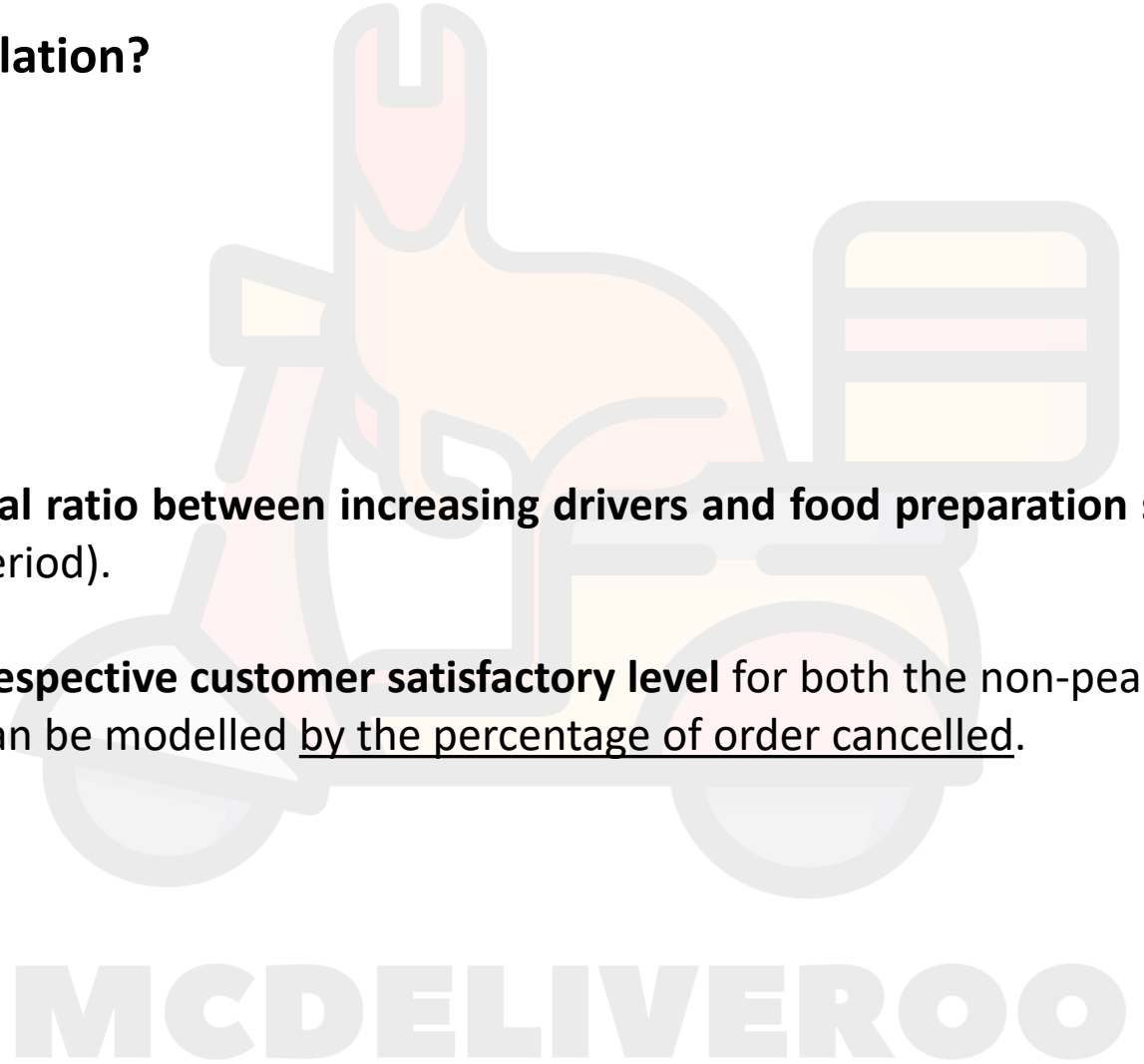
What is the goal of this simulation?



