

Process Analysis – [Continue](#)

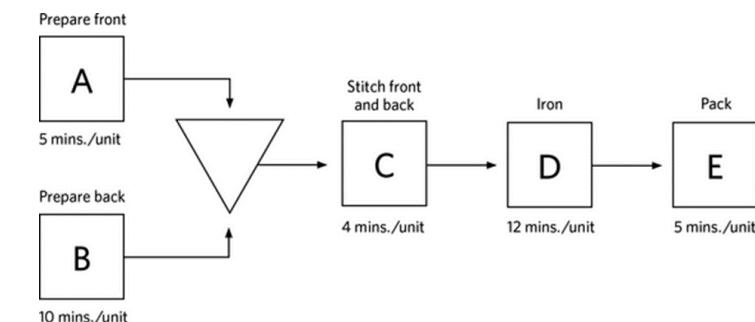
Process Analysis – Continue

= Min Capacity /
Actual Capacity

= cycle time X
min Capacity

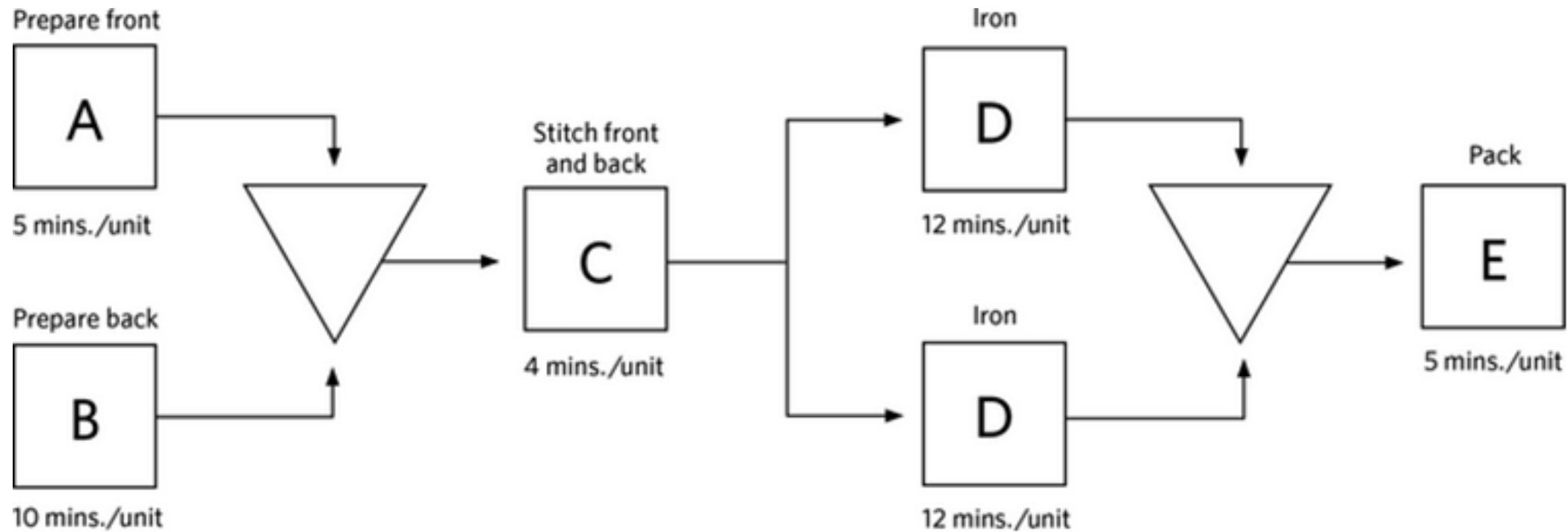
Activity	Cycle Time (min/unit)	Capacity (units/hr)	Capacity Utilization at Bottleneck Pacing	Work Time in min	Idle Time in min	Total
Task A	5	12	41.66666667	25	35	60
Task B	10	6	83.33333333	50	10	60
Task C	4	15	33.33333333	20	40	60
Task D	12	5	100	60	0	60
Task E	5	12	41.66666667	25	35	60
Total				180	120	300
Average				36	24	
Total capacity per shift	40					
Average Labour Work Time in min	36 /min					
Average Idle Time in min	24 / min					
Idle Time	40					
Capacity Utilization	60					

