**Kristen’s Cookie Case - Notes and Practice Questions**

**Notes:**

* Type of Process: Production Process
* The business operates like a make to order system as opposed to a make to stock system or a hybrid (assemble to order) system.
* Key Questions:
  + What prices to charge? **(Direct Labour Cost)**
  + What equipment(s) to order? **(Bottleneck Resources)**
  + How many orders to accept? **(Process Capacity)**
  + Can the business be more profitable? **(Analyze, Redesign to improve KPIs)**
* Available Equipment(s): Professional grade electric mixer (with one bowl), Tray(s) and spoons, Oven (with a capacity of one-tray)
* Electricity is paid.
* Variable cost = material cost + labor cost

**Exhibit 1: Process Details:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Tasks** | **Time (min)** | **Equipment** | **Human**  **Resources** | **Comment** |
| 0 | Order Entry | 0 | - | - | - |
| 1 | Wash/Mix | 6 | Bowl/Mixer | You | Mixer capacity = 3 dz. |
| 2 | Spooning | 2 | Bowl/ Tray | You | 2 min/tray |
| 3 | Loading and  Heating Oven | 1 | Tray/Oven | Roommate |  |
| 4 | Bake | 9 | Tray/Oven | - | Oven capacity = 1 tray |
| 5 | Remove | 0 | Tray/Oven | Roommate |  |
| 6 | Cool | 5 | Tray |  |  |
| 7 | Packing | 2 | Tray | Roommate |  |
| 8 | Collect payment | 1 |  | Roommate |  |

* Some assumptions:
* Spooning is done directly from the bowl, and hence the mixer is not available during the spooning process.
* Cooling is done in the tray and packing is done from the tray to the box. There are multiple trays and we do not have to wait for this cooling tray to work on the other orders (i.e., trays are not a bottleneck).

**Exhibit 2: Current Process Flow Diagram:**



**Exhibit 3: Activity-time diagram (Gantt chart) for the current process (with one dz. per order):**



**Exhibit 4: Process Analysis – Sample Questions and Answers**

Other details:

* Length of the shift = 4 hours/night.
* All the orders accepted during the shift must be completed (even if it goes beyond 4 hours).
* Assume a labour cost of $12/h, cost of cookie accounts for worked time and not the idle time.

|  |  |  |
| --- | --- | --- |
|  | **Question** | **Answer** |
| a | *How long will it take to fill a rush order, assuming that no other cookies are currently in process? (FLOW TIME OF FIRST ORDER)* | Assuming that the rush order comprises of 1 dz. cookies, the total flow time = 8+10+5+2+1 = 26 min. |
| b | *Identify the bottleneck. What is the duration of the bottleneck stage?* | Baking, 10 min (per dozen). |
| c | *What is the cycle time of the process?* | 10 min. Every 10 minutes, a tray of backed cookies will come out of oven. |
| d | *What is the capacity of the process?* | The slowest step is baking, which takes 10 minutes. Because the oven holds only one tray at a time, we cannot schedule production so that the oven processes more than six trays in an hour. Hence the capacity = 6 dz. /hour. |
| e | *How many orders can you fill in a night (4 hours)?* | Total no. of orders = {(4\*60-26)/10} + 1 = 22.4 = 22 orders. |
| f | *How much of your time and your roommate’s time will it take to fill each order? or*  *What is the direct labor content (min/cookie)?* | Total Labor time = (6+2) +(1+0+2+1) = 12 min.  You have either 8 minutes of work if it is the first tray of an order (6 minutes setup plus 2 minutes per tray) or only 2 minutes of work if you are on the second or third tray of a two-dozen or more cookie order.  In each cycle of 10 minutes, your roommate is working for 4 minutes. |
| g | *How much should you charge for your cookies (assume 1 dz. Order)?* | For a one-dozen cookie order, labor time is 12 minutes; If you value your time at $.20 per minute, you should charge at least $2.40 plus material costs of $.70 or $3.10 for a one-dozen cookie order. |

**Exhibit 5: Practice Questions**

**Note: Each of the following questions are independent.**

**Q 1:** Refer to the Kristen’s Cookie Case. Currently, the company has two human resources (yourself and your roommate). However, **your roommate is planning to take a week off and you will be performing all the tasks for this week.**

Analyse the impact of your roommate’s absenteeism on following performance measures: *cycle time*, *throughput time, total labor time, total throughput, and cost per cookie* under various scenarios listed below. Draw activity-time diagrams (Gantt chart) to show the flow time and cycle time under each of three scenarios (in excel).

