

- 11.4. Given the following data, calculate the average demand and the standard deviation.

Period	Actual Demand	Deviation	Deviation Squared
1	1700		
2	2100		
3	1900		
4	2200		
5	2000		
6	1800		
7	2100		
8	2300		
9	2100		
10	1800		
Total			

- 11.5. If sigma is 150 units, and the demand during the lead time is 200 units, calculate the safety stock and order point for:

- A 50% service level.
- An 85% service level.

Use the table in Figure 11.5 to help you calculate your answer.

- Answer.** a. Safety stock = zero
Order point = 200 units
b. Safety stock = 156 units
Order point = 356 units

- 11.6. The standard deviation of demand during the lead time is 100 units.

- Calculate the safety stock required for the following service levels: 75%, 80%, 85%, 90%, 95%, 99.99%.
- Calculate the *change* in safety stock required to increase the service levels from 75% to 80%, 80% to 85%, 85% to 90%, 90% to 95%, and 95% to 99.99%. What conclusion do you reach?

- 11.7. For an SKU, the standard deviation of demand during the lead time is 150 units, the annual demand is 10,000 units, and the order quantity is 750 units. Management says it will tolerate only one stockout per year. What safety stock should be carried? What is the average inventory? If the lead time is 2 weeks, what is the order point?

- Answer.** Safety stock 213 units
Average inventory = 588 units
Order point 598 units

11.20. A firm orders a number of items from a regional warehouse every 2 weeks. Delivery takes 1 week. Average demand is 200 units per week, and safety stock is held at 2 weeks' supply.

- Calculate the target level.
- If 600 units are on hand, how many should be ordered?

Answer. Target level = 1000 units

Order quantity = 400 units

11.21. A regional warehouse orders items once a week from a central warehouse. The truck arrives 3 days after the order is placed. The warehouse operates 5 days a week. For a particular brand and size of chicken soup, the demand is fairly steady at 20 cases per day. Safety stock is set at 2 days' supply.

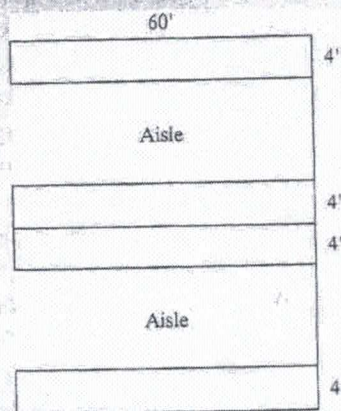
- What is the target level?
- If the quantity on hand is 90 cases, how many should be ordered?

11.22. A small hardware store uses a periodic review system to control inventory and calculate order quantities. Inventory is reviewed every 2 weeks and there is a 1-week lead time for delivery. Safety stock is set at 1 week's supply. The following table shows the products and the current on-hand inventory. Calculate the target level and order quantity for each of the items. Use 50 weeks per year for your calculations.

Item	Annual Demand	Target Level	On-Hand	Order Quantity
Nut - 6 mm	500		22	
Nut - 8 mm	750		54	
Bolt - 6 mm	200		0	
Bolt - 8 mm	100		6	
Screw #8 - 30 mm	250		12	
Screw #8 - 40 mm	200		8	
Washer - 8 mm	380		20	
Washer - 10 mm	100		5	
Pin - Split	400		40	

11.23. Using the data from problem 11.22, calculate the order quantities that would result if the store switched to a weekly review of inventory. What effect does more frequent ordering have on order quantities?

- 12.4. A company has a warehouse with the dimensions shown in the following diagram. How many pallets measuring $48'' \times 40''$ can be stored three high if there is to be a 2'' space between the pallets?



- 12.5. A company wishes to store the following SKUs so there is 100% accessibility. The items are stored on pallets that can be stacked three high.
- How many pallet positions are needed?
 - What is the cube utilization?
 - If the company bought racking for storing the pallets, how many pallet positions are needed to give 100% accessibility?

SKU	Number of Pallets	Pallet Positions Required
A	13	
B	4	
C	8	
D	10	
E	14	
Total		

- Answer.**
- Pallet positions needed = 19
 - Cube utilization = 86%
 - 17 pallet positions

- 12.6. A company wants to store the following seven SKUs so there is 100% accessibility. Items are stored on pallets that are stored four high.

- How many pallet positions are needed?
- What is the cube utilization?
- If the company bought racking for storing the pallets, how many pallet positions are needed to give 100% accessibility?

SKU	Number of Pallets	Pallet Positions Required
A	14	
B	17	
C	40	
D	33	
E	55	
F	22	
G	34	
Total		

- 12.7. a. Which of the following items are within tolerance?
b. What is the percent accuracy by item?

Part Number	Shelf Count	Inventory Record	Difference	% Difference	Tolerance	Within Tolerance?
A	650	635			$\pm 3\%$	
B	1205	1205			$\pm 0\%$	
C	1350	1500			$\pm 5\%$	
D	77	80			$\pm 5\%$	
E	38	40			$\pm 3\%$	
Total						

Answer. a. A, B, and D are within tolerance.
b. 60%

- 12.8. a. Which of the following items are within tolerance?
b. What is the percent accuracy by item?

