**2. Methods and agent-based model.**

The aim of our work is to find out how chopping probability of customers can affect the average waiting time for each of them spend in the food center. Due to the uniqueness of the chope tradition in Singapore, we can hardly find real world data from any sources or collect data ourselves. So we choose to simulate the situation inside the food center using agent-based model. There are two main agents in the system: customers and the food center itself. The behavior of the agents depends on both time and their own attributes. To make the model more convincing, every process is randomized.

2.1 Customers

Customers inside the food center have three states: standing in queue and waiting for ordering, looking for a seat and eating. For each customer we assign a specific probability p to them which signifies how likely they will reserve a seat. To diminish the variation caused by differences of each customer, the probability will be the same for all the customers. This p value decides which states they will enter first after going into the food center. We determine whether customers will chope or not by generating a random number r between 0 and 1 and compare this number to the probability. If p>r then the person will chope and vice versa. The average waiting time is calculated by adding up the time taken for queuing and looking for a seat of all the customers who have left the food center and get an average. The time consumed on waiting for food preparation and eating are 1 min and 25 mins respectively which are not taken account for the waiting time.

2.2 Food center

We define the inflow rate which stands for the number of people go inside the food center every minute. It follows a uniform distribution from 0 to M. One thing worth noticing is that the value M should be restricted to a range which is neither too small nor too large. If it is too small most people do not need to wait for the two processes and thus this situation has little value to research on. On the other hand if it is too large the queue for ordering will extend infinitely and the seats are easily fully occupied so customers have to wait for a very long time to get food and find a seat which is less likely to happen in the real world.

chop\_prob = 4 \* crowdedness \* (1 - crowdedness) \* 100

*chop\_prob = math.exp(12 \* crowdedness - 6) / (1 + math.exp(12 \* crowdedness - 6)) \* 100*