Restaurant Delivery Scheduling

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The Problem

How should a restaurant schedule their delivery orders so that customers are mostly satisfied?

- Happy Hot Hunan, a Chinese restaurant near Columbia University
- Got information by talking to several delivery men
- Customer satisfaction is strongly related to their waiting time
- What is the best schedule to minimize total lateness/tardiness?

Problem Setup

- Each order represents one job
- 4 machines: one delivery man can deliver at most 5 orders at one time
- 4 delivery areas: all the orders in the same area are delivered by one delivery man at one time
- Waiting time: total time a delivery man will wait to collect orders for one area
- Release time: the time orders arrive at the restaurant
- Processing time: the time a delivery man takes to deliver a order
- Cooking time: the time to cook a order
- Deadline: the longest time before customers are not satisfied
- Idle time: the time a delivery man gets back to the restaurant

Simulation

R[j]: release time, poisson distribution with arriving rate = 15 orders/hour=¼ order/min

P[j]: processing time, Uniform distribution[3,20] (Accept orders within 20 minutes riding time)

C[j]: cooking time, assume=10 min

D[j]: due time= R[j] + 45 min

L[j]: D[j]-R[j]-P[j]-C[j]

T[j] = 1 or 0

Algorithms

- We will choose EDD as our base algorithm.
- Greedy algorithm(FIFO) is same as EDD under our assumption, since we assume the due time = release time + 45 minutes.
- Longest Remaining Processing Time algorithm is not correct, since the processing time is proportional to distance. It doesn't make sense if we always deliver the furthest order first. In addition, we can take several orders each time.
- However, our problem is still NP hard, since we have two variables:
  1. Waiting time: Total time a delivery man can wait to collect all the orders.
  2. The Maximum number of orders a delivery man will take each time. (<=5, since one delivery man can't take more than 5 orders at one time).
- The result of our algorithms would be different combinations of waiting time and maximum orders taken each time.

Results & Analysis

Waiting time	Maximum orders delivered each time	Total Lateness (min)	Tardiness
N/A (pick and go)	1	342.55	14.10
N/A (pick and go)	2	186.98	13.32
N/A (pick and go)	3	228.68	13.74
0	5	5.51	1.22
5	5	19.23	3.82
15	5	90.53	11.61

Conclusion

- Waiting time approach is generally way better than fixed number of orders approach.
- Tried different job arrival rates, get the same results
- Further application of this project: implement more features and algorithms and help restaurants to plan their delivery methods given specific parameters.

Thank you!