



Ice-cream Shop Waiting Time Simulation

Yuejun Wu
Thuong Phan



Background

- Mom&pop shop
- One day in summer in Chicago
- Motivation: Minimize waiting time by hiring what level of experience employee is better? Estimate how much ice cream liquid to be prepared for one day?
- Simulation
 - Average waiting time(ordering + icecream ready) for each customer over each day with different random variables
 - Number of ice-cream units ($S - 1$ unit, $M - 1.5$ units, $L - 2$ units) sold for one day



Random Variables

- Customer: Number of ice-cream for each type ordered by customers
- Customer: Ordering time
- Customer: Thinking time
- Employee: Preparation time based on various levels of experience
- Number of customers comes to the shop in different time during a day
- Number of (experienced & new) chefs available



Strategies

- 2 queues for simulation

New customer arrives

Ordering queue

Customer joins 1st queue & waits for his turn to make an order

Icecream waiting queue

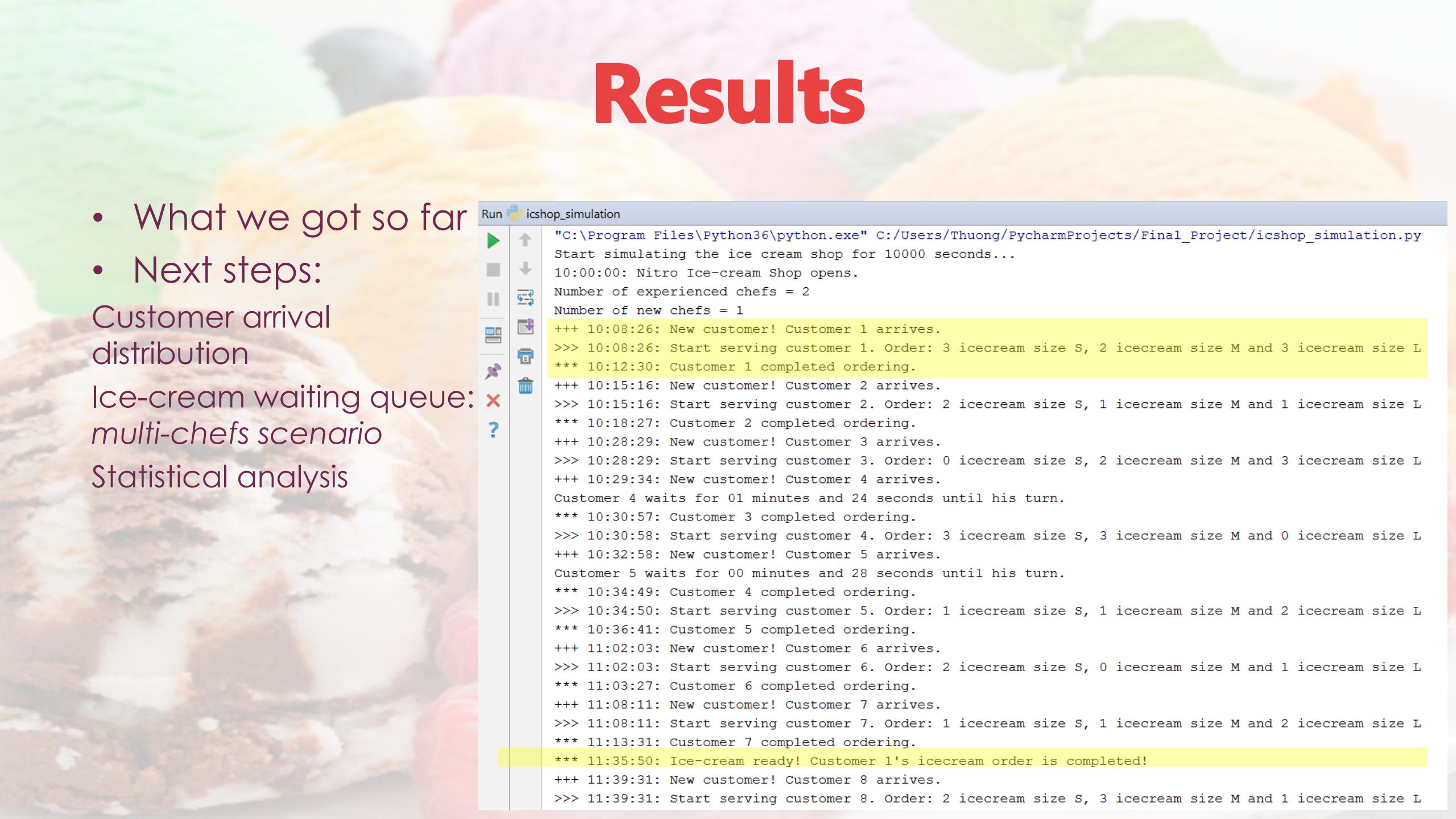
Icecream is added into 2nd queue & waits for the ‘Chef’ to make it.

