



**A Study Guide  
for the  
Certified Master Logistician  
(CML)  
Examination Program**

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**SOLE - THE INTERNATIONAL SOCIETY  
OF LOGISTICS**

**June 2012**

*Certification by a recognized professional organization has always been the hallmark of individual excellence in one's chosen profession.*

*For the Supply Chain Manager, this certification takes the form of the Certified Master Logistician (or CML) designation awarded by SOLE – The International Society of Logistics (SOLE). Attainment of this certification attests to our employers, fellow employees, and customers the commitment that we, as individuals and as an organization, have to providing the best supply chain management services and support for their programs.*

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## **Part I**

### **Introduction and Overview of the CML Program**

## **1. INTRODUCTION**

This guide provides a general outline of the scope and depth of knowledge that an individual is required to attain to successfully complete the examination leading to award by SOLE – The International Society of Logistics (“SOLE” or “the Society”) the certification of Certified Master Logistician (CML). This guide is not intended as a shortcut for individuals to gain superficial knowledge in order to pass the examination.

A companion document set is available to assist in conducting a comprehensive study program to prepare the individual to assume roles as logisticians in industry and government. This set of materials requires knowledgeable instructors to supplement the provided text in teaching the subject matter in each of the areas of Logistics and Supply Chain Management

### **1.1 The Certified Master Logistician Program**

The practice of logistics is a professional discipline. SOLE – The International Society of Logistics’ professional certification program recognizes the professional stature and ethics of logisticians within commerce, industry, defense, federal and local government agencies, and both academic and private institutions. The adoption of a Certified Professional Logistician (CPL) certification program in October 1972 was a major step by SOLE to further the accreditation of professionals in the logistics field. This certification recognizes the functional interrelationships within the professional responsibilities of logisticians regardless of their occupational roles. The extension of SOLE’s Certification Program to focus on the Logistics Chain Management element of the profession represents a continuing commitment to the professionals in the field and recognition of the changing nature of the profession.

The title “Certified Master Logistician” will be granted to individuals of proven competence in Supply Chain Management who, coupled with a solid base of experience in the field, pass an examination designed to test their broad knowledge of the entire supply chain management spectrum.

SOLE’s CML Certification Program is administered by the Certified Master Logistician Qualification Review Board (CPL-QRB) responsible for reviewing the eligibility of applicants, the conduct of the examination itself, and notifying candidates of the results.

#### ***1.1.1 CML Certificate, Identification Cards and Lapel Pins***

Candidates who successfully pass the certification examination are awarded a specially designed certificate, identification card, and lapel pin attesting to their accomplishment.

Successful candidates of the certification examination are granted the designation of “Certified Master Logistician” (or CML). The professional designation should be used in a dignified manner similar to the recognition accorded by the accounting, program management, engineering and other professional fields. Either the full expression or the initials may be used after the individual’s name on business cards and stationery, but always in a manner consistent with the dignity of the Society.

### **1.2. The Examination**

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Examinations are held twice annually, in May and November, at announced times, and are conducted by a proctor selected by SOLE – The International Society of Logistics.

### *1.2.1 Exam Overview*

The CML examination itself has been ranked as the equivalent of a Masters Degree for Supply Chain Managers and practitioners. The CML examination consists of three parts, each part consisting of 100 multiple choice questions. The subject areas covered in each of these exam areas are detailed in Part 2 of this Study Guide.

### *1.2.2 Examination Process*

The examination is conducted during one continuous six-hour period, consisting of three two-hour sessions, with short breaks between sessions.

Initially the CML candidate takes all three parts at one time and must pass all parts to be certified. If two of the three parts are passed, the candidate is permitted to retake only the one part failed. If the candidate does not pass two of the three parts he/she must retake all three parts at the next sitting.

There is no limit to the number of times an individual may apply to take the examination.

Multiple choice questions are used, and the examination is “closed book.” Only non-programmable calculators are acceptable, and no reference material, other than that authorized/provided by SOLE, is permitted in the testing area. Completed exams are graded under the auspices of SOLE’s Education Committee: the results of the examination are then forwarded to SOLE Headquarters for notification to the examinees, and for official retention.

## **1.3. Application Process**

### *1.3.1 Process and due dates*

The application for the examination is available from SOLE Headquarters, or off the SOLE website ([www.sole.org](http://www.sole.org)). The application must be processed to arrive at SOLE Headquarters not later than **3 months before the desired examination date**. This means that if you wish to sit for the November examination your application should arrive at SOLE not later than the first of September. For the May date it should arrive not later than the first of February.

