MS 3106 Simulation Project

AC3 Bistro in Cityu

Group 10

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Table of contents

01

Problem Description

AC3 Bistro in Cityu

What are the problems

Comments on AC 3 from students:

Everytime I visited in AC3, there are many people waiting in the queue for placing order and waiting for food especially in rush hours…..

It seems that there is insufficient staffs for preparing food because I have to wait a long time to wait for food……

My friends and I have to wait so long in the queue for placing order….

Too many people in the queue and not many staffs for serving food….

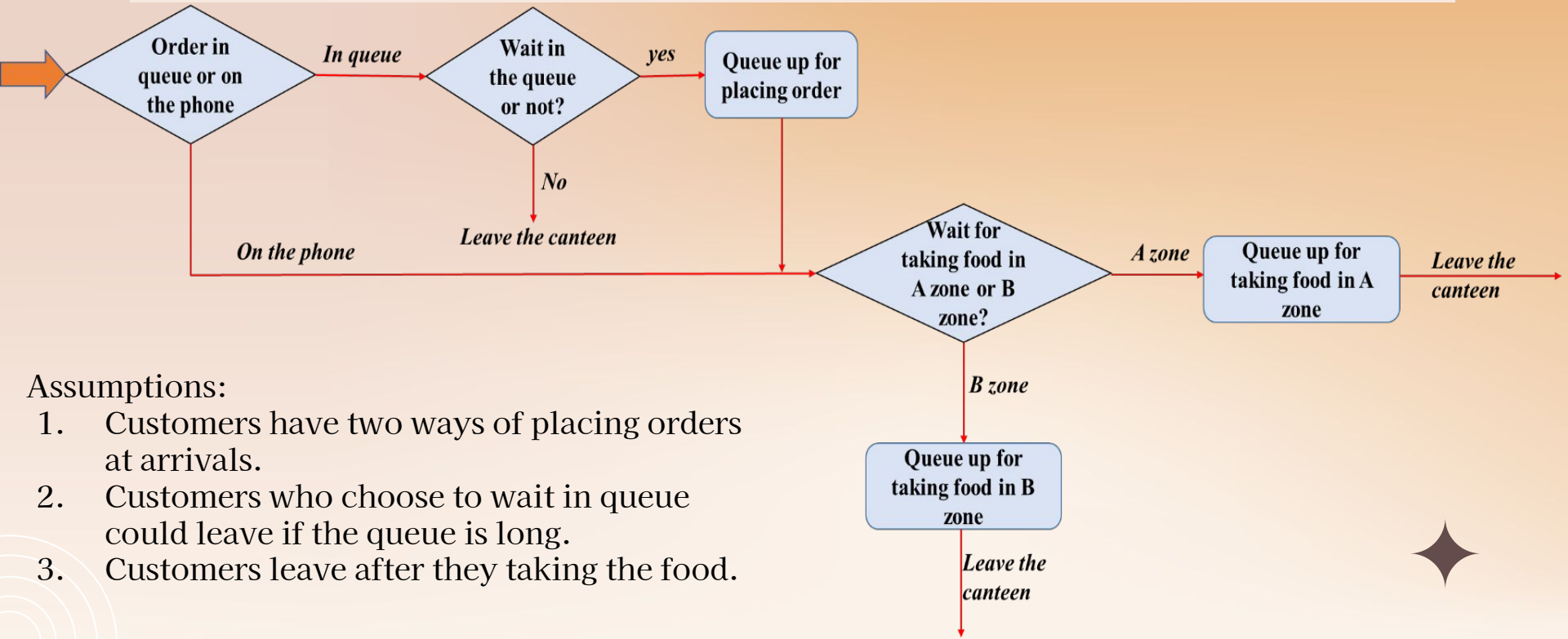
Major problems:

- Long waiting time
- Loss of customers because of long waiting time

Project Description

- **Simulate the system in AC 3 bistro from customers' arrivals at canteen to the process of placing order and waiting for the food.**
- **Analyze the output to find out the bottlenecks and suggest some recommendations on how to improve.**

AC3 Bistro - Draft Model



Assumptions:

1. Customers have two ways of placing orders at arrivals.
2. Customers who choose to wait in queue could leave if the queue is long.
3. Customers leave after they taking the food.

