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CS 6240 Final Project Presentation

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Investigate efficient way(s) to compute the optimal waiting location for the drivers based on the Uber pickups in New York City Dataset using the K-means clustering algorithm.

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Project Overview

- **Project Goal** : Compute the optimal waiting locations for Uber drivers based on pick-up locations history in New York City using K-means clustering algorithm run on Map-Reduce framework

- **Evaluation :** the optimal K values is evaluated using Silhouette Score

- **Data :** Coordinate of the pick-up locations stored in csv file, where the Latitude and Longitude of the pick-up location can be extracted

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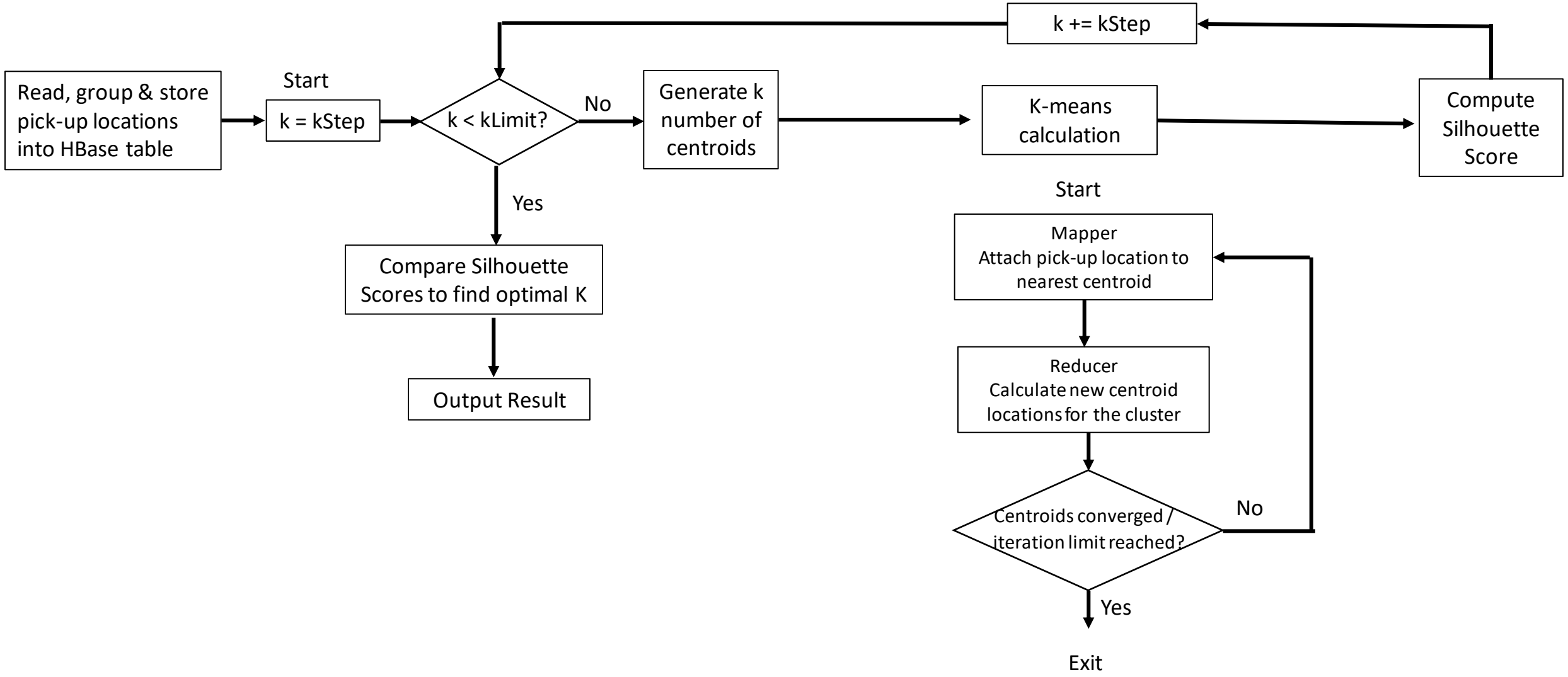
Main Program Design