Applications reflect your personal professionalism and as such should be typed or filled in on a computer.

**1.3.2 Qualifications for application**

To sit for the CML examination, applicants must submit an examination application showing they meet the eligibility requirements based on a combination of education and practical experience in the fields of logistics.

<b>Option</b>	<b>Educational (Note 2)</b>	<b>Experience (Note 1)</b>
A	No Formal Degree	8 Years
B	Bachelor's Degree	4 Years
C	Masters Degree	2 Years
D	Doctorate	2 Years

*Note 1: Experience requirements are a minimum 2 years experience in each of the following fields of logistics (persons with a doctoral degree may have experience in only one area):*

- *Program or Systems Management*
- *Distribution and Customer Support*

*Note 2: Educational Equivalents – Each academic year of undergraduate accredited coursework in logistics subjects is equivalent to one year of professional experience, with undergraduate credits limited to the equivalent of four years experience.*

Tasks associated with each of the logistics fields are shown in the table on the following page. These are examples: other tasks in these areas are also applicable

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<i>Systems Management</i>	<i>Distribution and Customer Support</i>
• Feasibility Studies	• Physical Supply and Distribution
• Operations Research and Systems Analysis	• Materials Requirements Planning
• Contingency Planning	• Packaging
• Sensitivity Analysis	• Transportation
• Risk and Uncertainty Determinations	• Traffic Administration
• Financial Management	• Warehousing and Storage
• Cost Accounting	• Technology Infusion
• Life Cycle Cost	• International Commerce and Shipping
• Time Value of Money	• Maintenance
• Return on Investment	• Technical Publications
• Payback and Break-even Analysis	• Training and Education
• Management Information Systems	• Systems and Equipment Phaseout
• Logistics Planning and Management	• Environmental Science
• Proposals	• Purchasing and Procurement
• Source Selection	• Material Flow
• Contract Negotiations	• Inventory Control
• Supervision	• Reverse Logistics
• Program Management	• Customer Service
	• Order Processing
	• Supply Chain Management
	• Logistics Organizations

#### **1.4 Administration of the CML and placement in the SOLE Organization**

The CML Examination is placed under the auspices of the Society's Vice President, Education, and is managed by SOLE's Director of Certification, who provides the overall CML program management. The applications for the exam are reviewed by the members of the Qualification Review Board. The examination itself is managed by exam principals, for each part of the exam.

The CML Qualification Review Board consists of representatives from industry and academia; it provides a review of the individual qualifications prior to the taking of the exam. This board provides the applicants with an evaluation of their qualifications to sit for the exam.

The Exam Principals provide for the overall contents of the exam itself. They are responsible for keeping the exam reflective of the practices in industry and Government. These members review all questions, and ensure that the study guide and study materials needed for exam preparation remain current with the contents of the exam. They select the questions for each sitting of the exam so as to maintain the continuing integrity of the exam process.

Recertification support is provided by a separate committee operating in conjunction with the QRB and Exam Principals to verify applicability of specific activities to the established requirements.

#### **1.5 Recertification**

*“Recognition of continuing commitment to excellence in our profession”*

The practice of Logistics, like the technology it employs and supports, has evolved at an ever-increasing rate since the founding of the Society. The Society, itself, and the recognition of professionalism through the Certified Professional Logistician and Certified Master Logistician certification programs, has continued to grow and keep pace with the changes in technology. We have witnessed changes in our basic processes, our individual domains and general deregulation of major industries.

Throughout this period the Society and its members have kept abreast of the changes and, in many cases, led the way for the implementation of new ideas. Key to your professional development and growth during this period will be your participation in seminars and educational opportunities assisting in developing new skills, or honing existing ones.

Recognizing this evolution the Society requires a recertification process for individuals who have earned the title of Certified Master Logistician. This recertification is an affirmation by the Society of the individual's commitment to continued professionalism in the practice of logistics and parallels the recertification program of the Certified Professional Logistician. Points are awarded to CMLs for activities that reflect participation in personal education and in the continuing education of other logistics practitioners through publications of logistics related articles, college courses in logistics related areas, industry sponsored logistics training, and participation in logistics and engineering seminars and symposiums.

