BerkeleyHaas

Practice Midterm Exam – Solution

Q1.

20 secs/headphone x 60 sec/min = 3 headphone/min
3 headphones/min x 60 min/hr = 180 headphones/hr

Q2.

We need to evaluate the capacity of each step:
Step 1: For 1 worker: 70 sec per unit=> 3600 sec/hr / 70 sec/unit = 51.4units per hr.
3 workers produce 3 x 51.4 = 154.2 units per hr.
Step 2: 3 units per min = 3 x 60 = 180 units per hr.
Step 3: 2 units per min = 2 x 60 = 120 units per hr.
2 workers x 120 units per hr = 240 units per hr.
Step 4: For 1 worker: 45 sec per unit = (3600/45) = 80 units per hr.
2 workers produce 2 x 80 = 160 units per hr.

The bottleneck is step 1 (minimum capacity). The process can produce 154.2 units per hr.

Q3.

The capacity of the cashier is 1 * 3600 seconds/hr / 35 seconds per customer = 103 customers/hr.
The capacity of the baristas is 2 * 3600 seconds/hr / 80 seconds per customer = 90 customers/hr.

The bottleneck is the baristas and the capacity of the process is 90 customers/hr. Demand is less than capacity, so this is demand constrained. That means the flow rate is 85 customers per hr. Barista utilization = 85 cust/hr / 90 cust/hr = 0.9444 = 94.44%

Q4.

The process is now supply constrained, so the flow rate is 90 cust/hr. The cashier utilization = 90 cust/hr / 103 cust/hr = 0.875

Q5.

With a supply constrained process the flow rate equals the capacity of the bottleneck. So the flow rate = R = 90 cust/hr. The cycle time = 1/R = 40 sec/cust.
Wages are 3 x $15 = $45 per hr = $0.0125 per sec
Cost of direct labor = Wages per sec x Cycle time = $0.0125 x 40 sec/cust = $0.50

Q6.

The bottleneck is barista, so the new employee should be a barista. The capacity of barista with 3 employees increases from 90 to 3 x 3600 sec/hr / 80 sec /cust = 135 cust/hr.
But now the bottleneck shifts to cashier, who has a capacity of 102.9 and that becomes the process capacity.

Q7.

EOQ= $\sqrt{\frac{2*85*50}{1.5}} = 75.27$

Order frequency: (12 * 50) / EOQ = 8 times per year

Q8.

Average inventory is EOQ/2. So months of supply = (EOQ / 2) / 50 = 0.75 months
Inventory costs per month = (EOQ / 2) * 1.50 = 56.46 $ / month

Q9.

The monthly holding cost per bag is $1 + 0.02 x 20 = 1.4.

Annual purchase quantity is 12 x 50 = 600 bags.

The average inventory will be 600 / 2 = 300, and so the monthly holding cost is 300 x $1.4 = $420. The yearly holding cost is 12 x $420 = $5040. The annual purchase cost is 600 x $20 = $12,000. The total annual cost of this option is $12,000 + $500 + $5040 = $17,540.

The current system operates at costs of 12* $\sqrt{2*85*50*1.5}$ +600 x 25=16,355

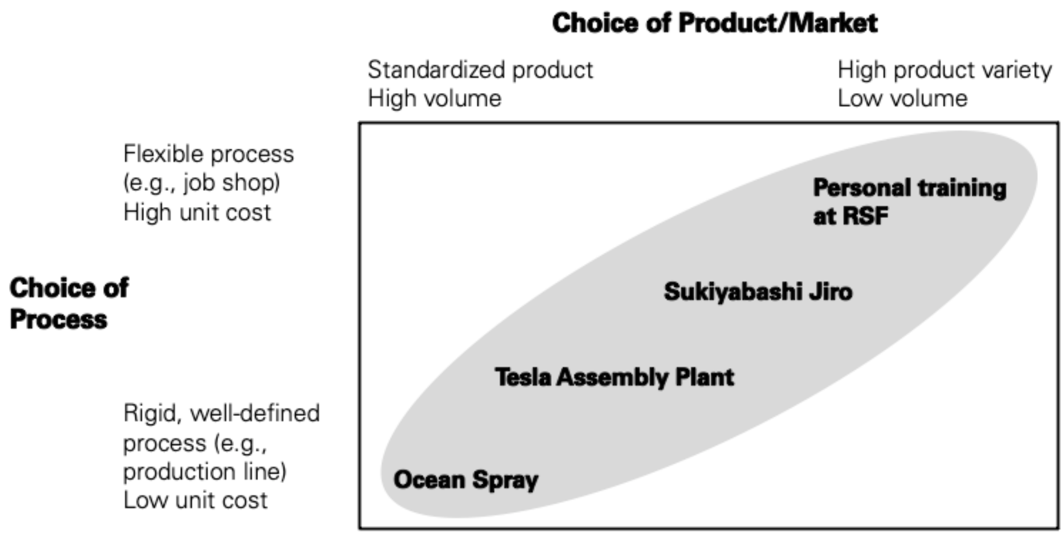
Thus, the original system is cheaper.

