

Supply Chain Management, 6e (Chopra/Meindl)

Chapter 12 Managing Uncertainty in a Supply Chain: Safety Inventory

12.1 True/False Questions

1) Safety inventory is inventory carried for the purpose of satisfying demand that exceeds the amount forecasted for a given period.

Answer: TRUE

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

2) Raising the level of safety inventory increases product availability and thus the margin captured from customer purchases.

Answer: TRUE

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Analytical thinking

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

3) Carrying excessive inventory can help counter demand volatility when new products come on the market.

Answer: FALSE

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

4) The appropriate level of safety inventory is determined by the uncertainty of both demand and supply and the desired level of cycle inventory.

Answer: FALSE

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Analytical thinking

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

5) Product availability reflects a firm's ability to fill a customer order out of available inventory.

Answer: TRUE

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

6) Product fill rate is the fraction of product demand that is satisfied from product in inventory.

Answer: TRUE

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

7) With periodic review, inventory status is checked at regular intervals and an order is placed to raise the inventory level to a specified threshold.

Answer: TRUE

Diff: 3

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

8) The expected shortage per replenishment cycle (ESC) is the average units of demand that are satisfied from inventory in stock per replenishment cycle.

Answer: FALSE

Diff: 3

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

9) For the same safety inventory, an increase in lot size increases the fill rate but not the cycle service level.

Answer: TRUE

Diff: 3

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.1: Describe different measures of product availability.

10) A goal of any supply chain manager is to reduce the level of safety inventory required regardless of the affect product availability.

Answer: FALSE

Diff: 1

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

11) In most supply chains, the key to reducing the underlying forecast uncertainty is to link all forecasts throughout the supply chain to customer demand data.

Answer: TRUE

Diff: 2

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

12) A reduction in supply can help dramatically reduce safety inventory required without hurting product availability.

Answer: FALSE

Diff: 2

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

13) Aggregation reduces the standard deviation of demand only if demand across the regions being aggregated is not perfectly positively correlated.

Answer: TRUE

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

14) In case demand in different geographical regions is about the same size and independent, aggregation increases safety inventory by the square root of the number of areas aggregated.

Answer: FALSE

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

15) The lower the coefficient of variation of an item, the greater the reduction in safety inventories as a result of centralization.

Answer: FALSE

Diff: 3

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

16) Manufacturer-driven substitution increases overall profitability for the manufacturer by allowing some aggregation of demand, which reduces the inventory requirements for the same level of availability.

Answer: TRUE

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

17) Postponement allows the supply chain to delay product differentiation, which results in disaggregating most of the inventories in the supply chain.

Answer: FALSE

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

18) When using a continuous review policy, a manager has to account for the uncertainty of demand during the lead time and the review interval.

Answer: FALSE

Diff: 1

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

19) *Cycle inventory* is inventory carried to satisfy demand that exceeds the amount forecasted for a given period.

Answer: FALSE

Diff: 1

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Analytical thinking

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

20) Given the product variety and high demand uncertainty in most high-tech supply chains, a significant fraction of the inventory carried is safety inventory.

Answer: TRUE

Diff: 1

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

12.2 Multiple Choice Questions

1) Inventory carried for the purpose of satisfying demand that exceeds the amount forecasted for a given period is

- A) cycle inventory.
- B) demand inventory.
- C) safety inventory.
- D) security inventory.

Answer: C

Diff: 1

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

2) Safety inventory is carried because

- A) demand forecasts are accurate.
- B) demand forecasts are uncertain.
- C) adequate supplies are available.
- D) excess product was manufactured.

Answer: B

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

3) The trade-off that a supply chain manager must consider when planning safety inventory is

- A) increasing product availability versus increasing inventory holding costs.
- B) decreasing product availability versus decreasing inventory holding costs.
- C) increasing product availability versus raising the level of safety inventory.
- D) decreasing product availability versus decreasing the level of safety inventory.

Answer: A

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

4) The issue of product availability and the level of safety inventory is particularly significant in industries where

- A) product life cycles are short and demand is stable.
- B) product life cycles are short and demand is very volatile.
- C) product life cycles are long and demand is stable.
- D) product life cycles are long and demand is very volatile.

Answer: B

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

5) The ability to provide a high level of product availability to customers while carrying very low levels of safety inventory in its supply chain has been a key to success at which company?