The CPL/CML Recertification Committee reviews applications for recertification, and maintains historical files of the points that are achieved. A separate list of approved activities and points awarded for each is provided after you successfully complete the CML exam.

After your application for recertification is approved you will be issued a new identification card indicating your new status and the date the application was approved.

## **Part II**

**Overview of the examination, a review of recommended educational experiences, and reading lists.**

## **2-1 Educational Recommendations**

As noted in the exam application you are required to have significant logistics education and experience before applying to sit for the examination. In addition in preparing for the examination you may wish to avail yourself of educational opportunities at local colleges and universities in several logistics related areas. Some suggested course areas are listed below:

### **Associate Degree Programs**

- Computer Engineering
- Production Planning
- Marketing & Purchasing
- Statistical Analysis & Methods
- Warehousing and Inventory Control
- Transportation and Distribution

### **Baccalaureate Degree Programs**

- Logistics Management
- Warehousing and Inventory Control
- Transportation and Distribution
- Quality Assurance
- Life Cycle Support
- Production Planning and Cost Analysis
- Logistics Acquisition
- Marketing
- Purchasing and Procurement
- Information Systems
- Contracts Management
- Business Law
- System Disposal

### **Graduate Degree Programs (Masters and Doctoral)**

- Logistics Research
- Reliability, Maintainability
- Human Factors
- Systems Analysis and Design
- Systems Management
- Production Planning and Control
- International Trade
- Packaging, Warehousing, and Inventory Management

**2-2 Recommended Reference Texts**

Every effort has been made to verify that the following documents are available at the time the guide is released. Changes in availability will require the individual student to substitute similar texts by other authors in the field. Since all exam material is fundamental, rather than author specific, this should not present a problem to the individual student or class coordinator. Specific questions in this area should be addressed to the CML e-mail addressee on the web site.

**2.2.1 References for the CML Examination**

Bowersox, Donald J., Closs, David J., Cooper M. Bixby, *Supply Chain Logistics Management*, McGraw Hill/Irwin (ISBN 0072351004, International ISBN 0071123067)

Coyle, J.J., E.J. Bardi, and C.J. Langley, *The Management of Business Logistics*, 7th Ed., South-Western Publisher, Mason, OH, 2003 (ISBN 032007515).

Frohne, Philip T., CPL, *Quantitative Measurements for Logistics*, McGraw-Hill SOLE Press, New York, NY, 2008 (ISBN 978-0-07-149415-1)

Lambert, Douglas M, Stock James R., Ellram, Lisa M., *Fundamentals of Logistics Management*, McGraw-Hill Education – (ISBN 0256141177; International ISBN 0071157522)

Stock, James R., Lambert, Douglas M., *Strategic Logistics Management*, 4<sup>th</sup> Edition, McGraw Hill/Irwin (ISBN: 0256136874)

**2.2.2 Additional references for all parts of the exam:**

There are a number of journals where logistics articles are published that provide a state-of-the-art perspective on logistics topics. While a listing of the specific articles is enormous, the journals that would include items are:

**Academic/Professional Journals**

*Journal of Business Logistics*  
*International Journal of Physical Distribution and Logistics Management*  
*The International Journal of Logistics Management*  
*Transportation Journal*  
*Logistics and Transportation Review*  
*Harvard Business Review*  
*Sloan Management Review*  
*Business Horizons*

**Trade Journals**

*Logistics Spectrum*  
*Logistics Management*  
*Distribution Management*  
*Handling & Shipping Management*  
*Modern Materials Handling*

**Proceedings of Conferences**

Council of Supply Chain Management Professionals (annual conferences)  
SOLE Annual International Logistics Symposium and Exposition (annual conferences)

There are a number of books that deal with specific logistics topics, which might also be helpful. Again, the list is lengthy, but the topics include customer service, supply chain management, quality, reengineering, JIT, EDI, reverse logistics, etc.

Examples of organizations that publish a number of research reports and books that deal with a variety of logistics topics include:

Council of Supply Chain Management Professionals (CSCMP)  
Warehousing Education and Research Council (WERC)  
APICS – The Association for Operations Management  
American Society of Transportation & Logistics (ASTL)

You can contact those organizations directly for a listing of their publications.

