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Operations Management: Processes and Supply Chains, 12e **(Krajewski)**
Chapter 2 Process Strategy and Analysis

2.1 Process Structure in Services

1) Process decisions are strategic in nature.
Answer: TRUE
Difficulty: Easy
Keywords: process strategy
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

2) No process can exist without at least one product or service.
Answer: TRUE
Difficulty: Easy
Keywords: process, product, service
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

3) All parts of an organization, as well as external suppliers and customers across the supply chain, need to be involved to ensure that processes are providing the most value to their internal and external customers.
Answer: TRUE
Difficulty: Easy
Keywords: supply chain process, business process
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

4) Processes, by their nature, are found only in the operations function of an organization.
Answer: FALSE
Difficulty: Easy
Keywords: operations function, process
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
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5) Customer involvement reflects the ways in which customers become part of the process and the extent of their participation.
Answer: TRUE
Difficulty: Moderate
Keywords: customer contact, customer participation, customer involvement
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

6) Service providers with a line process tend to move customers, materials, or information in a fixed sequence from one operation to the next.
Answer: TRUE
Difficulty: Moderate
Keywords: line process, service provider, standard process
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

7) A moment of truth or service encounter is face-to-face interaction between the customer and a service provider.
Answer: TRUE
Difficulty: Easy
Keywords: moment of truth, face-to-face interaction, customer, service provider
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

8) Divergence is the extent to which the process is customized with considerable latitude on how the tasks are performed.
Answer: TRUE
Difficulty: Moderate
Keywords: divergence, customization
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

9) A front office structure features high levels of customer contact where the service provider interacts directly with the internal or external customer.
Answer: TRUE
Difficulty: Easy
Keywords: front office process structure, customer contact, service provider interaction
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
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10) Back office work is typically routine, with many steps having considerable divergence.
Answer: FALSE
Difficulty: Easy
Keywords: back office process structure, divergence
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

11) People processing services require:
A) a high degree of process structure.
B) high capital intensity.
C) physical presence.
D) hybrid low volume–capital intensive operations.
Answer: C
Difficulty: Moderate
Keywords: people processing services, physical presence
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

12) A politician conducting a town hall meeting, face-to-face with her constituents, is an example of:
A) back office.
B) passive contact.
C) active contact.
D) hybrid office.
Answer: C
Difficulty: Easy
Keywords: service processes, passive contact
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

13) An interior designer decorates homes for a clientele that wants a one-of-a-kind living space. This service process can be described as:
A) divergent.
B) complex.
C) specialized.
D) hybrid.
Answer: A
Difficulty: Moderate
Keywords: service processes, process divergence
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
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14) The process structure that best describes a waiter's position at a restaurant would be classified as:
A) front office.
B) back office.
C) hybrid office.
D) inner office.
Answer: A
Difficulty: Easy
Keywords: services processes, process structure, front office
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

15) Field service representatives are classified as:
A) back office.
B) hybrid office.
C) front office.
D) mid office.
Answer: C
Difficulty: Easy
Keywords: services processes, process structure, front office
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

16) A process that is primarily back office is:
A) a taxi driver.
B) a loan officer at a bank.
C) the payroll clerk that calculates your paycheck.
D) the hostess at a restaurant.
Answer: C
Difficulty: Moderate
Keywords: service processes, process structure, back office
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

17) Front offices typically emphasize:
A) low cost operations and on-time delivery.
B) top quality and customization.
C) on-time delivery and standardization.
D) top quality and low cost operations.
Answer: B
Difficulty: Easy
Keywords: services processes, process structure, front office
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
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18) Back offices typically emphasize:
A) low cost operations and on-time delivery.
B) high divergence and customization.
C) on-time delivery and customization.
D) high customer contact and low cost operations.
Answer: A
Difficulty: Easy
Keywords: service processes, process structure, back office
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

19) What are three principles of process strategy that should govern choices that process designers make? Provide examples of well-conceived process strategy choices to illustrate each of your three principles.
Answer: The three principles discussed in the text are: 1) The key to successful process decisions is to make choices that fit the situation and that make sense together. They should not work at cross-purposes, with one process optimized at the expense of other processes. A more effective process is one that matches key process characteristics and has a close strategic fit. 2) Individual processes are the building blocks that eventually create the firm's whole supply chain. The cumulative effect on customer satisfaction and competitive advantage is huge. 3) Whether processes in the supply chain are performed internally or by outside suppliers and customers, management must pay particular attention to the interfaces between processes. Dealing with these interfaces underscores the need for cross-functional coordination. Examples of process strategy choices will vary.
Difficulty: Moderate
Keywords: process decisions, process strategy
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

20) What are the different dimensions of customer contact in service processes? Provide an example of a service that has high levels of customer contact and one that has very low levels of customer contact.
Answer: The dimensions of customer contact are physical presence, what is processed, contact intensity, personal attention, and method of delivery. Examples will vary.
Difficulty: Moderate
Keywords: customer contact intensity, physical presence, personal attention, delivery method, what processed
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

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21) Describe and highlight differences among the three process structures in services.
Answer: The three process structures form a continuum and are front office, hybrid office, and back office. The front office structure is a process with high customer contact in which the service provider interacts directly with the customer. This process is more complex and has considerable divergence. The back office structure is a process with low customer contact in which the service provider interacts little with the customer. The work tends to be standardized and routine, with line flows from one service provider to the next with little variation. The hybrid office is a process with moderate levels of customer contact and standard services with perhaps some options available. Work flow progresses from one station to the next with some dominant paths apparent. Work is reasonably complex and some customization exists in how the process is performed.
Difficulty: Moderate
Keywords: service process structure, front office, back office, hybrid office
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in services and how to position a service process on the customer-contact matrix.

2.2 Process Structure in Manufacturing

1) A continuous flow process is characterized by a high degree of job customization.
Answer: FALSE
Difficulty: Moderate
Keywords: continuous flow process, customization
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

2) A job process has the highest level of customization of the process choices.
Answer: TRUE
Difficulty: Moderate
Keywords: job process, customization
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

3) Job processes generally have higher volumes than batch processes.
Answer: FALSE
Difficulty: Moderate
Keywords: job process, batch process, volume
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

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4) In a line process, there is little variability in the products manufactured, and production and material handling equipment are often specialized.
Answer: TRUE
Difficulty: Moderate
Keywords: line process, product variability, specialized equipment
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

5) Petroleum refineries typically use continuous flow processes.
Answer: TRUE
Difficulty: Moderate
Keywords: continuous flow process
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

6) The product-process matrix brings together the elements of volume, process, and quality.
Answer: FALSE
Difficulty: Moderate
Keywords: product-process matrix, manufacturing volume, process, quality
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

7) An off-diagonal position in the product-process matrix is typically more profitable than a position on the diagonal.
Answer: FALSE
Difficulty: Easy
Keywords: product-process matrix, diagonal
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

8) A make-to-stock strategy involves holding items in stock for immediate delivery and is feasible for standardized products with high volumes and reasonably accurate forecasts.
Answer: TRUE
Difficulty: Easy
Keywords: make-to-stock strategy, standardized products, volume, product forecasts
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

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9) The degree of process divergence is what keeps a large batch process from being economically produced using a line process.
Answer: TRUE
Difficulty: Moderate
Keywords: batch process, line process, divergence
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

10) Assemble-to-order strategy produces a wide variety of products from relatively few assemblies and components after orders are received.
Answer: TRUE
Difficulty: Moderate
Keywords: assemble-to-order strategy
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

11) The principle of postponement is modeled by the worker that has known his assignment for several weeks, but waits until the day before the product is to be delivered to begin production.
Answer: FALSE
Difficulty: Moderate
Keywords: postponement, procrastination
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

12) Which of the following is sometimes called mass production?
A) batch process and make-to-order strategy
B) line process and make-to-stock strategy
C) continuous flow process and assemble-to-order strategy
D) job process and make-to-order strategy
Answer: B
Difficulty: Moderate
Keywords: manufacturing processes, mass production, line, line process
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

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13) A job process should be preferred when:
A) workforce and equipment are specialized.
B) products are made to stock type.
C) customization is high and volume is low.
D) customization is low and volume is high.
Answer: C
Difficulty: Moderate
Keywords: manufacturing processes, job process, customization, volume
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

14) Which of the following statements about process choice is *best*?
A) A batch process typically has a standard sequence of operations through the facility.
B) Automobiles and appliances are examples of products created using a continuous flow process.
C) Continuous flow processes are very capital intensive.
D) A custom cake operation is an example of a batch process.
Answer: C
Difficulty: Moderate
Keywords: manufacturing processes, process choice, continuous flow, capital, intensity
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

15) The product-process matrix used to analyze manufacturing operations brings together the elements of:
A) volume, process, and intensity.
B) process, intensity, and product design.
C) intensity, volume, and process.
D) customization, volume, and process.
Answer: D
Difficulty: Moderate
Keywords: manufacturing processes, product-process matrix
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

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16) Which one of the following statements about process management is *best*?
A) When customization must be high, equipment should be general purpose, and employees need to perform a broader range of duties.
B) The traditional relationship between capital intensity and resource flexibility is that if one is high, so is the other.
C) Creating a more capital-intensive process tends to reduce the fixed cost and raise the variable unit cost.
D) Economies of scope mean that a process should be devoted to a single product or service to achieve high volumes.
Answer: A
Difficulty: Challenging
Keywords: manufacturing processes, process management, customization
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

17) A manufacturer that produces standard products in large volumes is likely to be using a(n):
A) make-to-stock strategy.
B) make-to-order strategy.
C) assemble-to-order strategy.
D) engineer-to-order strategy.
Answer: A
Difficulty: Easy
Keywords: production and inventory strategies, make-to-stock
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

18) The principle of postponement is employed by a producer using a(n):
A) make-to-stock strategy.
B) make-to-order strategy.
C) assemble-to-order strategy.
D) engineer-to-order strategy.
Answer: C
Difficulty: Moderate
Keywords: production and inventory strategies, assemble-to-order
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

19) A(n) _____ process would probably not be used to produce products before a customer has placed a firm order.
Answer: job
Difficulty: Easy
Keywords: job process, make-to-order
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

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20) Describe the differences among make-to-order, assemble-to-order, and make-to-stock strategies from the producer's and from the customer's perspective.
Answer: A make-to-order strategy produces to customer specifications in low volumes; typically using highly divergent job or batch processes that are highly flexible. This level of customization requires a great deal of planning and control by the producer; the customer receives exactly what has been requested which may literally be a one-of-a-kind item. The customer must suffer through a lead time period during which the item is being fabricated. The assemble-to-order strategy produces wide variety from relatively few assemblies in a line or batch process. The process does not require as much flexibility and since the subassemblies are standardized, the production planning and supply chain management is easier for the producer. The customer again receives exactly what is ordered (which may be precisely what was desired) and the item could be one-of-a-kind. Again, the customer must wait for the item to be produced, but this wait tends to be shorter than in a make-to-order system. The make-to-stock strategy allows the producer to manufacture standardized items in high volumes based on a forecast. Production planning and control is much simpler and inventory can be used as a buffer for variable demand. The customer's order is filled immediately and the product is far from one-of-a-kind.
Difficulty: Moderate
Keywords: process strategy, make-to-order, make-to-stock, assemble-to-order
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

21) List and briefly define four different basic types of manufacturing processes.
Answer: The four basic process types are job process, batch process, line process, and continuous flow process. A job process creates the flexibility needed to produce a variety of products or services in significant quantities. Customization is relatively high, and volume for any one product or service is low. A batch process differs from the job process with respect to volume, variety, and quantity. The primary difference is that volumes are higher because the same or similar products or services are provided repeatedly. A line process lies between the batch and continuous processes on the continuum, volumes are high, and products or services are standardized. The continuous flow process is the extreme end of high-volume, standardized production with rigid line flows.
Difficulty: Moderate
Keywords: batch, job, line, continuous flow
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
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22) Sketch and discuss the product-process matrix for manufacturing.
Answer: The product-process matrix brings together the elements of volume, product design, and process. It synchronizes the product to be manufactured with the process. Good manufacturing design depends first on volume, so if high customization is needed, then volume is usually lower and vice versa. The vertical dimension of the product-process matrix deals with divergence and flow. Combinations that are best choices are reflected along the diagonal of the matrix.

		Less customization and higher volume				
			I. Low volume products, made to customer order	II. Multiple products, low to moderate volumes	III. Few major products, higher volume	IV. High volume, high standardization, commodity products
		Process Characteristics				
Less divergence and more line flows		I. Centralized processes, with flexible and unique sequence of tasks	Job process			
		II. Disconnected line flows, moderately repetitive work		Batch process		
		III. Connected line, highly repetitive work			Line process	
		IV. Continuous flows				Continuous flow process

Difficulty: Moderate
Keywords: product- process matrix, manufacturing, volume, customization, divergence, line-flow
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Understand the process structure in manufacturing and how to position a manufacturing process on the product-process matrix.

