Network Analysis: Location-Allocation

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Geoprocessing with Python – 6180

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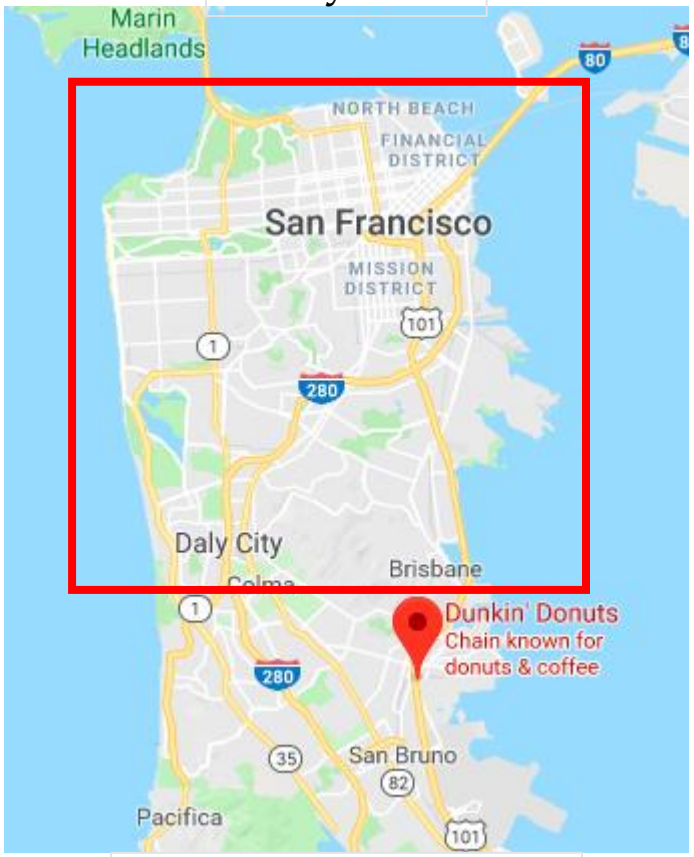
Background

- Find a new Dunkin Donuts store location in San Francisco
- The only current Dunkin Donuts is outside the current study area
- Looking for 5 minute or less commute time

Study Area



Google Maps Image

Objectives

- To simplify the process of network analysis
- This will speed up processing time and allow the script to run without have to wait in order to work on the next step.
- This tool will be able to make multiple iterations of various network analysis tools.

Data Requirements

- San Francisco Network Dataset
- Candidate Store Locations
- Demand Point: San Francisco Census Tract Centroids

Methods

- Set variables for later analysis

```
11  #Variables
12  inNetworkDataset = "Transportation/Streets_ND"
13  outNALayerName = "1StoreLocation"
14  impedanceAttribute = "TravelTime"
15  inFacilities = "Analysis/CandidateStores"
16  requiredFacility = "Analysis/ExistingStore"
17  inDemandPoints = "Analysis/TractCentroids"
18  measurement_units = "Minutes"
19  outLines = "Streets"
20  outRouteEdges = "RouteEdges"
21  outGeodatabase = "N:\Python(Fall 2018)\Project\N
22  outLayerFile = "N:\Python(Fall 2018)\Project\Net
    outNALayerName + ".lyr"
```