**2.3 Examination Content Overview**

**Part One - Systems Management**

- Basic Definition of Logistics Systems and Interfaces
- The Life Cycle Process
- Life Cycle Costs
- System Evaluation Factors
- Financial Methods
- Management Information Systems
- Logistics Planning
- Logistics Planning Implementation Methods
- Proposals, Source Selection, and Contract Negotiations
- Organization for Logistics
- Staffing the Organization
- Directing the Organization
- Controlling the Organization
- Basic Concept of Systems and Logistics
- System Hardware and Software
- Principles and Functions of Management
- Logistics Support

**Part Two - Distribution and Customer Support**

- Physical Distribution Management
- Distribution Systems
- Contractual Requirements
- Field Engineering
- Maintenance Shop Operations
- Storage and Handling
- Warehousing
- Quality Assurance
- Materials Management
- Packaging and Handling
- Transportation Modes
- International Logistics
- Customer Service
- Life Cycle Assessment
- Reverse Logistics
- Purchasing and Procurement
- Supply Chain Management
- Strategic Alliances and Partnerships
- Outsourcing
- Logistics Organizations and Human Resource Issues
- Order Processing
- Use of Technology and Information Systems

### **Part III - Practice Examinations**

*The following sections provide questions that are generally at the level that one can expect on the examination. Since the examination is comprehensive in nature and covers a large area of logistics knowledge, no short practice exam can completely represent the actual examinations.*



**Certified Master Logistician  
(CML)**

**MINI EXAM**

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***PART I –  
SYSTEMS MANAGEMENT***

1. Inbound and Outbound Logistics are two terms describing what era of integrated logistics management?
  - a. Fragmentation
  - b. Evolving integration
  - c. Total integration
  - d. A prior integration
  
2. Which of the following is not one of the three primary flows of the supply chain?
  - a. Data stream
  - b. Information
  - c. Cash
  - d. Product
  
3. Which of the following statements is false as it relates to customer service?
  - a. There exist different levels of customer service
  - b. A minimum level is required to stay in business
  - c. All customers should be treated equally
  - d. Priorities should be made between customers
  
4. What has had an impact on the empowerment of the consumer over the past couple of decades?
  - a. The Internet allows for greater information dissemination
  - b. Demographics have changed
  - c. Neither “a” nor “b”
  - d. Both “a” and “b” are correct
  
5. What is true about deregulation?
  - a. Deregulation allowed for greater flexibility for the transportation providers
  - b. Deregulation allows price to be set by signals emanating from the marketplace
  - c. All modes of transportation in the U.S. are deregulated
  - d. All the above are correct

6. The process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements is the definition of logistics \_\_\_\_\_:
- a. From an inventory perspective
  - b. Called the “Seven Rs”
  - c. Offered by the SOLE – The International Society of Logistics
  - d. Provided by the Council of Supply Chain Management Professionals
7. A product’s form utility is created when value is added to the product through a manufacturing, production or assembly process. However, logistics activity can provide form utility also. Which describes the creation of form utility by a logistics activity?
- a. When lumber is cut and made into a chair
  - b. When a firm’s finance manager approves customer purchases on a credit basis
  - c. When bulk computer disks in different colors are packed in three color assortments for sale to computer users
  - d. When flour, milk, and shortening are combined to bake loaves of bread
8. What is created when a product or service is at a point when demanded by customers?
- a. Form utility
  - b. Place utility
  - c. Time utility
  - d. Possession utility
9. What is it called when a company’s discount schedule for larger purchase quantities relates to carrier rate discount schedules in terms of weight?
- a. A competitive discount
  - b. A weight break
  - c. A schedule trade-off
  - d. A matching schedule
10. Logistics decisions about inventory, transportation, and warehouse should relate to which of the following?
- a. The globalization of business
  - b. The changing government infrastructure
  - c. Structural changes in business
  - d. Customer service requirements

11. Which of the following is not an example of customer service?
  - a. Guaranteeing delivery within specified time periods
  - b. Installing the product
  - c. Extending the option to sell on consignment
  - d. Outsourcing financial and credit terms
  
12. Which of the following is not considered part of the new customer service measurement?
  - a. Orders received on time
  - b. Link node selection for order handling
  - c. Orders received safely
  - d. Orders billed correctly
  
13. Which of the following is not an element of customer service?
  - a. Time
  - b. Dependability
  - c. Communication
  - d. Link-node selections
  
14. There are a number of activities for the procurement process, all of which add value to the supply chain. Which of the following is not one of those?
  - a. Identify or reevaluate needs
  - b. Define and examine user requirements
  - c. Decide whether to make or buy
  - d. Identify the timing of purchase
  