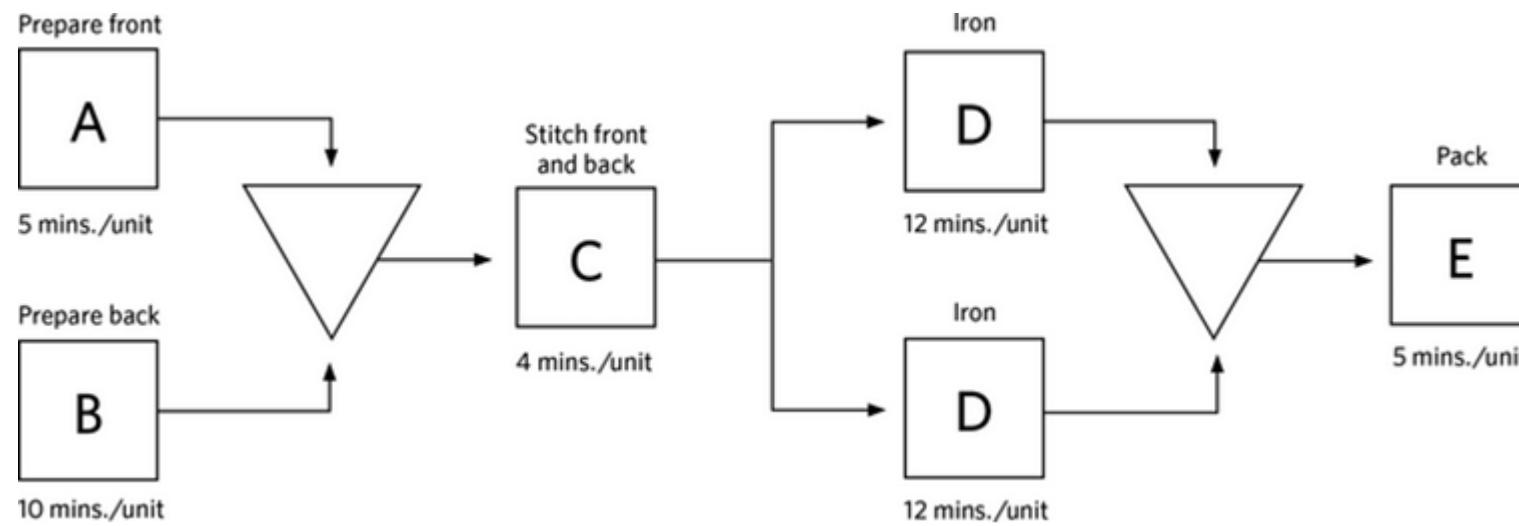
If you want to increase the capacity utilization and minimize the idle time ???