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2.3 Process Strategy Decisions

1) High customer involvement increases service provider productivity and makes quality measurement easier.
Answer: FALSE
Difficulty: Moderate
Keywords: customer involvement, productivity, quality
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

2) Capital intensive automation is appropriate for both high and low volume operations.
Answer: FALSE
Difficulty: Moderate
Keywords: automation, capital intensity
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

3) Fixed automation is appropriate for both line and continuous flow operations.
Answer: TRUE
Difficulty: Moderate
Keywords: fixed automation, continuous flow
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

4) The ability to reprogram machines is useful for both low-customization and high-customization processes.
Answer: TRUE
Difficulty: Moderate
Keywords: customization, programmable automation
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

5) A toaster is an example of flexible automation.
Answer: FALSE
Difficulty: Moderate
Keywords: flexible automation
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

6) In a service process, capital intensity varies with volume in both front office and back office operations.
Answer: TRUE
Difficulty: Moderate
Keywords: capital intensity, front office service, back office service
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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7) Customer involvement is especially important for service process strategy decisions, particularly if customer contact is high.
Answer: TRUE
Difficulty: Moderate
Keywords: service process, customer contact
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

8) Additive manufacturing capabilities, such as 3D printing, prevent firms from achieving substantial economies of scope.
Answer: FALSE
Difficulty: Moderate
Keywords: service process, economies of scope
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

9) Which of the following statements about customer involvement is *best*?
A) In service industries, customer contact is of minor importance.
B) High task divergence and flexible process flows require more flexibility of the process's employees, facilities and equipment.
C) A firm that produces standardized products often seeks customer specifications.
D) When customer involvement is highly customized, a process is more likely to use a standardized-services process rather than a customized-services process.
Answer: B
Difficulty: Moderate
Keywords: customer involvement
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

10) Active customer contact and personalized attention can lower cost to the customer by:
A) increasing the capital intensity.
B) trading fixed costs for an equivalent variable cost.
C) substituting customer efforts for those of the service provider.
D) lowering the level of technology involved.
Answer: C
Difficulty: Moderate
Keywords: customer contact, cost
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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Scenario 2.4
A company is considering two options for the production of a part needed downstream in the manufacturing process. Particulars are as follows:

Specialized automation	Fixed Costs = $9,000 / month	Variable Cost / Unit = $2
General automation:	Fixed Costs = $3,000 / month	Variable Cost / Unit = $5

11) Use Scenario 2.4 to answer this question. What is the monthly break-even quantity for choosing between the two automation approaches?
A) 1,000 units
B) 2,000 units
C) 6,000 units
D) 12,000 units
Answer: B
Difficulty: Easy
Keywords: capital-intensive operations, automation, break even quantity
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

12) Use Scenario 2.4 to answer this burning question. For a monthly volume of 3,000 units, which automation approach should be chosen?
A) specialized automation
B) general automation
C) Either approach is acceptable, because costs are the same for either option at 3,000 units.
D) Can't be determined with information given.
Answer: A
Difficulty: Moderate
Keywords: automation, total cost, low-cost option
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

13) Use Scenario 2.4 to solve this problem. What does the company save each month by selecting this low-cost option compared to the higher-cost option (for monthly requirements of 3,000 units)?
A) $1,000
B) $3,000
C) $6,000
D) Can't be determined with information given.
Answer: B
Difficulty: Moderate
Keywords: automation, total cost
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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Scenario 2.6
You currently purchase a part used in your production process from an outside supplier, and have decided to begin making this part in-house. You have two equipment options for moving production in-house: special-purpose equipment and general-purpose equipment. Cost information for these two options is as follows:

ALTERNATIVE	FIXED COST	VARIABLE COST
Special-Purpose Equipment	$200,000 per year	$15 per unit
General-Purpose Equipment	$50,000 per year	$20 per unit

14) Use Scenario 2.6 to answer this question. What is the break even quantity between the two options?
A) 30,000 units per year
B) 40,000 units per year
C) 50,000 units per year
D) 60,000 units per year
Answer: A
Difficulty: Easy
Keywords: capital-intensive operations, general-purpose equipment, special-purpose equipment, break even quantity
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

15) Use Scenario 2.6 to answer this question. What are total costs under the Special-Purpose Equipment option for an annual quantity of 40,000 units?
A) $400,000
B) $500,000
C) $800,000
D) $850,000
Answer: C
Difficulty: Easy
Keywords: general-purpose equipment, special-purpose equipment, total cost
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

16) Use Scenario 2.6 to answer this question. What are total costs under the General-Purpose Equipment option for an annual quantity of 40,000 units?
A) $400,000
B) $450,000
C) $800,000
D) $850,000
Answer: D
Difficulty: Easy
Keywords: general-purpose equipment, special-purpose equipment, total cost
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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17) Use Scenario 2.6 to solve this riddle. For what range of output is the General-Purpose Equipment the low-cost option?
A) 0-30,000 units per year
B) 30,000 or more units per year
C) 40,000 or more units per year
D) 0-40,000 units per year
Answer: A
Difficulty: Moderate
Keywords: general-purpose equipment, special-purpose equipment, total cost
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

18) Use Scenario 2.6 to answer this question. For what range of output is the Special-Purpose Equipment the low-cost option?
A) 30,000 or more units per year
B) 0 - 30,000 units per year
C) 0 - 40,000 units per year
D) 40,000 or more units per year
Answer: A
Difficulty: Moderate
Keywords: general-purpose equipment, special-purpose equipment, total cost, low-cost option
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

19) Use Scenario 2.6 to solve this mystery. At an annual requirement of 40,000 units, what does the company save per year by selecting the lower-cost option?
A) $150,000
B) $300,000
C) $50,000
D) $40,000
Answer: C
Difficulty: Easy
Keywords: general-purpose equipment, special-purpose equipment, total cost, low-cost option
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

20) A higher level of fixed automation can be justified by:
A) decreased labor productivity.
B) longer cycle time.
C) higher demand volumes.
D) lower sales.
Answer: C
Difficulty: Moderate
Keywords: fixed automation, volume
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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21) Which one of the following statements about flexible automation is *best*?
A) Investment cost is lower when a transfer machine handles many operations.
B) Chemical processing plants and oil refineries mainly utilize programmable automation.
C) It is an automatic process that can be reprogrammed to handle various products.
D) It achieves top efficiency; accommodating new products is difficult and costly.
Answer: C
Difficulty: Moderate
Keywords: flexible automation, reprogramming
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

22) With flexible automation, the ability to reprogram instructions can be useful in:
A) line flow, but not flexible flow, operations.
B) flexible flow, but not line flow, operations.
C) either line flow or flexible flow operations.
D) situations in which top efficiency is mandatory, but only if volumes are high.
Answer: C
Difficulty: Moderate
Keywords: flexible automation, reprogramming, line flow
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

23) Higher volume in a process is generally associated with:
A) more resource flexibility.
B) more capital intensity.
C) greater customer involvement.
D) fewer opportunities for standardization.
Answer: B
Difficulty: Moderate
Keywords: volume, process, capital intensity
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

24) Which of the following statements regarding resource flexibility is *best*?
A) Training is a small part of worker flexibility.
B) Specialization of employees is consistent with worker flexibility.
C) Worker flexibility is not a priority if the process is subject to hourly or seasonal peaks in demand.
D) Resource flexibility requires employees to be able to perform a broad range of duties, and equipment usually must be more general purpose.
Answer: D
Difficulty: Moderate
Keywords: resource flexibility, flexible workforce
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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25) Which of the following statements concerning resource flexibility is *best*?
A) Flexible equipment is useful to companies with low production volumes and high customization.
B) Investment in general-purpose equipment is warranted if the firm expects to sell more than the break-even amount.
C) Manufacturing efficiency increases with general-purpose equipment.
D) Resource flexibility is crucial for line-flow processing.
Answer: A
Difficulty: Moderate
Keywords: resource flexibility, volume, customization
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

26) Suppose that competitive priorities call for offering a wide variety of customized services. Which of the following process decisions would be more likely?
A) more capital intensity
B) more resource flexibility
C) more process automation
D) less customer involvement
Answer: B
Difficulty: Challenging
Keywords: resource flexibility, customized service
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

27) Which statement about economies of scope is *not* true?
A) Economies of scope are often attained through programmable automation.
B) Economies of scope bring together two competitive priorities—customization and low price.
C) Economies of scope reflect the ability to produce multiple products more cheaply in combination than separately.
D) Economies of scope reflect low capital intensity and high resource flexibility.
Answer: D
Difficulty: Moderate
Keywords: economies of scope, capital intensity, resource flexibility
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

28) Which of the following statements about additive manufacturing capabilities is *not* true?
A) Changes in product design are difficult and costly to incorporate.
B) It allows firms to react to a wider variety of customer demands.
C) Three-dimensional (3D) printing technology is one example of additive manufacturing.
D) It enables firms to achieve substantial economies of scope.
Answer: A
Difficulty: Moderate
Keywords: service process, economies of scope
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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29) Two manufacturing processes are being considered for making a new product. Process #1 is less capital intensive, with fixed costs of $50,000 per year and variable costs of $700 per unit. Process #2 has fixed costs of $400,000 annually, with variable costs of $200 per unit.
a. What is the break-even quantity for the two processes?
b. If annual sales are expected to be 600 units, which process should be selected?
c. If lowest overall costs per year is your overall objective, for what range of annual production quantities should you select Process #1? Process #2?
d. Operations and Engineering have found a way to reduce the cost of Process #2, such that the fixed costs for this process decrease from $400,000 to $300,000 annually. All other costs remain the same (Process #1 fixed = $50,000 / year, Process #1 variable = $700 / unit, Process #2 variable = $200 / unit). What is the new break even quantity between the two processes?
e. Does this change the process selection for the annual sales volume of 600 units? If so, for what range of annual production quantities should you select Process #1 and Process #2?

Answer:
a. $50,000 + $700(Q) = $400,000 + $ 200(Q)
$500(Q) = $350,000 → **Q = 700 units per year**

b. Process #1: $50,000 + $700(600) = $470,000
Process #2: $400,000 + $200(600) = $520,000

Process #1 should be selected, since it will save $50,000 compared to Process #2 at an annual volume of 600 units.

c. In part b, we have seen that Process #1 is the better choice at volumes below the break even quantity of 700 units per year. Therefore,

Process #1 should be selected for volumes from 0 - 700 units per year;
Process #2 should be selected for volumes of 700 or more units per year.

d. $50,000 + $700(Q) = $300,000 + $ 200(Q)
$500(Q) = $250,000 → **Q = 500 units per year**

e. In this case,
Process #1: $50,000 + $700(600) = $470,000
Process #2: $300,000 + $200(600) = $420,000

Process #2 should be selected, since it will now save $50,000 compared to Process #1 at an annual volume of 600 units.
Process #1 should be selected for volumes from 0 – 500 units per year;
Process #2 should be selected for volumes of 500 or more units per year.
Difficulty: Moderate
Keywords: general-purpose equipment, special-purpose equipment, break even quantity, total cost, low-cost option
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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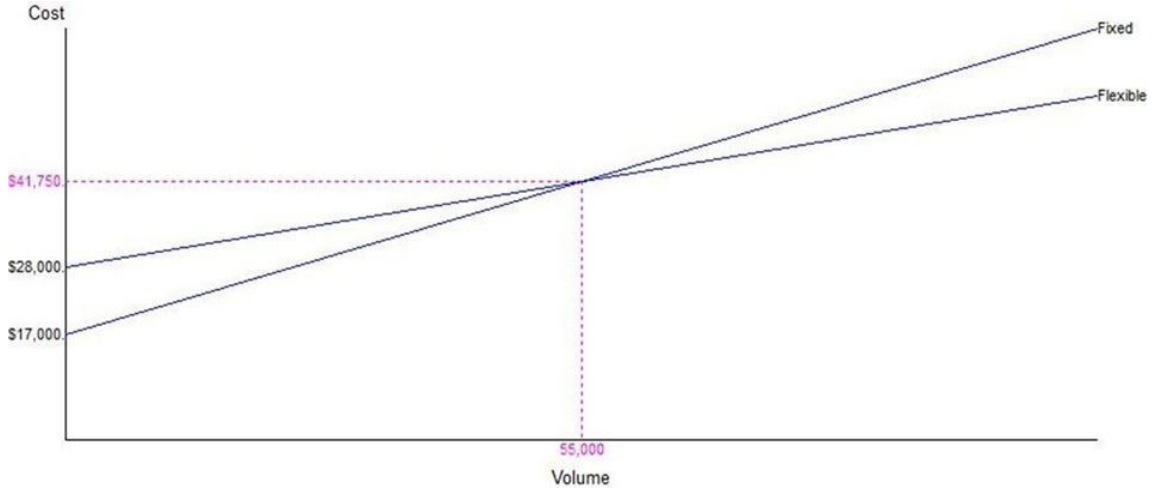
30) The break-even graph shown below represents the cost structure associated with a flexible production process and one that is fixed (less flexible). Using the information displayed in the graph, determine the cost structures associated with the two alternative production methods.