15. In the Item Procurement Importance Matrix, what describes low risk, low value?
  - a. Generics
  - b. Commodities
  - c. Criticals
  - d. Distinctives
  
16. In the Item Procurement Importance Matrix, what describes high risk, low value?
  - a. Generics
  - b. Commodities
  - c. Criticals
  - d. Distinctives

17. What vendor selection criteria is described by production capability, labor relations, and operating controls?
- a. Capability
  - b. Quality
  - c. Reliability
  - d. Financial
18. Which of the following commerce models can be viewed as an electronic auction?
- a. Buy-side system
  - b. Sell-side system
  - c. On-line trading community
  - d. Electronic marketplace
19. Which category of ocean shipping offers common carrier service, sailing on set schedules over specified sea routes?
- a. Liner service
  - b. Charter vessels
  - c. Private vessels
  - d. Demise charter vessels
20. A containerized shipment of French beauty products arrives at the port of Miami, Florida. The containers are offloaded into rail cars for shipment to Orlando, Florida. This describes which type of maritime bridge?
- a. Microbridge
  - b. Minibrige
  - c. Macrobridge
  - d. Mainbridge
21. Gemini products wishes to enter foreign markets but lacks the resources to do so. They evaluate their alternatives and approach Overseas Traders, LLC, a company that specializes in the foreign distribution of products of the type which Gemini manufactures. Overseas purchases \$50,000 of Gemini's products for sale on the international market. Overseas is which type of global logistics channel intermediary?
- a. NVOCC
  - b. Export packer
  - c. Export trading company
  - d. Customs house broker

22. A country's customs regulations have the objectives of providing revenue and
- a. Encouraging imports
  - b. Reducing paperwork
  - c. Protecting domestic industries
  - d. Providing for the national defense
23. Good A is valued at \$400, and is subject to an import duty of 10 percent. What type of import duty is assessed on Good A?
- a. Unit duty
  - b. Compound duty
  - c. Ad valorem duty
  - d. Protection tax
24. Which reason for physical supply inventory involves purchases for hedging against future price increases, strikes, changing political parties, delayed deliveries, rising or falling of interest rates, or currency fluctuations in world markets?
- a. Safety stock
  - b. Speculative purchases
  - c. Seasonal supply
  - d. Maintenance of supply sources
25. Which decision is one that involves the number of warehouses a firm should have?
- a. A transportation cost-maximization decision
  - b. An inventory cost decision
  - c. A centralization-decentralization decision
  - d. A link-node maximization decision



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(CML)**

**MINI EXAM**

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***PART II –  
DISTRIBUTION AND  
CUSTOMER SUPPORT***

1. Simplex Cables is a manufacturer of all types of cables and connectors for computer applications. Its order picking and preparation area provides separate storage and order areas. The order picking racks for connectors and cables are smaller than the storage bays for other items. The order picking racks which are located near the shipping area are inventoried and locked at regular intervals. Order filling is easier from the order picking racks than from the storage bays: picking time is reduced along with distance. This is which basic type of order picking and preparation layout?
  - a. The unit size approach
  - b. The popularity approach
  - c. The reserve/active area approach
  - d. The composite general area approach
  
2. Which is usually the most important determinant for selecting a particular carrier from within one mode?
  - a. Transit time reliability
  - b. Equipment availability
  - c. Line haul services
  - d. Claims processing
  
3. Museum Shows, Inc., is a company that holds exhibits of rare art and artifacts throughout the United States. The average value of an art piece shown is over \$500,000. The high-value of this art results in daily transportation insurance costing over \$100,000. Exhibits are often scheduled one day apart and 1,500 miles distant. The mode chosen has to be very dependable because damaged or destroyed shipments would be impossible to replace and difficult to restore. Museum's traveling manager is evaluating modes to transport the exhibits from city to city. Which would be most appropriate?
  - a. Rail
  - b. Motor
  - c. Water
  - d. Air
  
4. High fixed costs, low variable costs, long transit times, low accessibility, and capable of only transporting liquid products, is characteristic of which mode of transportation?
  - a. Pipelines
  - b. Railroads
  - c. Water carriers
  - d. Air carriers

5. What is a prime advantage of using an intermodal marketing company (IMC)?
  - a. Cost savings
  - b. Consolidation
  - c. Improved transit time
  - d. All of the above
  