Summarize your results in the table shown below:

|  |  |  |
| --- | --- | --- |
|  | Scenario 1  One-tray order  Two human resources | Scenario 2  One-tray order  One human resource |
| Flow time of first order (min) |  |  |
| Cycle Time (min) |  |  |
| Bottleneck |  |  |
| Total Labor Time (min/order) |  |  |
| Total Throughput  (# orders of cookies in 4 hr). |  |  |
| Total Throughput (orders)  (roundup). |  |  |
| Total Throughput (dz). |  |  |
| Total Throughput (#cookies). |  |  |
| Total Throughput Time (min) |  |  |
| Total Ingredient Cost ($) |  |  |
| Total Labour Cost ($) |  |  |
| Cost/cookie ($) |  |  |

Q 2: Analysing the impact of two-tray orders on the KPIs of the production process:

1. How long does it take to fill a **two-tray order**, if we assume that all the cookies in the order have the **same** ingredients? How many cookies can you produce in a night in this case? (Working hours = 4 hours /night). How much should you charge for your cookies in this case?
2. How long does it take to fill a **two-tray order**, if we assume that all the cookies in the order have **different** ingredients? Different ingredients imply that the mixing **cannot** be done together.

Summarize your results in the table shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Scenario 1  One-tray order | Scenario 2  Two-tray order  (same ingredients) | Scenario 3  Two-tray order  (different ingredients) |
| Flow time of first order (min) |  |  |  |
| Cycle Time (min) |  |  |  |
| Bottleneck |  |  |  |
| Total Labor Time (min/order) |  |  |  |
| Total Throughput  (# orders of cookies in 4 hr). |  |  |  |
| Total Throughput (orders)  (roundup). |  |  |  |
| Total Throughput (dz). |  |  |  |
| Total Throughput (#cookies). |  |  |  |
| Total Throughput Time (min) |  |  |  |
| Total Ingredient Cost ($) |  |  |  |
| Total Labour Cost ($) |  |  |  |
| Cost/cookie ($) |  |  |  |

**Q 3:** Refer to the Kristen Cookie Case. Currently, the Kristen Cookie has one oven, and is the bottleneck stage in the process. However, the company is considering increasing the production capacity of the cookie-making process by either of the following alternatives:

* **Alternative I: Adding another oven (identical to the current one) that can accommodate one tray at a time.**
* **Alternative 2:** R**eplacing the old oven with a new oven that can accommodate two trays at a time.**

Analyse the impact of these alternatives on following performance measures: *cycle time*, *throughput time, total labor time, total throughput, and cost per cookie* under various scenarios listed below. Draw activity-time diagrams (Gantt chart) to show the flow time and cycle time under each scenario (in excel).

How long does it take to fill an **order** under the scenarios list below? How many cookies can you produce in a night in this case? (Working hours = 4 hours /night). How much should you charge for your cookies this case?

Summarize your results in the table shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Scenario 1  One-tray oven | Scenario 2  Two-tray oven | Scenario 3  Three-tray oven |
| Flow time of first order (min) |  |  |  |
| Cycle Time (min) |  |  |  |
| Bottleneck |  |  |  |
| Total Labor Time (min/order) |  |  |  |
| Total Throughput  (# orders of cookies in 4 hr). |  |  |  |
| Total Throughput (orders)  (roundup). |  |  |  |
| Total Throughput (dz). |  |  |  |
| Total Throughput (#cookies). |  |  |  |
| Total Throughput Time (min) |  |  |  |
| Total Ingredient Cost ($) |  |  |  |
| Total Labour Cost ($) |  |  |  |
| Cost/cookie ($) |  |  |  |

**Q 4:** Refer to the Kristen’s Cookie Case. Currently, the company operates on a make-to-order as each order is potentially unique. I**f you decide to sell standard cookies instead and decide to operate as a make-to-stock process,** how should you change the production system? The order-taking process? Other policies?

Analyse the impact of the changes on following performance measures: *cycle time*, *throughput time, total labor time, total throughput, and cost per cookie* under various scenarios listed below. Draw activity-time diagrams (Gantt chart) to show the flow time and cycle time under each of three scenarios (in excel).

Summarize your results in the table shown below:

|  |  |  |
| --- | --- | --- |
|  | Scenario 1  One-tray order  Make-to-Order System | Scenario 2  One-tray order  Make-to-Stock System |
| Flow time of first order (min) |  |  |
| Cycle Time (min) |  |  |
| Bottleneck |  |  |
| Total Labor Time (min/order) |  |  |
| Total Throughput  (# orders of cookies in 4 hr). |  |  |
| Total Throughput (orders)  (roundup). |  |  |
| Total Throughput (dz). |  |  |
| Total Throughput (#cookies). |  |  |
| Total Throughput Time (min) |  |  |
| Total Ingredient Cost ($) |  |  |
| Total Labour Cost ($) |  |  |
| Cost/cookie ($) |  |  |