AUTONOMOUS VEHICLES IMPACT ON RIDE- HAILING

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TEAM - 3

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ASSUMPTIONS

- Resources are always stationary.

- Number of agents will remain fixed throughout the simulation.

- Speed at each road segment = speed_limit * ((map_average_trip_duration)/(TLC_average_trip_duration))

- Random intersection for empty cruise in search of resources.

- Unassigned resources are taken to the next pool until expiration.

Below parameters are made configurable in the project:

1. Number of Agents, Default: 5000
2. Resource Expiration Time, Default: 10 Mins
3. Assignment Period, Default: 30 Sec
4. Assignment Algorithm, Default: Fair (based on shortest pick up time)

ALGORITHMS EVALUATED

Built on the COMSET solution that took resources as introduced in the system and matched them to nearest agent one by one. We modified this to enable a matching to happen for a pool of resources.

FAIR ASSIGNMENT

Match the resources in a given pool with the closest available agent based on time.

OPTIMAL ASSIGNMENT

Used the Hungarian algorithm to perform a matching that would best optimize a benefit factor which is calculated as the ratio of the the pickup time to total trip fare i.e lower the benefit factor , the more profitable for an agent to pick up the resource.
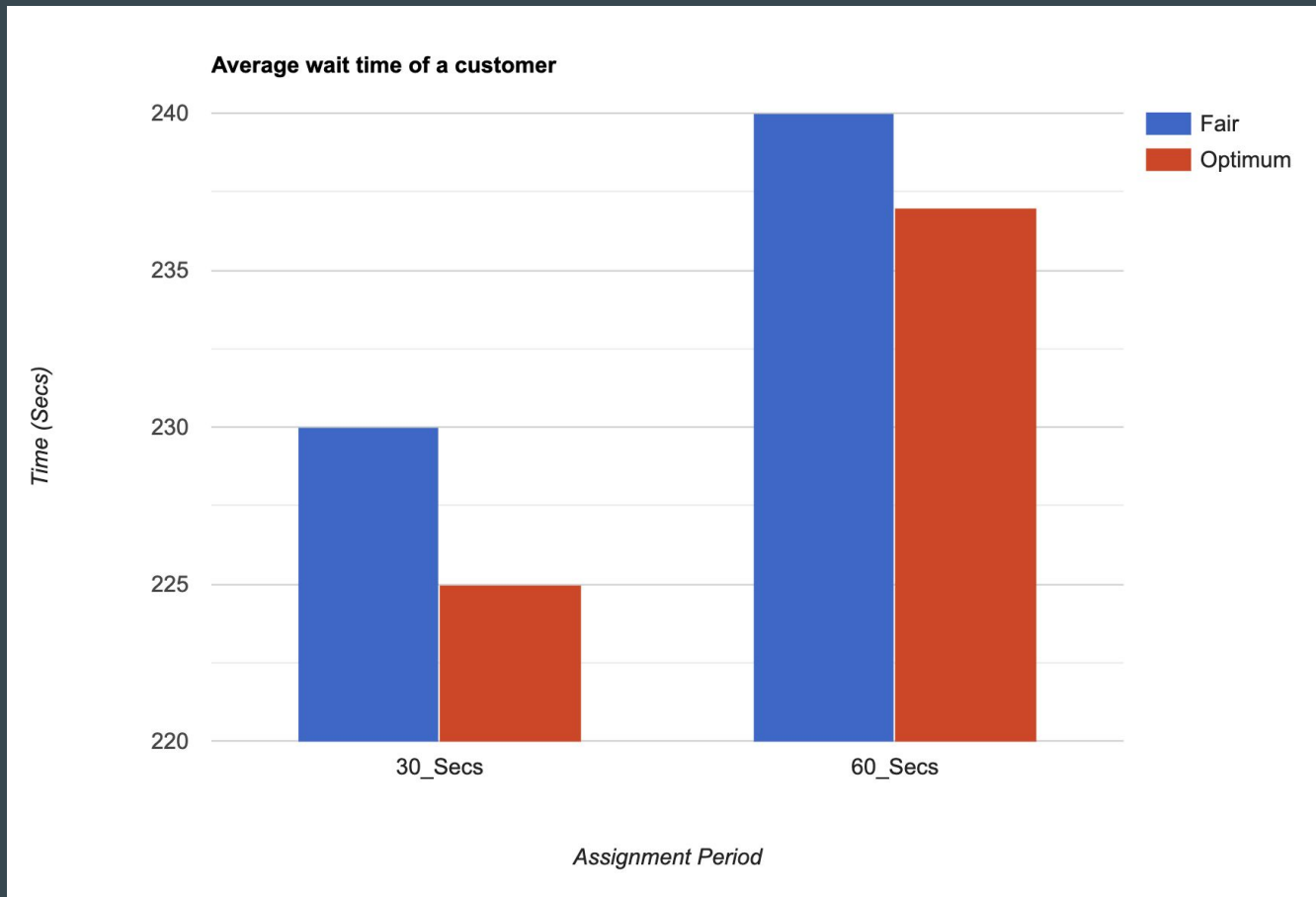
DEMO RESULTS

TEST DATE A MAY 17 2016

AVG. SEARCH TIME OF AN AGENT
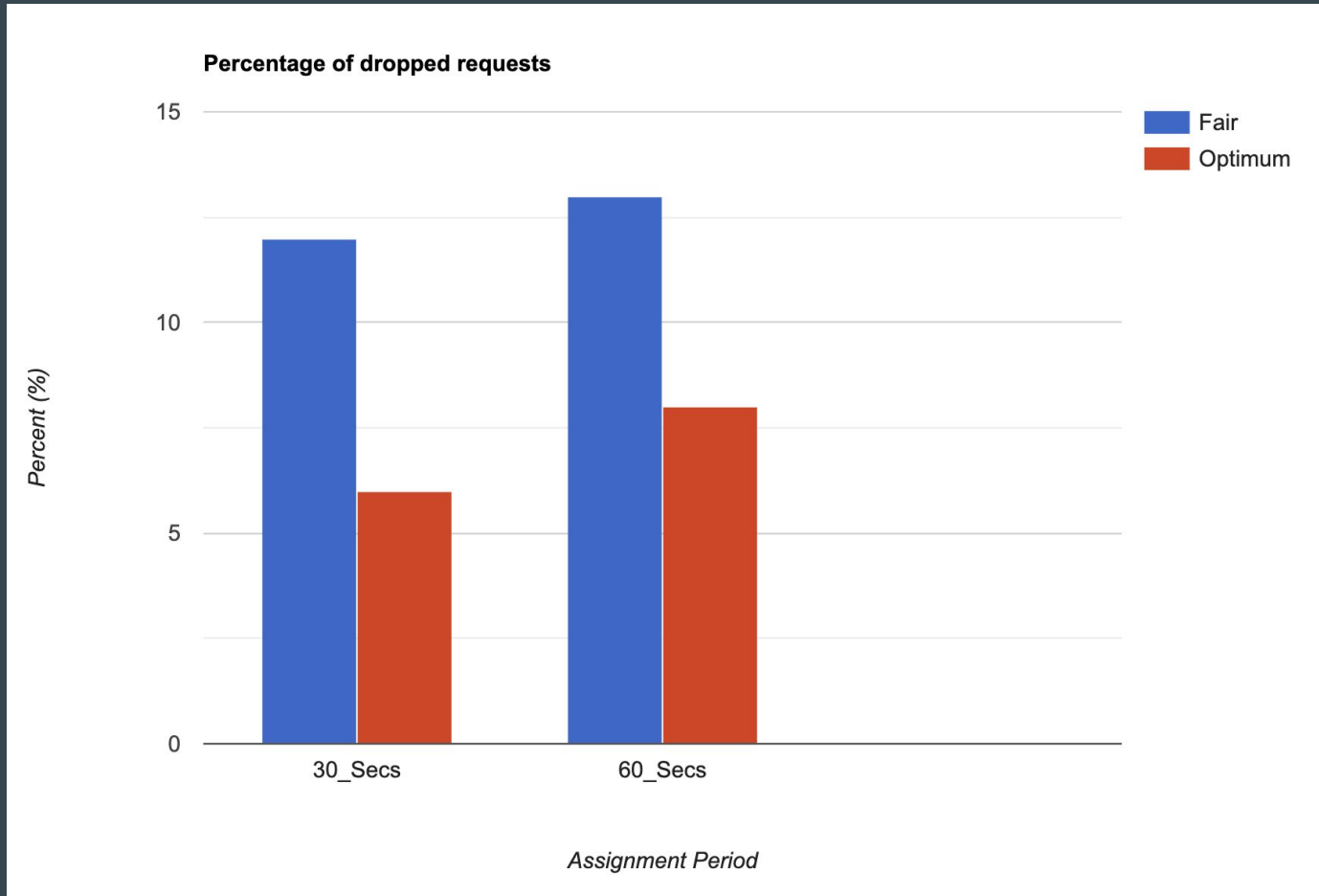
Average search time of an agent
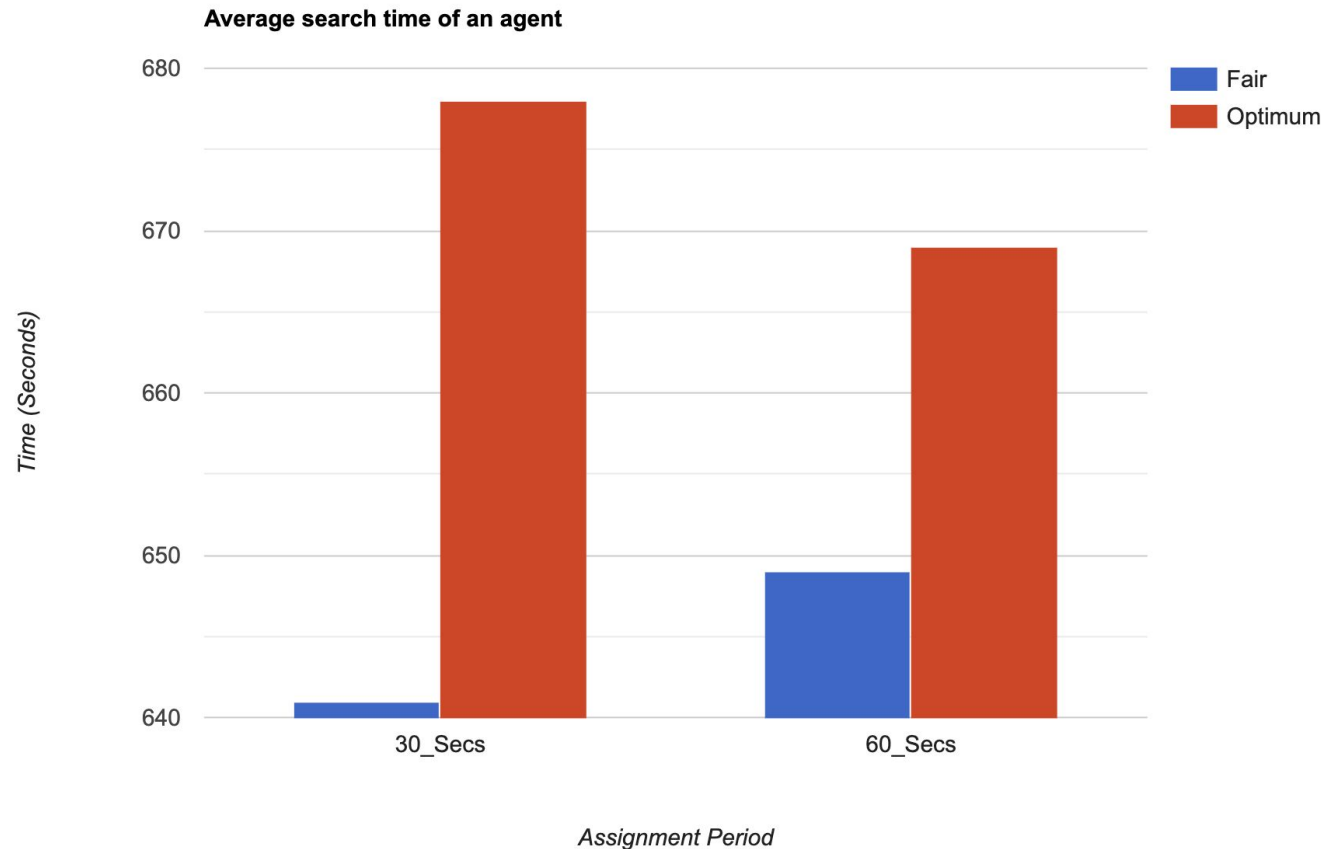
- The Average search time for an agent is more using the optimal algorithm as compared to the fair algorithm