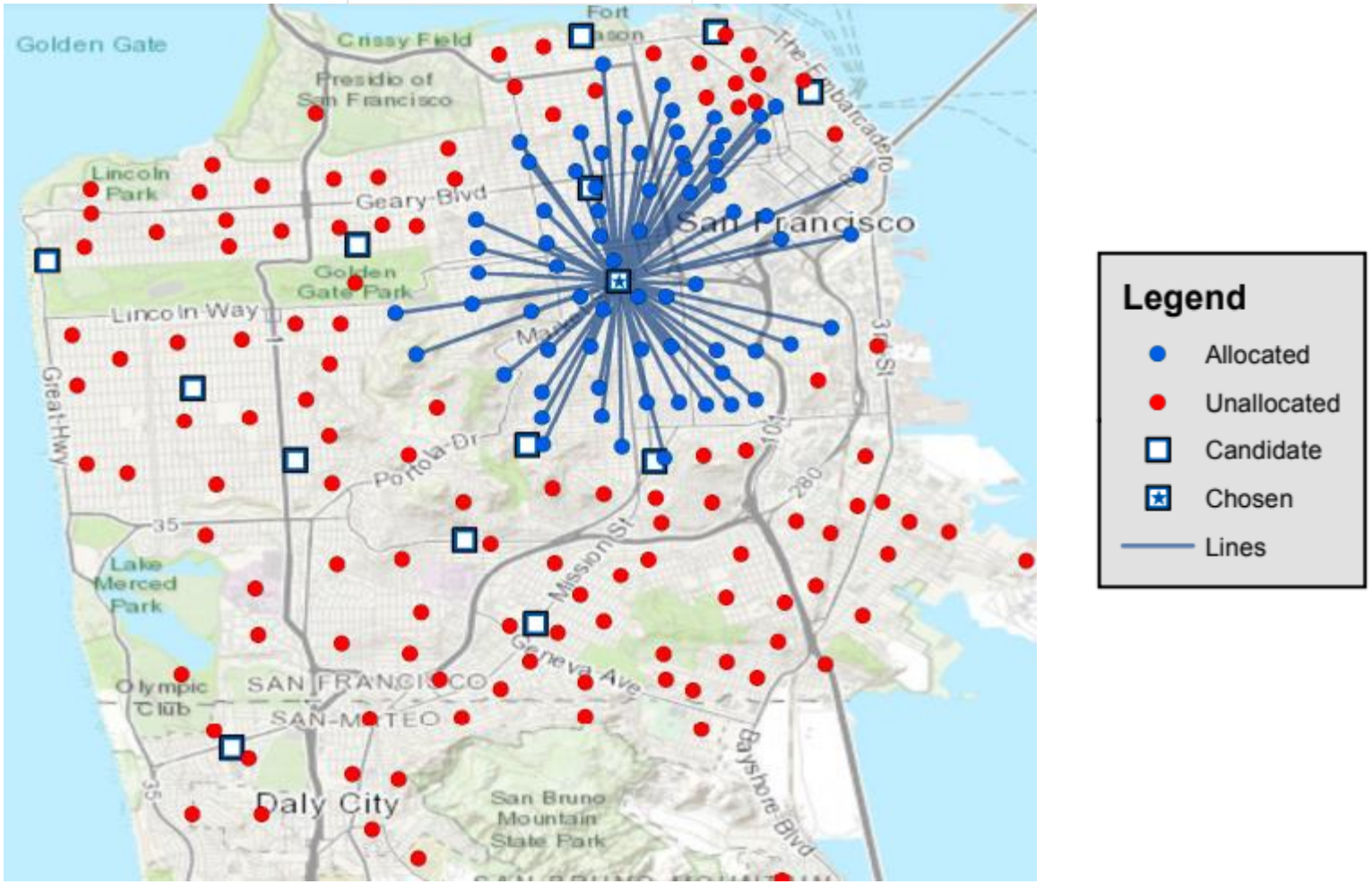
- Add and update the layers into the location-allocation layer
- Solve with the location allocation function

```
23  #Make the Location-Allocation Layer
24  outNALayer = arcpy.na.MakeLocationAllocationLayer(inNetworkDataset, outNALayerName, impedanceAttribute,
    "DEMAND_TO_FACILITY", "MAXIMIZE_ATTENDANCE",1,5, "LINEAR") #Number of facilities to find, impedance
    cutoff,
25  #Update the Layer
26  outNALayer = outNALayer.getOutput(0)
27  subLayerNames = arcpy.na.GetNAClassNames(outNALayer)
28  #Use to add
29  facilitiesLayerName = subLayerNames["Facilities"]
30  demandPointsLayerName = subLayerNames["DemandPoints"]
31  #Add Layer: CandidateStores
32  arcpy.na.AddLocations(outNALayer, facilitiesLayerName, inFacilities, "", "", exclude_restricted_elements =
    "EXCLUDE")
33  fieldMappings = arcpy.na.NAClassFieldMappings(outNALayer, facilitiesLayerName)
34  fieldMappings["FacilityType"].defaultValue = 1
35  #Add Layer: ExistingStores
36  arcpy.na.AddLocations(outNALayer, facilitiesLayerName, requiredFacility, fieldMappings, "", append =
    "APPEND", exclude_restricted_elements = "EXCLUDE")
37  #Map the Census Tract Centroids by population
38  demandFieldMappings = arcpy.na.NAClassFieldMappings(outNALayer, demandPointsLayerName)
39  demandFieldMappings["Weight"].mappedFieldName = "POP2000"
40  #Add Layer: Tract Centroids
41  arcpy.na.AddLocations(outNALayer,demandPointsLayerName ,inDemandPoints, demandFieldMappings, "",
    exclude_restricted_elements = "EXCLUDE")
42  #Solve to find best CandidateStores locations
43  #1 Store
44  arcpy.na.SolveLocationAllocation(inFacilities,inDemandPoints,"Minutes",inNetworkDataset,outGeodatabase,
    outLines,"Facilities", "DemandPoints",outRouteEdges,"MAXIMIZE_ATTENDANCE",1,5)
```