Answer: The Fixed alternative has a fixed cost of $17,000.
The Flexible alternative has a fixed cost of $28,000.
Their point of intersection is at an output volume of 55,000 units, which results in a cost of $41,750.
For the Fixed alternative, $41,750 = $17,000 + 55,000 × VC
VC = ($41,750 - $17,000)/55,000
VC = $0.45

For the Flexible alternative, $41,750 = $28,000 + 55,000 × VC
VC = ($41,750 - $28,000)/55,000
VC = $0.25
Difficulty: Moderate
Keywords: general-purpose equipment, special-purpose equipment, break even quantity, total cost, low-cost option
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
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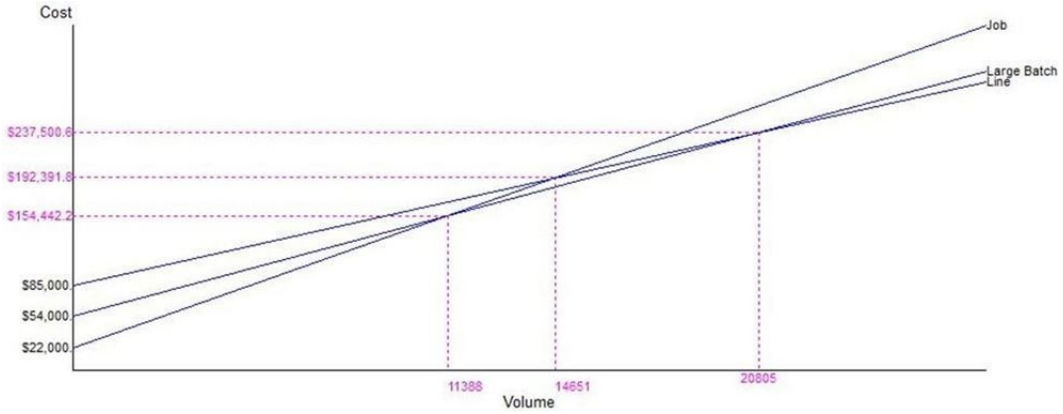
31) An entrepreneur considers three possibilities for the production of her new product. One alternative, a job process, would have fixed costs of $22,000 and a per unit cost of $11.63. The large batch option would have a fixed cost of $54,000 and a per unit cost of $8.82. The line process would have a fixed cost of $85,000 and a per unit cost of $7.33. Graph the total cost lines and determine over what range of output each production alternative is superior.
Answer: The Line alternative total cost line has the equation 85,000 + 7.33x
The Large Batch alternative total cost line equation is 54,000 + 8.82x
The Job alternative total cost line equation is 22,000 + 11.63x



We know that the alternative with the lowest fixed cost must initially be superior and the alternative with the lowest variable cost must ultimately be the cheapest alternative, so our answer begins at 0 output with Job and ends at infinity (or at least very large output with Line).

At a volume of 11,388 the Job process becomes more expensive than the Large Batch process.
54,000 + 8.82x = 22,000 + 11.63x
32,000 = 2.81x
x = 11,388

At a volume of 20,805 the Line process becomes less expensive than the Large Batch process.
85,000 + 7.33x = 54,000 + 8.82x
31,000 = 1.49x
x = 20,805

The Line and Job processes' point of indifference is immaterial since the Large Batch process cost is lower than both at their intersection point.

The ranges for each alternative are:
Job 0 - 11,388 units
Large Batch 11,388 - 20,805 units
Line 20,805 - infinite demand

Difficulty: Challenging
Keywords: break-even quantity, total cost
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Analytical Thinking
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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32) _____ is the ease with which employees and equipment can handle a wide variety of products, output levels, duties, and functions.
Answer: Resource flexibility
Difficulty: Moderate
Keywords: resource flexibility
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

33) _____ reflects the ways in which customers become part of the process and the extent of their participation.
Answer: Customer involvement
Difficulty: Moderate
Keywords: customer involvement, customer participation
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

34) _____ is the mix of equipment and human skills in a process.
Answer: Capital intensity
Difficulty: Moderate
Keywords: capital intensity, equipment, human skills
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

35) _____ automation produces only one type of product or part in a sequence of simple operations.
Answer: Fixed
Difficulty: Moderate
Keywords: fixed automation
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

36) _____ automation can handle various products through programmability.
Answer: Flexible
Difficulty: Moderate
Keywords: flexible automation, programmable automation
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
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Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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37) Provide examples of three different processes that rely on the customer for approximately 100% of the process; about 50%; and about 0%. What unique challenges exist for operations and supply chain managers and process designer in each one of these scenarios?
Answer: Examples will vary. Some students might argue that the process designer must be more careful to error-proof the process that relies more heavily on the customer while the manager takes a greater role in a process that does not rely on the customer. The burden for training shifts from an internal to an external focus as the customer becomes a bigger part of the production process. Students should also comment on customer buy-in for the final product and the appropriateness of a limited number and type of processes for customer involvement.
Difficulty: Moderate
Keywords: customer involvement
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

38) Comment on the need for flexibility in both the workforce and capital equipment. What process types and production situations require greater flexibility?
Answer: As the authors indicate, high task divergence and flexible process flows require more flexibility of the process's resources – its employees, facilities, and equipment. Employees need to perform a broad range of duties, and equipment must be general purpose. Otherwise, resource utilization will be too low for economical operations. Highly task divergent operations are required when customers have unique needs; casting these needs in the product-process matrix suggests that job processes and batch processes, both large and small, would benefit from flexibility. In the customer-contact matrix, both front office and hybrid office types would reap the benefits of greater worker and equipment flexibility.
Difficulty: Moderate
Keywords: resource flexibility, flexible workforce
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

39) Define economies of scope, and identify how they relate to flexible automation.
Answer: Economies of scope are the ability to produce multiple products more cheaply in combination than separately. Flexible automation provides economies of scope by allowing the producer to use the same productive resource to make intermediate volumes of a range of products, resulting in a shorter payback period for the capital equipment than if it were fixed automation.
Difficulty: Moderate
Keywords: economies of scope, flexible automation
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Explain the major process strategy decisions and their implications for operations.

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2.4 Strategic Fit

1) Front offices generally emphasize top quality and customization.
Answer: TRUE
Difficulty: Easy
Keywords: front-office, customer contact, service, internal customer, external customer
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

2) When volume is higher, automation and capital intensity are more likely.
Answer: TRUE
Difficulty: Moderate
Keywords: back office, line process
Learning Outcome: Describe the main types of operations processes and layouts in manufacturing and in services
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

3) Which one of the following statements on the concept of focused factories is *best*?
A) emphasizes economies of scale, rather than diseconomies of scale
B) prefers larger facilities producing all of the products or services the company offers
C) reduces the range of demands placed on an operation so management can concentrate on fewer tasks
D) emphasizes flexibility rather than cost
Answer: C
Difficulty: Moderate
Keywords: focused factory
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

4) One method for a factory to gain operational focus is to:
A) build large enough factories to produce all products and services the company offers.
B) hire more specialists and supervisors to control the operations.
C) reorganize existing facilities to the plant-within-plant (PWP) approach.
D) remodel stores to create the effect of many small boutiques under one roof.
Answer: C
Difficulty: Moderate
Keywords: focus, process, plants within plants
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

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5) A firm that chooses to compete based on delivery speed and variety would most likely have:
A) a make-to-order production and inventory strategy.
B) an assemble-to-order production and inventory strategy.
C) a make-to-stock production and inventory strategy.
D) an engineer-to-order production and inventory strategy.
Answer: B
Difficulty: Moderate
Keywords: assemble-to-order, delivery speed
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

6) Which one of the following statements on the concept of gaining focus is *best*?
A) Focused factories maximize the amount of customization.
B) Small sizes of many focused factories make it difficult to compete on the basis of shorter lead times.
C) Plants within plants are different operations within a facility that can have individualized competitive priorities and processes.
D) Focused factories are large factories producing all the products that the company offers.
Answer: C
Difficulty: Moderate
Keywords: focus, process, plants within plants
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

7) _____ are different operations within a facility with individualized competitive priorities, processes, and workforces under the same roof.
Answer: Plants within plants
Difficulty: Moderate
Keywords: plants within plants, PWP
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

8) Is an executive MBA program at your school a plant within a plant? Explain your reasoning.
Answer: Answers will vary. The definition offered for plants within plants is different operations within a facility with individualized competitive priorities, processes and workforces under the same roof. Depending on the crossover of faculty and co-location of facilities, this question will merit a different response from university to university.
Difficulty: Moderate
Keywords: plants within plants, PWP
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Discuss how process decisions should strategically fit together.

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2.5 Strategies for Change

1) Reengineering is the fundamental rethinking and radical redesign of processes to improve performance dramatically.
Answer: TRUE
Difficulty: Easy
Keywords: process reengineering, redesign, rethinking
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

2) With a dramatic flourish, the team leader tore the employee orientation guidelines into pieces. He then distributed blank pieces of paper to the team and asked them to envision the perfect orientation process without regard to how it has always been done. This team is probably engaging in process reengineering.
Answer: TRUE
Difficulty: Easy
Keywords: process reengineering, clean-slate
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

3) More often than not, process improvement takes place whether or not a process is reengineered.
Answer: TRUE
Difficulty: Easy
Keywords: reengineering, process improvement
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

4) Process analysis is the documentation and detailed understanding of how work is performed and how it can be redesigned.
Answer: TRUE
Difficulty: Easy
Keywords: process analysis
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

5) Process improvement teams that focus on processes that cut across departmental boundaries have the silo mentality.
Answer: FALSE
Difficulty: Easy
Keywords: silo, improvement teams, process analysis
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

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6) Which one of the following statements concerning the role of process reengineering is *best*?
A) Reengineering is the fundamental rethinking and radical redesign of business processes.
B) Reengineering efforts should focus on one functional department at a time.
C) Information technology should be kept separate from reengineering initiatives.
D) Reengineering requires an attitude of incremental improvement.
Answer: A
Difficulty: Moderate
Keywords: reengineering, radical redesign, information technology
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

7) Which of these tools is considered a primary enabler of process reengineering?
A) supply chain partners
B) information technology
C) logistics
D) infrastructure
Answer: B
Difficulty: Moderate
Keywords: process reengineering, information technology
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

8) A team consisting of members from each functional area affected by the process change is referred to as a(n):
A) reengineering team.
B) cross-functional team.
C) process team.
D) improvement team.
Answer: B
Difficulty: Moderate
Keywords: cross-functional team
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Interpersonal Relations and Teamwork
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

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9) A process selected for reengineering should be a:
A) core process.
B) front-office process.
C) hybrid office.
D) back office process.
Answer: A
Difficulty: Moderate
Keywords: reengineering, core process
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

10) Process analysis focuses on:
A) how work is actually done.
B) who is responsible for the customer.
C) the customer's needs.
D) the number of steps in between supplier and customer.
Answer: A
Difficulty: Easy
Keywords: process analysis
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

11) A systematic approach to process analysis includes the step:
A) reengineering.
B) integration.
C) order fulfillment.
D) define scope.
Answer: D
Difficulty: Moderate
Keywords: define scope, process analysis, systematic approach
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

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12) Performance measures such as average response times, repair times, and percent defective are referred to as:
A) benchmarks.
B) metrics.
C) targets.
D) tactics.
Answer: B
Difficulty: Moderate
Keywords: metrics, performance measures
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

13) Widespread participation in process analysis is essential not only because of the work involved but also because:
A) employees tend to neglect their regular work duties, thus no one falls too far behind.
B) it builds commitment.
C) no one can analyze a process by himself.
D) a silo mentality should prevail and this requires large numbers of workers.
Answer: B
Difficulty: Moderate
Keywords: process analysis, participation, commitment
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Interpersonal Relations and Teamwork
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

14) _____ is the documentation and detailed understanding of how work is performed and how it can be redesigned.
Answer: Process analysis
Difficulty: Moderate
Keywords: process analysis
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

15) The first step of the systematic approach to process analysis is _____.
Answer: identify opportunities
Difficulty: Moderate
Keywords: identify opportunities, process analysis
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

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16) The "Define" step of the Six Sigma Process Improvement Model entails establishing the _____ and boundaries of the process to be analyzed.
Answer: scope
Difficulty: Easy
Keywords: process scope, boundary
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

17) _____ are performance measures that are established for a process and the steps within it.
Answer: Metrics
Difficulty: Easy
Keywords: metric
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

18) Gaps between actual and desired performance are called _____.
Answer: disconnects
Difficulty: Moderate
Keywords: gap, disconnect
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

19) A(n) _____ means that a department focuses on its own tasks without understanding the role and processes of departments outside its own organizational boundaries.
Answer: silo mentality
Difficulty: Moderate
Keywords: silo mentality
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

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20) The authors list six key elements of reengineering. Pick any three and describe their contribution to the reengineering effort.
Answer: The six elements are:
1. Critical processes - focus on core business processes to reengineer, leave normal processes to incremental improvement
2. Strong leadership - senior executives must actively support reengineering or the effort will fail
3. Cross-functional teams - the team must be composed of each functional area affected by the change
4. Information technology - a primary enabler; most reengineering projects design processes around information flows
5. Clean slate philosophy - discard the old way of doing things and consider the way the customer wants to deal with the company
6. Process analysis - the reengineering team must understand things about the current process, how it performs, and have a grasp on the performance metrics
Difficulty: Moderate
Keywords: process reengineering, redesign, rethinking
Learning Outcome: Discuss operations and operations management as a competitive advantage for the organization
AACSB: Application of Knowledge
Learning Obj.: Compare and contrast the two commonly used strategies for change, and understand a systematic way to analyze and improve processes.