6. All are common carrier exceptions to liability, except for:
  - a. Act of public authority
  - b. Act or default by shipper
  - c. Act of God
  - d. Act of public enemy
  - e. Accident which is not the carrier's fault
  
7. What determines the claim value of a damaged commodity?
  - a. The amount the claimant requests
  - b. The amount the carrier offers in an attempt to settle
  - c. The market value at the time of shipment
  - d. The market value at destination
  
8. Which is correct regarding tapered rates?
  - a. Rates will taper with high value goods but not with low value goods
  - b. Rates will taper with low value goods but not with high value goods
  - c. Rates taper because the fixed costs associated with a shipment are spread out as the distance of the shipment increases
  - d. Shorter shipment distances cost less per mile than longer shipment distances
  
9. The class ratings of four commodities are: (1) 125, (2) 90, (3) 75, and (4) 60. Which commodity is charging the highest percentage of the first class rate?
  - a. (1)
  - b. (2)
  - c. (3)
  - d. (4)
  
10. Which type of rate involves a specific rate, two specific locations, and one specific direction of travel?
  - a. Commodity
  - b. Exception
  - c. Back haul rate
  - d. Directional rate

11. Which of the following is not one of the steps in the Process Model?
  - a. Decision to form relationship
  - b. Structure operating model
  - c. Evaluate alternatives
  - d. Reduce staff
  
12. The logistics information system for Allied Products was designed by its computer services department. A systems designer with some logistics experience was given responsibility for developing the system. The logistics manager has to maintain adequate materials stock levels for production. The only materials information available is the annual materials usage for the past five years. No demand information or forecasts are available in the system. The production system is frequently down due to material shortages. The situation reflects which issue characterizing quality of information?
  - a. Having the right information available
  - b. Accuracy information
  - c. Communication
  - d. Customized accounting practices
  
13. RF technology and on board computers with satellite tracking are examples of
  - a. Remote access
  - b. Management control systems
  - c. Ability to observe workers from a remote location
  - d. Data management in the new century
  
14. \_\_\_\_\_ represents a comprehensive set of computer oriented tools designed to help managers make better plans and gain broader insights into strategic issues of supply chain management.
  - a. Simulation
  - b. Inventory management and control
  - c. Modeling
  - d. Decision support
  
15. Of all respondents to a recent metric survey from the University of Tennessee, which was the least used metric?
  - a. Cost to serve
  - b. Product units processed per transportation labor unit
  - c. Third party storage cost
  - d. Case fill

16. The benefits of the measure outweigh the costs of collection and analysis describes
- a. A measure that uses economies of effort
  - b. Trust
  - c. Visibility
  - d. Understandability
17. Which is correct regarding tapering rates?
- a. The principle is based on the carrier's ability to spread certain fixed cost over a greater number of miles
  - b. Transportation rates increase with distance directly in proportion to the distance
  - c. In a one-source, one-market situation, the impact of the tapering rate will be to pull the location toward a point midway between the source and the market
  - d. All of the above
18. Which of the following is not a relationship based collaborative strategy?
- a. Vertical collaboration
  - b. Horizontal collaboration
  - c. Full collaboration
  - d. Value chain collaboration
19. Which is not one of the support activities according to Porter?
- a. Procurement
  - b. Marketing
  - c. Technology development
  - d. HR
20. Gross margin equals
- a. Sales minus COGS
  - b. Sales + taxes minus COGS
  - c. COGS – Sales
  - d. None of the above
21. Sales equals
- a. Profit divided by profit margin
  - b. Cost divided by revenue
  - c. Profit margin minus costs
  - d. Cost minus profit margin

22. Which technique has the most limited ability to determine multiple facility locations?
- a. Simulation
  - b. Linear programming
  - c. The grid technique
  - d. Heuristic programming
23. The grid approach is used to determine a fixed facility location that is the least cost center for moving both raw materials and finished goods within a geographic grid. This least cost center is also referred to as
- a. A zero point
  - b. A source point
  - c. Grid zero
  - d. A center of gravity
24. British Importers, Ltd. buys clothing and food items from British manufacturers for sale to the tourist trade. British Importers started its business in California, but in recent years its market shifted to the East Coast. The company is considering relocation to the East Coast because of the distance to its market and from its suppliers. Which are important locational determinants for British Importers?
- a. Logistics
  - b. Marketing
  - c. Financial
  - d. Operations
25. Which is not a trend in today's logistics environment that may have significant effects on decisions involving logistics facility location?
- a. Cross docking
  - b. Use of third-party suppliers
  - c. Direct, plant-to-customer shipments
  - d. Decentralized facilities