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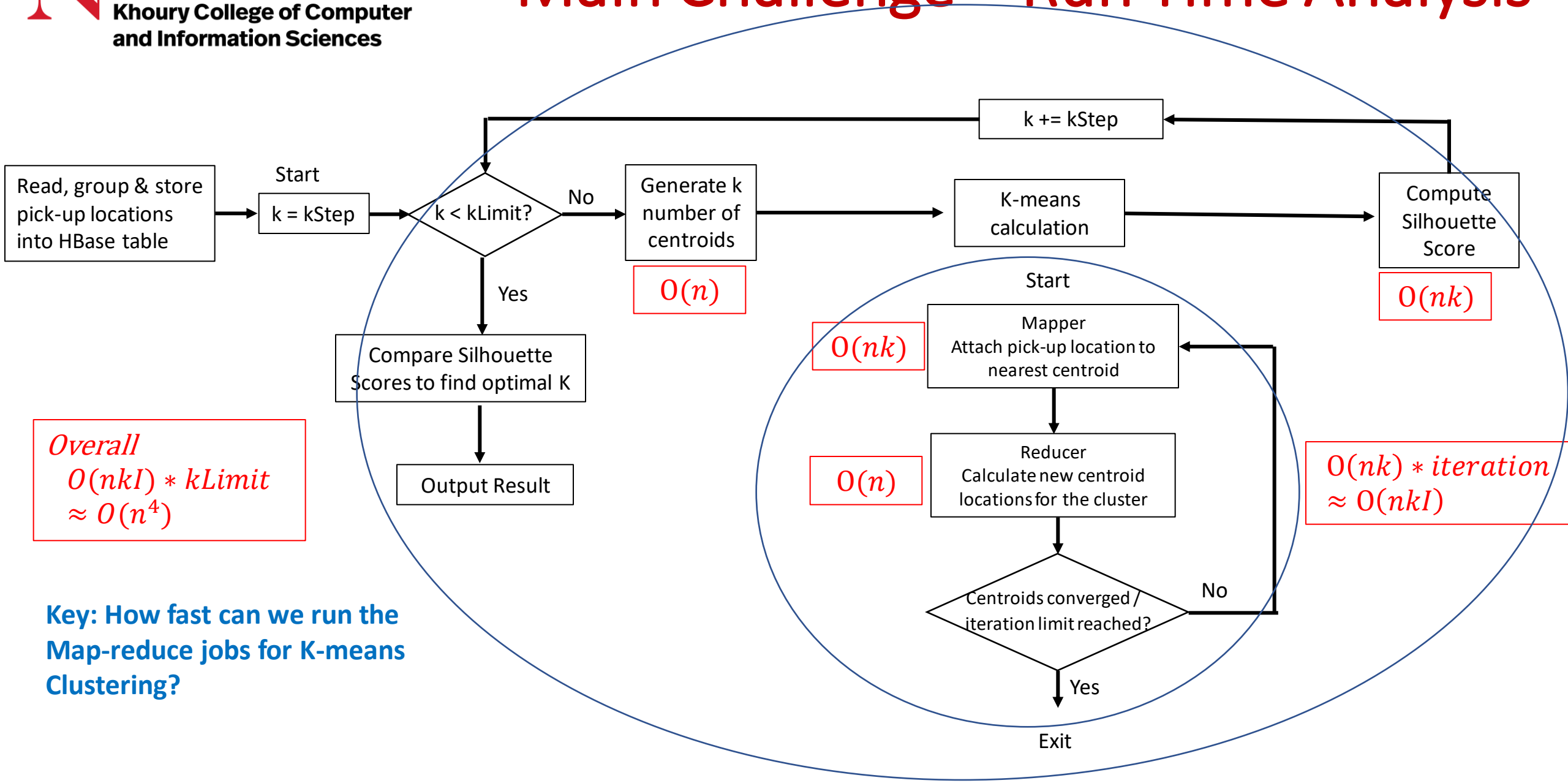
Main Challenge – Run Time Analysis



Overall
$O(nkI) * kLimit$
$\approx O(n^4)$

$O(nk) * iteration$
$\approx O(nkI)$

Key: How fast can we run the Map-reduce jobs for K-means Clustering?