- The Average search time also increases with increase in pool size

# WAIT TIME FOR A CUSTOMER

Average wait time of a customer

- The Average wait time for a customer is less using the optimal algorithm as compared to the fair algorithm

- The Average wait time also increases with increase in pool size

DROPPED REQUESTS


Percentage of dropped requests

- The Dropped requests percentage is less using the optimal algorithm as compared to the fair algorithm

- The Dropped requests percentage also increases with increase in pool size

RUNNING TIME OF THE ALGORITHM
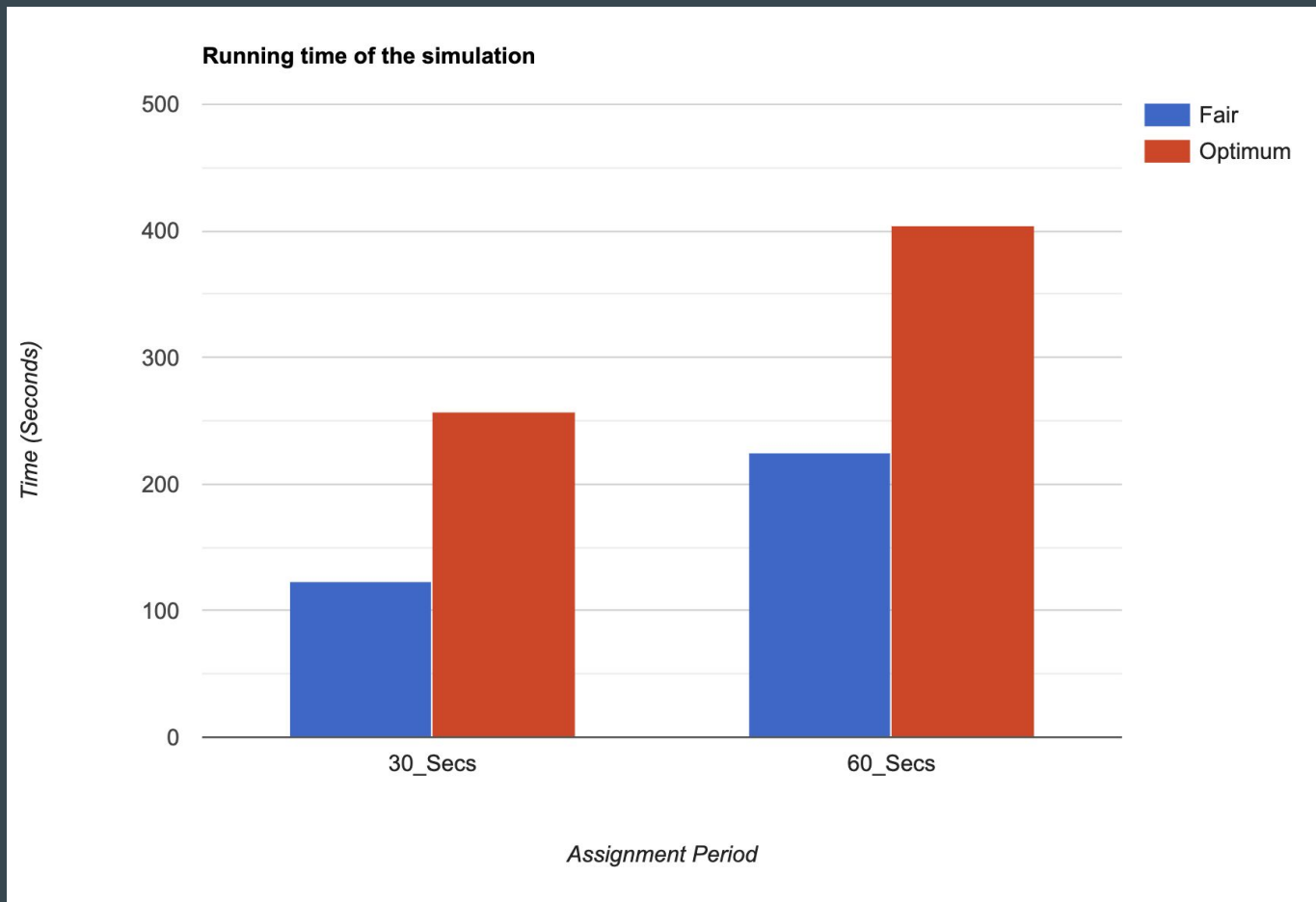
Running time of the algorithm is more for the optimal approach