Order completed



Results

- What we got so far
- Next steps:
Customer arrival distribution
Ice-cream waiting queue:
multi-chefs scenario
Statistical analysis



A screenshot of a PyCharm IDE showing the output of a Python script named `icshop_simulation.py`. The script simulates an ice cream shop for 10,000 seconds, starting at 10:00:00. It logs the opening of the shop, the number of chefs (experienced: 2, new: 1), and customer arrivals and completions. The log includes details about each customer's order size (S, M, L) and the time taken to serve them. The output is color-coded with yellow highlights around specific events like customer arrivals and order completions.

```
"C:\Program Files\Python36\python.exe" C:/Users/Thuong/PycharmProjects/Final_Project/icshop_simulation.py
Start simulating the ice cream shop for 10000 seconds...
10:00:00: Nitro Ice-cream Shop opens.
Number of experienced chefs = 2
Number of new chefs = 1
+++ 10:08:26: New customer! Customer 1 arrives.
>>> 10:08:26: Start serving customer 1. Order: 3 icecream size S, 2 icecream size M and 3 icecream size L
*** 10:12:30: Customer 1 completed ordering.
+++ 10:15:16: New customer! Customer 2 arrives.
>>> 10:15:16: Start serving customer 2. Order: 2 icecream size S, 1 icecream size M and 1 icecream size L
*** 10:18:27: Customer 2 completed ordering.
+++ 10:28:29: New customer! Customer 3 arrives.
>>> 10:28:29: Start serving customer 3. Order: 0 icecream size S, 2 icecream size M and 3 icecream size L
+++ 10:29:34: New customer! Customer 4 arrives.
Customer 4 waits for 01 minutes and 24 seconds until his turn.
*** 10:30:57: Customer 3 completed ordering.
>>> 10:30:58: Start serving customer 4. Order: 3 icecream size S, 3 icecream size M and 0 icecream size L
+++ 10:32:58: New customer! Customer 5 arrives.
Customer 5 waits for 00 minutes and 28 seconds until his turn.
*** 10:34:49: Customer 4 completed ordering.
>>> 10:34:50: Start serving customer 5. Order: 1 icecream size S, 1 icecream size M and 2 icecream size L
*** 10:36:41: Customer 5 completed ordering.
+++ 11:02:03: New customer! Customer 6 arrives.
>>> 11:02:03: Start serving customer 6. Order: 2 icecream size S, 0 icecream size M and 1 icecream size L
*** 11:03:27: Customer 6 completed ordering.
+++ 11:08:11: New customer! Customer 7 arrives.
>>> 11:08:11: Start serving customer 7. Order: 1 icecream size S, 1 icecream size M and 2 icecream size L
*** 11:13:31: Customer 7 completed ordering.
*** 11:35:50: Ice-cream ready! Customer 1's icecream order is completed!
+++ 11:39:31: New customer! Customer 8 arrives.
>>> 11:39:31: Start serving customer 8. Order: 2 icecream size S, 3 icecream size M and 1 icecream size L
```

Improvement

- Visualization of simulation
- Time: one day -> summer -> year
- Optimize waiting time -> optimize profit