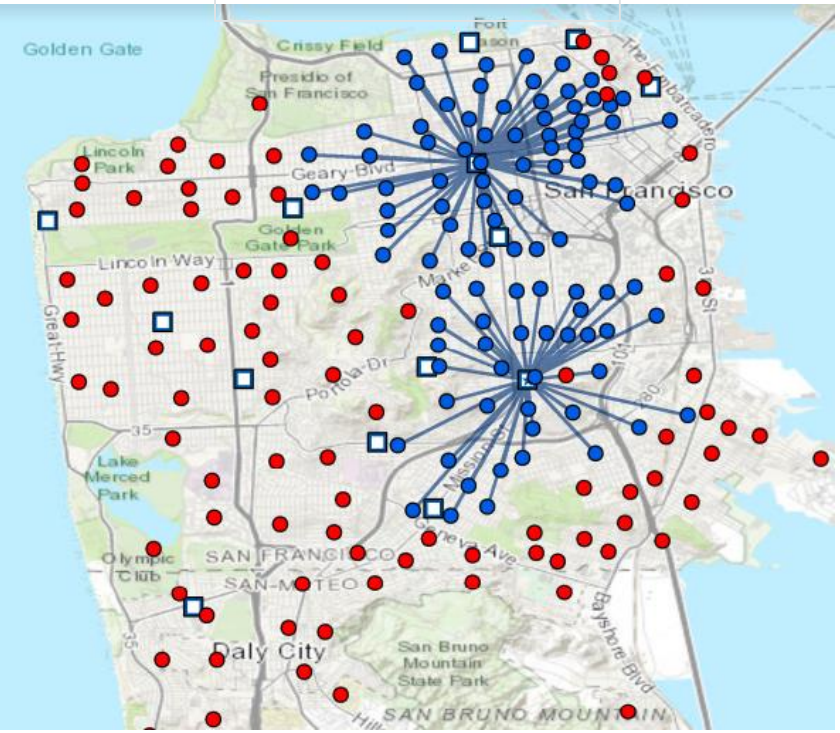
Results

- The code ran quickly
- The first iteration is the longest at under 5 minutes
- Will the later iterations run in under 2 minutes
- Commute times along the network of 5 minutes or less