Project Goal

	Description
Goal 1	Students leaved after arrivals
Goal 2	Waiting time for whole process
Goal 3	Waiting time for placing order at counter
Goal 4	Waiting time for taking food

Output performance Measures

1. The percentage of students leaved after arrivals at the restaurant.
2. The average waiting time for whole process
3. The average waiting time for placing order at counter
4. The average waiting time for taking food in Zone A / Zone B

02

Input data analysis

AC3 Bistro

- Operating from 7:00-9:00
  - Arrival process stopped at 9:00
- **1 Order Area**
  - Data Collection: based on observation
  - Time spent by each customer on ordering food has an **exponential distribution with mean 2 minutes**
    - Reason of using exponential distribution:
      - All events of customer time spending are **independent cases**
      - Customer time spending are **not equally likely**

AC3 Bistro

- Order Area Staff
  - Date collection: based on human counting

	Number of Staff
7:00 a.m.–12:00 noon	1
12:00 noon–2:00 p.m.	2
2:00 p.m.–5:00 p.m.	1

	Number of Staff
5:00 p.m.–8:00 p.m.	2
8:00 p.m.–9:00 p.m.	1

AC3 Bistro

- **2 Food delivery Zone [A Zone , B Zone]**
  - Data Collection: based on observation
  1. Time spend by each customer on waiting food at **A Zone** has an **exponential distribution with mean 3 minutes**
  2. Time spend by each customer on waiting food at **B Zone** has an **exponential distribution with mean 2 minutes**
  - Reason of using exponential distribution:
    - All events of customer waiting time are **independent cases**
    - Customer waiting time are **not equally likely**

AC3 Bistro

- A Zone Staff
  - Date collection: based on human counting

	Number of Staff
7:00 a.m.–12:00 noon	1
12:00 noon–2:00 p.m.	2
2:00 p.m.–5:00 p.m.	1

	Number of Staff
5:00 p.m.–8:00 p.m.	2
8:00 p.m.–9:00 p.m.	1

AC3 Bistro

- B Zone Staff
  - Date collection: based on human counting

	Number of Staff
7:00 a.m.–12:00 noon	1
12:00 noon–2:00 p.m.	2
2:00 p.m.–5:00 p.m.	1

	Number of Staff
5:00 p.m.–8:00 p.m.	2
8:00 p.m.–9:00 p.m.	1

AC3 Bistro

- Customer arrival schedule
  - Date collection: based on human counting

	Number of arrival
7:00 a.m.-9:00 a.m.	30
9:00 a.m.-12:00 noon	20
12:00 noon-2:00 p.m.	80
2:00 p.m.-5:00 p.m.	20

	Number of arrival
5:00 p.m.-7:00 p.m.	80
8:00 p.m.-9:00 p.m.	10
After 9:00 p.m.	0

AC3 Bistro

- Choice of ordering method
  - Data collection: Based on Observation

1. 80% of customer order in queue
   - If the current number of queuing customer are **more than 40** people, the customer **leave the queue**
2. 20% of customer order on phone
   - Directly wait for the food delivery at A Zone / B Zone

AC3 Bistro

- Decision on 2 **Food delivery Zone**
  - Data Collection: based on observation
  - 50% of customer collect food at A Zone
  - 50% of customer collect food at B Zone

