Akebono Simulation

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>> We're going to put our newfound simulation skills to the test with a slightly more complicated simulation. Remember, there's two approaches that we covered, aside from prototyping in Excel. The first was to make sure that we're simulating a single replicate, and make sure that works. And then, you can apply any loops around it to make sure that you can simulate multiple days or multiple replications.

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The other option is to use the random number generation, and to generate entire vectors of random numbers. This simulation will actually bring both of those methods together. The title of this case is Akebono Gets Angry! Do you know who Akebono is? This is Akebono versus Takanohana. Yes, sumo wrestlers.

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Akebono is an absolute tower at 6 foot 9 inches and full of muscle. I see an opportunity to get rich. Akebono has decided to move to Williamsburg. We're going to open a restaurant that specializes in sushi and sashimi. Akebono, aka Chad Rowan, former Sumo champion and the first non-Japanese Yokozuna is moving to town.

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He has quite a prodigious appetite, which is fine, and he's a gentleman, as are all sumo champions. But Akebono can get angry when his appetite is involved. He must have the freshest sashimi, only the best, Yellowfin and Bluefin. Now, has anyone here ever been fishing in the Outer Banks of North Carolina?

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Love to hear it. So, Akebono's favorites include Yellowfin Tuna, Ahi, and Bluefin. And he can make us rich. He's planning on building a Sumo stable, a Sumo beya, in Williamsburg. And these guys get hungry. Unlike Michael Jackson, no one will criticize Akebono. And that reference harkens back to the days of my youth.

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So I understand if you don't get it right away, but it's important to plan a world class operation to deliver the sashimi. So, in order to investigate this potential business opportunity, let's do some simulation. First off, where do we begin? Pretend you're a consultant, how would a consultant go about this process?

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Get caught up in the story, is sushi the right approach? Do we have availability of product? What type of setting are we looking to set up? How often during the year? Are there periods of time when we're not going to have any customers? What would you ask? And after you've started to gather your information, build a model.

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So what might your goals be for model? How will I use it for decision making? And how will my goals affect you as a consultant? If I'm the one looking to build this this restaurant? What effect will it have on the analysis? You might also ask about the process of catching fish.

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This is a general question about the process or technology of the system. How would you approach mapping this process? Are there any tools that you might use? Process mapping or influence diagrams? What's important about the process? What elements should a simulation include to satisfy the goals for the analysis?

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What are the goals? Do we just want to make money? Do we want to create jobs? Is there any chance that this model will have a life beyond the current situation? And what would that mean? Also focus on the nature of uncertainty. Where does it exist? What probability models best provide information?

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How might this change over time? And since you're now an expert in time series, you should always be thinking about the time dimension. Do we build a model in Excel in R? And can we analyze some data? What insights are available? We want to take the ambiguity of this situation and consume it to produce clarity.

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We want to turn insight into action, ultimately. So let's start. This will be the meat, pun intended, of your model. Where and how do we get product? So after asking some questions, we've assembled the following list. North Carolina's Outer Banks is the location for fishing. The boats set out early at 3:30 in the morning, and the captains of the boats observe the fishing conditions.

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The catch is dependent on the fishing conditions and those conditions occur as follows. 10% of the time, we have a scenario considered great. 60% of the time, OK and 30% of the time, it's bad. Now, we're going to go out in either case but it's going to affect the catch of the day.

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So given that conditions and I do love a pun, our number of fish in the daily catch is Poisson distributed. With the averages of the distributions, lambda, occurring as, If the weather conditions are great, then lambda is seven. If the wea, weather conditions are just okay, the number of fish on average is four.

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And if fishing is bad, on average it's two. So lambda equals the number of fish per day, and that would be the perimeter of our Poisson distribution. This also foreshadows what we're going to look at when we studying queuing, a non-stationary Poisson process, If you want to jump ahead you can look at Cox processes.

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C-O-X. Okay, back to our case. The mix of Yellowfin and Bluefin are observed to follow the following regime. 25% of the time 0% of the catch is Yellowfin. 50% of the time, one-quarter of the catch is Yellowfin, which means the other 75% is Bluefin. And 25% of the occasions, 35% of the catch is Yellowfin.

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So we're defining yet another empirical distribution. Now, we'll assume that every ca, every fish we catch is either Yellowfin or Bluefin. So if we catch two fish, one will be yellow,, well, both will be either yellow or blue. Now the yield is something else that we need to calculate.

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The weight of the fish is important. So no matter how many fish we catch, and they will be either yellow or blue, only fish weighing in excess of 20 pounds are allowed for capture. So Yellowfin and Bluefin weigh, on average, 30 and 35 pounds, respectively. This weight is normally distributed with a standard deviation of 18 pounds for both fish.

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By the way, this brings up an interesting sidebar. If the weight of something is normally distributed, Keep in mind that the normal distribution extends infinitely in either direction. So what would happen if we generated a weight less than zero? Well, you could implement what's called a truncated normal distribution.

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That is you just generate the negative value and then convert it to zero. Oftentimes, the standard deviation is small enough and the weight is high enough, far enough away from zero that it's extremely low probability that you ever have to worry about zeros. But in this case, two standard deviations and you're at zero.

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The North Carolina Game and Wildlife Department are very ready to prosecute the weight limits vigorously, including loss of fishing rights and a large penalty. And what does that mean for your business? Finally, once the catch is determined, some proportion of the fish that represents the edible yield. This is determined from a beta distribution with an alpha 70 and beta equals 30.

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The beta distribution is similar to the triangular distribution but it allows us to generate values between zero and one. It's often used for representing proportions. You can simulate this using R beta. Whatever percentage we simulate, this is the general case for OK fishing conditions. Now, if the conditions are great, we'll increase that base case by 10%.

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If the conditions are bad, we'll decrease by 25%. We're now including conditionals in our simulation. It would be very difficult at this point to try to create a closed form analytic model of what we're presenting here. The yield represents the edible pounds of fish. And the tuna is caught daily and brought to a dock at 11:30 AM where you have an agent there to buy and immediately transport the tuna to Williamsburg via helicopter.

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So, what is the problem? Uncertainty is the problem, we don't know the daily catch of Yellowfin and Bluefin. We don't know the percentage yield. We don't know, well, we know that environmental conditions affect the catch. Bad conditions could lead to lower yield. How many are Yellowfin, and how many are Bluefin, what's the weight of the fish, and so forth?

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All of this uncertainty, you can put into a single model, to determine the number of pounds of Yellowfin and the number of pounds of Bluefin that we can expect. And a probability distribution around them. Assuming our inputs are good, the simulation might provide us with enough information to decide whether or not our approach to fish in the waters of North Carolina could actually sus- sustain and support our business.

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Based on the anticipated demand of course. So as a restaurant owner, I would like to know, how many pounds of fish will be available on a daily basis from the Outer Banks. I wonder if there will be days where no fish will be available. If I promise Akebono an average quantity of daily pounds, what should it be for each type of fish?

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Bluefin and Yellowfin. Present the data from your simulation in clever and interesting ways given my desire not to make Akebono mad and to make some money. Feel free to pause and rewind this video.