AVERAGE BENEFIT PER AGENT

Benefit factor comparison - Assignment period - Test Date A - May 17, 2016
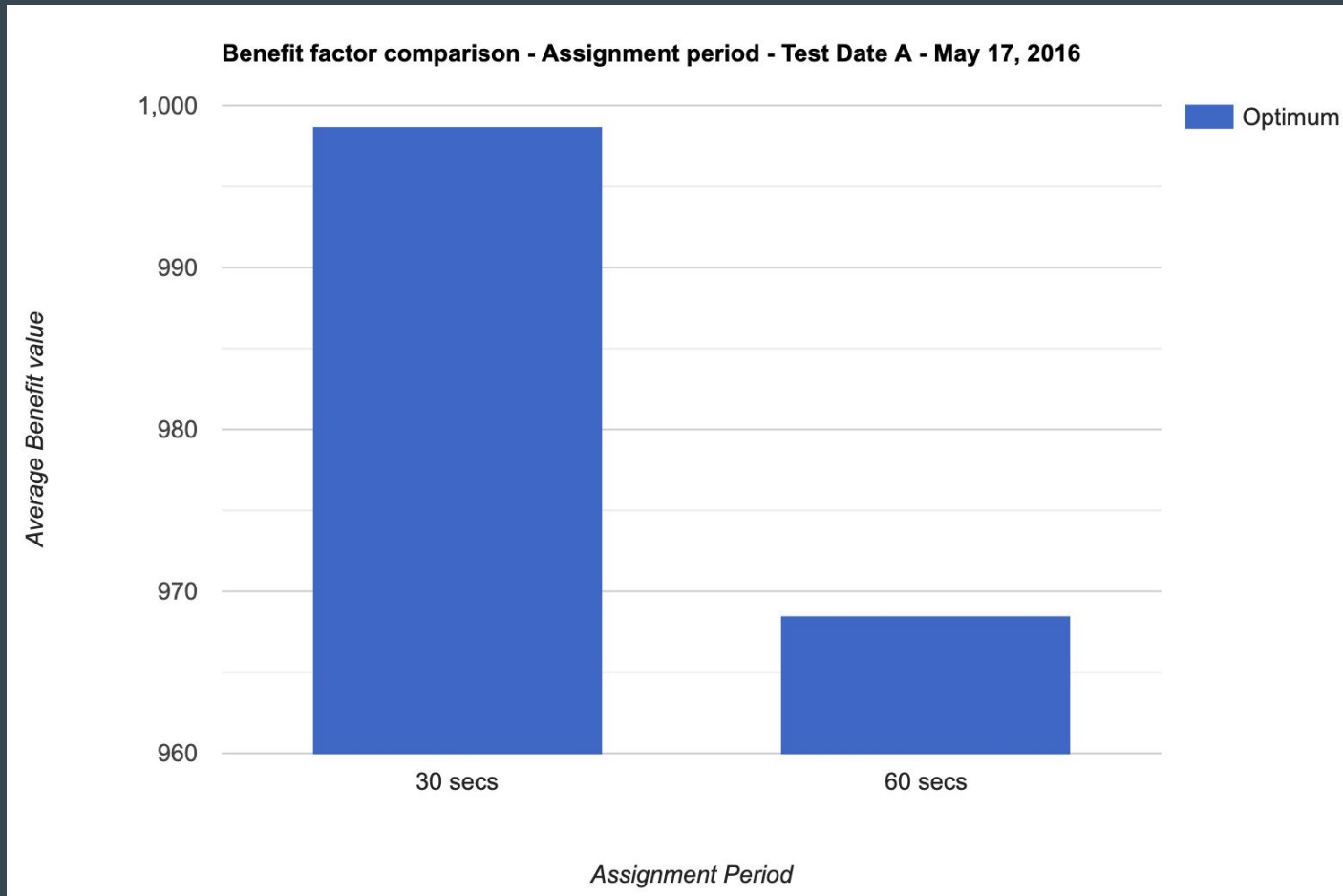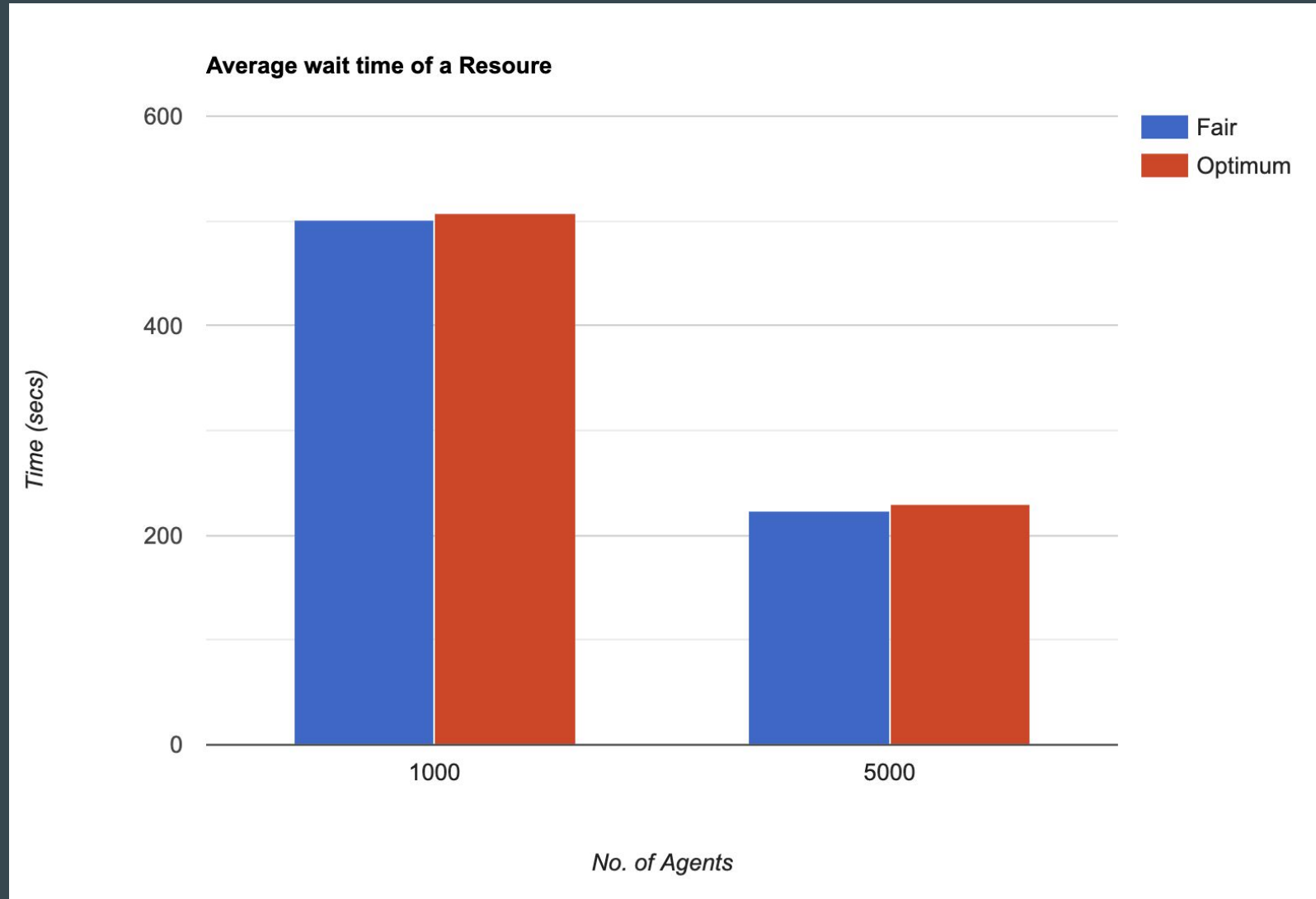
- The Average benefit is less for the 60 second assignment period as compared to the 30 second window.

- The results for the Average benefit is inversely proportional to the expiration percentage.
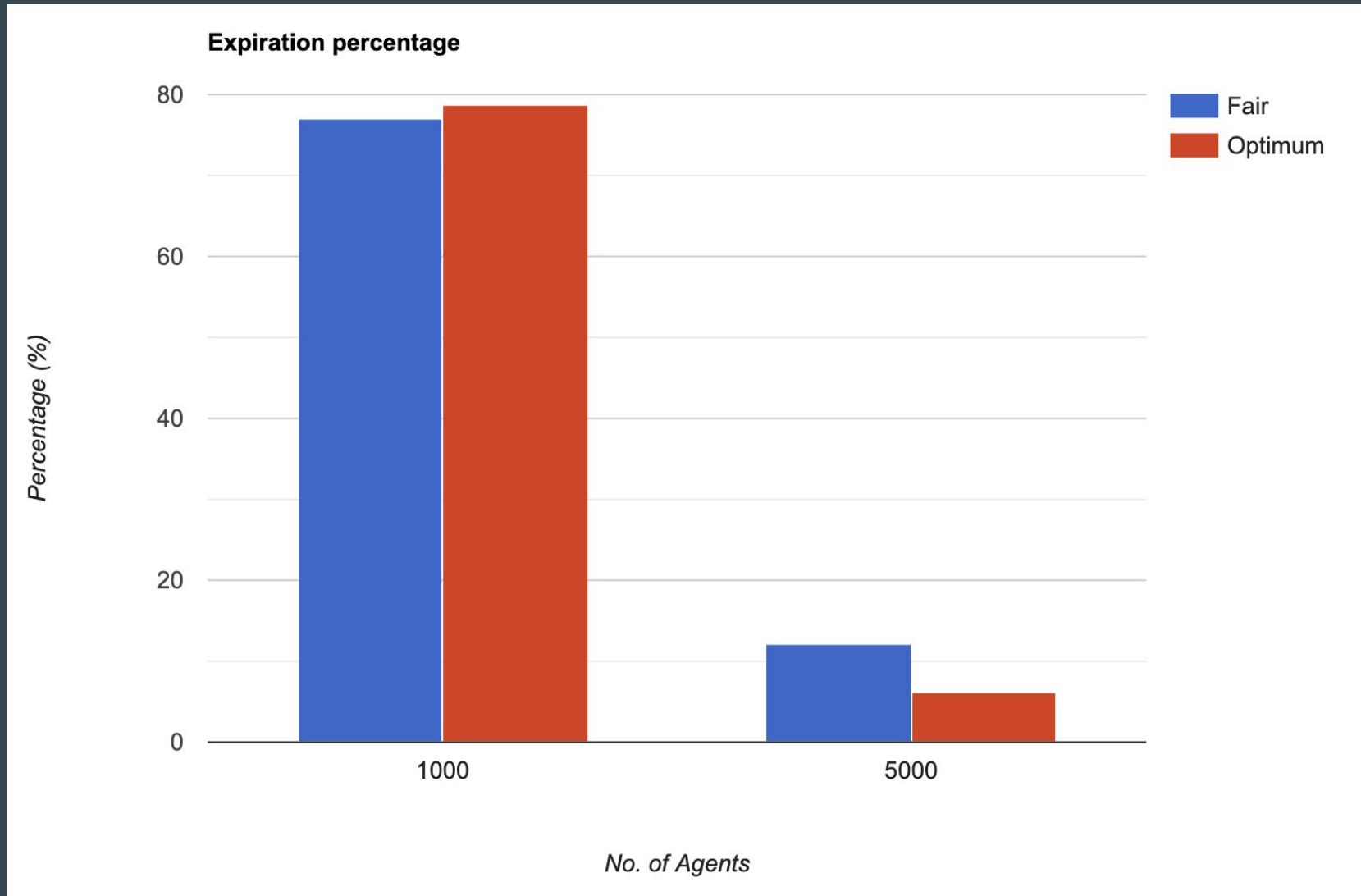
TEST DATE B
MAY 20 2016