Process Flow Diagram for Making a Shirt, with an Additional Worker

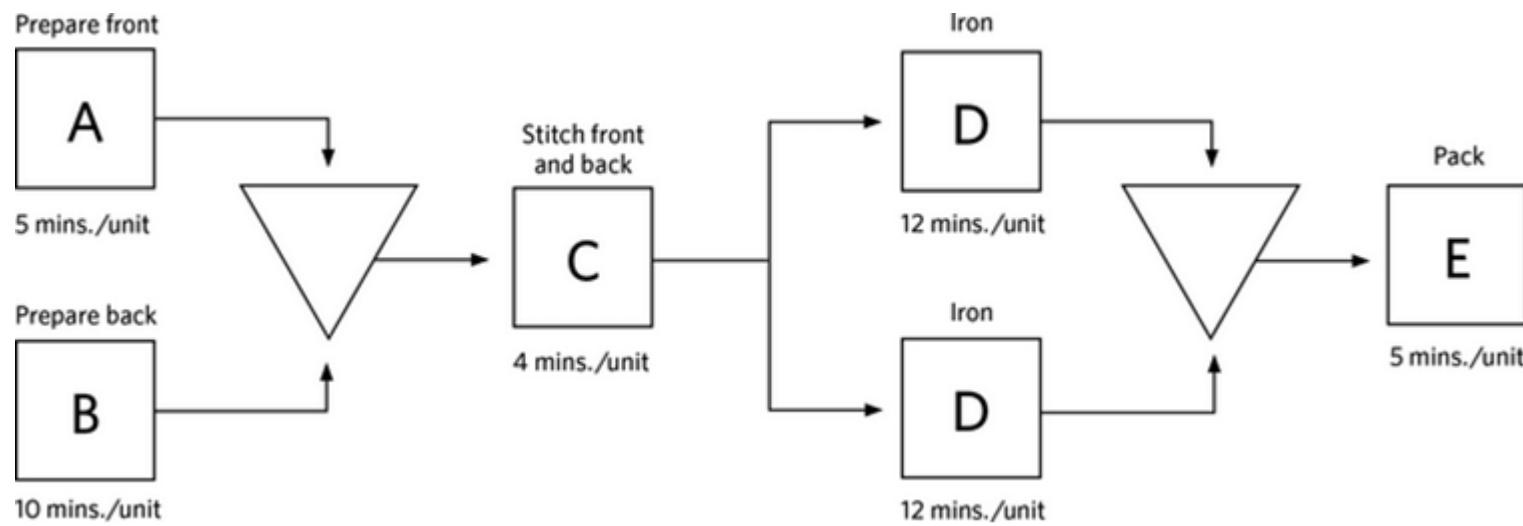
All steps (A, B, C, D, and E) in the below process are necessary to create each finished unit. Task times are shown for each step. A second worker has been hired to duplicate task D. Now shirts that have been through task C go to any one of the two workers on task D. The product still requires the five steps (A, B, C, D, E).





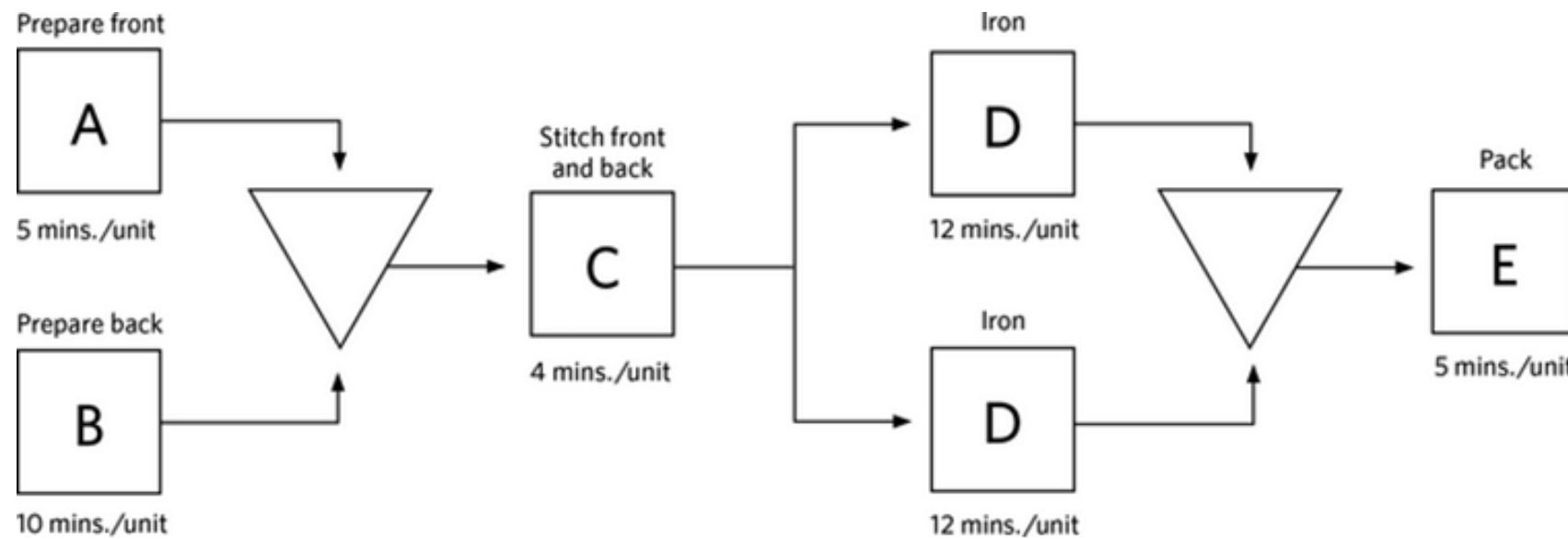
With an Additional Worker. If the entire system (all processes) is operating at full capacity, what is the system cycle time?