- A) Compaq
- B) Hewlett-Packard
- C) Dell
- D) Packard-Bell

Answer: C

Diff: 2

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

6) The fraction of product demand that is satisfied from product in inventory is the

- A) customer fill rate.
- B) product fill rate.
- C) order fill rate.
- D) cycle service level (CSL).

Answer: B

Diff: 1

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

7) The fraction of *replenishment cycles* that end with all the customer demand being met is the

- A) customer fill rate.
- B) product fill rate.
- C) order fill rate.
- D) cycle service level (CSL).

Answer: D

Diff: 1

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

8) The distinction between product fill rate and order fill rate is:

- A) not significant in a single product situation.
- B) significant in a single product situation.
- C) not significant when a firm is selling multiple products.
- D) significant when a firm is selling multiple products.

Answer: A

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

9) A company that tracks inventory and places an order for a lot size Q when the inventory declines to the reorder point (ROP) is using

- A) continuous review.
- B) daily review.
- C) occasional review.
- D) periodic review.

Answer: A

Diff: 1

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

10) A company that checks inventory status at regular periodic intervals and places an order to raise the inventory level to a specified threshold is using

- A) continuous review.
- B) daily review.
- C) occasional review.
- D) periodic review.

Answer: D

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

11) As the safety inventory is increased,

- A) fill rate increases and cycle service level decreases.
- B) fill rate decreases and cycle service level increases.
- C) both fill rate and cycle service level increase.
- D) both fill rate and cycle service level decrease.

Answer: C

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

12) For the same safety inventory, an increase in lot size

- A) decreases the fill rate but not the cycle service level.
- B) increases the fill rate but not the cycle service level.
- C) decreases both the fill rate and the cycle service level.
- D) increases both the fill rate and the cycle service level.

Answer: C

Diff: 3

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.1: Describe different measures of product availability.

13) The required safety inventory

- A) grows rapidly with a decrease in the desired product availability.
- B) grows rapidly with an increase in the desired product availability.
- C) decreases with an increase in the desired product availability.
- D) remains stable with an increase in the desired product availability.

Answer: B

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

14) The required safety inventory

- A) increases with an increase in the lead time and the standard deviation of periodic demand.
- B) decreases with an increase in the lead time and the standard deviation of periodic demand.
- C) remains stable with an increase in the lead time and the standard deviation of periodic demand.
- D) increases with a decrease in the lead time and the standard deviation of periodic demand.

Answer: D

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

15) A goal of any supply chain manager is to

- A) increase the level of safety inventory required in a way that does not adversely affect product availability.
- B) increase the level of safety inventory required regardless of the effect on product availability.
- C) reduce the level of safety inventory required regardless of the effect on product availability.
- D) reduce the level of safety inventory required in a way that does not adversely affect product availability.

Answer: D

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.1: Describe different measures of product availability.

16) As the uncertainty of supply or demand _____, the required level of safety inventories _____.

- A) grows, increases
- B) increases, decreases
- C) decreases, grows
- D) decreases, increases

Answer: A

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

17) The _____ is the average units of demand that are not satisfied from inventory in stock per replenishment cycle.

- A) ROP
- B) ESC
- C) EOQ
- D) CSL

Answer: B

Diff: 3

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.1: Describe different measures of product availability.

18) Both _____ and _____ increase as the safety inventory is increased.

- A) fill rate, cycle service level
- B) lead time, cycle service level
- C) fill rate, lead time
- D) reorder point, lead time

Answer: A

Diff: 3

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.1: Describe different measures of product availability.

19) Lead time is the gap between

- A) when an order is placed and when it is received.
- B) when an order is received and when it is put away.
- C) when an order is received and when it is used.
- D) when an order is acknowledged and when it is received.

Answer: A

Diff: 1

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

20) The coefficient of variation measures

- A) the accuracy of the demand forecast.
- B) the size of the uncertainty relative to demand.
- C) the relevance of cycle inventory to demand.
- D) the relative certainty of the forecast.

Answer: B

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

Scenario 12.1 - Charm City

Avon Barksdale's operation uses large quantities of prepaid cell phones, on average 500 per week with a standard deviation of 45. The lead time for their own brand of prepaid cell phones is two weeks and they have a lot size of 125 phones.

21) What is the standard deviation of demand during their lead time?

