Futures

The first task of my internship

How to solve a supply problem. **By Ziyin Xiong**

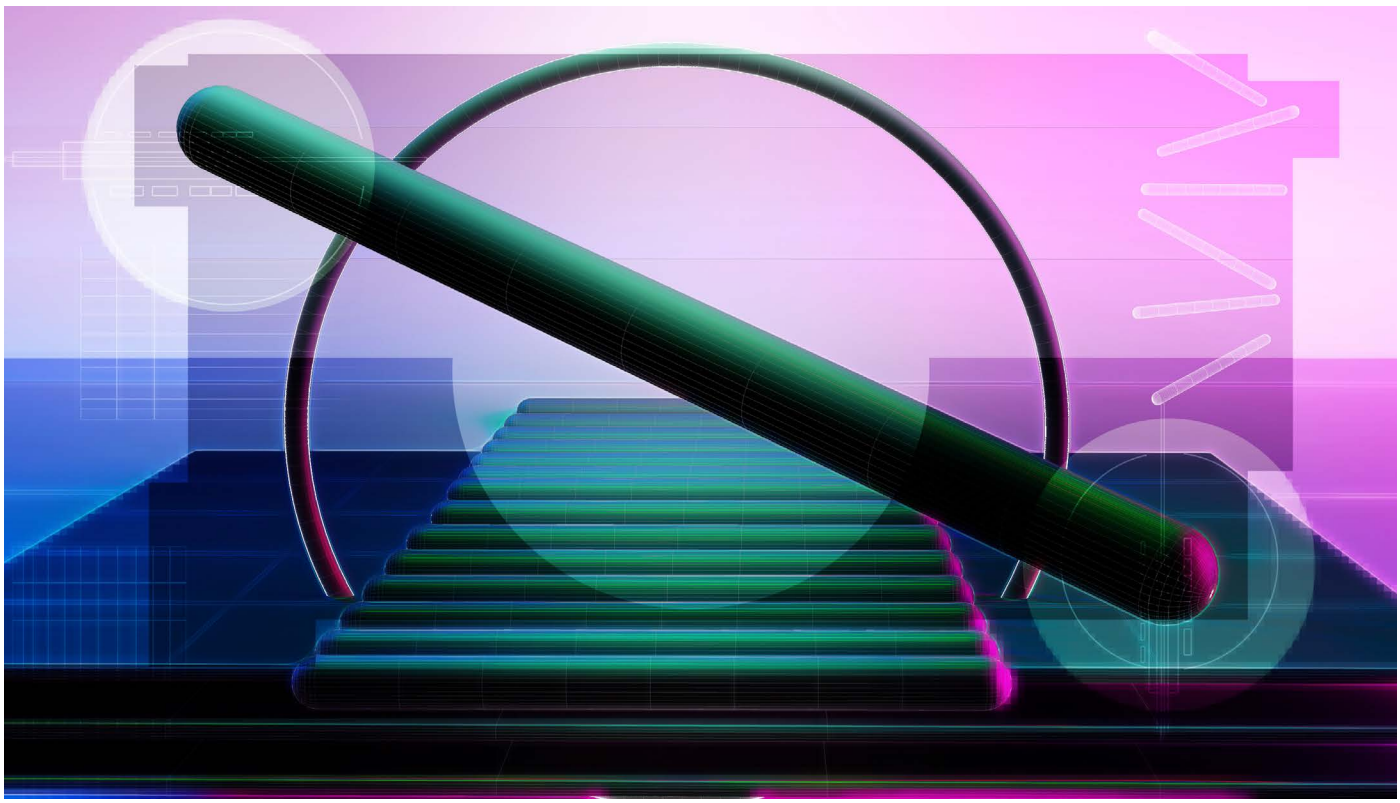

ILLUSTRATION BY JACEY

This is my first day working at Olive Garden, and the manager has asked me to help her figure out how to offer unlimited soup, salad and breadsticks to customers given our finite universe. I'm still trying to figure out the coffee machine, but I'll take a few minutes to help her solve this problem. *Note*: I use only breadsticks to simplify my explanation, but the solutions apply also to salad and soup. Here is my report.

Anti-human breadsticks

"Cheeseburgers are basically a symbol of bad environmental stewardship … humankind cannot eat unlimited cheeseburgers without harming the planet and ourselves," Anna Rothschild in a YouTube video from the *Washington Post* claims that in the movie *Avengers: Endgame*, it is wrong of someone to tell a little girl, "I'll get you all the cheeseburgers you want," because infinite cheeseburgers would be devastating to the environment.