At task D, two units can be processed in 12 minutes, so the average cycle time for the ironing task is 6 minutes. The bottleneck process is task B at 10 minutes/unit. Therefore, the cycle time for the entire process is 10 minutes/unit..



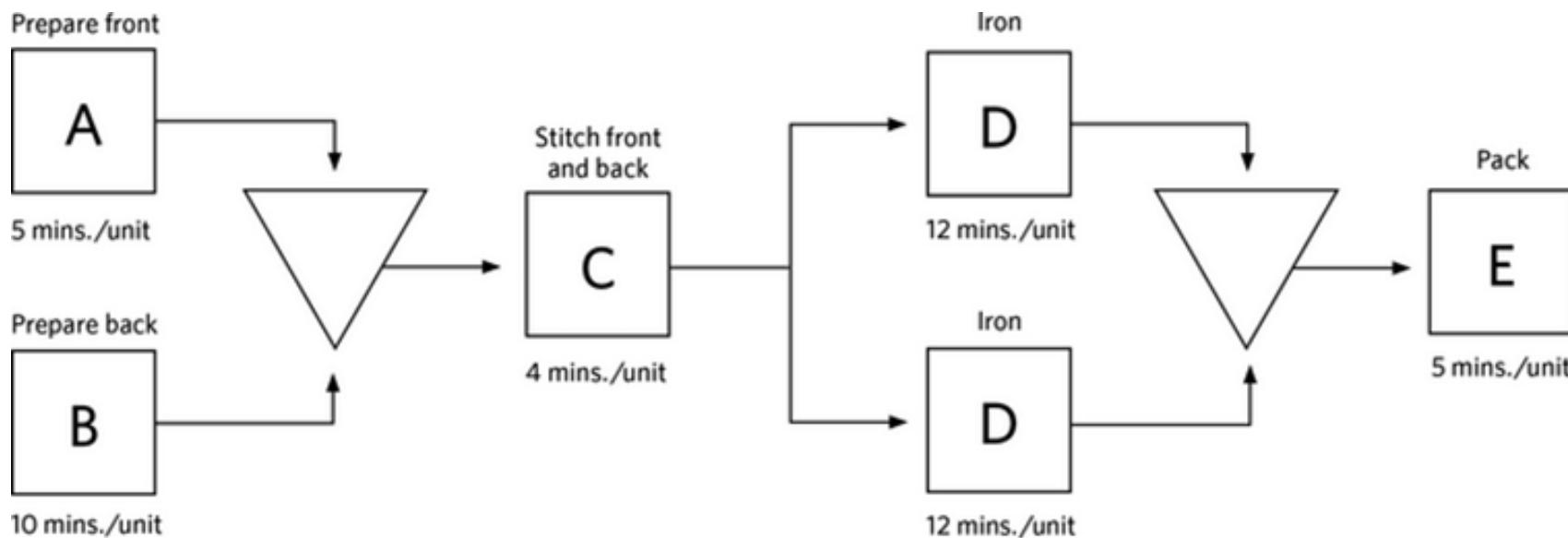
Assume that the process operates eight hours a day. What is its daily capacity, in units per day?

At task D, two units can be processed in 12 minutes, so the average cycle time is 6 minutes. The bottleneck is task B at 10 minutes/unit. The daily capacity is: $(8 \text{ hours/day} \times 60 \text{ minutes/hour}) / (10 \text{ minutes/unit}) = 48 \text{ units/day}$.