- A) 45 phones
- B) 64 phones
- C) 90 phones
- D) 109 phones

Answer: B

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

22) Suppose Mr. Barksdale sets his reorder point at 1100 phones. What is his average cell phone inventory?

- A) 87.5 phones
- B) 105 phones
- C) 162.5 phones
- D) 257.5 phones

Answer: C

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

23) What is the average flow time of a phone if the reorder point used by Mr. Barksdale is 2000 phones?

- A) 1.74 weeks
- B) 1.87 weeks
- C) 2.00 weeks
- D) 2.13 weeks

Answer: D

Diff: 3

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

Scenario 12.2 - Hamsterdam

Marlo Stanfield's operation also uses large quantities of prepaid cell phones, on average 1500 per week with a standard deviation of 145. The lead time for their own brand of prepaid cell phones is three weeks and they have a lot size of 350 phones. To ensure they never run out, they keep a safety stock of 500 phones with Proposition Joe.

24) What is the standard deviation of demand during lead time?

- A) 251 phones
- B) 2187 phones
- C) 4500 phones
- D) 4751 phones

Answer: A

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

25) What is the expected shortage per cycle under this policy?

- A) 1 phone
- B) 2.2 phones
- C) 4.5 phones
- D) 9.8 phones

Answer: B

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

26) What is the fill rate under this policy?

- A) 0.9398
- B) 0.9833
- C) 0.9921
- D) 0.9998

Answer: D

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

27) What safety stock should be held to put the expected shortage per cycle at 5 phones?

- A) 418 phones
- B) 433 phones
- C) 462 phones
- D) 487 phones

Answer: A

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

28) What safety stock should be held to put the fill rate at 0.99?

- A) 251 phones
- B) 145 phones
- C) 0 phones
- D) 100 phones

Answer: C

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

29) The expected shortage per replenishment cycle (ESC) is

- A) the units of demand that are not satisfied from inventory in stock in a given replenishment cycle.
- B) the units of demand that are satisfied from inventory in stock in a given replenishment cycle.
- C) the average units of demand that are not satisfied from inventory in stock per replenishment cycle.
- D) the average units of demand that are satisfied from inventory in stock per replenishment cycle.

Answer: C

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.1: Describe different measures of product availability.

30) Given a lot size of Q (which is also the average demand in a replenishment cycle),

- A) the fraction of demand lost is thus $ESC + Q$.
- B) the fraction of demand lost is thus $ESC - Q$.
- C) the fraction of demand lost is thus ESC/Q .
- D) the fraction of demand lost is thus $ESC \times Q$.

Answer: C

Diff: 3

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

31) A shortage occurs in a replenishment cycle

- A) only if the demand during the lead time exceeds the ROP.
- B) only if the demand during the lead time is less than the ROP.
- C) only if the demand during the lead time exceeds the average demand.
- D) only if the demand during the lead time is less than the average demand.

Answer: A

Diff: 2

Topic: 12.3 Determining the Appropriate Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

32) Often, safety inventory calculations in practice

- A) do not include any measure of supply uncertainty, resulting in levels that may be higher than required.
- B) do not include any measure of supply uncertainty, resulting in levels that may be lower than required.
- C) include measures of supply uncertainty, resulting in levels that may be higher than required.
- D) include any measures of supply uncertainty, resulting in levels that may be lower than required.

Answer: B

Diff: 3

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

33) A(n) _____ in supply uncertainty can help _____ safety inventory required without hurting product availability.

- A) reduction, increase
- B) increase, reduce
- C) reduction, reduce
- D) reduction, cancel

Answer: C

Diff: 2

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

Scenario 12.3 - The Cat Café

Daily demand for cat litter at the Cat Café in Jones is 1500 ounces with a standard deviation of 300 ounces. The proprietor orders the best cat litter money can buy online, and the average shipping time is 5 days. Of course, if the order is placed at the end of the week, then it may take a while longer to receive the shipment, so the standard deviation of lead time is 2 days. The state health department keeps a close eye on the condition of the Cat Café; a cat-loving inspector visits at least twice a week, ostensibly to inspect, but mostly to pet his favorite Scottish Fold cat named Groundskeeper Willie.

34) Suppose the café wishes to erase any hint of impropriety and wants to peg their service level at 99.5%. What is the level of safety inventory they should carry?