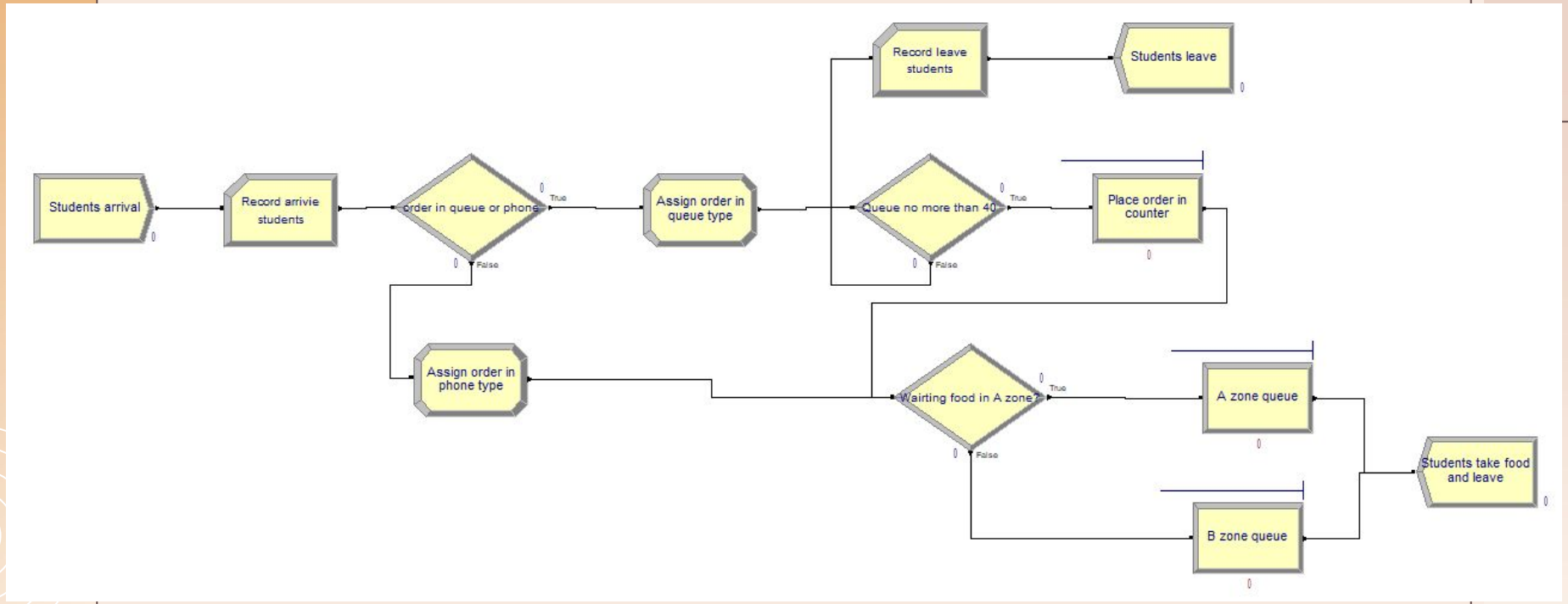
AC3 Bistro

- Output Performance Measures
  - Calculate the percentage of students who leave the queue when waiting for food ordering
  - (Number of leave students / Number of Arrived student) x 100%

03

Simulation Model

Base Model


Students arrival
Record arrivie students
order in queue or phone
True
False
Assign order in queue type
Record leave students
Students leave
Queue no more than 40
True
False
Place order in counter
Assign order in phone type
Wairting food in A zone?
True
False
A zone queue
B zone queue
Students take food and leave

Description of Base model

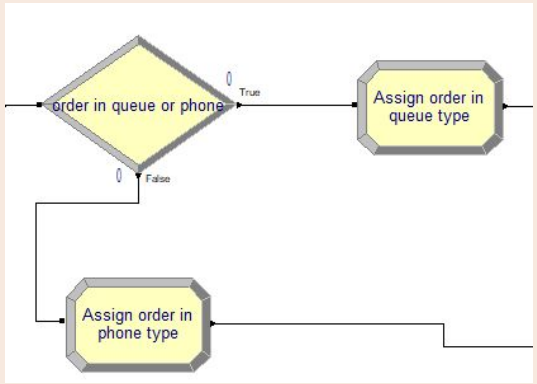
1. Assign entity type based on the order method students choose

   Purpose:
   to model real situation
   → identify which part has problem

Entity - Basic Process

	Entity Type	Initial Picture	H
1	Students	Picture.Yellow Ball	0.
2	Students order in queue	Picture.Red Ball	0.
3	Students order in phone	Picture.Blue Ball	0.