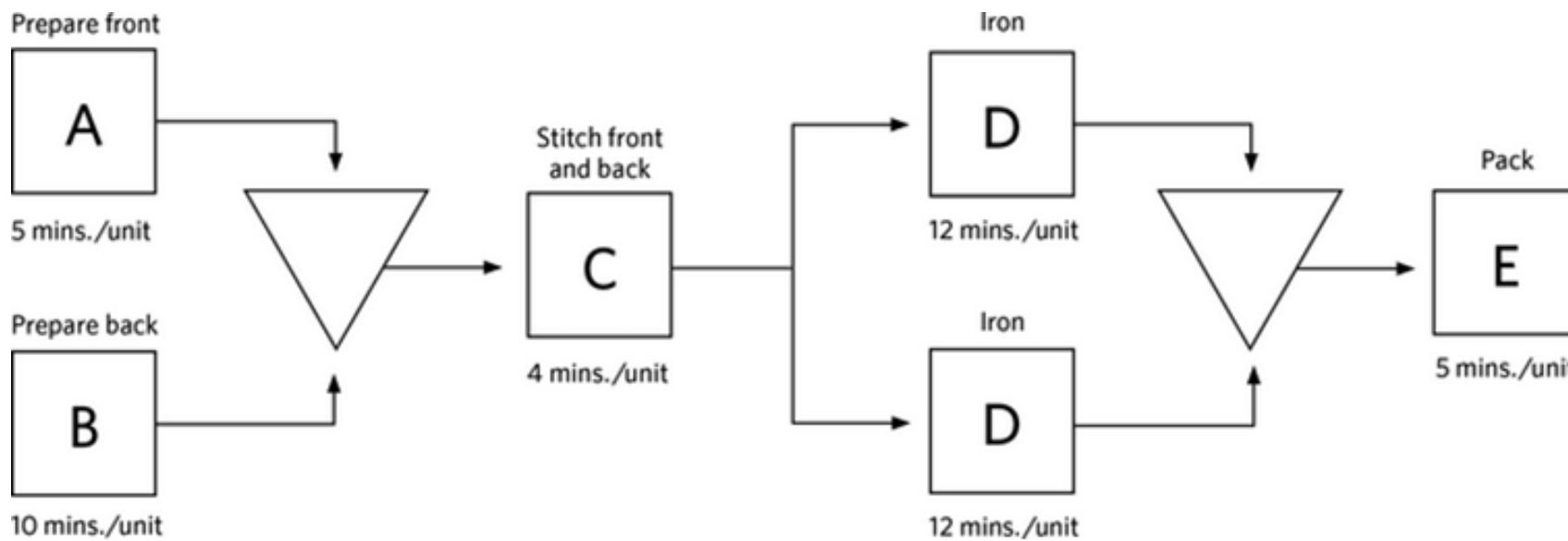
Assume the entire process is running at the pace of the bottleneck. Consider only task B. What is the capacity utilization for preparing the back?

Task B is the bottleneck process. If the process is operating at full capacity, capacity utilization at the bottleneck process is always 100%.



What is the throughput time, that is, the fastest a rush order of one unit can go through the process?

A one-unit rush order still requires each of the four process steps. Although tasks D is duplicated, one unit still requires 12 minutes to be processed. We assume for a one-unit rush order that it will never be “blocked” as it moves from task to task. Because the unit can move through task A faster than through the parallel task B, the front will have to wait for its companion back coming out of task B, so the fastest time for a rush order is: $10 + 4 + 12 + 5 = 31$ minutes.



Consider only task D, ironing. If an additional ironing worker were hired so that there were three workers working in parallel, what would be the minimum cycle time for the ironing task? Assume that the new worker is identical in capacity to the existing two.

The cycle time for each individual ironing worker is 12 minutes/unit. For three workers in parallel, thus for the entire ironing task, the cycle time is $12/3 = 4$ minutes/unit.