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Solving Main Challenge

- **Goal** : Minimize run time for a map-reduce job to compute K-means clustering algorithm
- **Potential Bottlenecks :** Computations time, Jobs set up overhead, IO overhead
- **Result :** (Computations time unlikely to be the bottleneck)

MR job Description	Main Run	4 x k	4 x n
Run time for each MR	38 – 40 seconds	38 – 40 seconds	38 – 40 seconds

- **IO overhead :** Currently writing data into HBase memory and reading data from it, could it be faster?
- **MR jobs set up overhead :** likely the culprit

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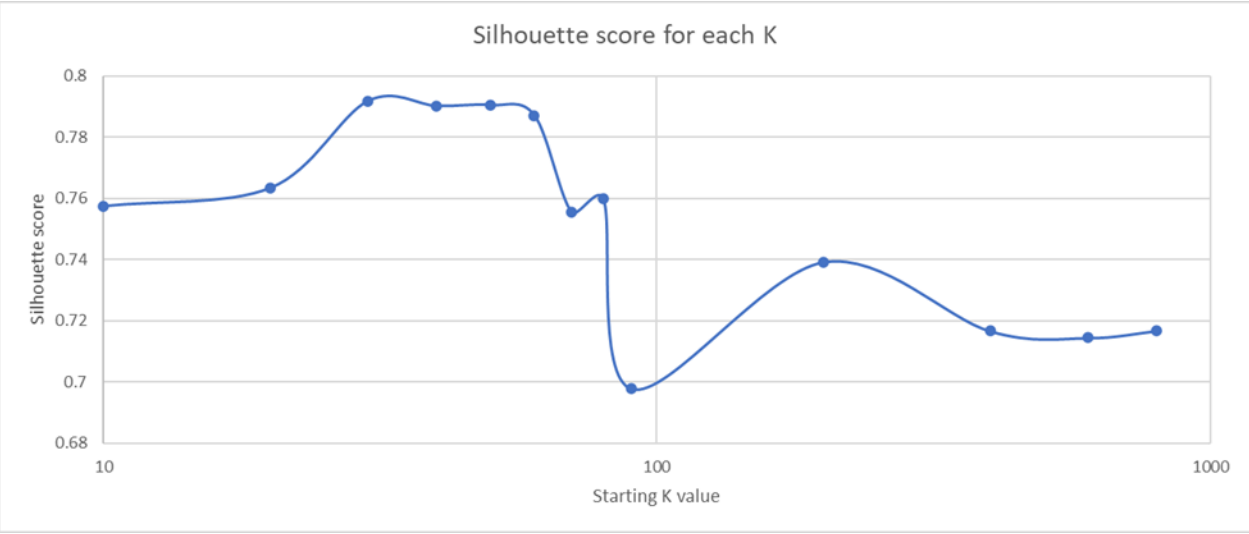
More Result

Computation Details	Machines Details	Total Run Time
22,000 pick-up locations K value from 10 to 100 in the step of 10, maximum 20 iterations	2 machines, of m5.xlarge	2 hours 34 minutes
22,000 pick-up locations K value from 10 to 100 in the step of 10, maximum 20 iterations	10 machines, of m5.xlarge	1 hour 58 minutes
22,000 pick-up locations K value from 200 to 1000 in the step of 200, maximum 20 iterations	10 machines, of m5.xlarge	54 minutes, 58 seconds
86,117 pick-up locations K value from 10 to 100 in the step of 10, maximum 20 iterations	10 machines, of m5.xlarge	2 hours, 1 minute