Despite the angry comments on the video, it is true that any type of food unlimited is inherently damaging, including the benign breadstick. Ultimately, in the process of baking, humans will deplete all the resources. However, 0 humans × ∞ breadsticks per person = 0 breadsticks, so the demand for infinite breadsticks per human can be met as long as there are no humans. Getting the population down to 0 might be the first solution to consider.

Infinitely reducible breadsticks

If you want to keep humanity alive, let's consider other solutions. I noticed that we don't try to bring the infinite breadsticks all at once, but instead bring them in baskets. It's unlimited in that a new basket will be brought when the last one is empty, but do we have to have the same amount in every basket? All-you-can-eat restaurants already keep making each order less substantial if you eat too much. Let's do the same thing, bringing half as many breadsticks each time until the basket has a single atom, then a few quarks, then a single quark, until they are infinitely small. There is a problem though: if matter isn't infinitely reducible, we will still run out of matter because we can't slice the orders in half any more. What if we can't get smaller than a quark?

Cycling breadsticks

Because the breadsticks are brought in quantized baskets, there is some finite time between basket a and basket $a+1$. During this time, the matter from the previous basket makes some progress in the recycling process. The matter is obviously not destroyed when consumed. It goes back into the life cycle, eventually finding its way into new wheat, and then new breadsticks. So, if we time it right, we can achieve an equilibrium in which the breadstick atoms will be recycled into new breadsticks at a rate in which new breadstick orders can always be fulfilled. There is still a small problem however:

the molecules are formed by the wheat plants using energy from the Sun. The Sun will eventually burn out. All stars will eventually burn out and the Universe will experience heat death with no new energy to sustain reactions.

Time-travelling breadsticks

We can avoid the limits on matter and energy by using an everyday time machine. If you go to any point in the future, you can acquire breadsticks (or the atoms needed to form them) from that time and bring them back to our time to serve to customers. You will have access to an infinite number of future times because the future extends infinitely.

In addition, after bringing those materials back to the present, they will cycle in the system, eventually reaching the future where they started, replenishing that point in time. For example, you acquire breadstick atoms from AD 30,000, bring them to AD 2020. Those atoms eventually reach AD 30,000 again as time passes, but the original breadsticks you took are still in AD 30,000 too, so the breadsticks will be duplicated. Put simply, you will have access to infinite resources if you source them from the future.

Parallel-universe breadsticks

If you don't have a time machine, just use a cheap parallel-universe machine. According to the many-worlds interpretation of quantum mechanics, every outcome of the quantum measurement

$$i\hbar\frac{\partial}{\partial t}|\psi(t)\rangle = \hat{H}|\psi(t)\rangle$$

(the wave function of a quantum-mechanical system) is realized physically in some world. Put simply, everything that has a probability to happen on a quantum level, *does* happen in some parallel world. The timeline splits infinitely. Thus, there are infinite parallel universes. The laws of conservation of energy only apply to one universe. There is infinite matter in the multiverse. Go get breadsticks from those other universes! You can even take them directly from parallel Olive Gardens (note: they might be called Apple Gardens or Olive Farms in other universes).

Higher-dimensional breadsticks

Imagine a cylinder. Now slice it into circles. With the proper knife, a 3D cylinder can be sliced into an infinite number of circles in 2D space because the circles will have no height.

Many scientists claim there are at least 11 dimensions in the Universe, and in fact this number is required for the M-theory of string theory, which posits additional dimensions whose objects intersect our 3D space. So, all you have to do is go to the fourth dimension (I'm sure there is a machine for this, too, and you can pay for it by selling your time machine or parallel-universe machine) and slice a bready, unimaginable 4D object into an infinite number of 3D breadsticks!

Rendered breadsticks

Have you seen *The Matrix*? Our world could be a simulation. What if what we see as breadsticks is really a rendering from a computer, just like an item in a 3D video game? Just as in those video games, perhaps the computer renders only those breadsticks that are actually being observed by the 'players' (us) at present. This allows the processor to render an essentially infinite Universe, as long as it doesn't render it all at once, repeats patterns, and isn't stored in memory. It's the same way *Temple Run* can go on forever. As Berkeley said, to be is to be perceived. Contact the IT manager for our rendered Universe and ask them to program an algorithm that continually produces breadsticks in front of you, then deletes the material from the already-consumed ones from memory.

Feel free to try whichever solution you want (although I would prefer that you avoid the first one as I'd like to live). Even if you fail to satisfy the infinite demand for breadsticks, you might solve some of the mysteries of the Universe in the process. Or, at the very least, it will keep you busy while I figure out the coffee machine.

Ziyin Xiong is a skilled coffee-machine user. She is a high-school senior student who plans to study entomology. She enjoys creating outrageously impossible organisms in the board game *Evolution*.