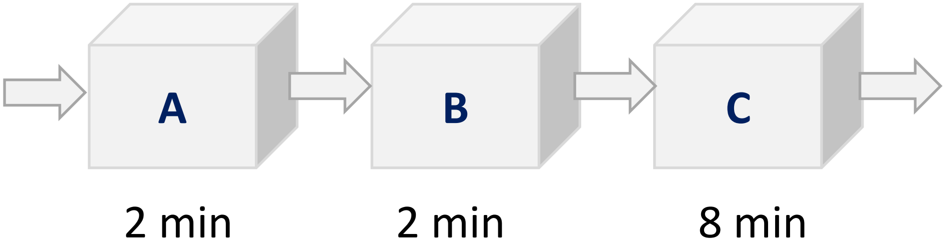
Six Sigma Academy Amsterdam 2016 ©

Exercise topic: Replacing push production

Exercise 1:Suppose that your plant is active 40 hours per week. Your client wants you to produce 1,200 cakes within 2 weeks. What is your takt time?

Exercise 2: Assume that the process of baking each cake is depicted below. As such, each cake must go through sub process A, B and C before it can be sold. What is the cycle time?



Exercise 3: The cycle time is longer than the takt time. Explain what kind of problem it causes.

Exercise 4: Solve the bottleneck issue so that we can meet the takt time of 4 minutes.

See next page for answers

Answers

Answer exercise 1:

Takt time = net available time / demand in that time period

As such takt time is 4 minutes because:

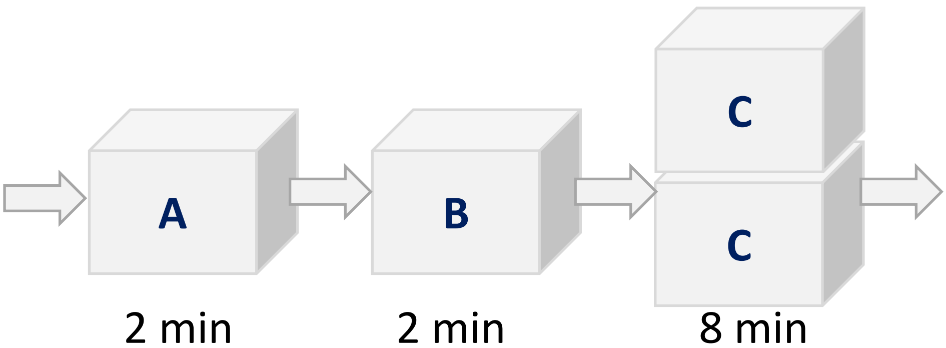
4 minutes = 4,800 minutes / 1,200 units

Answer exercise 2: Cycle time is equal to the slowest part of the chain which is referred to as the bottleneck. As such the cycle time is 8 minutes. This means that every 8 minutes, a cake is finished.

Answer exercise 3: Takt time is the max time per unit that you have at your disposal to meet total client demand. Since takt time was 4 minutes, it means that we can afford a maximum of 4 minutes between each finished cake. However, right now, it takes 8 minutes to finish an additional cake. This is obviously a problem since we cannot meet the total demand. We have to bring down cycle time to ar least 4 minutes.

Answer exercise 4: The solution depends on the nature of sub process C. Suppose for instance that sub process C is glazing the cake. In that case, we can 'break down' the process. What does that mean? That means that if we put additional people on the process, they can divide the task and the task will be completed sooner. If I put two people on the task, each can glaze 50% of the cake which means we need 50% of the time. In other words, the 8 minutes drops to 4 minutes and our cycle time becomes 4. We meet our takt time.

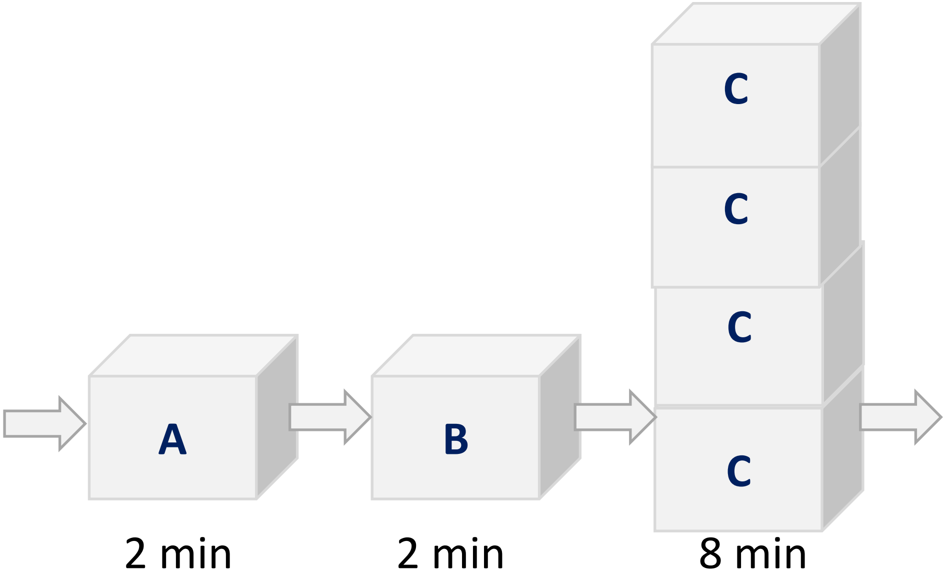
However, not all processes can be 'broken down.' For instance, suppose that step C is baking and that baking lasts 8 minutes. Putting extra people there will not bring down the 8 minutes baking time. The extra person will just join the first person in waiting 8 minutes. That is not a very productive thing to do. In this case, we need to 'augment' the process by adding extra machinery (extra ovens). How many extra ovens are needed? Let us start by adding one extra oven. The new situation is depicted below.



The extra oven will not structurally improve the situation since the third unit will get stuck in the bottleneck when it exits sub process B and cannot continue to any one of the 2 ovens because the first available time to use one of the ovens is at time 12, which is the time that the first unit exits the first oven (see table below).

	Enters A	Exits A	Enters B	Exits B	Enters C	Exits C
First	0	2	2	4	4	12
Second	2	4	4	6	6	14
Third	4	6	6	8		
Fourth						
Fifth						
Sixth						

We keep adding ovens and we come to the conclusion that structurally bypassing the bottleneck becomes possible when we have four ovens such as depicted below.



If we now look at our production schedule below, we see that it runs smoothly. Do notice by the way, that we have also brought down our cycle time to 2 which is well below the takt time. This even gives us some buffer when something goes wrong.

	Enters A	Exits A	Enters B	Exits B	Enters C	Exits C
First	0	2	2	4	4	12
Second	2	4	4	6	6	14
Third	4	6	6	8	8	16
Fourth	6	8	8	10	10	18
Fifth	8	10	10	12	12	20
Sixth	10	12	12	14	14	22