AVG. SEARCH TIME OF AN AGENT

Average search time of an Agent
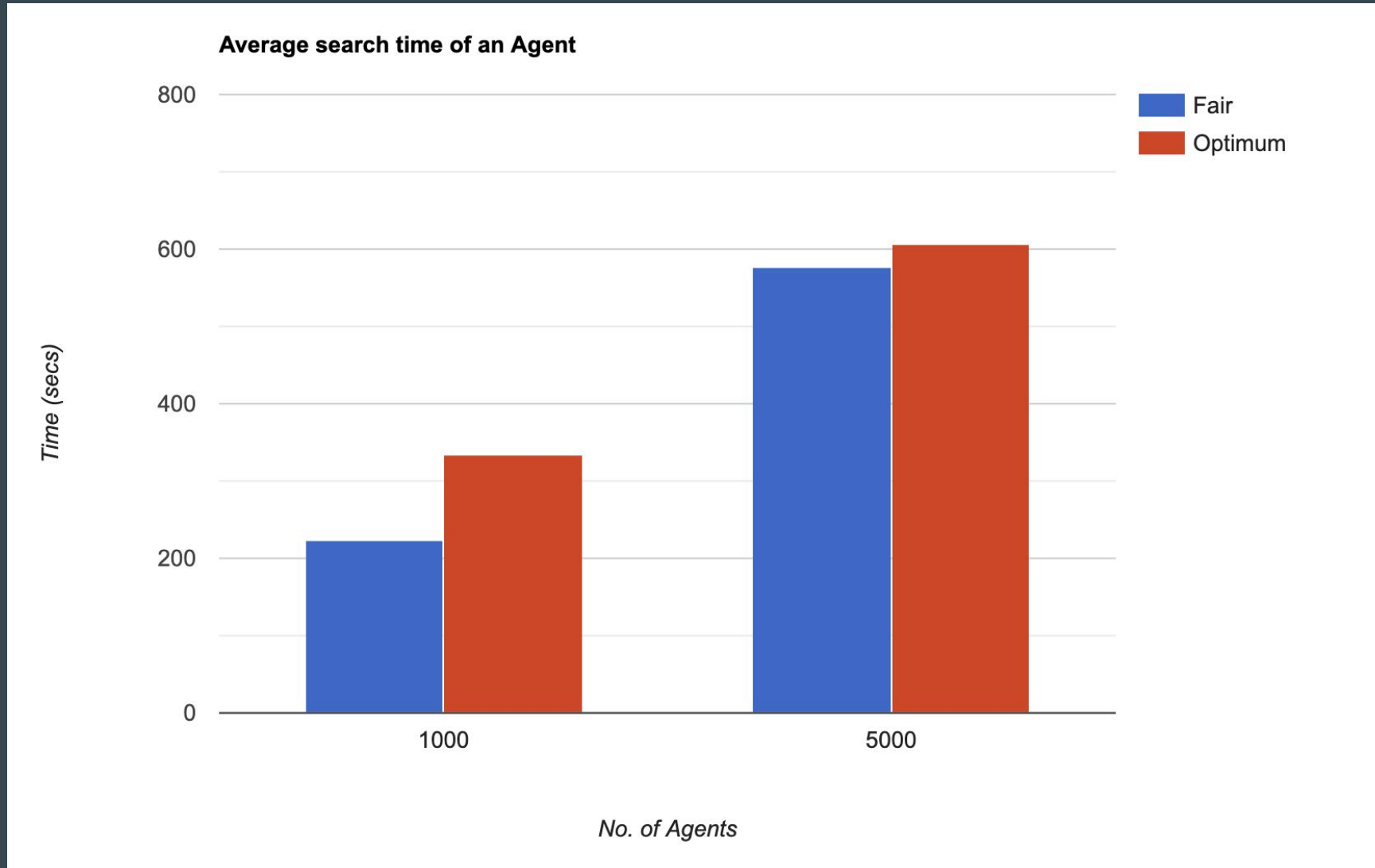
WAIT TIME FOR A CUSTOMER

DROPPED REQUESTS

INCONSISTENCIES

BETWEEN TEST DATA A AND TEST DATA B

No major inconsistencies in results between Test Date A and Test Date B

BETWEEN OTHER GROUPS

With Group 5: No major inconsistencies in results expect for the algorithm run time. After checking, found that the project assumptions were similar.

Differences with Group 9:

	Our Results		Group 9 Results	
	Fair	Optimum	Fair	Optimum
Search Time	10 Mins	12 Mins	19 Mins	4 Mins
Dropped Request	12 %	6 %	5 %	5.6 %
Wait Time	4 Mins	3.5 MIns	1 Min	1 Min
Running Time	1.5 Mins	4 Mins	18 Mins	13 Mins

EXPERIMENTS CONDUCTED

1. 2015 Year Trend by Month
2. Seasonal Comparison
3. Day/Night Comparison

Experiment Parameters: 1. Number of Agents: 5000 2. Resource Expiration Time: 10 Mins 3. Assignment Period: 30 Sec

4. Trend by Changing the Number of Agents

Experiment Parameters: 1. Number of Agents: 3000, 5000, 7000; 2. Resource Expiration Time: 10 Mins 3. Assignment Period: 30 Sec

Dataset Used: May 2015

Link to Simulation results: https://drive.google.com/open?id=1oJaJxk8MicwNKRI2dq-FBBOAL4Xxcqse