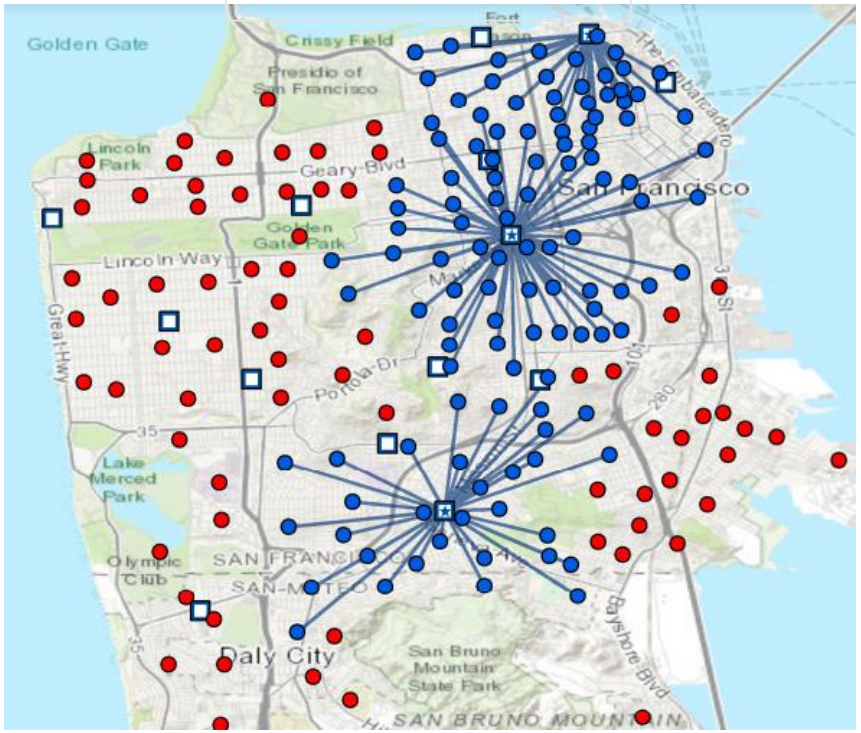
1 Store Location



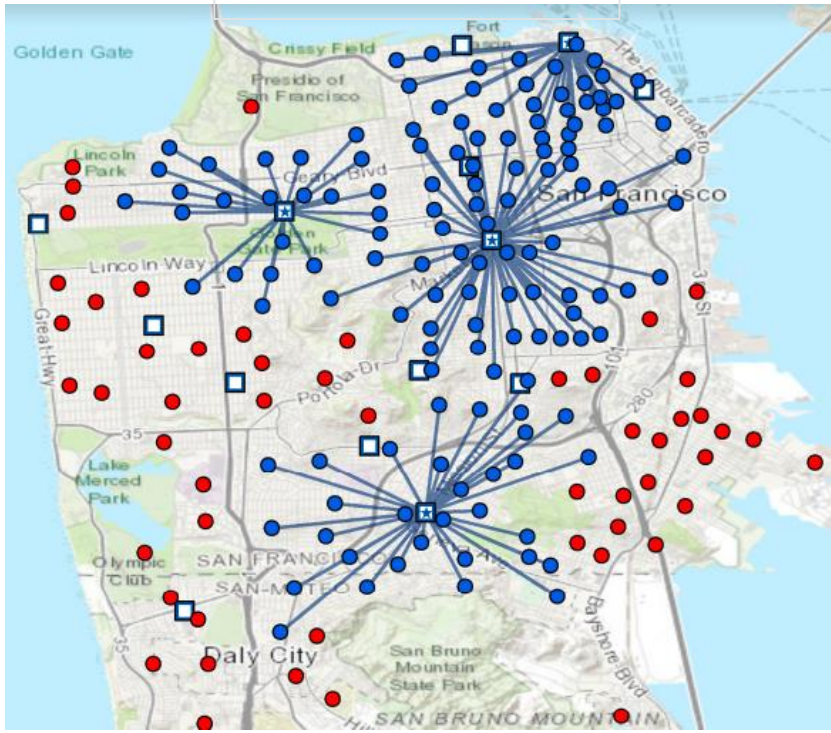
2 Store Locations



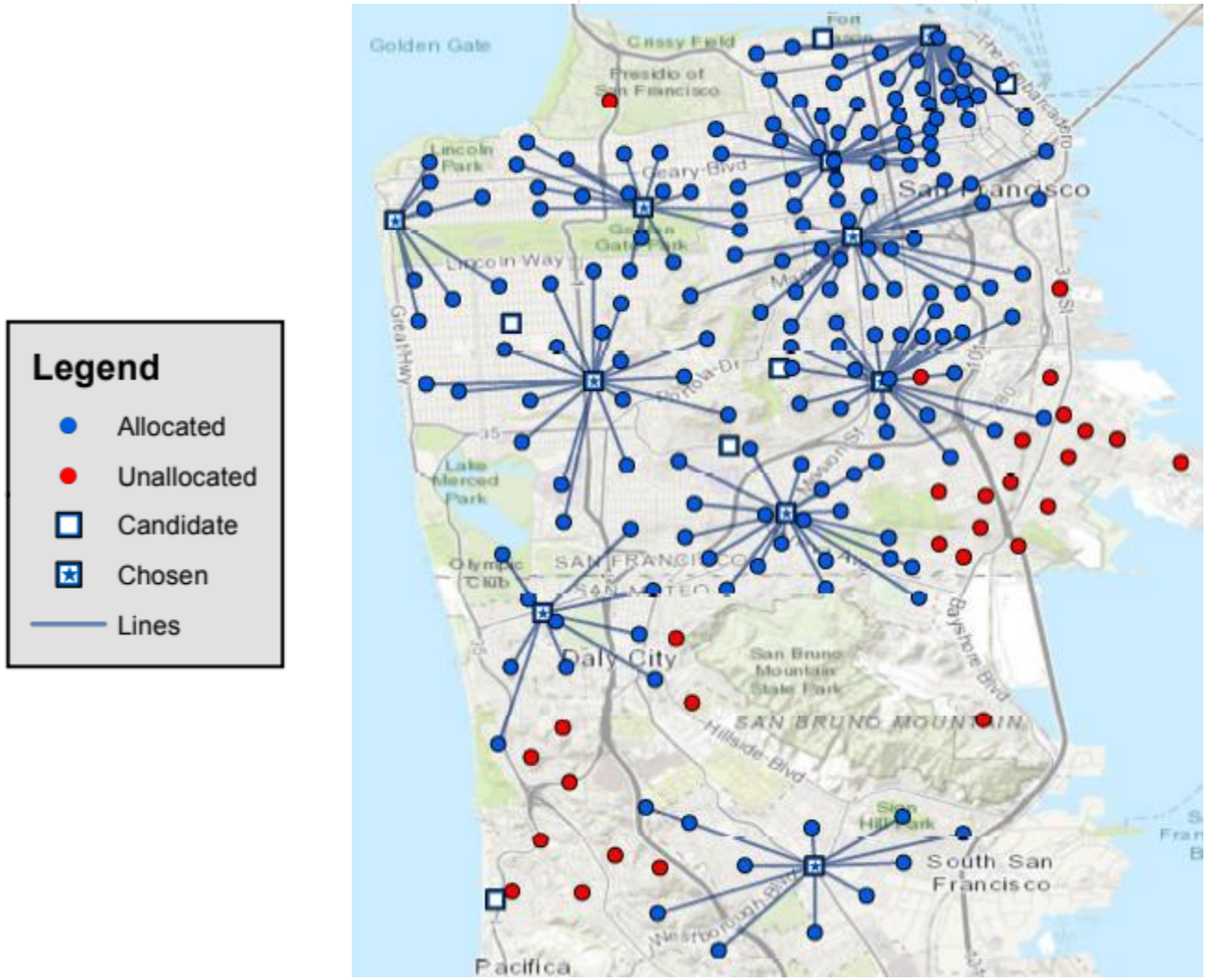
3 Store Locations



4 Store Locations

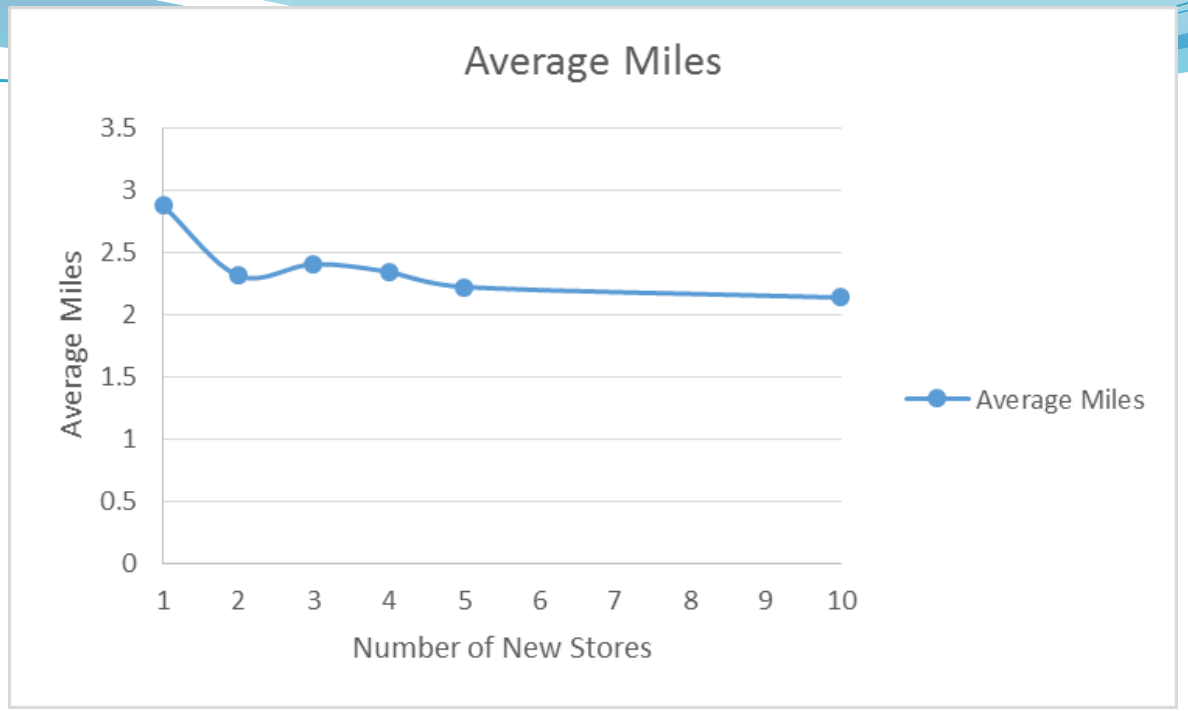


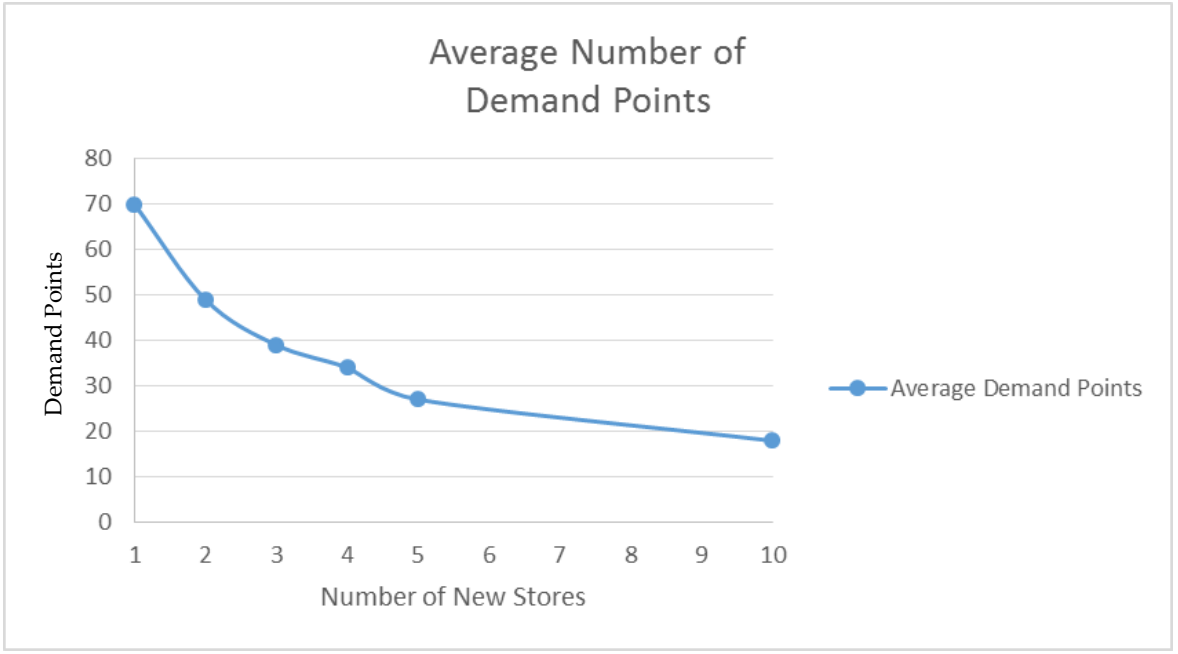
10 Store Locations



Graphics

- Both show a decreasing trend
- The more new store locations the lower the travel distance to each store
- The more new store locations the fewer the average number of demand points per store





Conclusion

- The more candidate stores that are chosen increases the distribution of the demand points.
- Demand points are selected based on a commute time of 5 minutes or less.
- The number of demand points per chosen location decrease when there are more new store locations.
- The driving distance does decrease for the number of new store locations but it plateaus at around 2 miles

Questions

References

- ESRI Resources
  - http://desktop.arcgis.com/en/arcmap/10.3/tools/network-analyst-toolbox/make-service-area-layer.htm
  - http://pro.arcgis.com/en/pro-app/tool-reference/network-analyst/make-location-allocation-layer.htm
  - http://proceedings.esri.com/library/userconf/proc15/tech-workshops/tw_1223-188.pdf
- Network Analysis Module
  - http://pro.arcgis.com/en/pro-app/arcpy/network-analyst/what-is-network-analyst-module.htm
- AGRC Transportation data
  - https://gis.utah.gov/data/transportation/
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- AGRC Police Station Locations/Schools
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