Concept Question 1.1

Which of the following is NOT one of Taiichi Ohno's seven wastes?

- A. transportation
- B. queues
- C. energy
- D. motion

Concept Question 1.2

Inventory reduction via JIT is an effective tool for identifying

- A. inefficiencies in warehouse layout.
- B. causes of variability.
- C. holding costs.
- D. setup costs.

Concept Question 1.3

The 5Ss developed by the Japanese do NOT include

- A. sort/segregate.
- B. standardize.
- C. simplify/straighten.
- D. safety.

Concept Question 1.4

What is a concept that results in material being produced only when requested and moved to where it is needed just as it is needed?

- A. requisition system
- B. push system
- C. pull system
- D. procrastination system

Concept Question 2.1

What is the formula for determining the number of kanban cards or containers?

- A. EOQ / Size of container
- B. (EOQ + Safety stock) / Size of container
- C. (Demand during lead time / Size of container) + Safety stock
- D. (Demand during lead time + Safety stock) / Size of container

Concept Question 2.2

Which of the following is NOT a Lean quality tactic?

- A. build fail-safe methods
- B. cross-train workers to add flexibility
- C. empower employees
- D. use statistical process control

Concept Question 2.4

Which of the following is NOT a Lean inventory tactic?

- A. reduce lot size
- B. use group technology
- C. use a push system to move inventory
- D. reduce setup time

Concept Question 3.1

Which of the following words means continuous improvement in Japanese?

- A. kaizen
- B. kanban
- C. poka-yoke
- D. sensei

Concept Question 3.2

Question Help

Which of the following is NOT one of the principles for standard work practice at Toyota?

- A. Improvements in the system must be made in accordance with the "scientific method," at the highest possible level in the organization.
- B. Work is completely specified as to content, sequence, timing, and outcome.
- C. Material and service flows are to be simple and direct.
- D. Internal and external customer-supplier connections are direct, specifying personnel, methods, timing, and quantity.

Concept Question 3.3

The Japanese call the practice of stopping production when a defect occurs

- A. jidoka.
- B. kanban.
- C. poka-yoke.
- D. kaizen.

Concept Question 4.1

JIT has an internal focus while lean production begins with an external focus on

- A. logistics.
- B. customers.
- C. design.
- D. supplier relationships.

Concept Question 4.2

Which of the following statements is true regarding lean sustainability?

- A. Lean and sustainability both seek to maximize resource and economic efficiency.
- B. Sustainability is focused on only the immediate process and system.
- C. Lean requires examining the systems in which the firm and its stakeholders operate.
- D. Lean drives out waste because waste has adverse affects on the environment, while sustainability drives out waste because waste adds nothing for the customer

Concept Question 4.3

Which of the following attributes is NOT for lean operations?

- A. Empower employees.
- B. Develop worker flexibility.
- C. Build processes that increase variability.
- D. Develop collaborative partnerships with suppliers.

Concept Question 4.4

Which of the following activities does NOT need to be virtually eliminated for a lean organization?

- A. inspection
- B. cross-training
- C. material handling
- D. inventory

Concept Question 5.1

What is the primary method in which airlines adjust to short-term fluctuations in customer demand?

- A. personnel availability
- B. changes in inventory
- C. postponement of service
- D. denial of service

Concept Question 5.2

Virtually every restaurant deals with its suppliers on

- A. a fixed-period inventory system basis.
- B. a production order quantity basis.
- C. a JIT basis.
- D. an EOQ basis.

Concept Question 5.4

Question Help

How do pharmacies implement lean operations to ensure that customers will always receive their medications upon demand?

- A. They locate no further than 10 miles away from their suppliers.
- B. They pay a premium for 60-minute delivery from their suppliers.
- C. They hold a large amount of safety stock for all of their drugs.
- D. They develop community networks as backup systems.

Problem 16.1

Carol Cagle has a repetitive manufacturing plant producing trailer hitches in Arlington, Texas. The plant has an average inventory turnover of only 12 times per year. He has therefore determined that he will reduce his component lot sizes. He has developed the following data for one component, the safety chain clip:

Setup labor cost	$25 per hour
Annual holding cost	$14 per unit
Daily production	992 units/8 hour day
Annual demand	31,200 (260 days each × daily demand of 120 units)
Desired lot size	124 units (one hour of production)

To obtain the desired lot size, the set-up time that should be achieved = 7.27 minutes *(round your response to two decimal places).*

$$S = \frac{C(EOQ)^2}{2 \times D} \times \frac{(p-d)}{p} \qquad \text{Setup time} = \frac{S}{\text{Labour rate}}$$

D=31,200 units		
d=120 units		
p=992 units (daily production rate)		
C=$14 per unit (carrying cost per unit per year)		
labor rate = $25 per hour		
EOQ= 124 units		
S=	3.032436	(14*(POWER(124,2))/(2*31200))*((992-120)/992)=**3.03**
	0.1212	3.03/25=**0.12**
setup time	**7.27**	0.1212*60=**7.27**

Problem 16.3

Rick Wing has a repetitive manufacturing plant producing automobile steering wheels. Use the following data to prepare for a reduced lot size. The firm uses a work year of 290 days.