2015 Year Trend and Seasonal Comparison

Resource Expiration Percentage
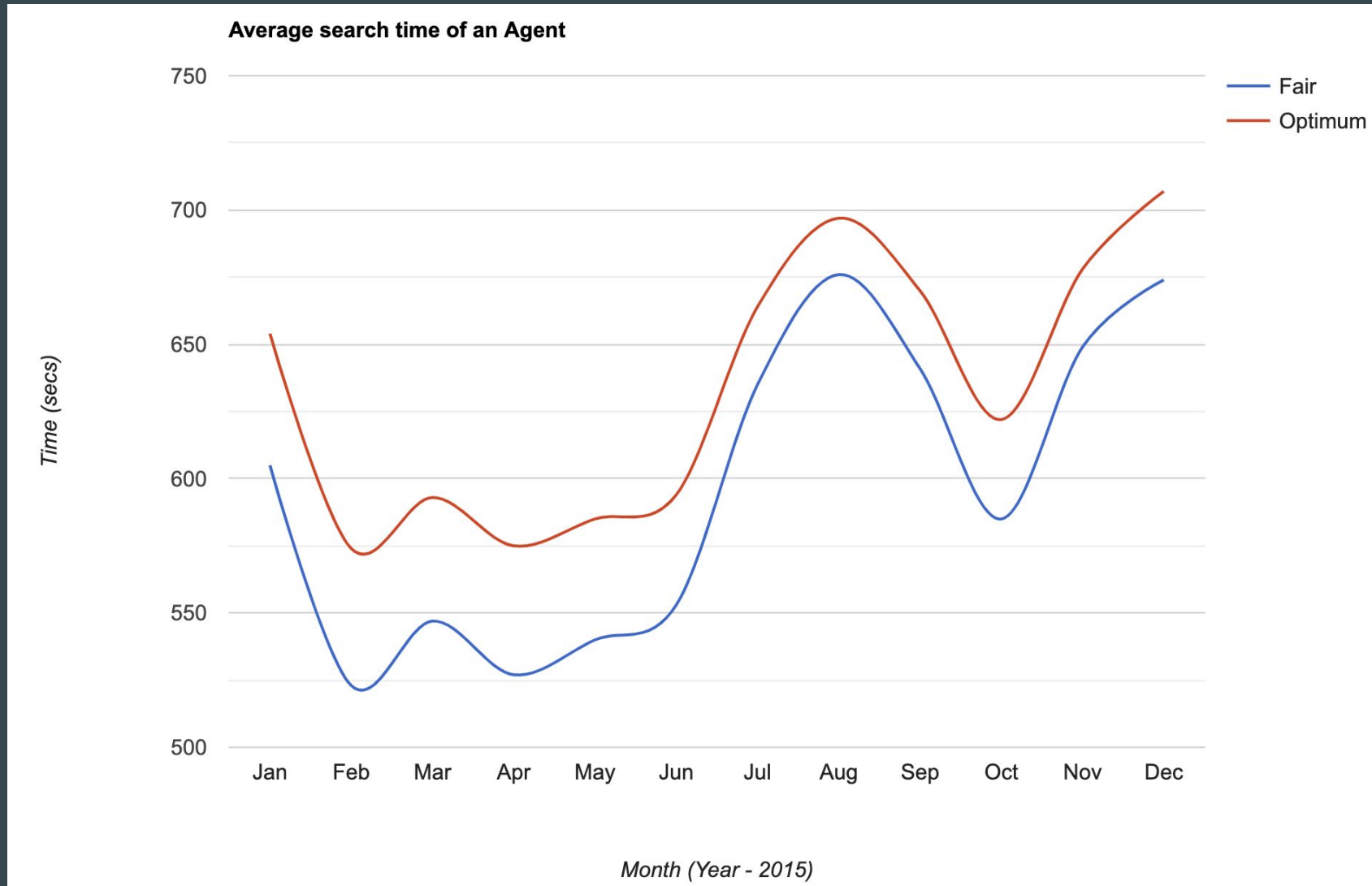

Resource Expiration percentage
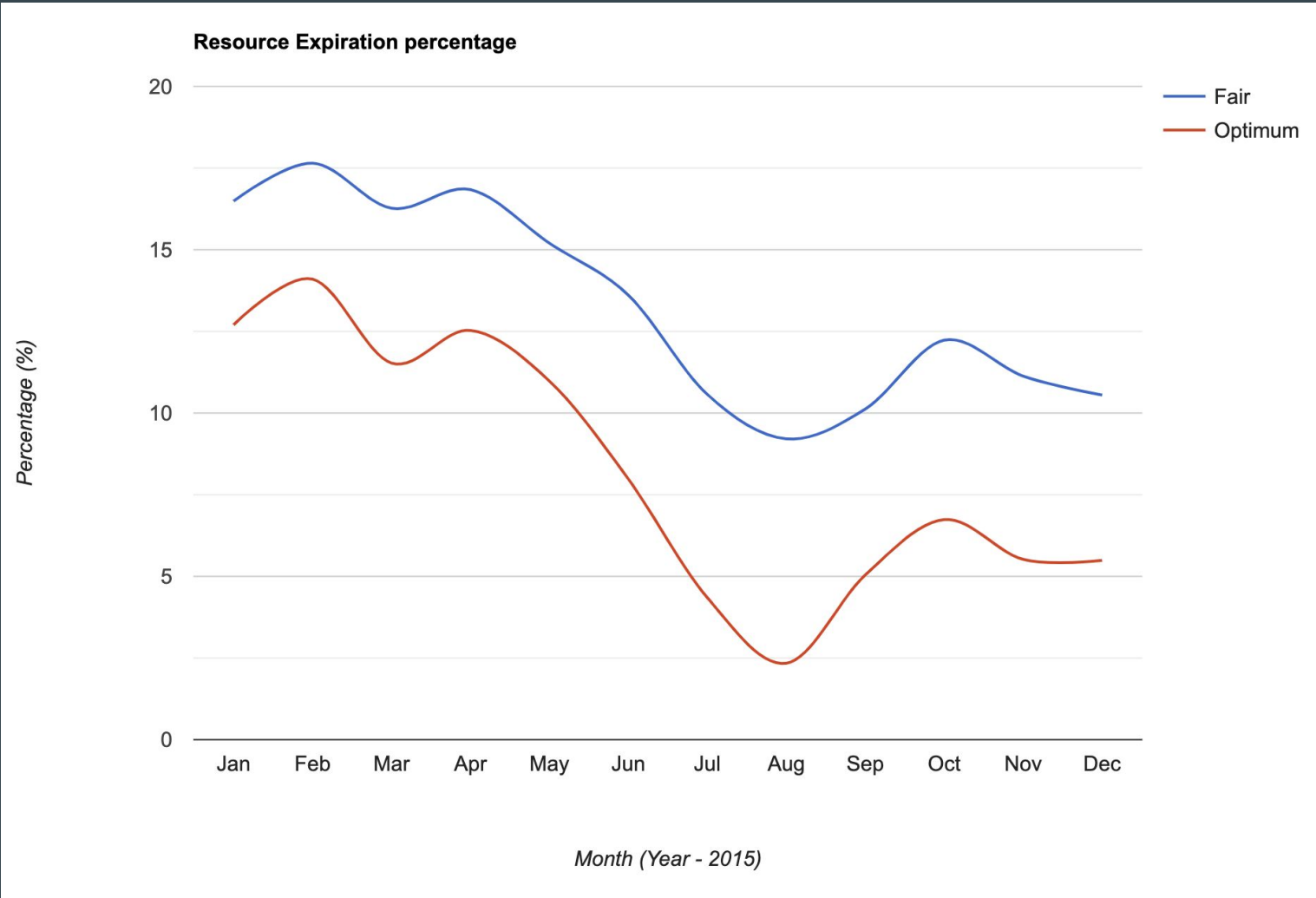
INSIGHTS:

-> From the plots, we can come to a conclusion that our graphs are majorly influenced by the following factors
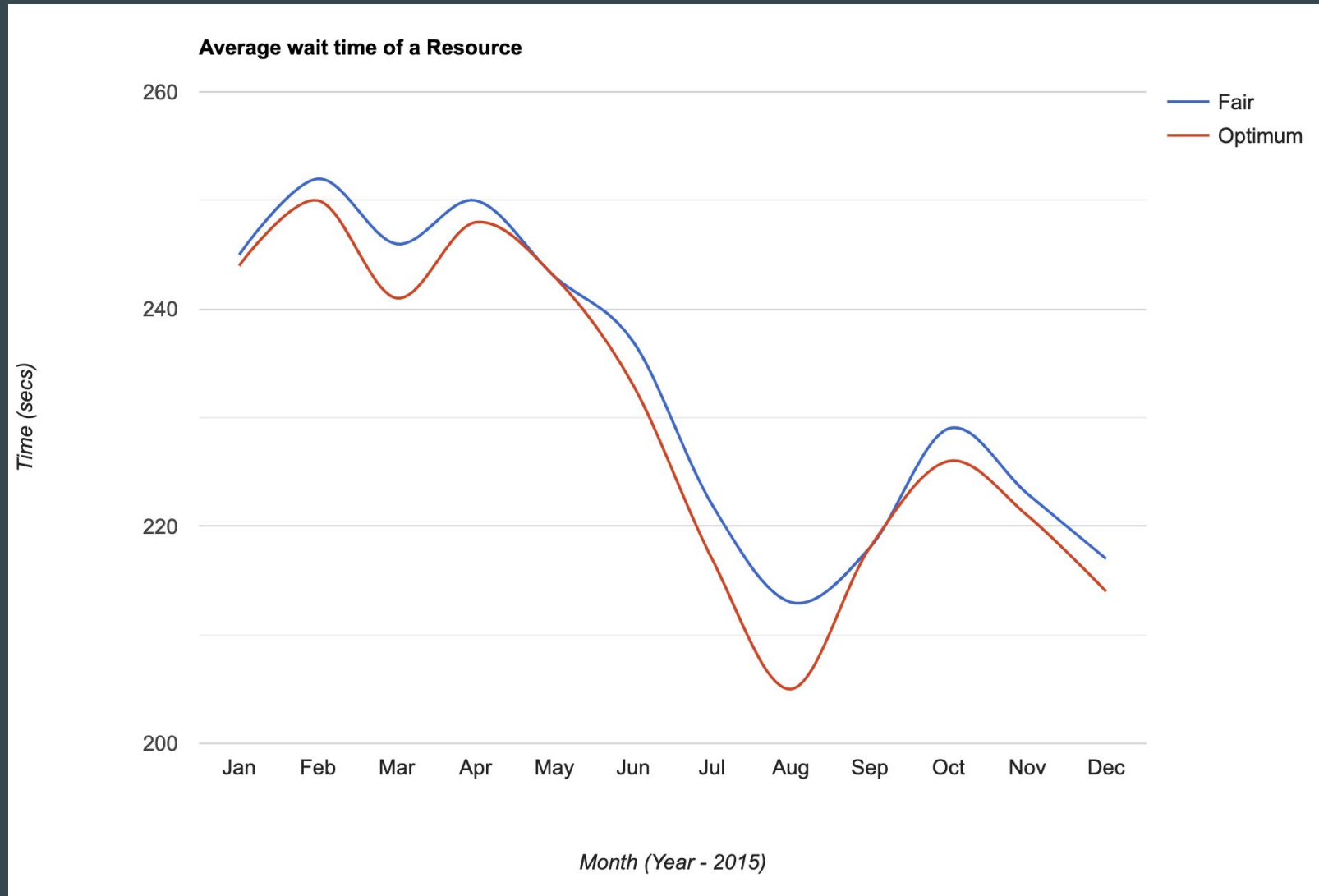
1. Temperature
2. Vacation Months.

-> Cab utilization is lesser during summer and vacation months.

-> As far as fair and optimum assignment is concerned, the difference in the results are almost identical irrespective of the above factors throughout all the metrics.
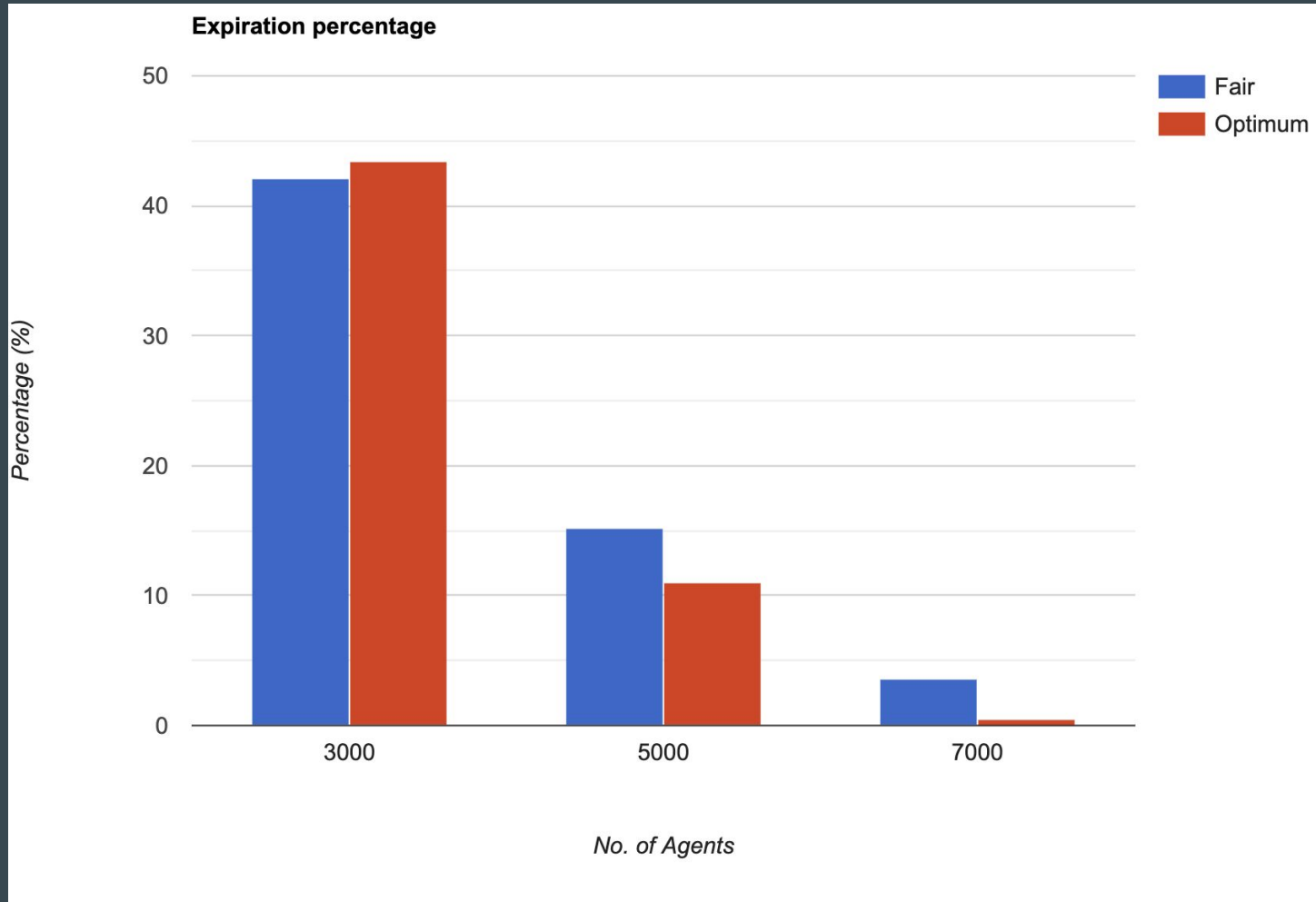
Average Search Time of an Agent

