One of the key mechanical principles to lean production is smoothing production, now if you happen to make several different products, smoothing production isn't always easy, that's essentially the point of this Belmont scenario, let's look.

The Belmont Company must produce fifteen hundred boxes of product A each year, ok, two thousand boxes of product B and five hundred boxes of product C. So I see three different products of which the overall annual demand is three different amounts, fine. The Belmont Company works two hundred and fifty days a year, alright so we know a little bit about their year, and it can make a total of sixteen boxes of product a day, any mix of products ABC, I might want to note that to the side here, because that is a production rate, sixteen a day, good to know. Alright, now what else, in the past Belmont would spend the first of the year producing product A, then producing just product B, and then just product C, however, the president of Belmont decided that the company should follow the principles of lean operation, including smoothing production of demand requirements of these three products into mixed, oh, mixed model scheduling, yes. Ok, in lean operations and mixed model scheduling, if you happen to make several different things, you want to make, basically, the same amount every day. Ah, but wait a minute, what is the first question in this particular scenario? When Belmont uses its traditional schedule, right, that's the one they were talking about, they did before, how many days does it spend producing product A at the beginning of the year? Oh, also known as the, good vocabulary term, runtime. Oh, because in their traditional schedule they make fifteen hundred boxes of A a year, oh, which means in their traditional schedule, they make fifteen hundred boxes of A at the beginning of the year, what is the run time on that order size? Now, run time actually has a formula associated with it, it's pretty simple, to calculate the runtime of any order size, Q, right, you just divide it by, its logic, divided by the production rate, now they were asking about A, right, so why don't we get organized here, let's see, product, could be a column, A, run time, well they need to produce fifteen thousand, excuse me, fifteen hundred, fifteen hundred, correct, we note that they can produce sixteen boxes a day. So fifteen hundred divided by sixteen, on my calculator, I see ninety three point seven five, and that's time, days. Oh, so, in their traditional schedule they spend the first part of the year making just boxes of product A, they spend ninety three and three quarter working days doing just that. Now wait, this question actually asked about all three products, we just did that part right there, when it switches then to product B, how many days does it spend producing B, alright, B, B you need to produce more, it said two thousand overall, a year, it's the same production rate though, sixteen, so I see on calculator, one hundred and twenty five, which is to say, ok, then they spend a hundred and twenty five days producing B. And then C, because it asks about C also, you only need five hundred a year, it's the same production rate, sixteen a day, ok, so that means thirty one point two five, now we picked up that other quarter of a day, I see, that we lacked in the run time of A, ok. Here's the actual answer to this question, this is what their year looks like under their traditional schedule, this is how long they spend on each one of the products. Alright, now, note, that is NOT smoothing production, that is a traditional approach.

The next question is more from the president standpoint. If Belmont implements a perfectly smooth, that's what the president was proposing, mixed model schedule, it will produce the same mix of three products every day. Oh, this is just a nice little fact, we would already know that from the fact that we know what mixed model scheduling is, that means you always produce the same amount every day.

How many of each product should be in this daily mix, ok. Well, once again, it might help to kind of just like work with this table style, for instance, there's this product A, now we're trying to figure out how many boxes of product A should be in the daily mix if in fact you produce the same mix every day. Here's how we do it, we say, well the target is fifteen hundred a year, correct, we want them to produce the same amount of A every day, so if they're working two hundred, that's where we are going to use that fact, they said they were open two hundred and fifty working days of the year, if you take the fifteen hundred and you divide the two hundred and fifty into it, it reveals that they need to make six per day. They need to make six per day in order to hit their target of fifteen hundred over the course of the entire year, while always making the same amount every day. Alright, now that's just A, it was asking about the mix, A through C, so with B, the target is different, they need to make a total of two thousand over the course the year, but it's the same two hundred and fifty working days, so they need to make somewhat more per day, I get eight per day, whereas for C, they only need to make five hundred over the course of the year, it's the same two hundred and fifty working days, to do that, do remember to make two boxes of C each day. Now this is the daily mix that the president would like to see in order to implement mixed model scheduling, except, we're not completely finished with this.

Well you can see that there's another question. Ideally, what would be the order, excuse me, ideally, in what order should this new daily mix, meaning this that we found right here, be completed during the day? You say huh, ok, do you remember their traditional schedule, in their traditional schedule there's A, B and C and they just made A, and then they just made B, and then they just made C, for the year, that's how they did their yearly calendar. And we said, no, no, no, no, no, it will be much better if you make the same mix every day, so everyday make six A, make eight B, and make two C. We've already done this, we determined this, right. This third question is asking you to, not treat the day like they used to treat the year, we're recommending six per day, but Ideally, in the spirit of lean production and perfectly smooth scheduling, they wouldn't make the six boxes of A in the morning, and then switch to B in the middle of the day, and then finish out the end of the day by making those two boxes of C. You say, well then what would they do? They would try to, within the day, do the same thing that we just did with the year, and figure out a way to smooth it so that we, sort of, keep mixing it up throughout the day. You say, well how am I supposed to do that? Well, you know what, there is not an exact technique for this, there are some advanced techniques for this, for much more complicated problems with many, many different products, but at this level, we can rely on our intelligence to break this problem down. Oh, and then maybe remember there are, kind of a couple of tips for coming up with a mixed model schedule. Now, what are the tips? First off, common denominators, here is the mix, the overall mix, and we want to figure out the absolute smoothest pattern that is as mixed up within the pattern as possible, look for common denominators, I see a common denominator here of two, well what am I supposed to do with that? Well, the first thing I would do is, I would split the day in half, I'm taking the two, right, and I'm using it to divide the day in half, now what do I mean by that, well, if you divided the day in half, in the spirit of mixed model assembly, that means that you'd have, you'd make three A's in the morning, four B's in the morning, and a C, right. I'm just taking half of each of these, and then there would be a lunch break, and then you make three A's, four B's, and a C, over the course of the afternoon. Alright, now wait a minute, that is a proposal, that's actually though not a really good proposal for perfect, really smooth scheduling, now what else can we do? Well here, we're just using our intelligence, and you can

come up with a couple of different patterns, but a good pattern, it will be as mixed up as possible, and now at least we are working with two smaller problems. So look at the smaller problem, half a day, one of the things that I've noticed is that we have more B's that we have A's, so, this is another tip, we've got kind of, near equal amounts of two things, so it, kind of, suggests maybe you go, how about this, then that, then this, then that, then this, then that, you know, to spread them out. If we have slightly more B's, I think we should start with B's, now I'm going to piece together an actual sequence for the day. Start by making a B, then make an A, then make a B, then a box of A, then a box of B, and a box of A, let's see, then a box of B, oops, so, one, two, three, A's, good, that's done, then, one, two, three, four, B's, good, that's done, and then a C. Oh alright, now that's just up to lunchtime, now repeat, a B, an A, a B, an A, a B, an A, another B and then a C, there we go. That is this part of that, a nice smooth mixed model sequence, right, what are we trying to do? We're trying to get all the clumps out as much as possible, within the day, we're trying to mix things up, and this is a pretty smooth sequence, there are a few variants on this sequence, that you might have come up with, but look and see if your sequence, basically, exhibits that same feature of, it is mixed up as possible across the day.