Capacity Utilization and Idle Time with addition machine

	Cycle Time (min/units)	Capacity (units/hr)	Capacity Utilization at Bottleneck Pacing		Work Time in min	Idle Time in min	Total
Task A	5	12	50		30	30	60
Task B	10	6	100		60	0	60
Task C	4	15	40		24	36	60
Task D1&2	6	10	60		72	0	72
Task E	5	12	50		30	30	60
Total					216	96	312
Average					43.2	19.2	
	Total capacity per shift	48					
	Average Labour Work Time in min	43.2 /min					
	Average Idle Time in min	19.2 / min					
	Idle Time	30.76923077					
	Capacity Utilization	69.23076923					

Capacity Utilization and Idle Time without addition machine

	Cycle Time (min/units)	Capacity (units/hr)	Capacity Utilization at Bottleneck Pacing		Work Time in min	Idle Time in min	Total
Task A	5	12	41.66666667		25	35	60
Task B	10	6	83.33333333		50	10	60
Task C	4	15	33.33333333		20	40	60
Task D	12	5	100		60	0	60
Task E	5	12	41.66666667		25	35	60
Total					180	120	300
Average					36	24	
	Total capacity per shift	40					
	Average Labour Work Time in min	36 /min					
	Average Idle Time in min	24 / min					
	Idle Time	40					
	Capacity Utilization	60					

Trade-Off between the Demand and Capacity

$$\text{Capacity Ratio Analysis} = \frac{(\text{Max capacity} - \text{Min Capacity})}{\text{Max Capacity}} * 100$$

Demand Pattern	Period	Process	Capacity Ratio	Capacity per 8 hr shift
Low Demand	January - March	Regular Production – No additional resource	67%	40
Medium Demand	April - June	Demand Pattern 1 (Added additional Iron machine)	60%	48
Peak Period	July - September	Demand Pattern 2 (Added One Iron Machine + Prepare Back)	33%	80
High Peak Period	October - December	Demand Pattern 3 (Added Two Iron Machine + One Prepare Back)	20%	96

Process Analysis

Kristen's Cookie Company

About the case

Case starts like this: You and your roommate are preparing to launch a cookie company in your college campus. This company is not a registered company, it is an unorganized sector. This may be considered as a startup idea to know the demand for the product and students will get some real time business experience without lot of investment, and to check their capability to do business.

The company will provide fresh cookies at late evening. You and your room meets are discussing to design a production process in order to make a policy decisions. Like Price Fixing, requirements of equipments, how many order to accept, how much time u will spend in your company because it is an part-time activity, Determining the business can be profitable or not, Knowing your competitor and their business strategies etc.,

Three OM Concepts from the case

1. Make-to-Order / Assemble to order
2. Short Waiting Time / Quick Response / Just-in-time
3. Product Variety

Production Process of Kristen's cookies

Process Steps

1. Place all the ingredients in a mixing bowl and mix them
2. Spoon the cookie dough onto a tray
3. Put the cookies into the oven
4. Bake
5. Take the tray of cookies out of the oven
6. Cool the cookies
7. Pack them in a box