Average Wait Time of the Resource

Average wait time of a Resource

Trend by Changing the Number of Agents
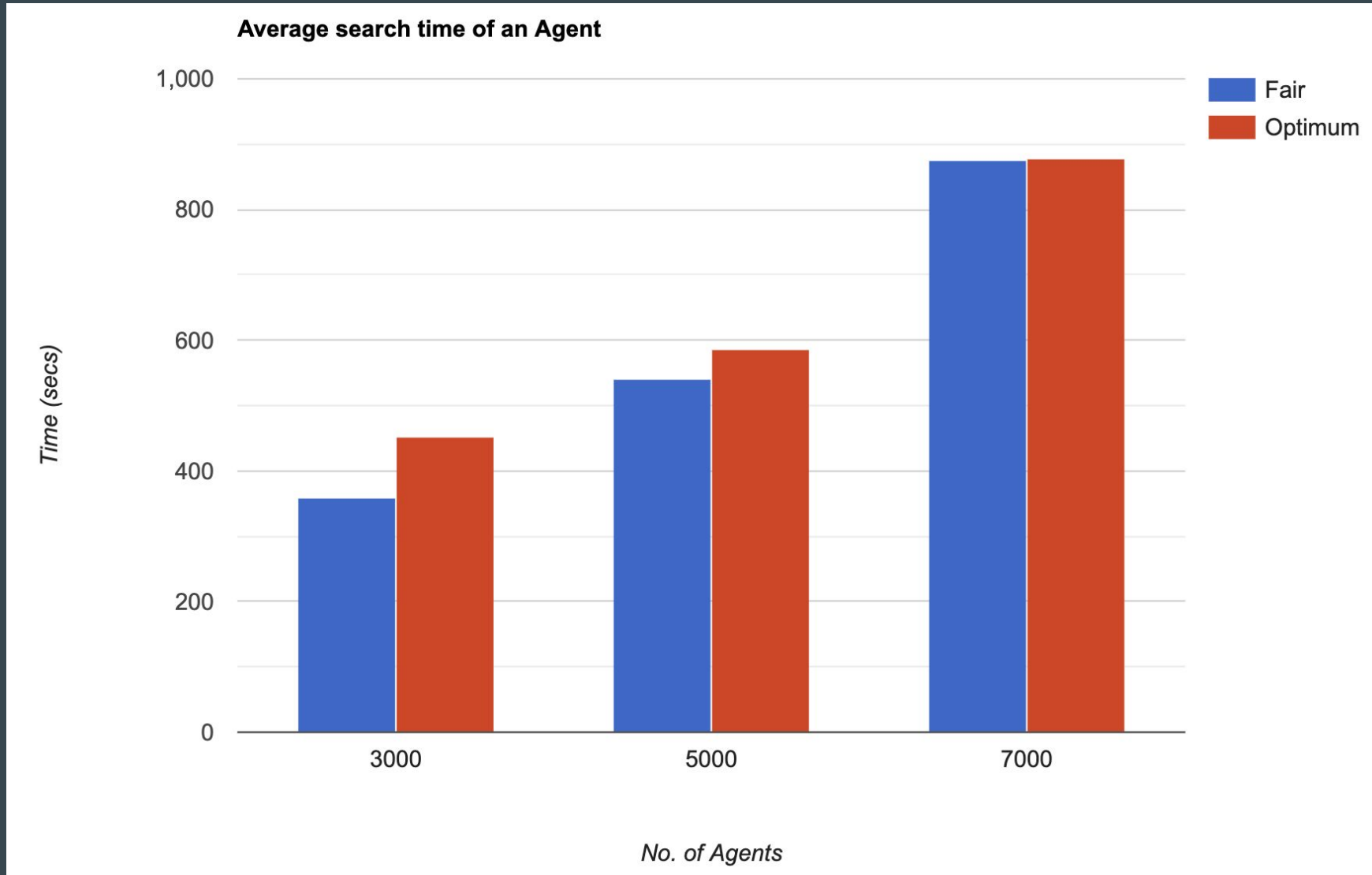
Resource Expiration Percentage

INSIGHTS:

-> From the plots we can see that the number of agents can play a major role in deciding the profit of the company.
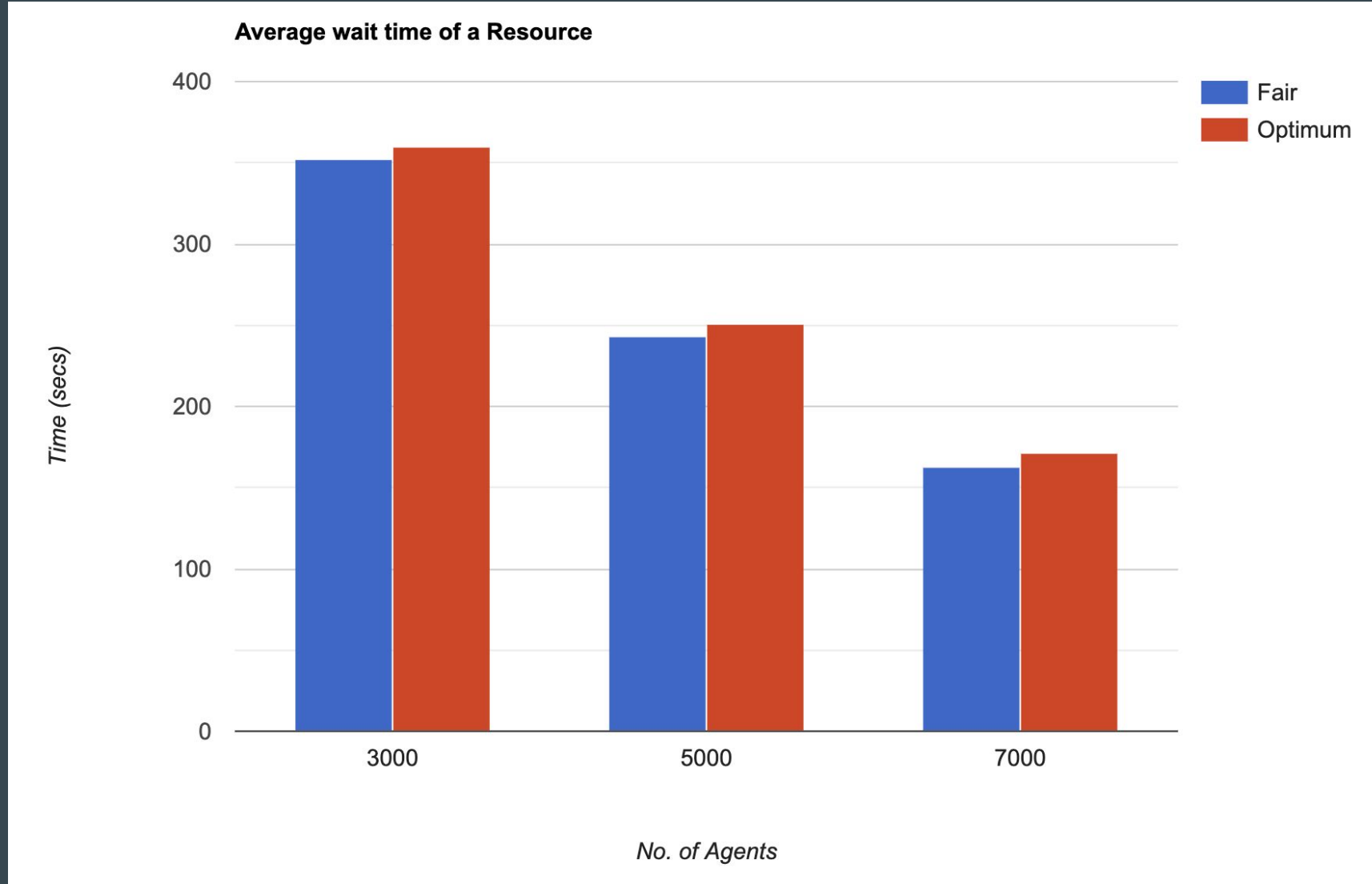
-> More assignments tend to happen with the increase in agents.