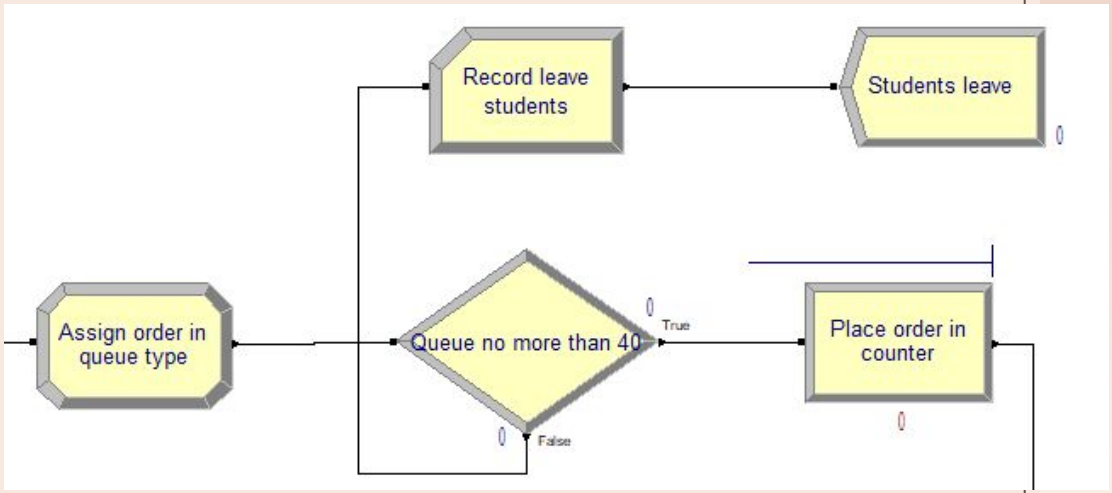
Double-click here to add a new row.



Description of Base model

2. Students will leave if people in the order queue is over 40

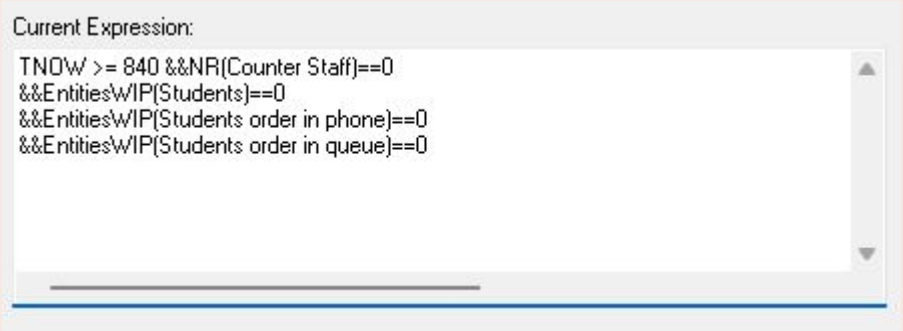
Purpose:
to model real situation
→ identify loss in customers in current model



Description of Base model

3. Terminating Condition

The whole simulation will stop
When time > = 9 pm, no entity are in WIP
All counter staff are not in used (Resources)



Description of Base model

4. Record and Statistic

Leave percentage
= (record of leaved students /record of arrived students)*100

Be the measurement → compare recommendation effective or not

Statistic - Advanced Process

	Name	Type	Expression	Report Label	Output File
1	Leave percentage	Output	NC(leave students)/NC(Arrived students) * 100	Leave percentage	

Double-click here to add a new row

04

Output analysis

Interpretation of Model Report

After Running the simulation in 20 replications

1. Total spent time for students(from placing order to finish taking the meal)

Total Time	Average
Students order in phone	28.8978
Students order in queue	47.6619

If students order via counter, need to wait nearly an hour in average

2. The wait time of different queues

Waiting Time	Average
A zone queue.Queue	10.2088
B zone queue.Queue	46.4473
Place order in counter.Queue	13.5147