2.6 Defining, Measuring, and Analyzing the Process

1) Flowcharts, service blueprints, and process charts are effective for defining and measuring processes.
Answer: TRUE
Difficulty: Easy
Keywords: flowchart, process definition
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

2) In a swim lane flowchart, the line of visibility is used to separate the process steps in view of the customer from those hidden from view of the customer.
Answer: FALSE
Difficulty: Moderate
Keywords: swim lane flowchart, service blueprint
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

3) A service blueprint is a flowchart of a service process that shows which of its steps has high customer contact.
Answer: TRUE
Difficulty: Moderate
Keywords: service blueprint, service process, flowchart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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4) Formal work measurement techniques estimate average times for each step in a process by relying on the judgment of skilled observers.
Answer: TRUE
Difficulty: Easy
Keywords: work measurement, labor standard, average process times
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

5) Elemental standard time data can help managers develop time standards for new work before production begins.
Answer: TRUE
Difficulty: Moderate
Keywords: elemental standard data
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

6) The predetermined data approach eliminates the need for time studies.
Answer: TRUE
Difficulty: Moderate
Keywords: predetermined data approach, time studies
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

7) A predetermined data approach to time standards can be completed before actual production begins.
Answer: TRUE
Difficulty: Moderate
Keywords: predetermined data approach
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

8) Work sampling can be used to estimate the proportion of time spent by people or machines on activities.
Answer: TRUE
Difficulty: Moderate
Keywords: work sampling, proportion
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

9) When using work sampling, the times of day when the analyst collects the sample data should be selected at random over the length of the study.
Answer: TRUE
Difficulty: Moderate
Keywords: work sampling, data collection
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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10) A learning curve is a line showing the relationship between processing time and the cumulative quantity of a product or service produced.
Answer: TRUE
Difficulty: Moderate
Keywords: learning curve analysis
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

11) The learning curve for a process depends on the rate of learning and the actual or estimated time for the first unit processed.
Answer: TRUE
Difficulty: Moderate
Keywords: learning curve analysis
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

12) The best data analysis tool for recording which gas pump most customers use would be a checklist.
Answer: TRUE
Difficulty: Moderate
Keywords: data analysis, checklist
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

13) The general principle that 80% of a company's complaints are generated by 20% of its product or service issues is known as the Pareto concept.
Answer: TRUE
Difficulty: Moderate
Keywords: Pareto chart, Pareto principle
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

14) A scatter diagram is a graphical technique that shows whether two variables may be related.
Answer: TRUE
Difficulty: Moderate
Keywords: scatter diagram, variables
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

15) A fishbone diagram identifies which category is most frequently observed out of all the categories for which you have data.
Answer: FALSE
Difficulty: Moderate
Keywords: fishbone diagram, cause-and-effect diagram
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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16) A flowchart traces the flow of all *except* the following:
A) information through a process.
B) customers through a process.
C) equipment through a process.
D) safety regulations through a process.
Answer: D
Difficulty: Moderate
Keywords: flowchart, information, customers, equipment
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

17) A flowchart created at the strategic level of an organization should show:
A) core processes and their linkages.
B) details of a process as bracketed by its scope.
C) individual steps that may have been aggregated at a higher level of analysis.
D) areas that are seen and unseen by the customer.
Answer: A
Difficulty: Moderate
Keywords: flowchart, strategic decision making
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

18) Cross-functional coordination is at particular risk where:
A) there is low process divergence.
B) there are handoffs in the process.
C) swim lane flowcharts are utilized.
D) it is not possible to create a flowchart.
Answer: B
Difficulty: Moderate
Keywords: handoff, coordination, cross functional coordination
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Interpersonal Relations and Teamwork
Learning Obj.: Discuss how to define, measure, and analyze processes.

19) A swim lane flowchart is an appropriate tool to use when:
A) the process features only intangible outputs.
B) the process involves more than one department.
C) the process scope is difficult to define.
D) the process has a person or group of people at a workstation or with a customer.
Answer: B
Difficulty: Moderate
Keywords: swim lane flowchart, process definition tool
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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20) An effective tool for showing steps of a service process with a high level of customer contact is a:
A) Pareto chart.
B) flowchart.
C) service blueprint.
D) check sheet.
Answer: C
Difficulty: Moderate
Keywords: service blueprint, customer contact, process definition tool
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

21) A process chart activity that changes, creates, or adds something is a(n):
A) operation.
B) transportation.
C) inspection.
D) delay.
Answer: A
Difficulty: Easy
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

22) A process chart activity that checks or verifies something but does not change it is a(n):
A) operation.
B) transportation.
C) inspection.
D) delay.
Answer: C
Difficulty: Easy
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

23) Which one of the following groups of activities is likely to be shown on a process chart?
A) operation, inspection, delay
B) operation, capital intensity, flow strategy
C) transportation, material flow, physical layout
D) storage, delay, personnel involved
Answer: A
Difficulty: Moderate
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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24) The five categories of activities (operation, transportation, inspection, delay, and storage) are used in which of the following methods of process analysis?
A) multiple-activity chart
B) process chart
C) capital budgeting
D) flow diagram
Answer: B
Difficulty: Moderate
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

25) A process chart activity that occurs when something is put away until a later time is a(n):
A) storage.
B) transportation.
C) inspection.
D) delay.
Answer: A
Difficulty: Easy
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

26) A professor can grade a quiz in 30 seconds. Over the course of an academic year he has 6 sections of a course with an average of 30 students with 10 quizzes in each section. If he is paid $40 an hour, how much is his annual quiz-grading labor cost to the university?
A) $60
B) $100
C) $600
D) $36,000
Answer: C
Difficulty: Moderate
Keywords: annual labor cost
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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27) A professor's graduate assistant can grade a quiz in 40 seconds. Over the course of an academic year he assists with 6 sections of a course with an average of 30 students with 10 quizzes in each section. If he is paid $8 an hour, how much is his annual quiz-grading labor cost to the university?
A) $60
B) $160
C) $576
D) $576,000
Answer: B
Difficulty: Moderate
Keywords: annual labor cost
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

28) A professor can grade a quiz in 2 minutes. Over the course of an academic year he has 6 sections of a course with an average of 25 students with 10 quizzes in each section. If he is paid $40 an hour, how much is his annual quiz-grading labor cost to the university?
A) $250
B) $500
C) $1,000
D) $2,000
Answer: D
Difficulty: Moderate
Keywords: annual labor cost
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

29) Highly customized job processes and processes that are highly divergent require the use of:
A) the time study method.
B) the elemental standard data approach.
C) the predetermined data approach.
D) the work sampling method.
Answer: B
Difficulty: Moderate
Keywords: elemental standard data
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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Scenario 2.1
Garman observes a worker assembling peanut valves and records the data displayed in the table.

Time (seconds)	Observations
21	15
25	12
30	12

30) Use the information in Scenario 2.1 to answer this question. What is the average time for this job element?
A) 15 seconds
B) 20 seconds
C) 25 seconds
D) 30 seconds
Answer: C
Difficulty: Moderate
Keywords: time study, average time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

31) Use the information in Scenario 2.1. What is the normal time for this job element if the rating factor is 80%?
A) 15 seconds
B) 20 seconds
C) 25 seconds
D) 30 seconds
Answer: B
Difficulty: Moderate
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

32) Use the information in Scenario 2.1. What is the standard time for this job element if the allowance for the process is 25%?
A) 15 seconds
B) 20 seconds
C) 25 seconds
D) 30 seconds
Answer: C
Difficulty: Moderate
Keywords: time study, standard time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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Scenario 2.2
Garman observes a worker assembling peanut valves and records the data displayed in the table.

Time (seconds)	Observations
10	18
15	25
20	17

33) Use the information in Scenario 2.2. What is the average time for this job element?
A) 15.06 seconds
B) 14.92 seconds
C) 13.42 seconds
D) 11.19 seconds
Answer: B
Difficulty: Moderate
Keywords: time study, average time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

34) Use the information in Scenario 2.2. What is the normal time for this job element if the rating factor is 75%?
A) 15.06 seconds
B) 14.92 seconds
C) 13.42 seconds
D) 11.19 seconds
Answer: D
Difficulty: Moderate
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

35) Use the information in Scenario 2.2. What is the standard time for this job element if the allowance for the process is 20%?
A) 15.06 seconds
B) 14.92 seconds
C) 13.42 seconds
D) 11.19 seconds
Answer: C
Difficulty: Moderate
Keywords: time study, standard time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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36) Garman observes a worker assembling peanut valves and records the data displayed in the table. What is the normal time for this job element if the worker is rated at 80%?

Time (seconds)	Observations
20	10
25	15
30	12
35	12

A) less than 23 seconds
B) greater than or equal to 23 seconds but less than 26 seconds
C) greater than or equal to 26 seconds but less than 29 seconds
D) greater than or equal to 29 seconds
Answer: A
Difficulty: Moderate
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

37) Keith assembles peanut valves and the recorded data is displayed in the table. What is the normal time for this job element if he is rated at 75%?

Time (minutes)	Observations
2.5	15
3.0	23
3.5	27

A) greater than or equal to 3 minutes
B) less than 3 minutes but greater than or equal to 2.6 minutes
C) less than 2.6 minutes but greater than or equal to 2.2 minutes
D) less than 2.2 minutes
Answer: C
Difficulty: Moderate
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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Scenario 2.3
A job consists of three elements. Twenty observations for each element were timed, and the resulting data are shown in the following table. A performance rating has also been assigned for each element, as shown in the table. The job has an allowance of 15% of normal time.

Element	Performance Rating (%)	Average Element Time (in minutes)
# 1	70	3.6
# 2	110	2.5
# 3	90	3.1

38) Use the information in Scenario 2.3. What is the normal time for job element #1?
A) greater than or equal to 3 minutes
B) less than 3 minutes but greater than or equal to 2.6 minutes
C) less than 2.6 minutes but greater than or equal to 2.2 minutes
D) less than 2.2 minutes
Answer: C
Difficulty: Easy
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

39) Use the information in Scenario 2.3. What is the normal time for job element #2?
A) greater than or equal to 3 minutes
B) less than 3 minutes but greater than or equal to 2.6 minutes
C) less than 2.6 minutes but greater than or equal to 2.2 minutes
D) less than 2.2 minutes
Answer: B
Difficulty: Easy
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

40) Use the information in Scenario 2.3. What is the normal time for job element #3?
A) greater than or equal to 3 minutes
B) less than 3 minutes but greater than or equal to 2.6 minutes
C) less than 2.6 minutes but greater than or equal to 2.2 minutes
D) less than 2.2 minutes
Answer: B
Difficulty: Easy
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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41) Use the information in Scenario 2.3. What is the normal time for the *entire job*?
A) greater than or equal to 10.0 minutes
B) less than 10.0 minutes but greater than or equal to 8.5 minutes
C) less than 8.5 minutes but greater than or equal to 7.0 minutes
D) less than 7.0 minutes
Answer: C
Difficulty: Moderate
Keywords: time study, normal time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

42) Use the information in Scenario 2.3. What is the standard time for the *entire job*?
A) greater than or equal to 10.0 minutes
B) less than 10.0 minutes but greater than or equal to 8.5 minutes
C) less than 8.5 minutes but greater than or equal to 7.0 minutes
D) less than 7.0 minutes
Answer: B
Difficulty: Moderate
Keywords: time study, standard time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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Scenario 2.5
A job consists of three distinct work elements that were timed with a highly accurate Swiss watch by a trained industrial engineer. The engineer recorded ten observations listed in the following table. All recorded times are in seconds.