-> But we have to consider the fact the increasing the number of agents can increase the operational cost which could be decided from future studies.
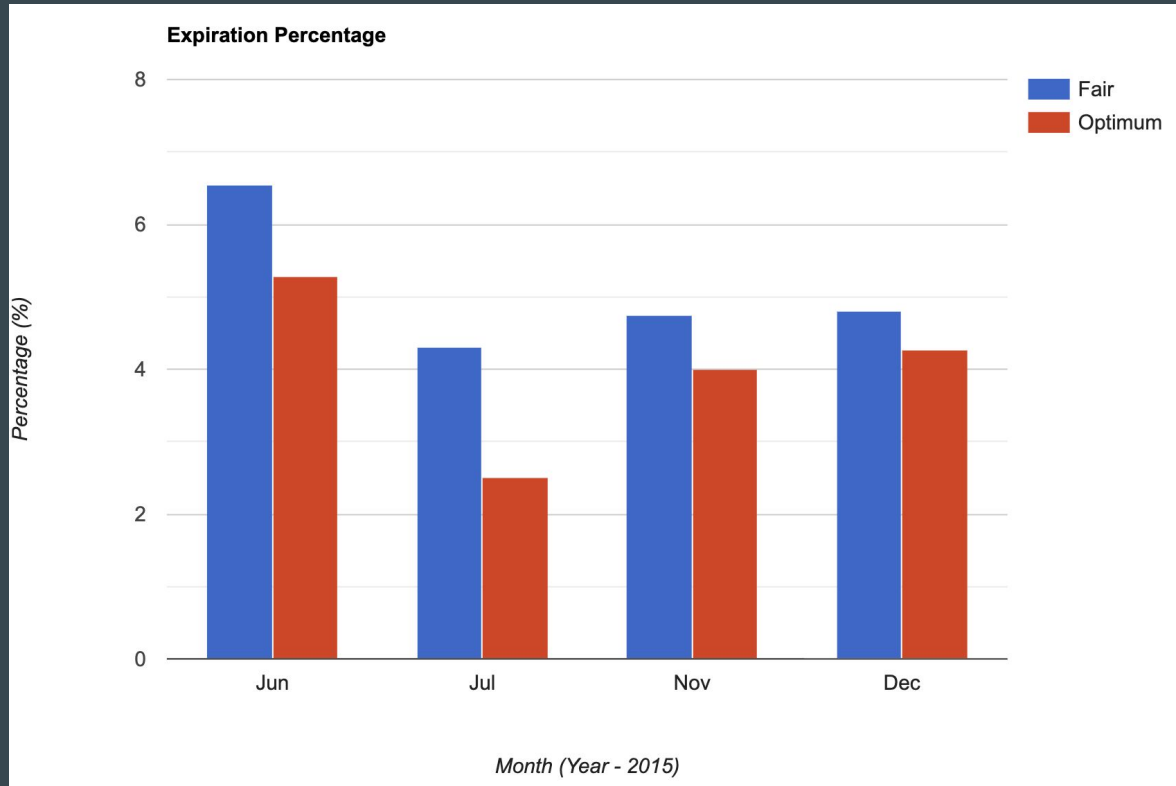
Avg. Search Time of an Agent

Average search time of an Agent

Legend: Fair (blue), Optimum (red)

Y-axis: Time (secs) — 0, 200, 400, 600, 800, 1,000

X-axis: No. of Agents — 3000, 5000, 7000

Avg. Wait Time of a Resource
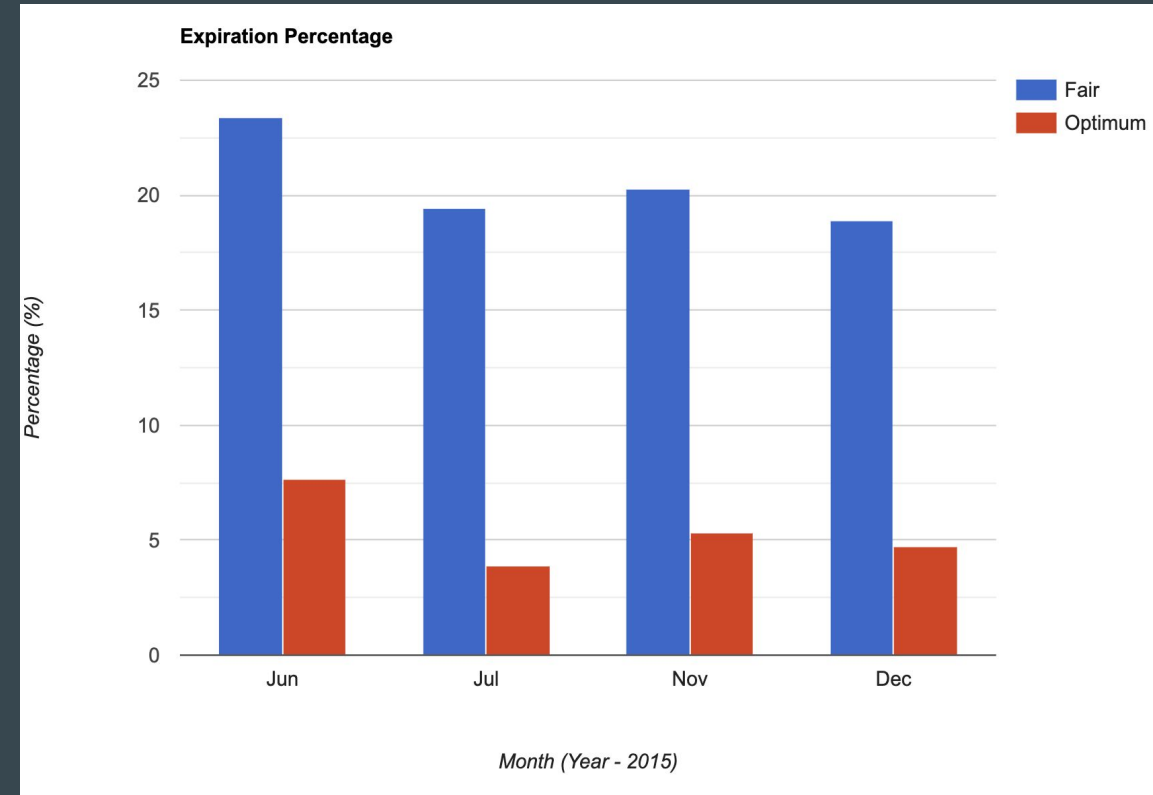

Average wait time of a Resource

Day (6 AM - 6 PM)/Night (6 PM - 6 AM) Comparison and Seasonal Comparison

# Resource Expiration Percentage
DAY
NIGHT

- During night, most of the cab utilization is usually between the hours 6 PM and 10 PM after which there is a huge drop in the number of resources. Whereas, during the day it's equally spread out through the hours.

- From the above plots we could evidently see that Optimum algorithm has the same expiration percentage throughout Day and Night handling high demands in short period in such way to make more profit.