The queue in B zone takes the most of time to wait
B zone is the bottleneck in the whole system

Time unit: minute

Interpretation of Model Report

After Running the simulation in 20 replications

3. Leave percentage (Leaved student / Arrived student)

Output	Average	Half Width	Minimum Average	Maximum Average
Leave percentage	0.6573	0.84	0.00	7.6175

Average value is in acceptable range

but maximum average is still too high

Can prevent the loss in customers by recommendation (Goal 1)

05

Recommendations

Recommendations

Problems identified:

1. Long waiting time in zone B (food taking queue) – *Goal 4*
   = an hour
   Reason : lack of labour in peak hours

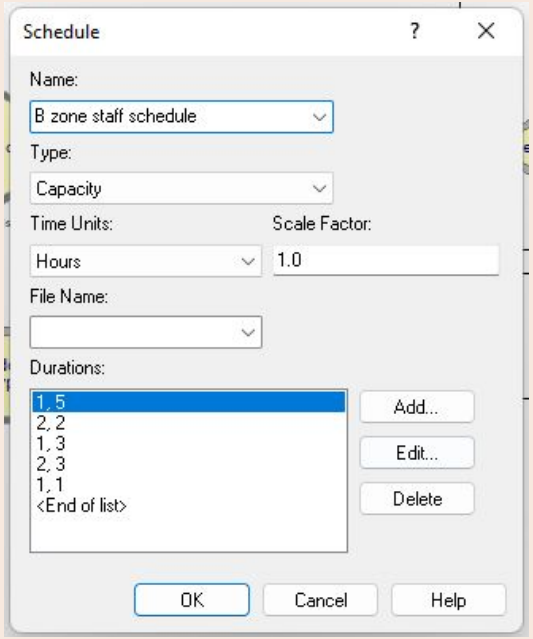
Suggestion: add one more staff in zone B in rush hours

2. Relatively long waiting time in placing order – *Goal 3*
   Reason : too many students arrived in rush hours

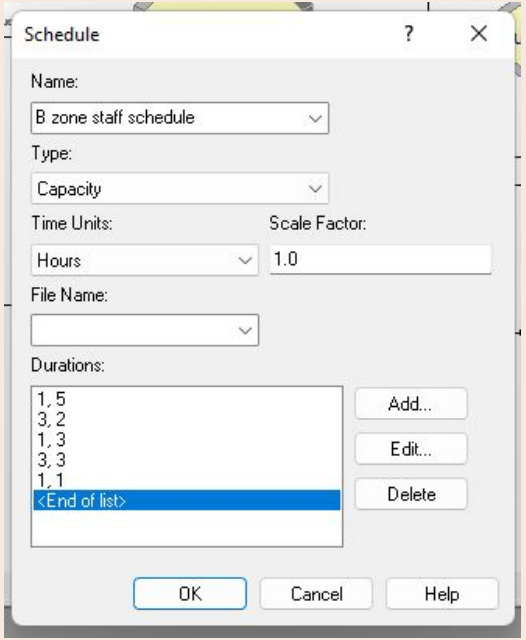
Suggestion: add a self-checkout machine (e.g. Ac1)

✖ Add staff at counter
∵ limited space of counter
& the queue is still long in visual = loss in customer