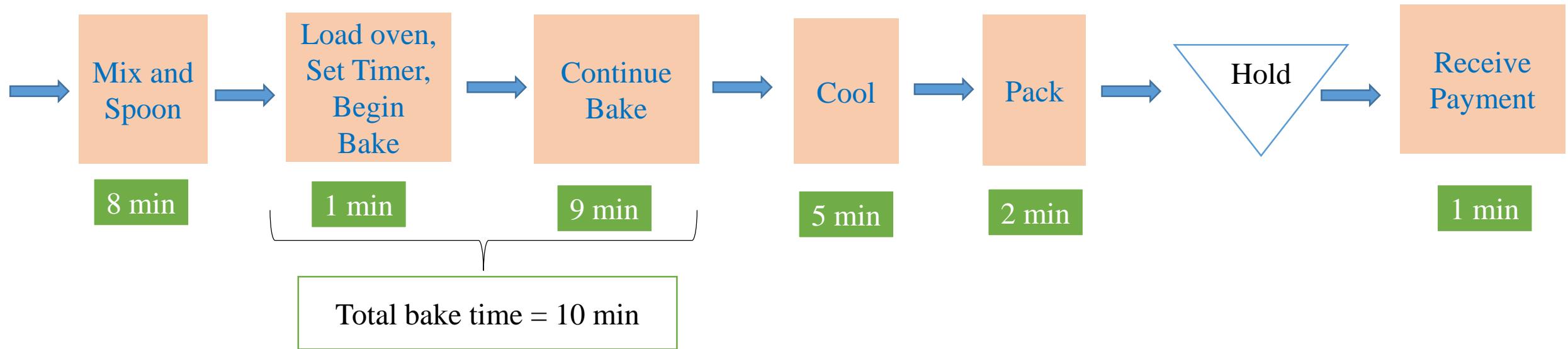
Equipment Capacity

1. High Grade Electric Mixture
2. Cookie Trays
3. Spoons
4. Oven

Variable Cost

1. Ingredients Cost: 0.60\$ per dozen
2. Packing Box Cost: 0.10\$ per box
3. Your Time cost = 0.20\$ per minute

Process Flow Diagram



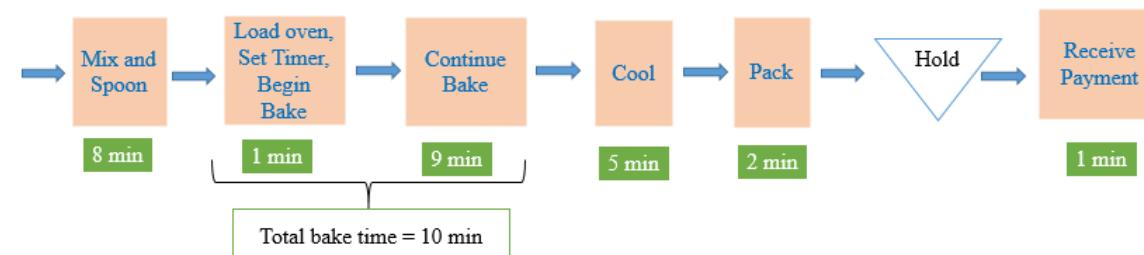
Key questions to answer before your business launch

Q1: How long will the process takes you to fill a rush order?

For an order of one dozen rush order cookies, which can made on one tray, The through put time is

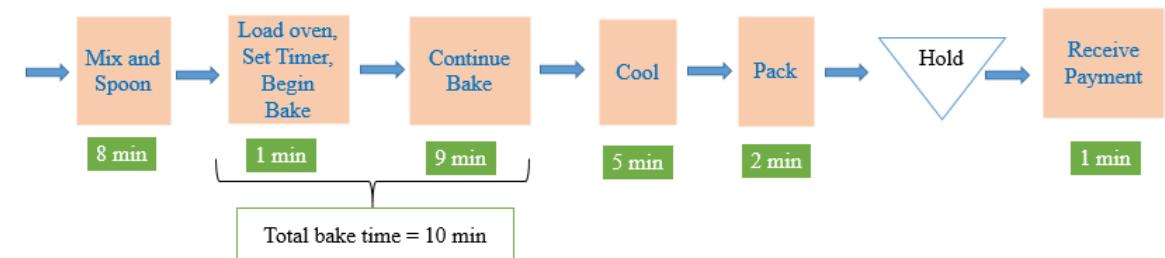
1. Mixing and spooning = 8 min
2. Loading and Baking = 10 min
3. Cooling = 5 min
4. Packing = 2 min
5. Receiving Payment = 1 min

Total = 26 min (it is known as **throughput time**)



Q2: How many order will you fill in a night

- Total working hours = 4
- Throughput time = 26 min per order
- Total available minutes = 240min
- Production capacity based on Throughput time = 10 order.
- Production capacity Based On cycle Time : $240/10 = 24$ order.



Q3: How many order can you produce in a night if everyone order one dozen cookies at a time?

