Lecture 33 — More Advanced Queueing Theory

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New Considerations

New considerations – or complications – arise.

We'll talk about two settings, one that I love and one that I hate: food halls and Service Ontario.

No points for guessing which is which.

Multiple Services

At Service Ontario, every staff member can help you with any task.

But at the food hall, the Gelato place cannot provide tacos.

Are tacos and gelato interchangeable? Maybe...

Maintenance, Planned and Unplanned

Services have downtime, both planned and unplanned.

If the pizza oven breaks, no more pizza today.

Usually we do not think about unplanned downtime in service capacity design.

New Things Too?

New services can appear: what if a Banh Mi place opens?

Restaurant opening is rarely a surprise...

Interchangeability

Interchangeability of services is a spectrum:

- Full; Starving? Tacos, pizza, shawarma? Just feed me now!
- Partial; Just a bit hungry? Want tacos, would have shawarma.
- None; I came for tacos and want nothing else.

Nutritionist

All the food hall examples are about food – at least the possibility of interchangeability exists.

Dietitian: To be healthy you should eat fruit and vegetbles.
Me: So I am allowed to consume only that.
Dietitian:

But: I came for a drivers' license; a new health card is not a possible substitute.

Too Long

Three Kinds of Problem

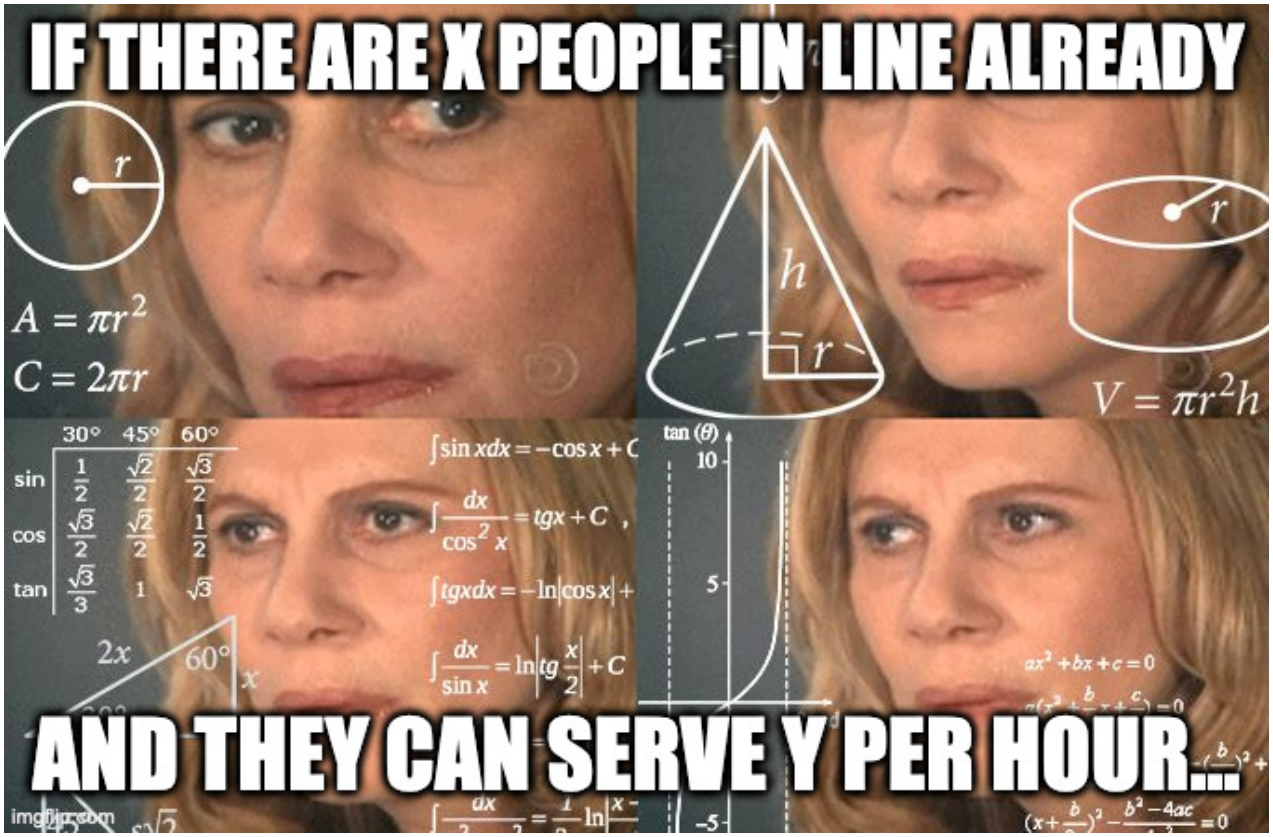
Balking: don’t get in the line at all.

Reneging: get in line, get frustrated, leave.

Loss: No capacity, request to enqueue refused (M/M/k/k system).

How Long Now?

In both cases where I choose to leave, there is an implicit or explicit calculation – what would I calculate?



Compare the calculated value with my willingness to wait...

I Got It Wrong?

One possibility: my estimate of service time or queue length wrong.

What if people can join the line ahead of me?

Priority

Priorities for queueing may exist: some can go to the front of the line!

Example: people with mobility restrictions at Service Ontario.

This makes my wait longer and might make give up waiting.

Priorities are Interesting

Priorities open up new questions, such as:

- How much, if any, does giving priority to one group over another help the group being given priority?
- How much, if any, does giving priority to one group disadvantage the group not being given priority?

Priorities are Interesting

Priorities open up new questions, such as:

- Can the priority system incentivize people to choose things that are less popular?
- Recognizing that if everyone has priority, nobody has priority, how many requests can have priority before all benefit is lost?

Laboratory Study with a Mouse

Yes. That mouse.