Part Number	Shelf Count	Inventory Record	Difference	% Difference	Tolerance	Within Tolerance?
A	75	80			$\pm 3\%$	
B	120	120			$\pm 0\%$	
C	1400	1500			$\pm 5\%$	
D	75	76			$\pm 5\%$	
E	68	66			$\pm 2\%$	
Total						

- 12.9. A company does an ABC analysis of its inventory and calculates that out of 5000 items, 22% can be classified as A items, 33% as B items, and the remainder as C items. A decision is made that A items are to be cycle counted once a month, B items

every 3 months, and C items twice a year. Calculate the total counts and the counts per day by classification. The company works 5 days per week and 50 weeks per year.

Classification	Number of Items	Count Frequency per Year	Number of Counts per Year	% of Total Counts	Counts per Day
A					
B					
C					
Total counts per year					
Work days per year					
Total counts per day					

Answer. Counts per day A = 53; B = 26; C = 18

12.10 A company does an ABC analysis of its inventory and calculates that out of 10,000 items, 19% can be classified as A items, 30% as B items, and the remainder as C items. A decision is made that A items are to be cycle counted twice a month, B items every 3 months, and C items once a year. Calculate the total counts and the counts per day by classification. There are 250 working days per year.

Classification	Number of Items	Count Frequency per Year	Number of Counts per Year	% of Total Counts	Counts per Day
A					
B					
C					
Total counts per year					
Work days per year					
Total counts per day					

CASE STUDY 12.1

CostMart Warehouse

Amy Gordon could not have been more pleased when she was first appointed as the new inventory management supervisor for the CostMart regional warehouse. She had previously worked part time as a clerk in the local CostMart Department Store while she finished her university degree. After she got the degree, she was named as the section head in charge of roughly one-fourth of the store. Now, a year later, she started to wonder about

“...but you ask for more just might get it.”

33. A buyer in England would like to import a Harley-Davidson motorcycle directly from a dealer in the United States. Which Incoterm would minimize the buyer's efforts? Would arranging the shipment themselves save money for the buyer?
34. What is meant by the term *green reverse logistics*?
35. Describe how a 3PL would benefit a company that sells their product to individuals through the Internet.
36. Describe how reverse logistics would apply to your school bookstore.

PROBLEMS

- 13.1. A company normally ships to a customer by rail at a cost of \$500 per load. The transit time is 14 days. The goods can be shipped by truck for \$700 per load and a transit time of 4 days. If transit inventory cost is \$35 per day, what does it cost to ship each way?

Answer. Rail, \$990; truck, \$840

- 13.2. A company manufactures component parts for machine tools in North America and ships them to Southeast Asia for assembly and sale in the local market. The components are shipped by sea, transit time averages 6 weeks, and the shipping costs \$1000 per shipment. The company is considering moving the parts by air at an estimated cost of \$7500; the shipment taking 2 days to get there. If inventory in transit for the shipment costs \$150 per day, should they ship by air?

In Chapter 8, it was said that forecasts are more accurate for nearer periods of time. Should this be considered? What activities are affected by the shorter lead time?

- 13.3. For a given commodity, the line-haul cost is \$13 per mile. For a trip of 200 miles and a shipment of 300 cwt., what is the cost per hundredweight? If the shipment is increased to 500 cwt., what is the saving in cost per hundredweight?

Answer. \$3.47 per cwt.

- 13.4. A company ships a particular product to a market located 1500 miles from the plant at a cost of \$4 per mile. Normally it ships 500 units at a time. What is the line-haul cost per unit?

- 13.5. In problem 13.4, if the company can ship the units unassembled, it can ship 800 units in a truck. What is the line-haul cost per unit now?

Answer. Line-haul cost per unit = \$7.50.

- 13.6. A company processes feathers and ships them loose in a covered truck. The line-haul cost for an average shipment is \$400, and the truck carries 2000 pounds of feathers. A bright new graduate has just been hired and has suggested that they should bale the feathers into 500-pound bales. This would make them easier to handle and also allow them to be compressed into about one-tenth of the space they now occupy. How many pounds of feathers can the truck now carry? What is the present line-haul cost per pound? What will it be if the proposal is adopted?

- 13.7. A company in Calgary serves a market in the northwestern United States. Now it ships LTL at an average cost of \$30 per unit. If the company establishes a distribution center in the market, it estimates the TL cost will be \$15 per unit, inventory-carrying costs will be \$7 per unit, and the local LTL cost will average \$6 per unit. If the company forecasts annual demand at 200,000 units, how much will they save annually?

Answer. Annual saving = \$400,000

- 13.8. A company ships LTL to customers in a market in the Midwest at an average cost of \$40 per cwt. It proposes establishing a distribution center in this market. If TL shipment costs \$20 per cwt., the estimated inventory-carrying costs are \$5 per cwt., and the local cartage (LTL) cost is estimated at \$6 per cwt. If the annual shipped volume is 100,000 cwt., what will the annual savings be by establishing the distribution center?