Q10.

Examples

1. Environmental: source from green suppliers, use greener products, recycled materials, use renewable energy
2. People: Ensure healthy and safe work environment, community engagement
3. Economic: source from local suppliers (rather than South America, improve pay for employees.

Q11.



Q12.

Examples: Identify a bottleneck in the process and add capacity. Offer highly customized/personalized service. Anticipate clients' needs as well as responding to their needs. Instant pacification: respond to customers' complaints right away. Empower the PT staff by allowing them authority. Provide continuous training to the staff through daily line-up meetings.

Q13. (27calls/hour/60min/hour *10min/call/)/5=0.9

Q14. (15min/call*5stumper+30min/call*2nasty)/(60min/hour*3)=0.75

Q15. The process is off-centered. Cpk = min((15-12) / (3x5) , (12-8.5) / (3x5)) = 3/15 = <u>0.2</u>

Q16.

z1 = (8.5-12) / 5 = -3.5/5 = -0.7 →P(lighter than 8.5 grams) = P (z <= -0.7) = 0.24196

z2 = (15-12) / 5 = 3/5 = 0.6 → P(heavier than 15 grams) = 1 – P(z <= 0.6) = 1 - 0.72575 = 0.27425

P(defect) = 0.24196 + 0.27425 = 0.51621 = <u>51.621%</u>

Q17.

Now the process is centered → P(within the limits) = 75.8%, meaning we have P(lighter than 8.5 grams) = 12.1% → z is -1.17

-1.17 = (8.5 – 11.75) / sigma → sigma is 2.7778

Q18.

X-bar is 11.498333. A2 = 0.483. UCL = 11.75 + 0.473 x 0.215 = 11.8517
LCL = 11.75 - 0.473 x 0.215 = 11.6483
This batch is out of control.

Q19.

- Waiting for a customer order: this is wasteful as it leaves the waiter idle

- Taking the order: taking orders is probably what waiters are supposed to do and hence is value add work. You might argue that this could be done cheaper with an app; that is entirely a matter what the customer values. Most likely depends on the customer

- Waiting for the kitchen to confirm: again, this is idle time. Also, confirmation does not help add value to the customer

- Bringing the food: this really is transportation and hence waste, though unless the customer is eating in the kitchen, this will be required.

- Serving the customer: most likely value add

- Collecting payment: again, most likely value add, though some of us would prefer to pay through an app

Q20.

Answer: Ordering frequency = 40,000/15,000=2.67/yr

Ordering cost=2.67*$50=$133.33

Holding cost=15,000/2*$0.4*0.25=$750

Inventory cost=$133.33+$750=$883.33

Q21.

There are no variable costs (e.g., production or maintenance) in this problem, so it is simpler than the usual capacity planning problem.

Annual opportunity cost of capital for one space = (10,000)(0.20) = 2,000

The marginal (last) parking space is only useful on weekdays, so we should amortize the $2,000 over 250 working days, which is about $8 per day.

Loss = 8.

Gain = 10.

So the critical ratio is 10/(10 + 8) = 0.555.

Q22.

This means that z = 0.14

We should build 50 + 0.14*(20) = 52.8 (or 53) parking spaces.

Q23.

A only because higher WIP inventory increases actual time in the process or higher flow time. Cycle time is only affected from the actual processing time.

Q24.

E. The flow rate remains the same because it is demand constrained. Since the capacity of the bottleneck increases, the utilization (= flow rate / capacity) of the bottleneck will decrease. Inventory turns and days of supply can never both increase.
Assume that the first activity (Step 1) is the bottleneck and there exists unlimited demand.