Element 1	Element 2	Element 3
15	23	45
17	25	51
16	23	52
13	26	49
15	25	46
14	23	43
16	24	51
14	25	50
15	23	49
16	22	49

43) Use the data in Scenario 2.5 to answer this question. If the performance rating factor is 15%, what is the *average time* for Element 1?
A) 15.1 seconds
B) 16.61 seconds
C) 19.1 seconds
D) 14.44 seconds
Answer: A
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

44) Use the data in Scenario 2.5 to answer this question. If the rating factor is 1.15, what is the *normal time* for Element 2?
A) 23.9 seconds
B) 27.5 seconds
C) 28.1 seconds
D) 31.6 seconds
Answer: B
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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45) Use the data in Scenario 2.5 to answer this question. If the rating factor is 1.15, what is the *normal time* for Element 3?
A) 44.3 seconds
B) 55.8 seconds
C) 50.9 seconds
D) 48.5 seconds
Answer: B
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

46) Use the data in Scenario 2.5 to answer this question. If the rating factor is 15% for all the elements, what is the normal process time for the entire job?
A) 109.27 seconds
B) 82.62 seconds
C) 100.63 seconds
D) 95.02 seconds
Answer: C
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

47) Use the data in Scenario 2.5 to answer this question. If the rating factor is 10% for all the elements and the allowance is 15% for the whole process, what is the standard process time for the job?
A) 110.69 seconds
B) 82.62 seconds
C) 109.27 seconds
D) 95.02 seconds
Answer: A
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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48) A time study analyst is attempting to determine the standard time for a work element. She observes a worker performing the work element at a higher-than-average pace. How will this fact be reflected in the time standard that is eventually created?
A) The frequency of the work element per cycle will be increased.
B) The proportion of allowance time will be increased above 1.0.
C) The performance rating factor will be set greater than 1.0.
D) The normal time for the work element will be increased.
Answer: C
Difficulty: Challenging
Keywords: performance rating factor
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

49) A manager is interested in setting a time standard for a machining operation. Which one of the following is *least* likely to be of use?
A) time-study method
B) elemental standard data approach
C) predetermined data approach
D) work sampling method
Answer: D
Difficulty: Moderate
Keywords: work sampling
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

50) Which of the following is *not* an advantage of the predetermined data approach to work measurement?
A) Standards can be set before production begins.
B) New work methods can be compared without conducting a time study.
C) Performance ratings are not needed to derive standards.
D) The approach is particularly applicable to firms with a flexible flow strategy.
Answer: D
Difficulty: Moderate
Keywords: predetermined data
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

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51) Which work measurement technique breaks down tasks into a series of generic micromotions?
A) time study method
B) elemental standard data approach
C) predetermined data approach
D) work-sampling method
Answer: C
Difficulty: Moderate
Keywords: micro-motion, work measurement, predetermined data
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

52) Work sampling is most often used in situations in which:
A) a time standard is needed for a repetitive job.
B) an estimate of the proportion of the time spent on a particular activity is needed.
C) it is important to keep the sample size down.
D) special training is required for the observer, and stopwatches must be used.
Answer: B
Difficulty: Moderate
Keywords: work sampling
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

53) A work sampling method is used to determine the proportion of the time a machine is idle. The following information was gathered on a random basis.

Day	No. Times Machine Idle	Total No. of Observations
Monday	4	12
Tuesday	2	8
Wednesday	4	10
Thursday	2	10

What is the proportion of idle time observed for this machine?
A) less than or equal to 5%
B) greater than 5% but less than or equal to 15%
C) greater than 15% but less than or equal to 25%
D) greater than 25%
Answer: D
Difficulty: Easy
Keywords: work sampling
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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54) A work sampling method is used to determine the proportion of the time a worker is idle. The following information was gathered on a random basis.

Time	No. of Times Clerk Idle	Total No. of Observations
8:00 - 10:00 am	2	6
10:00 am - 12:00 pm	3	8
1:00 - 3:00 pm	2	7
3:00 - 5:00 pm	1	9

What is the proportion of idle time observed for this worker?
A) less than or equal to 5%
B) greater than 5% but less than or equal to 10%
C) greater than 10% but less than or equal to 20%
D) greater than 20%
Answer: D
Difficulty: Easy
Keywords: work sampling
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

55) A work sampling method is used to determine the proportion of the time a worker is idle. The following information was gathered on a random basis.

Day	No. of Times Clerk Idle	Total No. of Observations
Monday	8	26
Tuesday	8	32
Wednesday	7	28
Thursday	7	34

What is the proportion of idle time observed for this worker?
A) less than or equal to 5%
B) greater than 5% but less than or equal to 10%
C) greater than 10% but less than or equal to 20%
D) greater than 20%
Answer: D
Difficulty: Easy
Keywords: work sampling
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56) The first unit of production takes 12 hours to produce and the learning rate is expected to be 80 percent. How long will it take to produce the fourth unit?
A) less than or equal to 7.0 hours
B) greater than 7.0 hours but less than or equal to 7.5 hours
C) greater than 7.5 but less than or equal to 8.0 hours
D) greater than 8.0 hours
Answer: C
Difficulty: Moderate
Keywords: learning curve, learning effect, labor
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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57) The first unit of production takes 12 hours to produce and the learning rate is expected to be 80 percent. How long will it take to produce the sixth unit?
A) less than or equal to 6.0 hours
B) greater than 6.0 hours but less than or equal to 7.7 hours
C) greater than 7.7 but less than or equal to 9.5 hours
D) greater than 8.0 hours
Answer: B
Difficulty: Moderate
Keywords: learning curve, learning effect, labor
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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58) The first unit of production takes 20 hours to produce and the learning rate is expected to be 90 percent. How long will it take to produce the fourth unit?
A) less than or equal to 12.0 hours
B) greater than 12.0 hours but less than or equal to 15.0 hours
C) greater than 15.0 but less than or equal to 18.0 hours
D) greater than 18.0 hours
Answer: C
Difficulty: Moderate
Keywords: learning curve, learning effect, labor
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59) The first unit of production takes 20 hours to produce and the learning rate is expected to be 90 percent. How long will it take to produce the eighth unit?
A) less than or equal to 12.0 hours
B) greater than 12.0 hours but less than or equal to 15.0 hours
C) greater than 15.0 but less than or equal to 18.0 hours
D) greater than 18.0 hours
Answer: B
Difficulty: Moderate
Keywords: learning curve, learning effect, labor
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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60) The first unit of production takes 20 hours to produce and the learning rate is expected to be 90 percent. How long will it take to produce the twelfth unit?
A) less than or equal to 11.0 hours
B) greater than 11.0 hours but less than or equal to 13.0 hours
C) greater than 13.0 but less than or equal to 15.0 hours
D) greater than 15.0 hours
Answer: C
Difficulty: Moderate
Keywords: learning curve, learning effect, labor
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Table 2.15
An analyst notes the time that customer appointments end with a tax preparer that is assigned customers requiring only the 1040EZ form. The times indicated in the table represent the departure times of the first eight clients for one tax preparation specialist. The 1040EZ tax forms among the different customers are very similar. The tax preparer started the first return at 12:00pm.

Customer #	Time
1	12:45 pm
2	1:22 pm
3	1:55 pm
4	2:26 pm
5	2:56 pm
6	3:24 pm
7	3:50 pm
8	4:15 pm

61) Which statement about Table 2.15 is *best*?
A) Learning effects are not present because the time between successive customer departures is not always shorter than the preceding time.
B) Learning effects are present, but the actual percentage reduction cannot be determined.
C) Learning effects are present because in general the time between successive departures drops.
D) Learning effects are present here, but the actual percentage reduction cannot be determined.
Answer: C
Difficulty: Moderate
Keywords: learning curve analysis
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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62) Based on the data in Table 2.15 which value is closest to the learning rate for the tax preparer?
A) 80%
B) 82%
C) 87%
D) 92%
Answer: B
Difficulty: Moderate
Keywords: learning curve analysis
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63) Based on Table 2.15, how long should it take the tax preparer to complete the 16th return of the day?
A) 16 minutes
B) 19 minutes
C) 21 minutes
D) 24 minutes
Answer: C
Difficulty: Challenging
Keywords: learning curve analysis
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

64) A process troubleshooter has to decide which problem to address first with his or her cause-and-effect diagram. The data analysis tool that will help him decide which problem to tackle first is a:
A) scatter diagram.
B) check sheet.
C) flowchart.
D) Pareto chart.
Answer: D
Difficulty: Moderate
Keywords: Pareto chart, relative problem frequency
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65) A manager of a fiberglass molding operation suspects that the number of process failures is related to the number of total units produced of a particular product. A tool most useful in this analysis would be a:
A) checklist.
B) cause-and-effect diagram.
C) Pareto chart.
D) scatter diagram.
Answer: D
Difficulty: Moderate
Keywords: scatter diagram
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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Learning Obj.: Discuss how to define, measure, and analyze processes.

66) Which one of the following techniques will help management trace customer complaints directly to the process involved?
A) cause-and-effect diagram
B) quality circles
C) quality engineering
D) specification management
Answer: A
Difficulty: Moderate
Keywords: cause-and-effect diagram
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67) A restaurant manager tracks complaints from the diner satisfaction cards that are turned in at each table. The data collected from the past week's diners appear in the following table.

Complaint	**Frequency**
Food taste	27
Food temperature	9
Order mistake	5
Slow service	19
Table/utensils dirty	47
Too expensive	9

Using a classic Pareto analysis, what top categories comprise 80% of the total complaints?
A) Table/utensils dirty
B) Table/utensils dirty, Food taste, Slow service
C) Food taste, Food temperature, Order mistake, Slow service, Table/utensils dirty
D) Food taste, Food temperature, Order mistake, Slow service, Too expensive
Answer: B
Difficulty: Moderate
Keywords: Pareto analysis
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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68) A restaurant manager tracks complaints from the diner satisfaction cards that are turned in at each table. The data collected from the past week's diners appear in the following table.

Complaint	**Frequency**
Food taste	80
Food temperature	9
Order mistake	2
Slow service	16
Table/utensils dirty	47
Too expensive	4

Using a classic Pareto analysis, what bottom categories comprise about 20% of the total complaints?
A) Order mistake, Too expensive, Food temperature
B) Slow service, Order mistake
C) Food taste, Food temperature, Slow service
D) Food taste, Table/utensils dirty
Answer: A
Difficulty: Moderate
Keywords: Pareto analysis
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69) A farmer that has been well-trained in the scientific method divides his acreage into several plots and plants the same variety of hay in each. He varies the amount of fertilizer applied to each plot and carefully records the yield, in bales per acre, for each of the plots. Which of these tools would be the best to help him analyze the effect of fertilizer application on hay yield?
A) cause and effect diagram
B) scatter diagram
C) Pareto chart
D) flow chart
Answer: B
Difficulty: Moderate
Keywords: scatter diagram
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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Learning Obj.: Discuss how to define, measure, and analyze processes.

70) Which of the following analyses is *best* suited for a scatter diagram?
A) A professor plots a student's exam score against the number of homework problems the student completed prior to the exam.
B) A professor determines a student's letter grade based on their final course average.
C) A professor determines the curve on the most recent exam by categorizing students into groups called A, B, C, etc.
D) A professor studies his student evaluations and classifies complaints into broad categories such as Assign More Homework and Make Exams More Challenging.
Answer: A
Difficulty: Moderate
Keywords: scatter diagram
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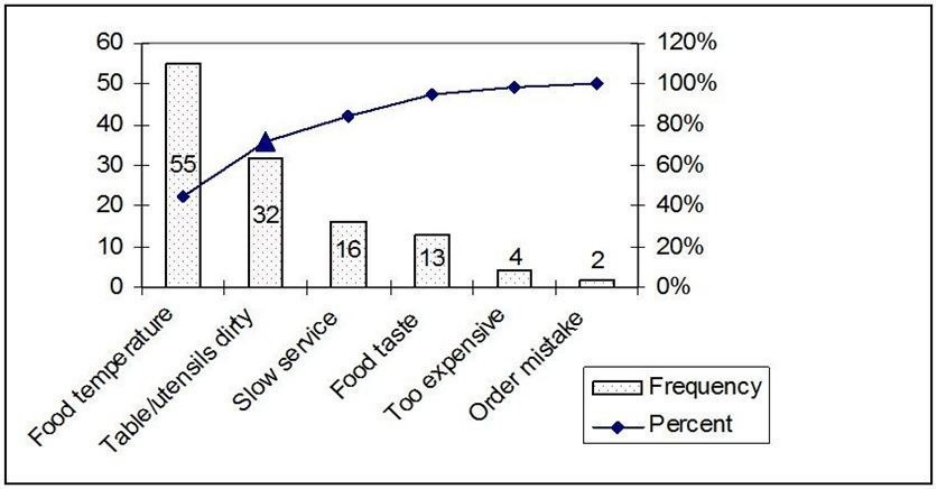
71) A restaurant manager tracks complaints from the diner satisfaction cards that are turned in at each table. The data collected from the past week's diners have been plotted and appear in the following graph. The number of complaints for each category is with each bar.