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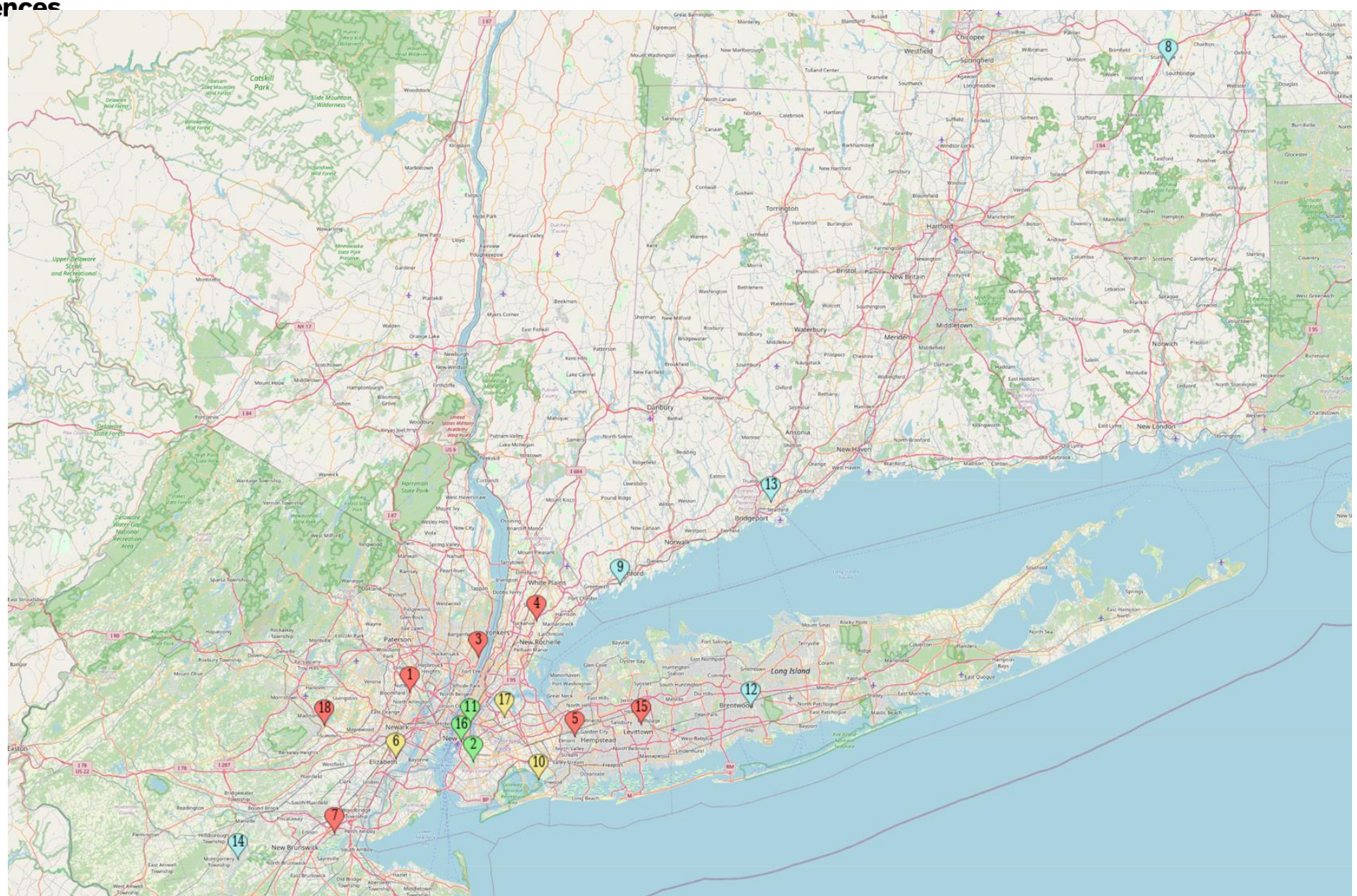
Optimal Waiting Locations