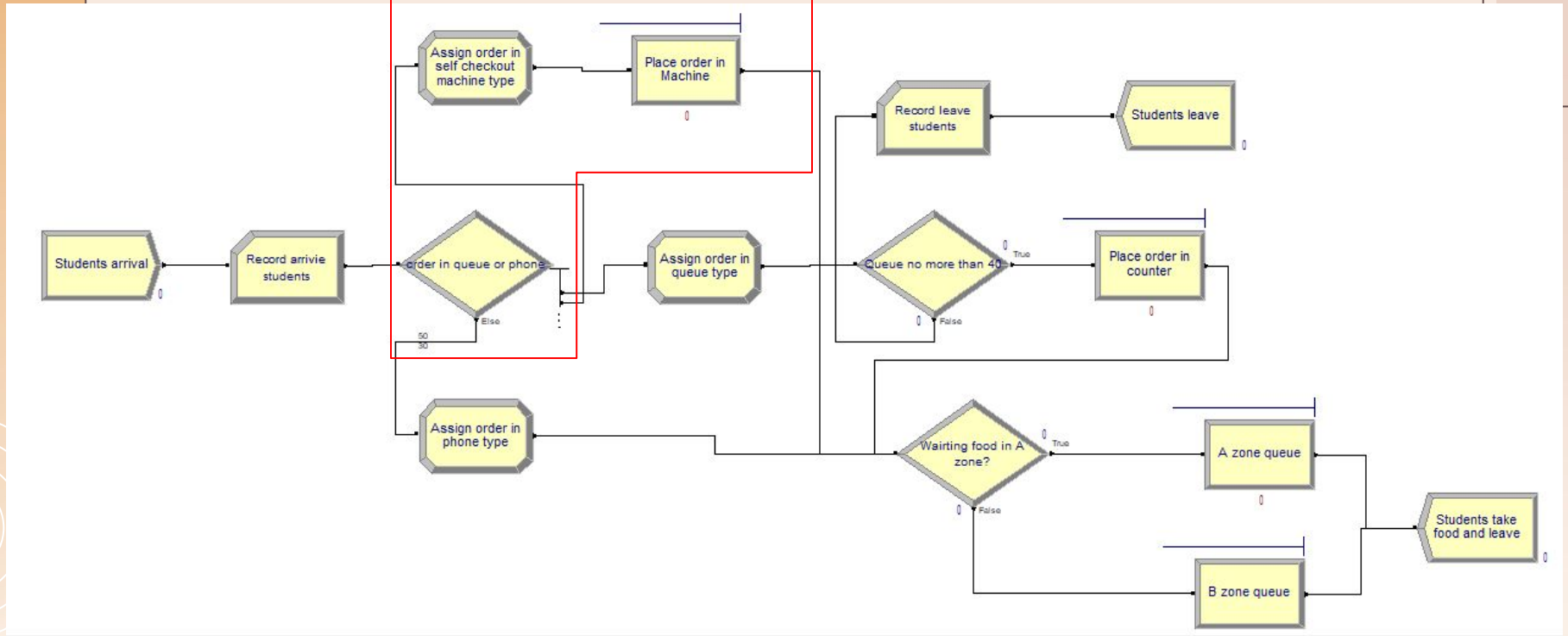
Change in Arena Model



2 Staff → 3 Staff

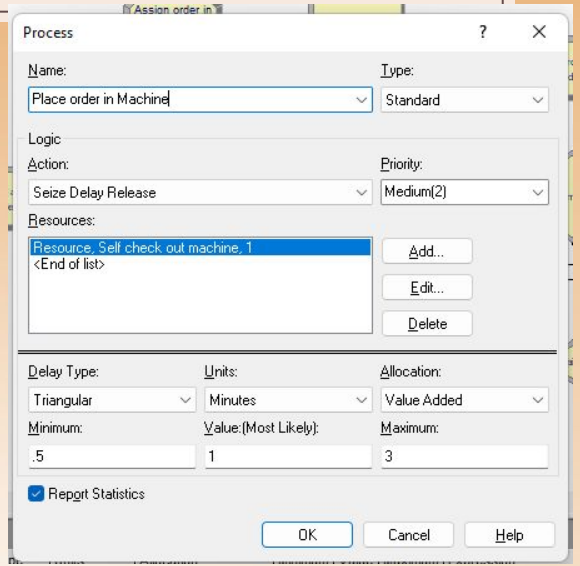


Change in Arena Model



Change in Arena Model

- Add resource : Self-checkout machine
- Assign new entity type : Students order in Self-checkout machine
- Set up queue to simulate the practical queue
  → keep track the waiting time
  → prevent long waiting time in new measure
  → Triangular(0.5,1,3)



