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2.4, 2.5, 2.6, 2.7, and 2.12

3.4 and 3.7

2.4

*(Apparel Retailing) A large catalog retailer of fashion apparel reported $100,000,000 in*

*revenues over the last year. On average, over the same year, the company had $5,000,000*

*worth of inventory in their warehouses. Assume that units in inventory are valued based on*

*cost of goods sold (COGS) and that the retailer has a 100 percent markup on all products.*

*a. How many times each year does the retailer turn its inventory? [2.4]*

*b. The company uses a 40 percent per year cost of inventory. That is, for the hypothetical*

*case that one item of $100 COGS would sit exactly one year in inventory, the company*

*charges itself a $40 inventory cost. What is the inventory cost for a $30 (COGS) item?*

*You may assume that inventory turns are independent of the price. [2.4]*

1. Since the annual revenue over the last year is $100,000,000. It means that our COGS is $50,000,000. And by the Little's law, we can calculate the time retailers turn the inventory by COGS/inventory. Therefore, the number of turn is $50,000,000/$5,000,000 = 10
2. Since the inventory turns are independent of the price, the number of turns remains 10 times. As a result, for each turn, the cost of inventory is 40%/10 = 4% of COGS. And for a $30 COGS, the inventory cost will be $30\*4% = $1.2.

2.5

*(LaVilla) LaVilla is a village in the Italian Alps. Given its enormous popularity among*

*Swiss, German, Austrian, and Italian skiers, all of its beds are always booked in the winter*

*season and there are, on average, 1,200 skiers in the village. On average, skiers stay in*

*LaVilla for 10 days.*

*a. How many new skiers are arriving—on average—in LaVilla every day? [2.3]*

*b. A study done by the largest hotel in the village has shown that skiers spend on average*

*$50 per person on the first day and $30 per person on each additional day in local*

*restaurants. The study also forecasts that—due to increased hotel prices—the average*

*length of stay for the 2003/2004 season will be reduced to 5 days. What will be the*

*percentage change in revenues of local restaurants compared to last year (when skiers*

*still stayed for 10 days)? Assume that hotels continue to be fully booked! [2.3]*

1. By applying the Little's Law: inventory I = (flow rate R)\*(flow time T), we can calculate flow rate R as inventory/flow time, which is 1200 skiers/10 days = 120 skiers/day. Therefore, there are 120 new skiers arriving everyday on average.
2. We assume that hotels are fully occupied, the previous daily revenue can be calculated as 1200\*(50+9\*30)/10 = $38,400. And for the 2003/2004 season, daily revenue can be calculated as 1200\*(50+4\*30)/5 = $40,800. And the percentage change of the revenue is (40800-38400)/38400 = 6.25%

2.6

*(Highway) While driving home for the holidays, you can’t seem to get Little’s Law out of*

*your mind. You note that your average speed of travel is about 60 miles per hour. Moreover,*

*the traffic report from the WXPN traffic chopper states that there is an average of 24*

*cars going in your direction on a one-quarter mile part of the highway. What is the flow*

*rate of the highway (going in your direction) in cars per hour? [2.3]*

By applying the Little's Law: inventory I = (flow rate R)\*(flow time T), we can calculate the flow rate as R = I/T = 24 cars/(0.25/60) hour = 5760 cars/hour. Therefore, the flow rate of the highway is 5760 cars per hour.

2.7

*(Industrial Baking Process) Strohrmann, a large-scale bakery in Pennsylvania, is laying*

*out a new production process for their packaged bread, which they sell to several grocery*

*chains. It takes 12 minutes to bake the bread. How large an oven is required so that the*

*company is able to produce 4,000 units of bread per hour (measured in the number of units*

*that can be baked simultaneously)? [2.3]*

By applying the Little's Law: inventory I = (flow rate R)\*(flow time T), we can calculate inventory I=RT = (12/60) hour \* 4000 units of bread/hour = 800 units of bread. Therefore, the required size of the oven is can at least hold 800 units of bread.