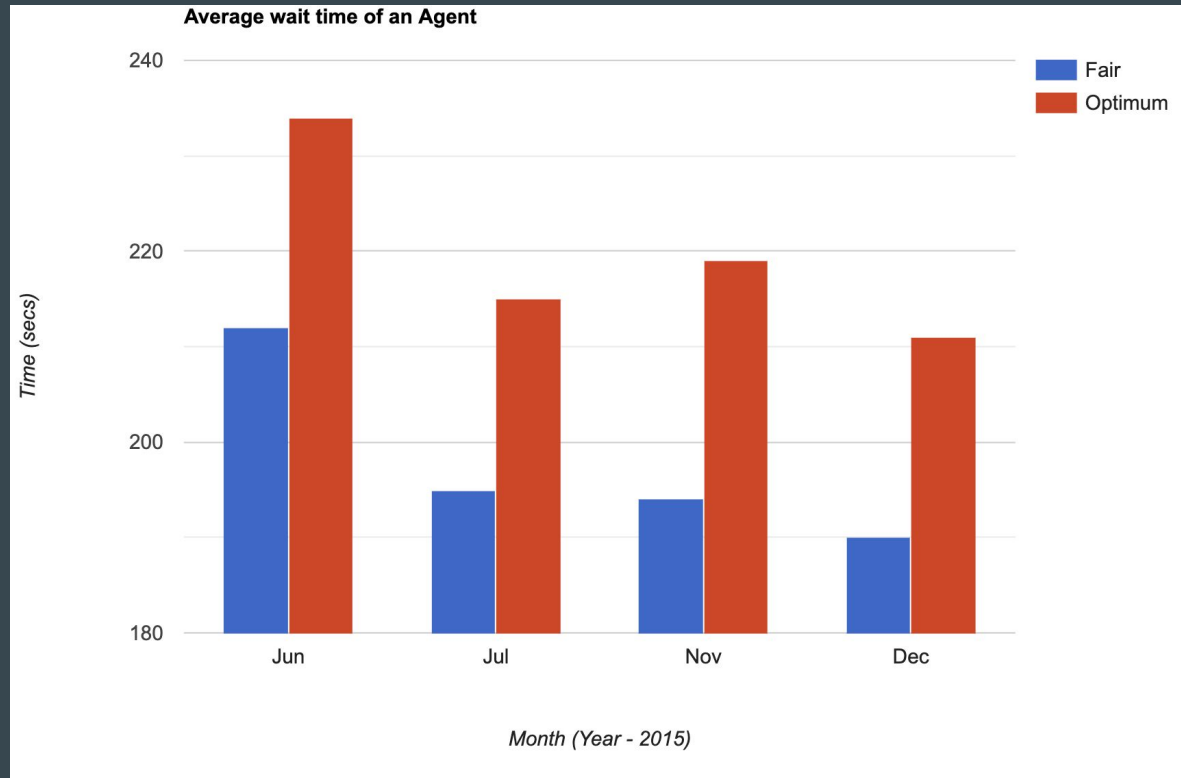# Avg. Search Time of an Agent
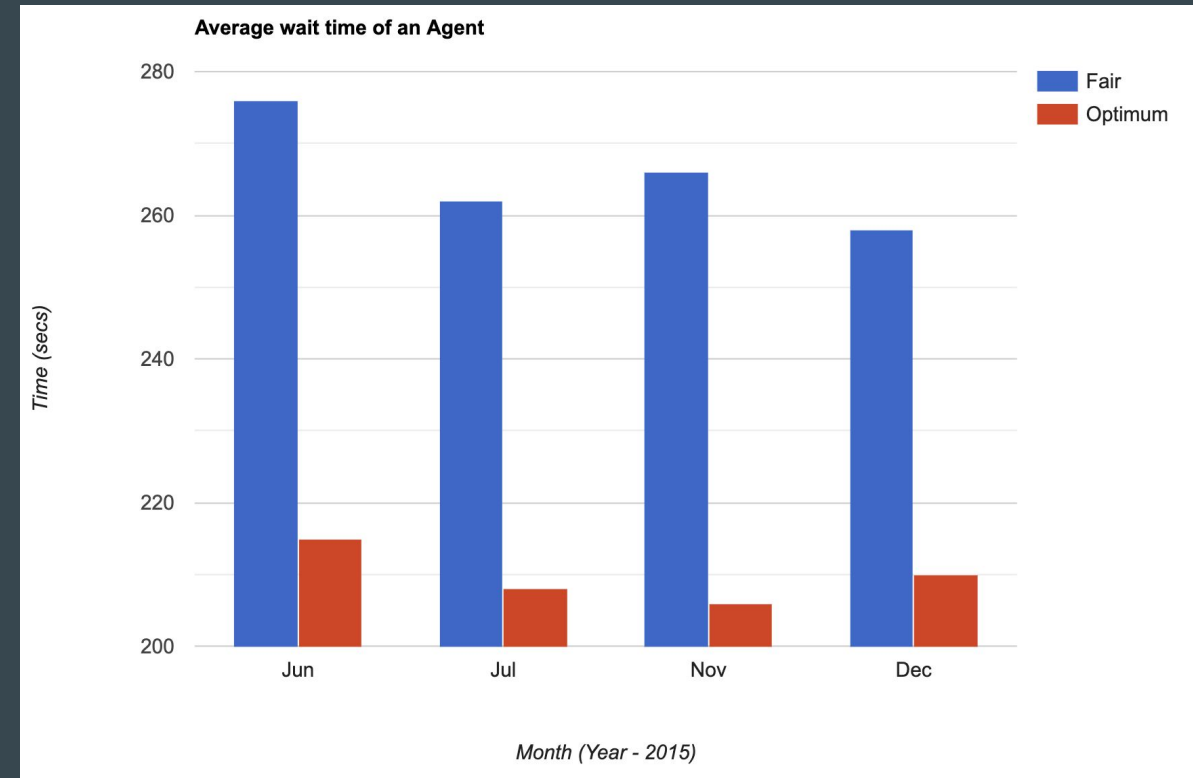## DAY
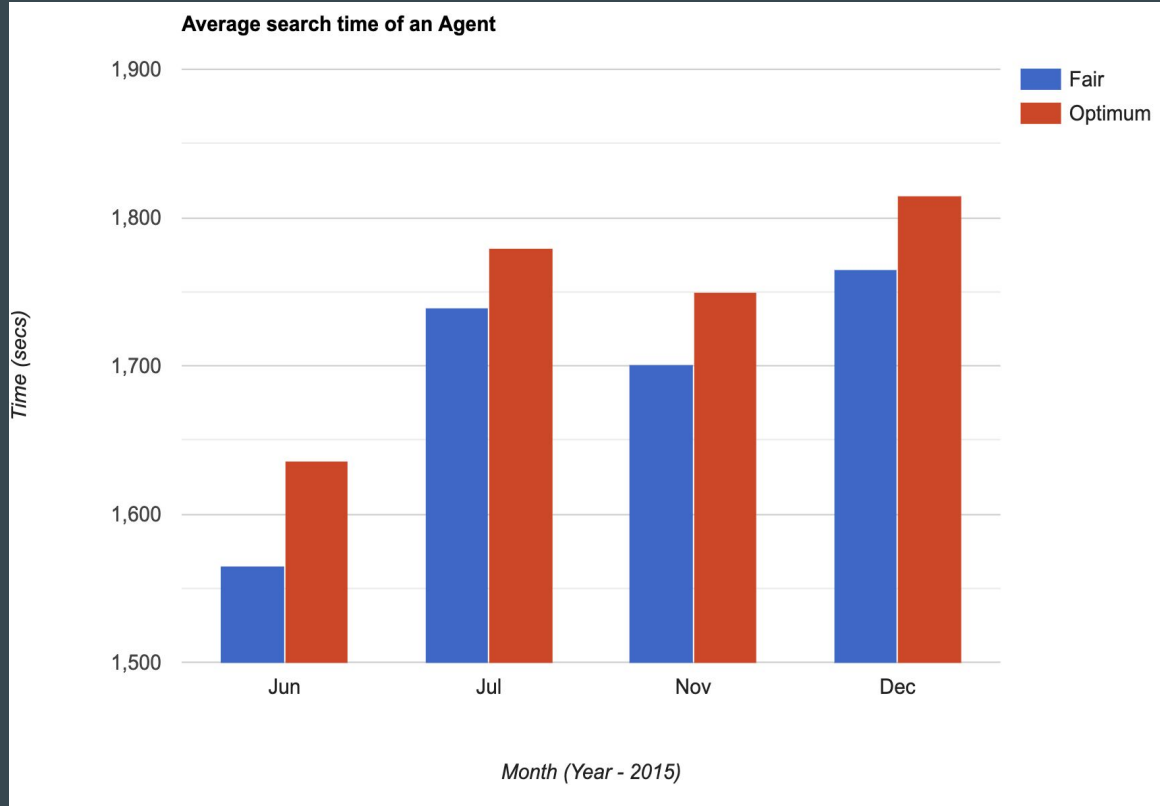
NIGHT
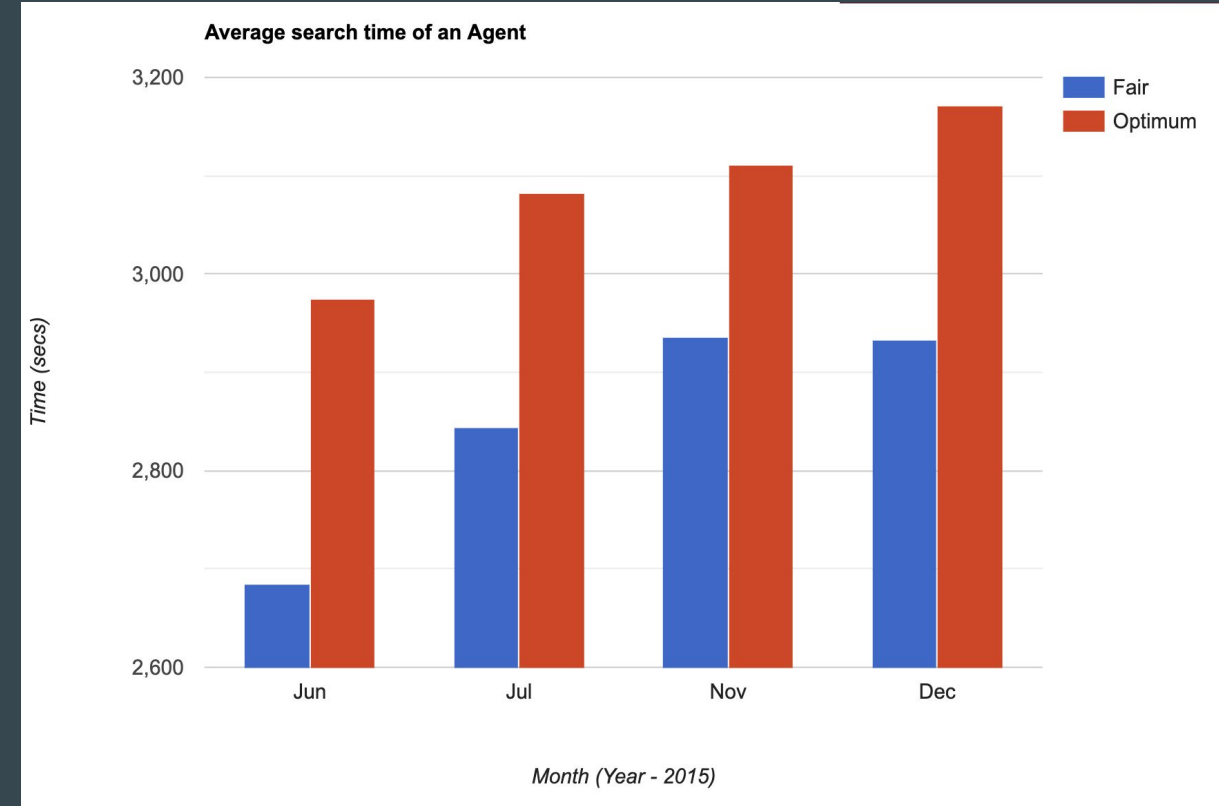
- Generally, in our plot we see that Optimum Algorithm has higher search time than Fair. This is followed in the above plots as well.
- The increase in difference during the night can be due to fact that after 10 PM, there would be minimal number of resources since most of the requests are concentrated between 6 PM and 10 PM.

Avg. Wait Time of a Resource

DAY

NIGHT

Thank You !