Resource - Basic Process

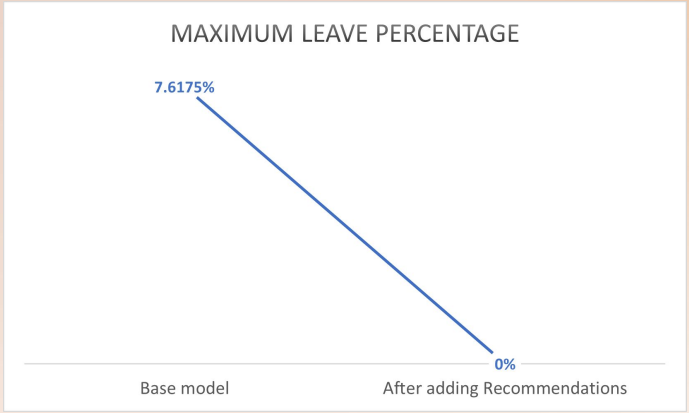
	Name	Type	Capacity
1	Counter Staff	Based on Schedule	Counter staff schedule
2	A zone Staff	Based on Schedule	A Zone staff schedule
3	B zone Staff	Based on Schedule	B zone staff schedule
4	Self check out machine	Fixed Capacity	1

Assign - Basic Process

	Name	Assignments
1	Assign order in phone type	1 rows
2	Assign order in queue type	1 rows
3	Assign order in self checkout machine type	1 rows

Results after adding Recommendations

Goal 1: Minimum leave percentage



Goal 2: Lower whole process time

Total Time	Average
Students order in phone	28.8978
Students order in queue	47.6619

Base model

Total Time	Average
Students order in phone	13.5494
Students order in queue	17.1036
students order in self check out machine	16.3543

After

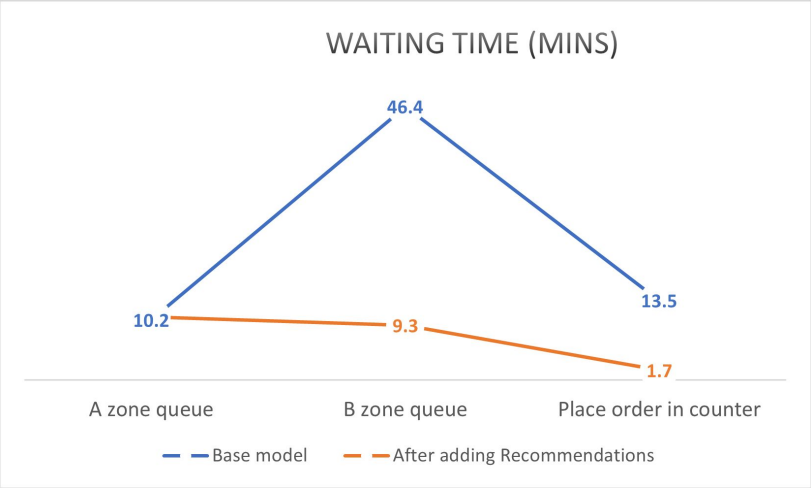
Order in phone: 29 mins → 14 mins (52% less)
Order in queue: 48 mins → 17 mins (65% less)
Order in machine: acceptable range

Results after adding Recommendations

Goal 3: Lower order time & Goal 4: Lower time of taking food

Waiting Time	Average
A zone queue.Queue	10.2088
B zone queue.Queue	46.4473
Place order in counter.Queue	13.5147

Waiting Time	Average
A zone queue.Queue	10.7154
B zone queue.Queue	9.2930
Place order in counter.Queue	1.6606
Place order in Machine.Queue	1.1028



Significant change in B zone queue
→ **80%** decrease in time
Big success in Goal 4

06

Conclusion

Conclusion

- Our simulation model proves the problems
  → Long waiting time in food waiting area

- Our proposed recommendation takes effect for reaching our 4 goals stated at the beginning

- Model limitation : X cost consideration
  Some decide rate might be overestimated

Thank You

Q&A