2.12

*(Kroger) The following provides 2012 financial information for Kroger (in million $s):*

*Kroger*

*Inventory $ 6,244*

*Revenue $ 95,751*

*Cost of goods sold $* *76,858*

1. *In 2012, what were Kroger’s inventory turns? [2.4]*

By applying the Little's Law: inventory I = (flow rate R)\*(flow time T), we can calculate that the inventory turns t = I/R = $76,858/$6244 = 12.31

3.4

*(Western Pennsylvania Milk Company) The Western Pennsylvania Milk Company*

*is producing milk at a fixed rate of 5,000 gallons/hour. The company’s clients request*

*100,000 gallons of milk over the course of one day. This demand is spread out uniformly*

*from 8 a.m. to 6 p.m. If there is no milk available, clients will wait until enough is produced*

*to satisfy their requests.*

*The company starts producing at 8 a.m. with 25,000 gallons in finished goods inventory.*

*At the end of the day, after all demand has been fulfilled, the plant keeps on producing*

*until the finished goods inventory has been restored to 25,000 gallons.*

*When answering the following questions, treat trucks/milk as a continuous flow process.*

*Begin by drawing a graph indicating how much milk is in inventory and how much*

*milk is “back-ordered” over the course of the day.*

*a. At what time during the day will the clients have to start waiting for their requests to be*

*filled? [3.3]*

First, we derive the demand of the milk per hour, which is 100,000/10 = 10,000 gallons/hour. And the production rate of milk is 5,000 gallons/hour. And the finished inventory every day is 25,000 gallons. Therefore, when the finished inventory was used up, the clients have to start waiting. T = 25,000/(10,000 – 5,000) = 5h. Therefore, when it's 1 p.m., the client has to start waiting.

1. *At what time will clients stop waiting? [3.3]*

When the total production meets the total demand, the clients stop waiting. Therefore, the total production time is (100,000-25,000)/5,000 = 15h. Therefore, when it's 11p.m., the clients will stop waiting.

*c. Assume that the milk is picked up in trucks that hold 1,250 gallons each. What is the*

*maximum number of trucks that are waiting? [3.3]*

By applying the Little's Law: inventory I = (flow rate R)\*(flow time T), we can calculate the maximum number of trucks as I/R = 25000 gallons /1250 gallons/unit = 20 units of truck

*d. Assume the plant is charged $50 per hour per waiting truck. What are the total waiting*

*time charges on a day? [3.3]*

Since until 11p.m., the plant meets the demand requirement of one day. And the clients start waiting at 1.p.m. Therefore, they need to wait for 10 hours. The total waiting time charges per day = (10\*20)\*0.5\*50 = $5,000

3.7

CC Car Wash specializes in car cleaning services. The services offered by the company, the exact service time, and the resources needed for each of them are described in the following table:

图形用户界面, 文本, 应用程序

描述已自动生成

The company offers the following packages to their customers:

∙ Package 1: Includes only car wash (service A).

∙ Package 2: Includes car wash and waxing (services A and B).

∙ Package 3: Car wash, waxing, and wheel cleaning (services A, B, and C).

∙ Package 4: All four services (A, B, C, and D).

Customers of CC Car Wash visit the station at a constant rate (you can ignore any effects of variability) of 40 customers per day. Of these customers, 40 percent buy Package 1, 15 percent buy Package 2, 15 percent buy Package 3, and 30 percent buy Package 4. The mix does not change over the course of the day. The store operates 12 hours a day.

1. What is the implied utilization of the employee doing the wheel cleaning service? [3.6]

Demand=45%

Task capacity = (

Implied utilization

1. Which resource has the highest implied utilization?

Implied utilization of A: =55.56%

Implied utilization of B: =33.33%

Implied utilization of C: =17.5%

Implied utilization of D: =33.33%

A has the highest implied utilization.

For the next summer, CC Car Wash anticipates an increase in the demand to 80 customers per day. Together with this demand increase, there is expected to be a change in the mix of packages demanded: 30 percent of the customers ask for Package 1, 10 percent for Package 2, 10 percent for Package 3, and 50 percent for Package 4. The company will install an additional washing machine to do service A.

1. What will be the new bottleneck in the process?

Implied utilization of A: =55.56%

Implied utilization of B: =77.78%

Implied utilization of C: =46.67%

Implied utilization of D: =111.11%

D would be the bottleneck.

d. How many customers a day will not be served? Which customers are going to wait?

Explain your reasoning!

Implied utilization of D：

Demand of Service D is equal to 36

Customers a day will not be served = 40 – 36 = 4

Because customers of CC Car Wash visit the station at a constant rate, so customers would come to visit every

Processing time of D: 20mins

In case there are only 1 employee, so the second customer starts to wait and all the rest customers have to wait until the last customer finished washing.