To determine what is the **optimal ratio between increasing drivers and food preparation speed** to cater to the frequency of orders (non-peak and peak period).

Our end goal was **to achieve a respective customer satisfactory level** for both the non-peak and peak period. We assumed that the customer satisfaction can be modelled by the percentage of order cancelled.

Parameters – Non Peak Period

Total McDonalds: 4

For the **non-peak period**, the fixed parameters are:

- **Target Cancellation** **: 2%**
- Likelihood Cancellation Rate : 0.05
- Min Cancellation Time : 60mins
- Food Order Frequency : 0.002

Assumption: For non-peak periods, customers are willing to wait longer and less likely to cancel.

Parameters – Peak Period (Lunch)

For **<u>lunch</u> peak period**, the fixed parameters are:

- **Target Cancellation** **: 5%**
- Likelihood Cancellation Rate : 0.06
- Min Cancellation Time : 45mins
- Food Order Frequency : 0.003

Assumption: For peak periods (lunch), customers are in a hurry and would be less willing to wait longer. The cancellation rate is slightly higher. Order frequency is going to increase as people who prefer convenience will order online.

Parameters – Peak Period (Dinner)

For **<u>dinner</u> peak period**, the fixed parameters are:

- **Target Cancellation : 2%**
- Likelihood Cancellation Rate : 0.04
- Min Cancellation Time : 60mins
- Food Order Frequency : 0.004

Assumption: For peak periods (dinner), customers have ended work and are less likely to cancel as they are not in a hurry and since we assumed them to be free, their patience time will also increase. We assumed that there will be more food orders during Peak dinner period compared to any other periods as people will be eating with their loved ones. The likelihood cancellation rate will also decrease.

For both periods, the variable parameters are:

1. Number of Drivers

1. Food Preparation Speed

Important Note:

- Max Food Prep Speed : 0.6
- Max Drivers : 40 (10 per McDonalds)

Rationale: It is illogical to assume that the driver will be able to collect the food upon arriving at the McDonalds, based on our observation **there is always a waiting period** hence setting the Max Food Prep speed to 1.0 is **unrealistic**.

From the same observation, there are usually **no more than 10 drivers per** McDonalds' outlet hence we decided to cap our simulation to up to 40 drivers. The distribution of the drivers is random however each rider will travel to the nearest McDonald upon receiving an order.

Simulation Results Analysis

Our Parameters:

- Number of Drivers
- Food Preparation Speed

Important Note:

The riders are following **the shortest path algorithm** to deliver to the customer house, however when they received an order, they **might not be the nearest one to the McDonald**. As such during our simulation, we noticed that there are times the % of Order Cancelled or the Average Delivery Time will **increase** even though we **have improved** the food preparation speed.

Eg. *5 Drivers at 0.2 food prep speed will result in a 55% of order cancelled but increasing food prep speed to 0.3 caused the % of order cancelled to increase to 58% instead.*

Simulation Results Analysis – Percentage of Order Cancelled (Non Peak Period)

Non-Peak	Food Preparation Speed					
Number of Drivers	0.1	0.2	0.3	0.4	0.5	0.6
5	59	55	58	56	51	50
10	19	18	18	15	10	10
15	2	1	0	1	1	0
20	0	0	0	0	0	0
25						
30						
35						
40						

Conclusion: Our team managed to achieve its targeted % of Order Cancelled for this non-peak period with the parameters, 15 driver and at least 0.1 food preparation speed. Based on this, we could also conclude that increasing *Food Preparation Speed* from 0.1 to 0.6 for the same amount of driver **does not have any significant impact** on reducing the *Percentage of Order Cancelled*.