**Certified Master Logistician  
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**MINI EXAM**

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***PART III –  
INTEGRATED CASE STUDY***

### **Performance Control at Happy Chips, Inc.**

Wendell Worthmann, Manager of Logistics Cost Analysis for Happy Chips, Inc., was faced with a difficult task. Harold L. Carter, the new Director of Logistics, had circulated a letter from Happy Chips' only mass merchandise customer, Buy 4 Less, complaining of poor operating performance. Among the problems cited by Buy 4 Less were: (1) frequent stockouts, (2) poor customer service responsiveness, and (3) high prices for Happy Chips' products. The letter suggested that if Happy Chips were to remain a supplier to Buy 4 Less, it would need to eliminate stockouts by: (1) providing direct store delivery four times per week (instead of three), (2) installing an automated order inquiry system to increase customer service responsiveness (\$10,000.00), and (3) decreasing product prices by 5 percent. While the previous director of logistics would most certainly have begun implementing the suggested changes, Harold Carter was different. He requested that Wendell prepare a detailed analysis of Happy Chips' profitability by segment. He also asked that it be prepared on a spreadsheet to permit some basic analysis. This was something that Wendell had never previously attempted, and it was needed first thing in the morning.

#### **Company Background**

Happy Chips, Inc., is the fifth largest potato chip manufacturer in the metropolitan Detroit market. The company was founded in 1922 and following an unsuccessful attempt at national expansion has remained primarily a local operation. The company currently manufactures and distributes one variety of potato chips to three different types of retail accounts: grocery, drug, and mass merchandise. The largest percentage of business is concentrated in the grocery segment, with 36 retail customer locations accounting for 40,000 annual unit sales and more than 50 percent of annual revenue. The drug segment comprised 39 customer locations which account for 18,000 annual unit sales and more than 27 percent of annual revenue. All distribution is store-direct, with delivery drivers handling returns of outdated material and all shelf placement and merchandising.

Recently, Happy Chips has actively sought growth in the mass merchandise segment because of the perceived profit potential. However, while the company is acutely aware of overall business profitability, there has never been an analysis on a customer segment basis.

#### **Performance Statistics**

Wendell recently attended a seminar at a major Midwestern university concerning activity-based costing. He was anxious to apply the techniques he had learned at the seminar to the current situation, but was unsure exactly how to proceed. He did not understand the relationship between activity-based costing and segment profitability analysis, but he knew the first step in either is to identify the relevant costs. Wendell obtained a copy of Happy Chips' most recent income statement (Table 1).

He also knew specific information concerning logistics costs by segment (Table 2).

**TABLE 1** **Income Statement**

Income	
Net Sales	\$150,000.00
Interest and Other Income	<u>3,215.00</u>
	153,615.00
Cost and Expenses	
Cost of Goods Sold	84,000.00
Other Manufacturing Expense	5,660.00
Marketing, Sales and Other Expenses	52,151.20
Interest Expense	<u>2,473.00</u>
	144,284.20
Earnings before Income Taxes	9,330.80
Income Taxes	<u>4,198.86</u>
Net Earnings	<u><u>5,131.94</u></u>

**TABLE 2** **Annual Logistics Costs by Segment**

<b>Cost Category/Segment</b>	<b>Grocery</b>	<b>Drug</b>	<b>Mass Merchandise</b>
Stocking Cost (\$/Delivery)	\$1.80	\$1.20	\$2.80
Information Cost (Annual)	1,000.00	8,000.00	1,000.00
Delivery Cost (\$/Delivery)	5.00	5.00	6.00

All deliveries were store-direct with two deliveries per week to grocery stores, one delivery per week to drug stores and three deliveries per week to mass merchandisers. To obtain feedback concerning store sales, Happy Chips purchased scanner data from grocery and mass merchandise stores at an aggregate annual cost of \$1,000.00 per segment. The drug store segment required use of handheld scanners by delivery personnel to track sales. The cost of delivery to each store was dependent on the type of vehicle used. Standard route trucks were used for drug stores and grocery stores, while extended vehicles were used to accommodate the volume at mass merchandisers.

