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1. (Pizza) In the production of pizza, which of the following four variables is not an input

variable? [7.1]

a. The amount of dough prepared for the pizza

b. The temperature of the oven

c. The type of cheese on the pizza

d. The time that the customer leaves the pizza in the refrigerator

1. (MakeStuff) John is a newly minted quality engineer at MakeStuff Inc. His boss, intending

to promote higher quality in the company, tells him to increase the process capability index of their main product. John decides to simply increase the upper specification limit and reduce the lower specification limit.

Choose the correct sentence [7.2]:

A. The process capability index does not increase, because the variation in the process is unchanged.

B. The process capability index does not increase, because the process capability index would only change if the control limits were changed.

C. The process capability index does increase, though one might question if the underlying process is really better

D. The process capability index does increase, which is why the process quality is reduced.

E. More data is needed to answer the question

3. (Precision Machining) For a key joint, a precision machining process has a lower specification

limit of a width of 0.99 mm and an upper specification limit of 1.01 mm. The standard deviation is 0.005 mm and the mean is 1 mm.

1. What is the process capability index for the bottle filling process? [7.2]

capability index Cp = =

1. The company now wants to reduce its defect probability and operate a “six sigma process.” To what level would they have to reduce the standard deviation in the process to meet this target [7.2]

capability index Cp =

0.005-0.0017=0.0033

They have to reduce 0.0033 standard deviation in the process to meet this target.

4. (Vetro Inc) Vetro Inc. is a glass manufacturer that produces glasses of every shape and type. Recently it signed a contract to supply round glasses to Switch, a Swiss watch manufacturer. The specifications require the diameter to be between 4.96 cm and 5.04 cm. With the current production process, Vetro Inc. manages to produce glasses whose diameter is, on average, equal to 5 cm; however, a closer inspection reveals some variability in the process, with the diameter of the glass being normally distributed with standard deviation equal to 0.01cm.

1. What is the capability index (score) of Vetro Inc.? [7.2]

capability index Cp =

2. What is the maximum standard deviation allowed for the process to meet the rigorous six-sigma standards? [7.2]

capability index Cp =

The maximum standard deviation would be 0.0067.

5. (CycloCross) A company making tires for bikes is concerned about the exact width of their cyclocross tires. The company has a lower specification limit of 22.8 mm and an upper specification limit of 23.2 mm. The standard deviation is 0.25 mm and the mean is 23 mm.

a. What is the process capability index for the process? [7.2]

capability index Cp =

b. The company now wants to reduce its defect probability and run a “six-sigma process.”

To what level would they have to reduce the standard deviation in the process to meet this target? [7.2]

capability index Cp =

0.27-0.033=0.237

They have to reduce 0.237 standard deviation.

6.(Quality check) Once the raw materials are collected, a single flow unit manufacturing

process comprises three sequential steps:

∙ Step 1 consumes large amounts of an expensive paint

∙ Step 2 is the bottleneck

∙ Step 3 has a large amount of idle time

There exists a 20 percent chance at each step to produce a defect, and raw materials have a 20 percent chance to have a defect. However, defects are not immediately observable. A defect reduces the value of the final product to zero; that is, a product with just one defect has no value and must be discarded. Consider the following statements. The process presently is capacity constrained. Which of the following statements best captures good advice on where to locate a single inspection point? [7.6]

A. The only inspection point should be before step 1.

B. If the focus is on cost savings of the expensive paint, the inspection should occur before step 1. If the focus is on flow rate, the inspection point should be before step 2.

C. If the focus is on cost savings of the expensive paint, the inspection should occur before step 2. If the focus is on flow rate, the inspection point should be before step 3.

D. The only inspection point should be before step 3.

7. (Waste) An employee in a restaurant spends his time on the following: waiting for a customer order, taking the order, forwarding the order to the kitchen, waiting for the kitchen to confirm the order, bringing the food to the customer, serving the customer, and collecting the payment. Which of these time commitments are waste, which are non–value-added work, and which are value-added work? [8.3]

Waste: waiting for a customer order, waiting for the kitchen to confirm the order

Non-value-added work: forwarding the order to the kitchen, bringing the food to the customer

Value-added work: taking the order, serving the customer, collecting the payment

8. (Push) A production process has two machines. The first machine has a capacity of 100 units

per hour and the second machine has a capacity of 60 units per hour. Demand for the process is 100 units per hour.

1. In a push process, what would be the utilization of the first machine? What would happen to the inventory of the process? [8.4]

100%, inventory increase by 40 units/hour before the second machine

1. How would the situation change with a pull system? [8.4]

Utilization: 60% in Machine1 and 100% in Machine 2, inventory doesn't increase.

9. (Three Step) Consider a worker-paced line with three process steps, each of which is

staffed with one worker. The sequence of the three steps does not matter for the completion

of the product. Currently, the three steps are operated in the following sequence.

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1. What would happen to the inventory in the process if the process were operated as a push system? [8.4]

Step1 would create 20 units per hour, step 2 would create 15 units per hour and step 3 would create 12 units per hour.

20-15=5 units

15-12=3units

Therefore, the inventory increases in the buffer before Step2 and Step3 for 5 units and 3 units separately.

1. How would you implement a pull system? [8.4]

We use Kanban cards as tools in pull system to pass the information from the last step to the former step, and in the pull system, we should avoid the situation that the production rate over the actual demand.

10. (Heijunka) If you were to implement heijunka at a production facility, which of the following tasks would you prioritize? [8.4]

a. Encourage feedback among workers so as to introduce kaizen teams.

b. Reduce setup and changeover times at the different stations.

c. Reduce the number of Kanban cards.

d. Introduce jidoka if not present.

e. Train the design team following the teachings of poka-yoke.

f. Increase the storage space for finished products.

11. (ITAT) Consider the following two production processes making an electronic component

for a navigation system. Both processes consist of 20 stations and operate at a cycle time of 1 minute/unit. Their most error prone operation is step 9.

Process 1: Has a final inspection at the end of the process and has about 300 units of inventory between step 9 and the inspection.

Process 2: Has each worker check the work of the previous steps and about 50 units of inventory between step 9 and the end of the process, roughly equally distributed across the remainder of the process.

What would be the information turnaround time for a defect made at station 9? [8.4]

Process 1: 300 units \* 1min/unit = 300min

Process 2: 50/11 \* 1min/unit= 4.55min

12. (Jidoka) In the Toyota Production System, jidoka refers to [8.4]

a. Level production, where different models are produced alongside each other on the assembly line.

b. Continuous improvement, where workers organize meetings to discuss ways of improving the production process.

c. The inventory retrieval system where parts are replenished only when they are needed.

d. The aggressive reduction of changeover and setup times.

e. Continuous line-balancing to maximize utilization.

f. The cross-training of workers for a wide range of skills.

g. None of the above.

13. (Kanban) What is the relationship between the number of Kanban cards in a process and the inventory level? Pick one of the following answers [8.4].

A. There can never be more inventory in the process than what was authorized via Kanban cards.

B. The inventory of the process grows with the square root of the number of Kanban cards.

C. The inventory of the process is reduced by adding more Kanban cards.

D. There is no relationship between the two.