- The slowest stage is baking = 10 min (bottleneck operation)
- Oven will handle only one tray = 12 cookies
- Oven produce 6 trays in an hour ($60/10$)
- For four hour = 24 dozen
- Some time start up and shutdown time is required
 - First dozen cannot start until 8 min after you open
 - Last dozen must come out of the oven eight min before you close
- So you can bake only 22 dozen in a night

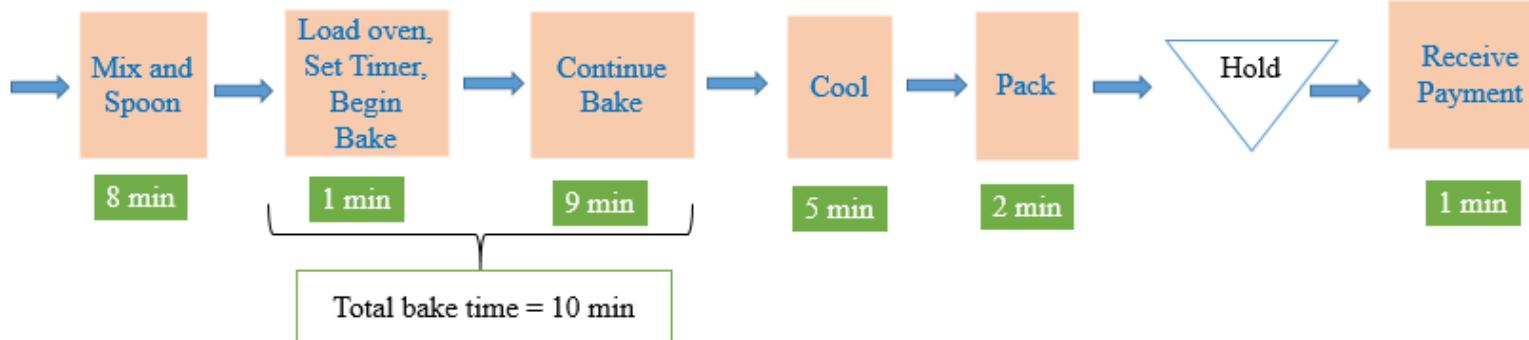
Q4: How many order can you produce in a night if everyone order two dozen cookies at a time?

- The mixing stage takes exactly 10 min per order (6 minutes for mixing + 4 min for spooning out the two tray)
- Any how
- The slowest stage is baking = 10 min (bottleneck operation)
- For four hour same 24 dozen is produced
- start up and shutdown time is also same
- So you can bake only 22 dozen in a night

From this we can understand the capacity does not depends on order size.

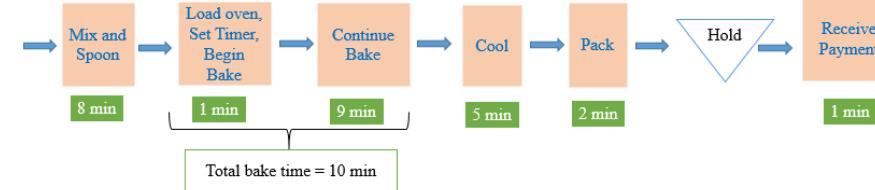
Q5: How much time are the two of you going to have to devote to these production steps?

- This is to calculate the labor utilization time and idle time.
- During each 10 min cycle of the oven, your roommate will work for 4 min and idle for 6 min
- You have 8 min of work if it is an first tray of an order (6min mix + 2 min spooning) or only 2 min of work if you are on the second or third tray.



If your company accepts orders for fewer than 22 dozen cookies per night, you will have more idle time.

Q6: How much would you charge for your cookies?



- Depends on Demand for your unique cookies and your production cost
- For demand you want to survey the market and the competition
- Production cost = material cost + cost of your labor time
- Total labor time is the sum of the labor times in each of the process steps.
- **Setup labor time** is 7 min (Mixing 6 min + Payment 1 min)
- **Run Time labor** is 5 min (Spoon 2 min + loading 1 min + packing 2 min)

One Dozen Cookie order = 12 min

Two Dozen Cookie order = 17 min

Value of your time = 0.20\$ per minute

Material cost = 0.70\$

You Should charge for one order = 2.40\$ + 0.70\$

Total = 3.10\$

You can give a discount for two dozen order

You can charge 1.40 less because setup does not repeated

Thank you