Setup labor cost	$40.00 per hour
Annual holding cost	$15 per unit
Daily production (8 hours)	1,040 units/day
Annual demand for steering wheels	31,900 (290 days × daily demand of 110 units)
Desired lot size (2 hours of production)	Q = 260 units

a) Setup cost = $ 14.21 *(round your response to two decimal places).*

b) Setup time = 21.32 minutes *(round your response to two decimal places).*

$$S = \frac{C(EOQ)^2}{2 \times D} \times \frac{(p-d)}{p} \qquad \text{Setup time} = \frac{S}{\text{Labour rate}}$$

D=31,900 units		
d=110 units		
p=1040 units (daily production rate)		
C=$15 per unit (carrying cost per unit per year)		
labor rate = $40 per hour		
EOQ= 260 units		
S=	**14.21**	(15*(POWER(260,2))/(2*31900))*((1040-110)/1040)=**14.21**
	0.3553	14.21/40=**0.3553**
setup time	**21.32**	0.3553*60=**21.32**

Problem 16.4

Hartley Electronics, Inc., in Nashville, produces short runs of custom airwave scanners for the defense industry. You have been asked by the owner, Janet Hartley, to reduce inventory by introducing a kanban system. After several hours of analysis, you develop the following data for scanner connectors used in one work cell. How many kanbans do you need for this connector?

Daily demand	1,200 connectors
Lead time	3 days
Safety stock	0.50 day
Kanban size	500 connectors

Number of kanbans = 8 kanbans *(round your response to the nearest whole number).*

number of kanbans=(demand during lead time + safety stock)/size of container

demand during lead time =lead time x daily demand

safety stock=safety stock (in days) x daily demand

demand during lead time	
3600	3*1200=**3600**
safety stock	
600	0.5*1200=**600**
number of kanbans	
8.4	(3600+600)/500=**8.4** round to 8

Problem 16.5

Question Help

Tej Dhakar's company wants to establish kanbans to feed a newly established work cell. The following data have been provided. *Note: This is a level production system.*

Daily demand	275 units
Production lead time	2.00 days
Safety stock	1.00 day
Kanban size	50 units

How many kanbans are needed? 17 kanbans *(round your response to the nearest whole number).*

number of kanbans=(demand during lead time + safety stock)/size of container

demand during lead time =lead time x daily demand

safety stock=safety stock (in days) x daily demand

demand during lead time	
550	2*275=**550**
safety stock	
275	1*275=**275**
number of kanbans	
16.5	(550+275)/50=**16.5** round to 17

Problem 16.6

Pauline Found Manufacturing, Inc., is moving to kanbans to support its telephone switching-board assembly lines. Determine the size of the kanban for subassemblies and the number of kanbans needed.

Setup cost	$30
Annual holding cost	$120 per subassembly
Daily production	20 subassemblies
Annual usage	4,500 (50 weeks × 5 days each × daily usage of 18 subassemblies)
Lead time	12 days
Safety stock	2 days' production

Kanban container size = 150 units *(round your response to the nearest whole number).*

Number of kanbans needed = 2 kanbans *(round your response to the nearest whole number).*

$$Q_p = \sqrt{\frac{2DS}{H\left(1-\frac{d}{p}\right)}}$$

Demand during lead time = Lead time × Daily demand

Safety stock in units = Number of days × Daily production

Number of Kanban = (Demand during lead time + safety stock)/(container size)

D=4500					
S=30					
H=120					
d=18					
p=20					
Q=	**150**	SQRT((2*4500*30)/(120*(1-(18/20))))=**150**			
demand during lead time	12 days of daily usage x 18 subassemblies= **216**				
safety stock	2 days of prduction x 18 subassemblies= **36**				
number of kanbans	**1.69**	(218+36)/150=**1.69**	round up to **2**		

Problem 16.7

Maggie Moylan Motorcycle Corp. uses kanbans to support its transmission assembly line. Determine the size of the kanban for the mainshaft assembly and the number of kanbans needed.

Setup cost	$20
Annual holding cost	$200 per mainshaft
Daily production	360 mainshafts/day
Annual usage	25,000 (50 weeks × 5 days each × daily usage of 100 mainshafts)
Lead time	2 days
Safety stock	1.00 days' production

Kanban container size = 83 mainshafts *(round your response to the nearest whole number).*

Number of kanbans = 7 kanbans *(round your response to the nearest whole number).*

$$Q_p = \sqrt{\frac{2DS}{H\left(1-\frac{d}{p}\right)}}$$

Demand during lead time = Lead time × Daily demand

Safety stock in units = Number of days × Daily production

Number of Kanban = (Demand during lead time + safety stock)/(container size)

D=25,000						
S=$20						
H=200						
d=100						
p=360						
Q=	**83**	SQRT((2*25000*20)/(200*(1-(100/360))))=**83**				
demand during lead time	2 days of daily usage x 100 mainshafts=**200**					
safety stock	1 days of prduction x 360 mainshafts= **360**					
number of kanbans	**6.75**	(200+360)/83=**6.75**		round to **7**		