- A) 7500 ounces
- B) 3074 ounces
- C) 19350 ounces
- D) 7918 ounces

Answer: D

Diff: 2

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

35) Suppose the café wishes to erase any hint of impropriety and wants to peg their service level at 99%. How many days of safety inventory they should carry?

- A) 4.77 days
- B) 5.12 days
- C) 5.33 days
- D) 5.67 days

Answer: A

Diff: 2

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

36) Suppose the café wishes to carry 8 days of demand as their safety inventory. What service level would they achieve?

- A) 93.9%
- B) 94.4%
- C) 95.2%
- D) 95.7%

Answer: B

Diff: 3

Topic: 12.4 Impact of Supply Uncertainty on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

37) _____ is the ability of a supply chain to delay product differentiation or customization until closer to the time the product is sold.

- A) Specialization
- B) Centralization
- C) Postponement
- D) Aggregation

Answer: C

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

38) Aggregation reduces the standard deviation of demand

- A) only if demand across the regions being aggregated is perfectly positively correlated.
- B) only if demand across the regions being aggregated is not perfectly positively correlated.
- C) even if demand across the regions being aggregated is not perfectly positively correlated.
- D) whenever demand across the regions being aggregated is not perfectly positively correlated.

Answer: B

Diff: 3

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

39) Which approach to aggregation requires an information system that allows access to current inventory records from each location?

- A) Information centralization
- B) Specialization
- C) Product substitution
- D) Component commonality

Answer: A

Diff: 1

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Information technology

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

40) Which approach to aggregation would stock the fast-moving items at decentralized locations close to the customer and slow-moving items at a centralized location?

- A) Information centralization
- B) Specialization
- C) Product substitution
- D) Component commonality

Answer: B

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

41) The use of one product to satisfy demand for a different product is

- A) information centralization.
- B) specialization.
- C) product substitution.
- D) component commonality.

Answer: C

Diff: 1

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

42) Which use of common components in a variety of products has been a very effective supply chain strategy to exploit aggregation and reduce component inventories?

- A) Information centralization
- B) Specialization
- C) Product substitution
- D) Component commonality

Answer: A

Diff: 1

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

43) The ability of a supply chain to delay product differentiation or customization until closer to the time the product is sold is

- A) information centralization.
- B) specialization.
- C) product substitution.
- D) postponement.

Answer: D

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

44) Which approach to aggregation has the goal of moving product differentiation as close to the pull phase of the supply chain as possible?

- A) Information centralization
- B) Specialization
- C) Product substitution
- D) Postponement

Answer: D

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

45) Periodic review policies for inventory replenishment require safety inventory to cover demand during

- A) lead time only.
- B) the review interval only.
- C) both lead time and the review interval.
- D) neither lead time or the review interval.

Answer: C

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

46) Continuous review policies for inventory replenishment require safety inventory to cover demand during

- A) lead time only.
- B) the review interval only.
- C) both lead time and the review interval.
- D) neither lead time or the review interval.

Answer: A

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

47) Periodic review policies require

- A) more safety inventory than continuous review policies for the same level of product availability.
- B) less safety inventory than continuous review policies for the same level of product availability.
- C) the same safety inventory as continuous review policies for the same level of product availability.
- D) no more safety inventory than continuous review policies for the same level of product availability.

Answer: A

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

48) All inventory between a given stage in the supply chain and the final customer is called the

- A) cycle inventory.
- B) demand inventory.
- C) echelon inventory.
- D) safety inventory.

Answer: C

Diff: 3

Topic: 12.7 Managing Safety Inventory in a Multiechelon Supply Chain

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

- 49) A distributor should decide his safety inventory levels based on
- A) the level of safety inventory carried by all retailers supplied by him.
 - B) the level of safety inventory carried by other distributors.
 - C) the level of safety inventory carried by manufacturers supplying him.
 - D) the level of cycle inventory carried by all retailers supplied by him.

Answer: A

Diff: 3

Topic: 12.7 Managing Safety Inventory in a Multiechelon Supply Chain

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

- 50) As retailers decrease the level of safety inventory they carry, the distributor will have to
- A) decrease his or her safety inventory.
 - B) increase his or her safety inventory.
 - C) keep his or her safety inventory at the same level.
 - D) increase his or her cycle inventory.