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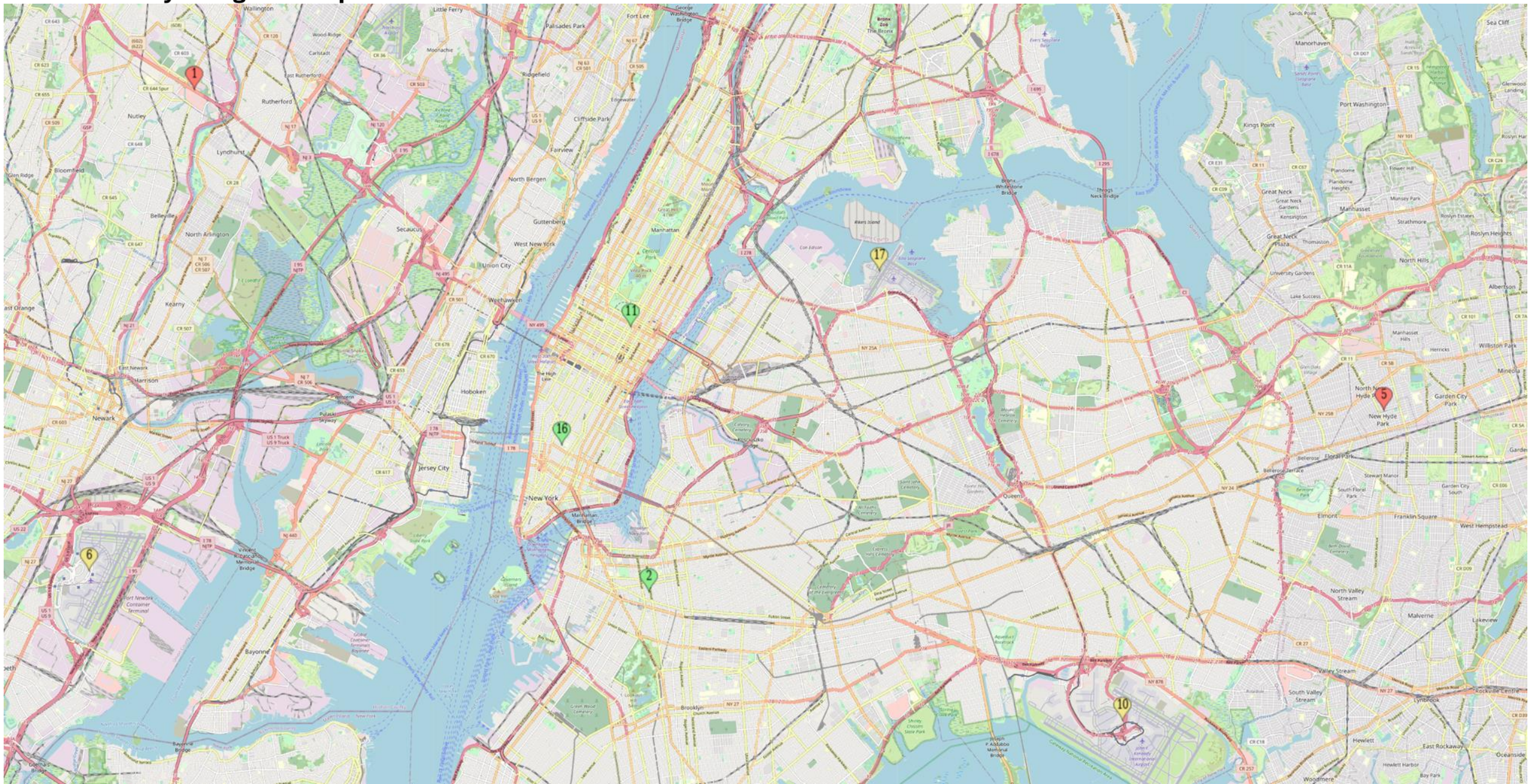
Optimal Waiting Locations



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Conclusion

- Current program can compute the optimal waiting locations but have limited application in Real-time.
- Still can be used if the result is not required immediately
- Similar map-reduce programs will likely have same bottleneck : map-reduce set up overheads

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Q & A

Thank You!