How was the value for the point represented by the triangle calculated?

A) $\frac{3}{55 + 32}$

B) $\frac{55 + 32}{55 + 32}$

C) $\frac{32}{55 + 32 + 16 + 13 + 4 + 2}$

D) $\frac{55 + 32}{55 + 32 + 16 + 13 + 4 + 2}$

Answer: D
Difficulty: Moderate
Keywords: Pareto analysis
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72) _____ is represented in a process flow chart when an outgoing arrow from one step splits into two or more arrows that lead to different boxes.
Answer: Divergence
Difficulty: Moderate
Keywords: decision point, divergence, flow chart
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73) A(n) _____ shows processing steps grouped according to which company department is responsible for performing them.
Answer: swim lane flowchart
Difficulty: Moderate
Keywords: swim lane flowchart, flow chart
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74) The _____ in a service blueprint separates which steps are in view of the customer from those that aren't.
Answer: line of visibility
Difficulty: Moderate
Keywords: line of visibility, service blueprint
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75) _____ is the process of creating labor standards based on the judgment of skilled observers.
Answer: Work measurement
Difficulty: Easy
Keywords: work measurement
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76) The time added to adjust for factors such as fatigue or equipment malfunction is called _____.
Answer: allowance, allowance time
Difficulty: Moderate
Keywords: allowance, allowance time
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77) _____ involves estimating the proportion of time spent by people and machines on activities, based on a large number of observations.
Answer: Work sampling
Difficulty: Moderate
Keywords: work sampling
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78) The _____ can be represented by a line called a learning curve.
Answer: learning effect
Difficulty: Moderate
Keywords: learning effect, learning curve
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79) An eighty percent learning curve means that for each doubling of output, the time required to complete the last task is _____ percent less than before.
Answer: twenty
Difficulty: Moderate
Keywords: learning effect, learning curve
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80) A(n) _____ is a form used to record the frequency of occurrence of certain product or service characteristics related to quality.
Answer: checklist
Difficulty: Moderate
Keywords: checklist
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81) A(n) _____ is a bar chart on which the factors are plotted in decreasing order of frequency along the horizontal axis.
Answer: Pareto chart
Difficulty: Moderate
Keywords: Pareto chart
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82) A(n) _____ would be a useful tool to determine the effect that the number of practice problems solved correctly has on the midterm score.
Answer: scatter diagram
Difficulty: Moderate
Keywords: scatter diagram
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83) A(n) _____ is a diagram that relates a key quality problem to its potential causes.
Answer: cause-and-effect diagram
Difficulty: Moderate
Keywords: cause-and-effect, fishbone, Ishikawa
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84) How can flowcharts and process charts be used to study and improve operations? Include descriptions of these two tools, the types of questions that can be addressed with them, and the extent to which teams can be used.
Answer: Flowcharts trace the flow of information, customers, employees, equipment, or material through a process. Process charts record all the activities performed by a person or a machine, at a workstation, with a customer, or on materials. Answers will vary.
Difficulty: Moderate
Keywords: flowchart, information flow, customer flow, employee flow, material flow
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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85) The sales team has just finished creating a process chart of the sales-call process. After fifteen minutes of high-fiving, they decide to tape the flowchart to the conference room wall and stand back a safe distance admiring the many symbols on the chart. You join them, and while you don't know much about sales calls, your expertise in process analysis and improvement is well-respected. What would you look for in the chart that would let you know whether their sales-call process was well-conceived?
Answer: Flowcharts trace the flow of information, customers, employees, equipment, or material through a process. At a glance, you might count the number of symbols representing transportation, inspection, and delays, since these process steps are typically not value-adding. You might also check for loops in the process and determine why there is a need to recirculate the information, customers, material, or workers through some of the process steps. Were these loops added because process steps are not always performed correctly the first time? Another general flow chart element to examine is the degree of branching. Are decision points clearly indicated and is there an unambiguous method for the worker or customer to realize which branch is the most appropriate one to take as they move forward through the process? Finally, you should realize that the flowchart was constructed by a group that is probably not accustomed to flowcharting (after all, they are in sales) so you might confirm that the process that has been charted is truly an "as-is" representation of the process and not a "hoped for" or "according to policy" representation.
Difficulty: Moderate
Keywords: flowchart, customer flow, employee flow, process improvement
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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86) You have been hired as an external consultant to improve processes at a business. You are unfamiliar with exactly how the work is currently done but are intimately familiar with charting techniques and data analysis tools. What is a general sequence for use of these tools and why should you use them in the sequence you specify?
Answer: Because you are unfamiliar with the process, you should first use a flowchart, service blueprint, or process chart. This diagram will give you a big-picture view of what is currently happening. Once you are more familiar with the organization and the departmental responsibilities, it might be helpful to re-cast this flowchart in the form of a swim lane flowchart to identify handoffs in the process flow. Flow charts in general will also provide some insight into key data collection points where workers might use checklists to collect some data. After data has been collected, elementary data analysis may be performed using a histogram, Pareto chart, and scatter diagram as appropriate. The tallest/leftmost bar on a Pareto chart can be the head of the first fishbone diagram (if the bars represent problems). Once the largest problem is solved, more data can be collected to verify that improvements in the process have taken place.
Difficulty: Challenging
Keywords: checklist, histogram, Pareto chart, fishbone, cause-and-effect, flowchart, service blueprint
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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87) Consider the four steps in a time study. If an analyst were to make a mistake, during which step would the impact on the standard time be the greatest? Explain your reasoning.
Answer: The four steps are selecting work elements, timing the elements, determining the sample size, and setting the standard. Answers will vary as to the step that has the greatest impact on the standard time determination. If the work elements are not selected properly, then the analyst may include too many process steps, thereby inflating the standard time or too few, which would result in a standard time that is too low. A stopwatch error can also be too high or too low and might have the same impact. If the task is a 40-yard dash and the organization is an NFL team, those consequences can be disastrous. A sample size that is too small might result in some measurement error that could fall either way, but a sample that is too large would simply result in more time and effort expended collecting data than necessary. This large sample would yield a more accurate estimate than is absolutely necessary. Setting the standard improperly can again overestimate or underestimate the true standard time depending on the nature of the mathematical error.
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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88) Explain why a sampling schedule is important in a work sampling study.
Answer: A sampling schedule should determine when the workers are to be observed because the observations are just snapshots of time. In addition, the observation times should be randomized to avoid biases in worker performance.
Difficulty: Moderate
Keywords: work sampling, schedule
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89) Compare and contrast the method of time study to the method of work sampling. What are the strengths and limitations of each, and for which applications are they best suited?
Answer: Both are direct observation methods. However, a time study observes several cycles of work elements to determine a time standard, whereas work sampling takes "snapshots" of the facility to determine the percentage of time engaged in an activity. Time studies require experienced analysts, should not be used for tasks that vary each time, and are many times found to be objectionable to workers. Work sampling does not require special training and is generally accepted by workers because it tends to examine activities of the group rather than of the individual. In addition, many work sampling studies can be conducted simultaneously.
Difficulty: Challenging
Keywords: time study, work sampling
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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90) A manager of a company producing computer chips knows that in the early stages of production for a new product, the expenditures exceed receipts, whereas in the latter stages, the reverse is true. Give an explanation for this phenomenon.
Answer: The learning curve theory states that the direct labor costs will exceed the average in the early stages of production, whereas the reverse is true in the latter stages. Pricing is often predicted on average costs.
Difficulty: Challenging
Keywords: learning curves, direct labor
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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91) An industrial engineer observes a brand new process and develops time standards for several of the manual components of the production line. What are the implications of learning effects on the time standards and the line balance? What could be done to address this situation?
Answer: The learning curve theory states that the labor requirement will be greater in the early stages of production and lower as workers enjoy several repetitions of their jobs. A line balance that is performed using inflated times will have increased idle time and decreased efficiency as learning effects occur. The industrial engineer can compensate for learning effects by applying a smaller performance rating factor (or allowance factor if downtime is an issue). If the industrial engineer is unsure of the workers' learning rate, the line can be balanced, and then a second study performed to rebalance it.
Difficulty: Challenging
Keywords: learning curves, output rate, time standard, line balance
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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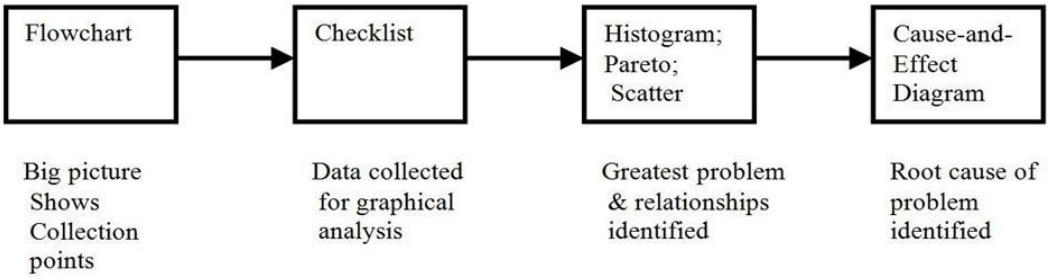
92) How could a fishbone chart be used to design a new process?
Answer: Also called a cause-and-effect diagram, the classic fishbone chart relates a key quality problem to its potential causes. Instead of placing a problem at the head of the fish, the process designers might place the desired process outcome at the head of the fish, e.g., "100% accuracy in order fulfillment" and then fill out the skeletal structure with elements that can help achieve this desired process outcome.
Difficulty: Moderate
Keywords: fishbone diagram, cause-and-effect diagram
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Discuss how to define, measure, and analyze processes.

93) Create a flowchart that displays the proper sequential use of the major graphical tools in Chapter 2, "Process Strategy and Analysis." Include a note next to each tool that explains how the output of one tool is used as the input for the following tool.
Answer: A flowchart shows a big picture view of the process. The output from this step is a view that shows appropriate points for data collection using a checklist. Once the checklist has been deployed, the data that has been collected can be analyzed by a histogram or a Pareto chart (if data can be categorized) or a scatter diagram (if coordinate data fall more naturally into continuous distributions). Finally, the tallest bar in the Pareto chart serves as the input to a fishbone (or cause-and-effect) diagram as the fishbone's head.



Difficulty: Moderate
Keywords: flowchart, checklist, histogram, Pareto, scatter, fishbone, cause-and-effect
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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94) An existing insurance application process requires manual keying of three different forms by a team of data entry operators. The three forms' input times appear in the following table along with the numbers of each type of form anticipated for the coming year. A proposed refinement in the process would reduce the number of forms but make each slightly longer. This would be combined with a search of public records on the World Wide Web as necessary. These times and quantities appear in the lower half of the table. If the labor rate for the data entry operators is the same, which method is preferable?