Answer: B

Diff: 3

Topic: 12.7 Managing Safety Inventory in a Multiechelon Supply Chain

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

- 51) What is the descriptive term for demand that occurs not in a steady stream of single units but in periodic large lots?

- A) Batch
- B) Bulky
- C) Lumpy
- D) Polled

Answer: C

Diff: 2

Topic: 12.9 Estimating and Managing Safety Inventory in Practice

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

52) What is an explanation offered for why firms have not historically tracked stockouts very well?

- A) There is no agreed upon definition of stockouts.
- B) There is no way to track stockouts.
- C) Stockouts occur after the fact.
- D) Stockouts are difficult to track.

Answer: D

Diff: 2

Topic: 12.9 Estimating and Managing Safety Inventory in Practice

AACSB: Application of knowledge

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

12.3 Essay Questions

1) Discuss the role of safety inventory in the supply chain and the trade-offs involved.

Answer: The primary role of safety inventory is providing product availability for customers when demand and supply are uncertain. The trade-offs that a supply chain manager must consider when planning safety inventory involve product availability and inventory holding costs. On one hand, raising the level of safety inventory increases product availability and thus the margin captured from customer purchases. Raising the level of safety inventory however, increases inventory holding costs. This issue is particularly significant in industries where product life cycles are short and demand is very volatile. Carrying excessive inventory can help counter demand volatility but can really hurt if new products come on the market and demand for the product in inventory dries up. The inventory on hand then becomes worthless.

In today's business environment, firms experience great pressure to improve product availability while increasing product variety through customization. As a result, markets have become increasingly heterogeneous and demand for individual products is very unstable and difficult to forecast. Both the increased variety and the increased pressure for availability push firms to increase the level of safety inventory they hold.

At the same time, product life cycles have shrunk. This increases the risk to firms of carrying too much inventory. Thus, a key to the success of any supply chain is to figure out ways to decrease the level of safety inventory carried without hurting the level of product availability.

Diff: 3

Topic: 12.1 The Role of Safety Inventory in a Supply Chain

AACSB: Application of knowledge

Objective: LO 12.2: Understand the role of safety inventory in a supply chain.

2) Discuss the various measures of product availability.

Answer: Product availability reflects a firm's ability to fill a customer order out of available inventory. A *stockout* results if a customer order arrives when product is not available. There are several ways to measure product availability. All availability measures are defined on average over a given time frame, which can range from hours to a year.

Product fill rate (*fr*) is the fraction of product demand that is satisfied from product in inventory. It is equivalent to the probability that product demand is supplied from available inventory.

Order fill rate is the fraction of orders that are filled from available inventory. In a multi-product scenario, an order is filled from inventory only if all products in the order can be supplied from the available inventory. Order fill rates tend to be lower than product fill rates because all products must be in stock for an order to be filled.

Cycle service level (CSL) is the fraction of *replenishment cycles* that end with all the customer demand being met. A replenishment cycle is the interval between two successive replenishment deliveries. The CSL is equal to the probability of not having a stockout in a replenishment cycle. Observe that a CSL of 60 percent will typically result in a much higher fill rate.

The distinction between product fill rate and order fill rate is not significant in a single product situation. When a firm is selling multiple products, however, this difference may be significant. For example, if most orders include 10 or more different products that are to be shipped, an out-of-stock situation of one product results in the order not being filled from stock. The firm in this case may have a poor order fill rate even though it has good product fill rates. Tracking order fill rates is important when customers place a high value on the entire order being filled simultaneously.

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Reflective thinking

Objective: LO 12.1: Describe different measures of product availability.

3) Describe the two types of ordering policies and the impact each has on safety inventory.

Answer: A replenishment policy consists of decisions regarding when to reorder and how much to reorder. These decisions determine the cycle and safety inventories along with the fr and the CSL. There are several forms that replenishment policies may take. We restrict attention to two instances:

1. *Continuous review*: Inventory is continuously tracked and an order for a lot size Q is placed when the inventory declines to the reorder point (ROP). The time between orders may fluctuate given variable demand. When using a continuous review policy, a manager has to account only for the uncertainty of demand during the lead time (L).