Simulation Results Analysis – Percentage of Order Cancelled (Lunch Peak Period)

Peak (Lunch)	Food Preparation Speed					
Number of Drivers	0.1	0.2	0.3	0.4	0.5	0.6
5	72	71	67	70	67	69
10	45	43	45	47	42	45
15	29	24	16	15	17	17
20	7	6	5	5	4	5
25	7	4	4	4	4	4
30	8	4	4	3	4	3
35	7	4	4	3	2	3
40	5	3	2	2	2	1

Conclusion: Once again, McDeliveroo has **managed to achieve its targeted % of Order Cancelled** of 5% during a peak lunch period, this time round with an increasing number of drivers at 25 and food preparation speed of 0.2. As with the previous simulation (Non-Peak period), increasing the number of riders from 5 to 10 and to 15 have **a much larger reduction** in % of order cancelled compared to increasing it beyond 20. **There is a diminishing return in hiring more drivers**.

Simulation Results Analysis – Percentage of Order Cancelled (Dinner Peak Period)

Peak (Dinner)	Food Preparation Speed					
Number of Drivers	0.1	0.2	0.3	0.4	0.5	0.6
5	73	73	70	70	68	69
10	53	49	48	44	45	46
15	34	30	28	27	26	23
20	14	10	7	8	8	7
25	2	0	0	0	0	0
30	1	0	0	0	0	0
35						

Conclusion: **The target 2% of order cancelled was achieved** with 25 riders and 0.1 food preparation speed during peak dinner period.

Simulation Results Analysis – Percentage of Order Cancelled (Conclusion)

Our group determined that it is **more optimal to increase the number of drivers to 15** for non-peak period and **to 25** for peak periods.

As for food preparation speed, a value of 0.2 and above gives **the best result**, **more** customers are **satisfied** with the delivery timing and there are **less cancellations**.

There is also no suitable trade-off between increasing food preparation speed over number of drivers as in all the simulation runs we did, **increasing riders give a much more significant improvement**.

Simulation Results Analysis – Percentage of Order Cancelled (Interesting Observation)

Unexpectedly, while increasing drivers has **reduced** the % of order cancelled **significantly**…
We found out that there is **marginal improvement** in the average delivery time per order as shown at the following slides.

Simulation Results Analysis – Average Delivery Time Per Order (min) (Non Peak Period)

Non-Peak	Food Preparation Speed					
Number of Drivers	0.1	0.2	0.3	0.4	0.5	0.6
5	56.5	55.9	57.7	56	51.1	54.6
10	49.4	45	47.4	43.3	46.3	39.2
15	36.5	35.2	33	33.7	33.8	34
20	34.5	32.3	32.2	32.4	32.4	32.9
25						
30						
35						
40						

Simulation Results Analysis – Average Delivery Time Per Order (min) (Lunch Peak Period)

Peak (Lunch)	Food Preparation Speed					
Number of Drivers	0.1	0.2	0.3	0.4	0.5	0.6
5	47.6	45.4	46.9	46.6	48.1	45.6
10	42.8	43.7	43.1	44	43.3	43.8
15	40.8	38.7	37.4	38.2	37.3	37.9
20	35.2	33.7	32.6	32.7	33.4	33.1
25	34.8	32.7	32.9	31.9	32	31.4
30	33.7	32.9	31.6	31.7	30.6	30.7
35	34	31.5	31	31.5	31.3	31.1
40	33	32.1	30.8	31.1	31	29.7

Simulation Results Analysis – Average Delivery Time Per Order (min) (Dinner Peak Period)

Peak (Dinner)	Food Preparation Speed					
Number of Drivers	0.1	0.2	0.3	0.4	0.5	0.6
5	58.9	58.7	59	58	60.8	56.6
10	61.3	55.3	58.7	54.6	57	56.8
15	53.1	51.5	52.8	51.8	51.2	50.4
20	49.3	44.3	41.8	43.7	44.3	42.2
25	38.8	35.3	35.3	34	34.3	33.4
30	36.8	32.9	32.3	32.4	32.2	32.1
35						
40						