Form	Time to Input (minutes)	Quantity (forms/year)
Part A – Existing Method	3	1,200,000
Part B – Existing Method	3	1,200,000
Part C – Existing Method	4	1,100,000
P art A – Proposed Method	4	1,200,000
Part B – Proposed Method	4	1,200,000
Web Search – Proposed Method	2	650,000

Answer: Annual Labor Cost = (Time to Perform Process) × (Number of Times Performed/Year)

Existing Method

Part A 3 minutes × 1,200,000 = 3,600,000

Part B 3 minutes × 1,200,000 = 3,600,000

Part C 4 minutes × 1,100,000 = 4,400,000

Proposed Method

Part A 4 minutes × 1,200,000 = 4,800,000

Part B 4 minutes × 1,200,000 = 4,800,000

Part C (web) 2 minutes × 650,000 = 1,300,000

Total Proposed Process: 10,900,000 minutes - A savings of 700,000 minutes/year

Difficulty: Moderate
Keywords: annual labor cost
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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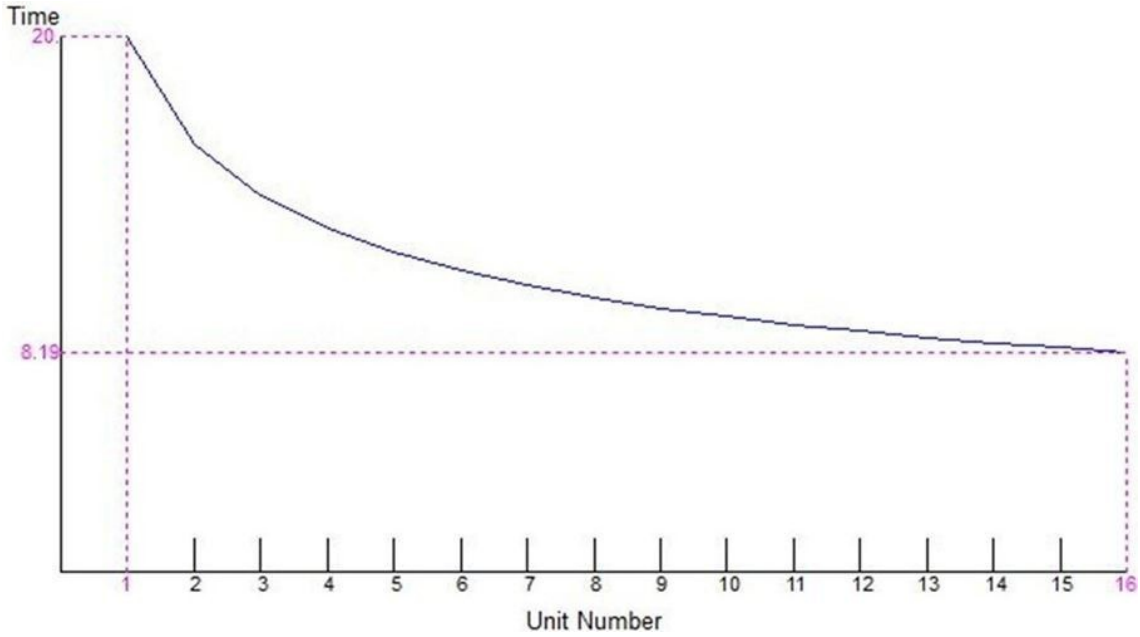
95) The labor time for successive units produced is plotted in the graph shown below. What is the learning percentage reflected by this graph?



Answer: The first unit takes 20 units of time and the 16th unit takes 8.19 of the same time units. From the first to the 16th unit there are four doublings of output, each with an identical reduction in percentage of time needed for the last unit. In the absence of the classic learning curve formula, a student might set up a goal seek in Excel to find the appropriate learning curve percentage or use a trial and error approach with POM for Windows.
Difficulty: Challenging
Keywords: learning curve
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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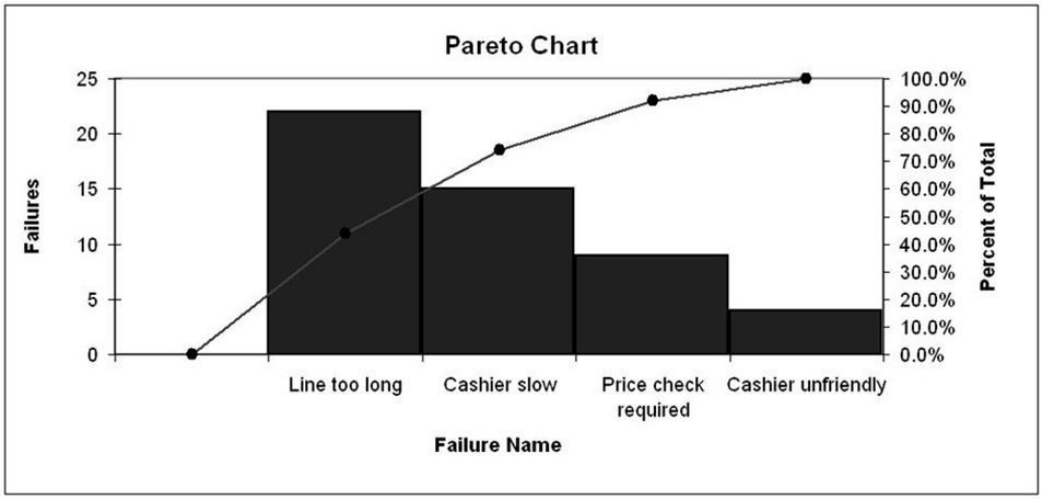
96) A discount store is experiencing an unacceptable number of dissatisfied customers leaving from the checkout process. Information from customer complaints about the checkout process was collected and is found in the following table. Construct a Pareto chart to identify the significant problems.

Problem Type	Total Problems
Cashier slow	15
Price check required	9
Line too long	22
Cashier unfriendly	4

Answer:



Difficulty: Moderate
Keywords: Pareto chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

97) Develop a fishbone diagram from the perspective of a pizza restaurateur to troubleshoot the pizza delivery process to determine why weekend pizza deliveries are usually late. Make sure your diagram includes at least four bones and ten ribs.
Answer: Answers will vary, but the head of the fishbone diagram should show "late pizza delivery on the weekend" as the problem to be studied. Major bones might include materials, manpower, machinery, methods, procedures, other, policies, among others. Specific statements for ribs will provide the greatest variety but might include a lack of ingredients, mislabeled ingredients, poor handwriting, computer glitch, ovens of insufficient capacity, poorly trained employees, low staffing levels, poor delivery vehicles, and directionally-challenged drivers, among others.
Difficulty: Moderate
Keywords: fishbone diagram
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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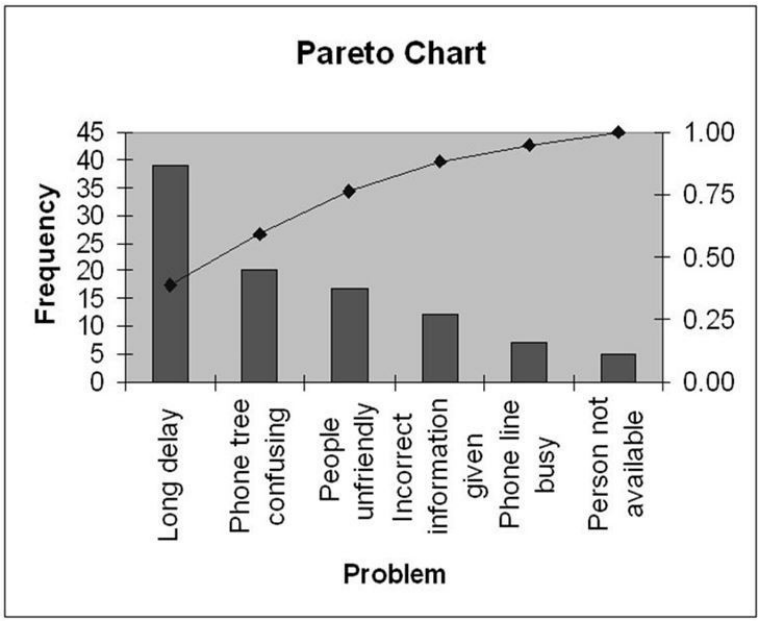
98) Because a telephone customer service center has experienced several problems, it has begun to analyze the data from customer complaints. The first step was to construct the following table. Use this data to build a Pareto chart to help identify the "vital few" problems.

Process Failure	Total Failures
Person not available	5
Incorrect information given	12
Phone line busy	7
Long delay	39
Phone tree confusing	20
People unfriendly	17

Answer:



Difficulty: Moderate
Keywords: Pareto chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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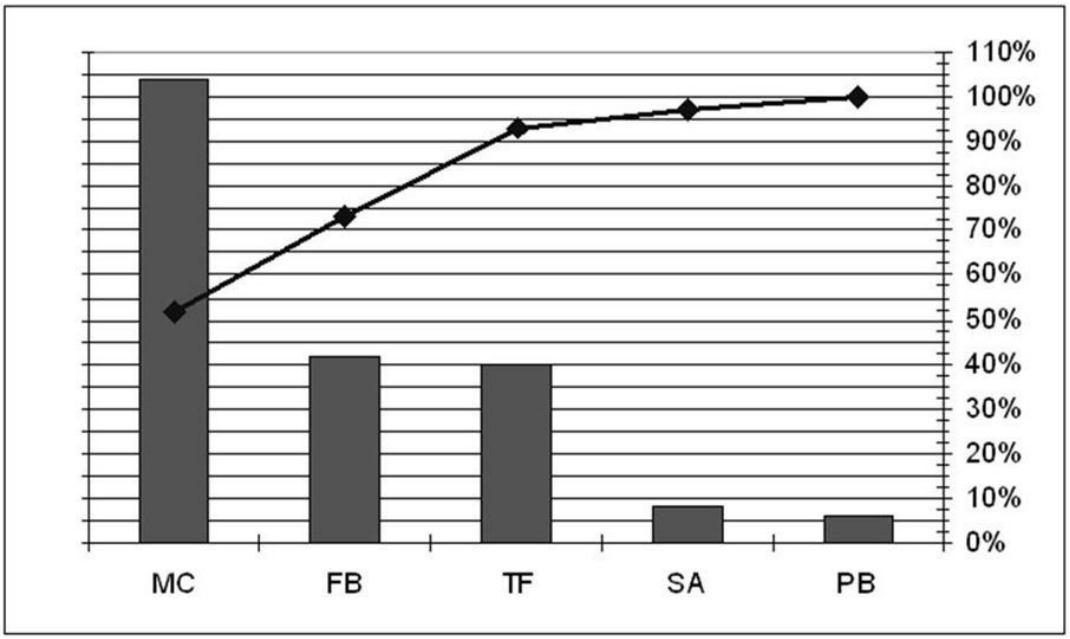
99) The semester project came back from the copy store and to her horror, the project leader has just noticed that the left side y-axis of a key Pareto chart was cut off due to a printing error. The bar chart component uses the missing left side y-axis and the cumulative percentage line on the Pareto chart uses the right side y-axis. The project leader is pretty sure that the total number of observations in all combined categories is 200. Can you help her develop estimates of the counts for each of the five categories?



Answer: The actual counts for the five categories are:

Category	Count
MC	104
FB	42
TF	40
SA	8
PB	6

Some allowance should be made for alignment in reading the graph's right hand y-axis and matching up the location of the cumulative percentage markers for each category. Because the total number of observations equals 200, the percentages on the right side y-axis can be multiplied by 200 to yield estimates of the count values. Based on a rough reading:
MC = 200 × 52.5 = 105
FB = 200 × (72.5 - 52.5) = 40
TF = 200 × (92.5 - 72.5) = 40
SA = 200 × (97.5 - 92.5) = 10
PB = 200 × (100 - 97.5) = 5
Difficulty: Moderate
Keywords: Pareto chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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100) Develop a process chart for a manual car wash.
Answer: Answers will vary, but a typical answer might look like the following process chart:

Process: Manual Car Wash
Subject: Car
Beginning: Get instructions
Ending: Car given to customer

Insert Step
Append Step
Remove Step

Summary

Activity	Number of Steps	Time (min)	Distance (ft)
Operation ●	6	9.00	
Transport ➡	3	1.20	70
Inspect ■	1	0.50	
Delay ◗	2	1.00	
Store ▼	--	--	

Step No.	Time (min)	Distance (ft)	●	➡	■	◗	▼	Step Description
1	1.00		X					Attendant accepts instructions from customer
2	0.40	20.0		X				Car driven into vacuuming area
3	0.50					X		Delay waiting for vacuuming
4	2.00		X					Car driven into vacuuming area
5	0.30	10.0		X				Car vacuumed
6	0.50					X		Delay waiting for wash
7	3.00	20.0	X					Car washed
8	0.50	10.0	X					Car dried
9	0.50	10.0		X				Car moved to hand dry area
10	2.00		X					Car hand dried
11	0.50				X			Final inspection
12	0.50		X					Car given to customer

Difficulty: Challenging
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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101) Develop a process chart for one of the following:
1) Researching and writing a paper for your Operations Management class
2) Managing, developing and completing a team project for a Finance (or other) class
3) Planning for your job interview process as you approach graduation (including resume preparation, developing interview skills, researching company backgrounds, etc.)
4) Studying and developing a process improvement plan for a business or other process you are familiar with (e.g., fast food restaurant, obtaining tickets to a university-sponsored event, dry cleaners, book purchases for next term, and the like)
Answer: Answers will vary, but should follow the approach used to develop the following process chart for a manual car wash. The process chart should include all value adding and non-value adding steps, and a summary of the steps and times that recap the process.