2. *Periodic review*: Inventory status is checked at regular periodic intervals and an order is placed to raise the inventory level to a specified threshold. In this case, the time between orders is fixed. The size of each order, however, can fluctuate given variable demand. Periodic review replenishment policies require more safety inventory than continuous review policies for the same lead time and level of product availability, because the safety inventory has to cover for demand uncertainty over the lead time and the review interval ($L + T$). Periodic review policies are simpler to implement for retailers because they do not require that the retailer have the capability of continuously monitoring inventory. Given that higher uncertainty must be accounted for, periodic review policies will require a higher level of safety inventory.

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

4) Explain the impact of supplier lead time on safety inventory.

Answer: The required safety inventory increases with an increase in the lead time and the standard deviation of periodic demand. Reducing the supplier lead time (L) will reduce the need for safety inventory. If lead time decreases by a factor of k , the required safety inventory decreases by a factor of k . The only caveat here is that reducing the supplier lead time requires significant effort from the supplier, while reduction in safety inventory occurs at the retailer. Thus it is important for the retailer to share some of the resulting benefits. A reduction in supply uncertainty can help dramatically reduce safety inventory required without hurting product availability.

Often, safety inventory calculations in practice do not include any measure of supply uncertainty, resulting in levels that may be lower than required. This hurts product availability.

Diff: 2

Topic: 12.2 Factors Affecting the Level of Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.3: Identify factors that influence the required level of safety inventory.

5) Explain the impact of aggregation on safety inventory.

Answer: Aggregation reduces the standard deviation of demand only if demand across the regions being aggregated is not perfectly positively correlated. Demand for most products does not show perfect positive correlation across different geographical regions. In case demand in different geographical regions is about the same size and independent, aggregation reduces safety inventory by the square root of the number of areas aggregated. In other words, if the number of independent stocking locations decreases by a factor of n , the average safety inventory is expected to decrease by a factor of n .

There are two major disadvantages of aggregating all inventory in one location:

1. Increase in response time to customer order
2. Increase in transportation cost to customer

Both disadvantages result because the average distance between the inventory and the customer increases with aggregation. With this situation, either the customer has to travel more to reach the product or the product has to be shipped over longer distances to reach the customer. However, there are clear benefits to aggregating safety inventory.

Diff: 2

Topic: 12.5 Impact of Aggregation on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

6) Weekly demand for corn tortillas at Big Truck Tacos is normally distributed with a mean of 1500 and a standard deviation of 300. Marco's takes one and one half weeks to supply a Big Truck order. Big Truck is targeting a CSL of 95 percent and monitors its inventory continuously. How much safety inventory of corn tortillas should Big Truck carry? What should their ROP be?

Answer:

$$\begin{aligned}ss &= F_s^{-1}(\text{CSL}) \times \sigma L \\&= \text{NORMSINV}(0.95) \times 300(\sqrt{1.5}) \\&= 470.87 \approx 471\end{aligned}$$

$$\begin{aligned}\text{ROP} &= \text{DL} + ss \\&= 1500(1.5) + 471 \\&= 2721\end{aligned}$$

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

7) Weekly demand for 12" hot dogs at Mutt's Amazing Dogs is normally distributed with a mean of 2850 and a standard deviation of 425. The store manager continuously monitors inventory and currently orders 500 hot dogs each time the inventory drops to 6000 frames. The manufacturer currently takes two weeks to fill an order. How much safety inventory does the store carry?

Answer:

$$ROP = DL + ss$$

$$ROP = 6000$$

$$ss = ROP - DL$$

$$= 6000 - (2850 \times 2)$$

$$= 300$$

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.

8) Weekly demand for avocados at the Guac Shop is normally distributed with a mean of 2500 and a standard deviation of 650. The store manager has decided to follow a periodic review policy to manage inventory of avocados. They plan to order every two weeks. The farmers currently take two weeks to fill an order. Given a desired CSL of 97.5 percent, how much safety inventory should the Guac Shop carry? What should their OUL be?

Answer:

$$ss = F_S^{-1}(CSL) \times \sigma T + L$$

$$= NORMSINV(0.975) \times (650 \times \sqrt{4})$$

$$= 2547.95 \approx 2548$$

$$OUL = DT + L + ss$$

$$= 2500(4) + 2548$$

$$= 12,548$$

Diff: 2

Topic: 12.6 Impact of Replenishment Policies on Safety Inventory

AACSB: Analytical thinking

Objective: LO 12.4: Use available managerial levers to lower safety inventory without hurting product availability.