

	Census Tract	% In Poverty
0	532901	6.9
1	532902	8.6
2	533400	8.5
3	508000	9.9
4	531101	11.3

In the dataframe, tract four has the highest poverty rate while tract zero has a much lower poverty rate than any other tract in consideration. Based on this metric, it makes the most sense to put a library in tract four or three.

c. Percent of population with broadband internet

	Census Tract	% With Broadband Internet
0	532901	83.1
1	532902	83.1
2	533400	75.1
3	508000	89.1
4	531101	79.0

In this case, broadband internet access is highest among the residents of tract three and lowest among the residents of tracts two and four. Based on this metric, tracts two and four would be good candidates for a new library.

d. Percent of population over the age of 25 who have graduated high school or earned a GED

	Census Tract	% Graduated from Highschool by 25
0	532901	98.1
1	532902	94.2
2	533400	94.5
3	508000	99.1
4	531101	87.1

In this dataframe, tract four definitely has the lowest graduation rate among all tracts in consideration, with a 7.1% difference between tract four and tract one. The residents of tract four would probably benefit more from job training resources at a library.

5. Discussion

Overall, I think that census tract four (number 531101) would be a good location for a new library. While this tract is the closest to a library of those I considered, it is still far enough away to benefit from having a new library, and the relatively high poverty rate and low graduation rates and access to broadband internet, the residents of this census tract seem to be most in need of the services that a library could provide.

While tract zero is far from the nearest library, it has a low poverty rate and a high high school graduation rate when compared to the other tracts being considered. As a result, this tract seems to be less in need of the services provided by a library.

Tract one is the second farthest from a library, but it has a low poverty rate with all other metrics being somewhat average, making it seem that the services of a library would be appreciated, but not as necessary as they would be in tract four.

Tracts two has the lowest rate of access to broadband internet, but it is about average for all other metrics, and tract three has a relatively high poverty rate but a high graduation level and access to broadband, making it seem less urgent to build a library in this tract.

6. Conclusion

Altogether, there are almost infinite combinations of criteria which can be used to determine the ideal location for a new library depending on the goals of those involved and the data that is available. Based on the criteria I have selected, tract two (number 531101) seems like the best candidate for a new library.

7. Data Citations

- Library locations are from Foursquare API
- Akron, Ohio geojson file. (n.d.). Retrieved August 10, 2020, from <https://nominatim.openstreetmap.org/ui/search.html?q=Akron%2C+Ohio>. - used for Akron borders
- Data.census.gov - source of numbers of all census tracts in Akron and the coordinates of

every census tract in Ohio

- "This product uses the Census Bureau Data API but is not endorsed or certified by the Census Bureau." , American Community Survey 5-Year Data (2009-2018). (2019, December 19). Retrieved August 10, 2020, from <https://www.census.gov/data/developers/data-sets/acs-5year.html> - used for data on each census tract in Akron