Process: Manual Car Wash
Subject: Car
Beginning: Get instructions
Ending: Car given to customer

Insert Step
Append Step
Remove Step

Summary

Activity	Number of Steps	Time (min)	Distance (ft)
Operation ●	6	9.00	
Transport ➡	3	1.20	70
Inspect ■	1	0.50	
Delay ◗	2	1.00	
Store ▼	--	--	

Step No.	Time (min)	Distance (ft)	●	➡	■	◗	▼	Step Description
1	1.00		X					Attendant accepts instructions from customer
2	0.40	20.0		X				Car driven into vacumming area
3	0.50					X		Delay waiting for vacuuming
4	2.00		X					Car driven into vacumming area
5	0.30	10.0		X				Car vacuumed
6	0.50					X		Delay waiting for wash
7	3.00	20.0	X					Car washed
8	0.50	10.0	X					Car dried
9	0.50	10.0		X				Car moved to hand dry area
10	2.00		X					Car hand dried
11	0.50				X			Final inspection
12	0.50		X					Car given to customer

Difficulty: Moderate
Keywords: process chart
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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102) A pilot work study has been conducted on a new operation with four work elements. The following times, in seconds, were obtained using a time study.

	Observations					
Element	1	2	3	4	5	**RF**
1	11	15	10	14	15	1.10
2	26	30	25	29	30	1.05
3	11	8	7	13	11	0.85

a. What is the normal time for this operation?
b. If an allowance of 20 percent is used, what is the standard time for this task?
Answer:

Work Element	**Rating Factor**	**Average Time**	**Normal Times**
1	1.10	13.0	14.3
2	1.05	28.0	29.4
3	0.85	10.0	8.5

a. Normal time = 14.3 + 29.4 + 8.5 = 52.2 seconds
b. Standard time = (52.2)(1.20) = 62.64 seconds
Difficulty: Moderate
Keywords: time study, normal time, standard time
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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103) An undergraduate business student studies diligently in the library late in the term in anticipation of an outstanding performance on her final exams. She asks a friend to spy on her at random intervals to determine what percentage of time she is actually studying. Over the course of three days, her friend records the following observations:

Observation Period	Times Studying	Times Not Studying	Observations
Monday	19	4	23
Tuesday	22	4	26
Wednesday	9	2	11

Based on this work sample, what percentage of time was the student actually studying?
Answer: Total observations = 60
Number of observations student was studying = 50
% of time studying = 50 / 60 = 83.3%
Difficulty: Moderate
Keywords: work sampling study, work sample
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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Scenario 2.5
A job consists of three distinct work elements that were timed with a highly accurate Swiss watch by a trained industrial engineer. The engineer recorded ten observations and assigned the performance rating that is recorded in the bottom row of the table under the corresponding work element. All recorded times are in seconds.

Element 1	Element 2	Element 3
15	23	45
17	25	51
16	23	52
13	26	49
15	25	46
14	23	43
16	24	51
14	25	50
15	23	49
16	22	49
110	115	105

104) The allowance factor assigned is 20% for the data recorded. The rating factor for Element 1 is 10%, for Element 2 is 15%, and for Element 3 is 5%. What is the standard time for the three-element job?
Answer: The average for Element 1 is 15.1 seconds; the average for Element 2 is 23.9 seconds; the average for Element 3 is 48.5 seconds.
The normal time for Element 1 is 16.61 seconds; the normal time for Element 2 is 27.49 seconds; the normal time for Element 3 is 50.93 seconds.
Add them all up to get 95.03 seconds and multiply by 1.20 to get a standard time for the job of 114.04 seconds.
Difficulty: Moderate
Keywords: time study
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Discuss how to define, measure, and analyze processes.

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2.7 Improving and Controlling Process Improvements

1) A group of people, who are knowledgeable about the process and its disconnects, meets to propose ideas for change in a rapid-fire manner. Such a session is called a brainstorming session.
Answer: TRUE
Difficulty: Easy
Keywords: brainstorming, process ideas
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Interpersonal Relations and Teamwork
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

2) Brainstorming sessions can be effectively conducted on the Internet using software that allows one person to see another's ideas and build on them.
Answer: TRUE
Difficulty: Easy
Keywords: brainstorming, Internet software
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Information Technology
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

3) The bursar's office at a large state school sends a team to the bookstore on campus to see how they handle customers and process payments. This is an example of functional benchmarking.
Answer: FALSE
Difficulty: Moderate
Keywords: functional benchmarking, internal benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

4) All forms of benchmarking are best applied in situations where long-term continuous improvement is desired.
Answer: TRUE
Difficulty: Moderate
Keywords: benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

5) Benchmarking is a continuous, systematic procedure that measures a firm's products, services, and processes against those of industry leaders.
Answer: TRUE
Difficulty: Moderate
Keywords: benchmarking, measure, industry leader
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

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6) Which of these questions is not one of the initial round questions typically used to uncover opportunities during a process redesign?
A) What is being done?
B) When is it being done?
C) Who is doing it?
D) Why are we doing it?
Answer: D
Difficulty: Moderate
Keywords: process redesign, questioning, brainstorming
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

7) Brainstorming sessions must have:
A) all participants together in the same room.
B) a mechanism for evaluation of the ideas as they are surfaced.
C) a means of implementing ideas as they are surfaced.
D) a way for all participants to communicate.
Answer: D
Difficulty: Easy
Keywords: brainstorming
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Interpersonal Relations and Teamwork
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

8) Xerox benchmarked its distribution system against that of L. L. Bean's. This is an example of:
A) competitive benchmarking.
B) internal benchmarking.
C) functional benchmarking.
D) disaggregate benchmarking.
Answer: C
Difficulty: Moderate
Keywords: benchmarking, functional
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

9) Benchmarking studies must have:
A) a direct competitor for comparison.
B) a team composed of at least one member from each department in the organization.
C) a team composed of at least one member from each department in the organization plus one customer of each process output.
D) quantitative goals.
Answer: D
Difficulty: Moderate
Keywords: benchmarking, data, quantitative goals
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

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10) An accounting firm realizes it is woefully inadequate at cultivating new clients. It is allowed to observe a rival firm perform the new-client cultivation process in hopes of gleaning improved methods it can adopt. This is an example of:
A) competitive benchmarking.
B) functional benchmarking.
C) internal benchmarking.
D) generic benchmarking.
Answer: A
Difficulty: Moderate
Keywords: benchmarking, competitive
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

11) An accounting professor realizes she is woefully inadequate at performing research. She discusses the art of research with a colleague and gains important insights that permit her to establish a research agenda. This is an example of:
A) competitive benchmarking.
B) functional benchmarking.
C) internal benchmarking.
D) generic benchmarking.
Answer: C
Difficulty: Moderate
Keywords: benchmarking, internal
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

12) An accounting firm realizes it is woefully inadequate at cultivating new clients. It is allowed to observe a law firm perform the new-client cultivation process in hopes of gleaning improved methods it can adopt. This is an example of:
A) competitive benchmarking.
B) functional benchmarking.
C) internal benchmarking.
D) generic benchmarking.
Answer: B
Difficulty: Moderate
Keywords: benchmarking, functional
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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13) Which of these benchmarking metrics is *not* suitable for a support process?
A) average employee turnover rate
B) total cost of payroll processes per $1,000 revenue
C) the impression that applicants have as they submit applications
D) number of accepted jobs as a percent of job offers
Answer: C
Difficulty: Easy
Keywords: benchmarking metrics
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

14) When managing processes, it is vital that:
A) attention is paid to competitive priorities and strategic fit.
B) design teams are allowed to function creatively and set their own charter.
C) design teams are not held accountable since their involvement ends once the new process rolls out.
D) the organization is not satisfied unless fundamental reengineering changes are made.
Answer: A
Difficulty: Moderate
Keywords: managing processes, competitive priorities, strategic fit
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

15) When managing processes, it is vital that:
A) design teams are allowed to function creatively and set their own charter.
B) the organization is not satisfied unless fundamental reengineering changes are made.
C) sound project management practices are used to implement the redesigned process.
D) people are redesigned at the same time the process is redesigned.
Answer: C
Difficulty: Moderate
Keywords: managing processes, project implementation
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

16) Good process management should include:
A) a mechanism for identifying what goes wrong and who is responsible.
B) a method for creating self-directed work teams.
C) at least half time dedicated to each employee's self-actualization.
D) an infrastructure for continuous improvement.
Answer: D
Difficulty: Moderate
Keywords: managing processes, continuous improvement
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

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17) A(n) _____ is a method where a group of people, knowledgeable about the process and its disconnects, propose ideas for change in a rapid-fire manner.
Answer: brainstorming session
Difficulty: Moderate
Keywords: brainstorming
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Interpersonal Relations and Teamwork
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

18) _____ is a continuous, systematic procedure that measures a firm's products, services, and processes against those of industry leaders.
Answer: Benchmarking
Difficulty: Moderate
Keywords: benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

19) The bursar's office at your university decides to benchmark the collections department of a credit agency to improve their own collection rate. This is an example of _____.
Answer: functional benchmarking
Difficulty: Moderate
Keywords: benchmarking, functional benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

20) _____ is based on comparison of processes with a direct adversary in industry.
Answer: Competitive benchmarking
Difficulty: Moderate
Keywords: benchmarking, competitive benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

21) _____ data is probably the easiest to obtain compared to other types of benchmarking data.
Answer: Internal benchmarking
Difficulty: Moderate
Keywords: internal, internal benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

22) _____ involves using an organizational unit with superior performance as the ideal for other departments.
Answer: Internal benchmarking
Difficulty: Moderate
Keywords: benchmarking, internal
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
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Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

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23) Provide examples for each of the three types of benchmarking.
Answer: Examples will vary, but the three types are competitive, functional, and internal. Competitive benchmarking is comparison with a direct competitor; functional benchmarking is a comparison with similar functions outside the firm but not of a direct competitor; and internal benchmarking is a comparison with another department or function in the same company.
Difficulty: Moderate
Keywords: benchmarking, competitive, internal, functional
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

24) The authors discuss seven mistakes when managing processes, arguing that failure to manage processes is ultimately a failure to manage the business. What are any four of those mistakes?
Answer: Answers will vary depending on which four mistakes are chosen. The full list of seven mistakes are:
1. *Not Connecting with Strategic Issues*. Is particular attention being paid to core processes, competitive priorities, impact of customer contact and volume, and strategic fit during process analysis?
2. *Not Involving the Right People in the Right Way*. Does process analysis closely involve the people performing the process, or those closely connected to it as internal customers and suppliers?
3. *Not Giving the Design Teams and Process Analysts a Clear Charter, and then Holding Them Accountable*. Does management set expectations for change and maintain pressure for results? Does it allow paralysis in process improvement efforts by requiring excessive analysis?
4. *Not Being Satisfied Unless Fundamental "Reengineering" Changes are Made*. Is the radical change from process reengineering the expectation? If so, the cumulative effect of many small improvements that could be made incrementally could be lost. Process management efforts should not be limited to downsizing or to reorganization only, even though jobs may be eliminated or the structure changed. It should not be limited to big technological innovation projects, even though technological change occurs often.
5. *Not Considering the Impact on People*. Are the changes aligned with the attitudes and skills of the people who must implement the redesigned process? It is crucial to understand and deal with the people side of process changes.
6. *Not Giving Attention to Implementation*. Are processes redesigned, but never implemented? A great job of flowcharting and benchmarking is of only academic interest if the proposed changes are not implemented. Sound project management practices are required.
7. *Not Creating an Infrastructure for Continuous Process Improvement*. Is a measurement system in place to monitor key metrics over time? Is anyone checking to see whether anticipated benefits of a redesigned process are actually being realized?
Difficulty: Challenging
Keywords: processes, managing processes
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Application of Knowledge
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

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25) Suppose you have owned and operated your own package delivery business for a year. You would like to engage in competitive benchmarking to make sure your business is run as smoothly as possible. What firms and processes would you consider for benchmarking? Defend your choices of these firms and processes. What specific metrics would you focus on and why? How could the data be reliably collected at your own business?
Answer: Answers will vary, but processes that might be considered are the pick up and delivery processes, sorting, billing, customer service, and many others. The student might identify some processes as being more crucial to customer satisfaction or more tightly coupled with their own corporate strategy, or perhaps processes that they feel are the most difficult to master. Metrics include the percent of on-time delivery, fraction of correct bills, profit per package, number of days delivery, fill rate of delivery vehicles, and many others. The data may be collected via information technology in the field or automatically collected as packages pass delivery checkpoints. Customer satisfaction data can be collected by comment cards or by customer service representatives staffing a calling center.
Difficulty: Moderate
Keywords: benchmarking, competitive benchmarking
Learning Outcome: Discuss the total cost of quality and compare the common methods of managing quality
AACSB: Analytical Thinking
Learning Obj.: Identify the commonly used approaches for effectively improving and controlling processes.

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