Trade prices for each unit were different for grocery (\$1.90), drug (\$2.30), and mass merchandise (\$1.50) customers. Wendell was also aware that Buy 4 Less required Happy Chips to cover the suggested retail price with a sticker bearing its reduced price. The machinery required to apply these labels had an annual rental cost of \$5,000.00. Labor and materials cost an additional \$.03 per unit.

## **Conclusion**

As Wendell sat in his office compiling information to complete the segment profitability analysis, he received several unsolicited offers for assistance. Bill Smith, manager marketing, urged him not to bother with the analysis:

*Buy 4 Less is clearly our most important customer. We should immediately implement the suggested changes.*

Steve Brown, director of manufacturing disagreed. He felt the additional manufacturing cost required to meet Buy 4 Less' requirements was too high:

*We should let Buy 4 Less know what we really think about their special requirements. Stickers, of all things! What business do they think we are in?*

The sales force had a different opinion. Jake Williams felt the grocery segment was most important:

*Just look at that volume! How could they be anything but our best customers?*

The broad interest being generated by this assignment worried Wendell. Would he have to justify his recommendations to everyone in the company? Wendell quietly closed his office door.

Based on the available information and his own knowledge of ABC systems, Wendell Worthmann needed to complete a segment profitability analysis and associated spreadsheet before his meeting with Harold in the morning. With all these interruptions, it was going to be a long night.

## **Case Study Questions**

1. Activity Based Costing and Segment Profitability Analysis are complementary tools used in operations planning.
  - a. True
  - b. False
  
2. The Grocery Segment has a profit level of
  - a. \$76,000.00
  - b. \$7,540.00
  - c. \$34,000.00
  - d. \$3,400.00

3. When listed from highest to lowest the segments provide profitability in the following order
  - a. Drug, Mass Merchandise, Grocery
  - b. Grocery, Drug, Mass Merchandise
  - c. Grocery, Mass Merchandising, Drug
  - d. Mass Merchandising, Drug, Grocery
  
4. Changing the labels on the Buy 4 Less deliveries will increase profits in the segment
  - a. True
  - b. False
  
5. Changing to the new labels will change the per unit costs for the Mass Merchandise market by a/an
  - a. Decrease of \$0.03
  - b. Increase of \$1.80
  - c. Decrease of \$1.50
  - d. Increase of \$1.20
  
6. Changing the new labels will require changing the price by
  - a. Increase of 0.5%
  - b. Increase if 10%
  - c. Increase of 20%
  - d. No Change will be required although profits will decrease
  
7. Other potential considerations when making a change in pricing include
  - a. Unprofitable sales promotes sales in other segments
  - b. Refusing to service a customer may have negative impacts on other customers
  - c. There are other solutions to providing logistics services
  - d. All of the above

***CML MINI-EXAM SOLUTION MATRIX***

<b>QUESTION</b>	<b>PART I</b>	<b>PART II</b>	<b>Part III</b>
<b>1</b>	<b>b</b>	<b>b</b>	<b>a</b>
<b>2</b>	<b>a</b>	<b>a</b>	<b>b</b>
<b>3</b>	<b>c</b>	<b>d</b>	<b>b</b>
<b>4</b>	<b>d</b>	<b>a</b>	<b>b</b>
<b>5</b>	<b>d</b>	<b>d</b>	<b>d</b>
<b>6</b>	<b>d</b>	<b>e</b>	<b>c</b>
<b>7</b>	<b>c</b>	<b>d</b>	<b>d</b>
<b>8</b>	<b>b</b>	<b>c</b>	
<b>9</b>	<b>d</b>	<b>a</b>	
<b>10</b>	<b>d</b>	<b>a</b>	
<b>11</b>	<b>d</b>	<b>d</b>	
<b>12</b>	<b>d</b>	<b>a</b>	
<b>13</b>	<b>d</b>	<b>a</b>	
<b>14</b>	<b>d</b>	<b>d</b>	
<b>15</b>	<b>a</b>	<b>b</b>	
<b>16</b>	<b>d</b>	<b>a</b>	
<b>17</b>	<b>a</b>	<b>a</b>	
<b>18</b>	<b>c</b>	<b>d</b>	
<b>19</b>	<b>a</b>	<b>b</b>	
<b>20</b>	<b>a</b>	<b>a</b>	
<b>21</b>	<b>c</b>	<b>a</b>	
<b>22</b>	<b>c</b>	<b>c</b>	
<b>23</b>	<b>c</b>	<b>d</b>	
<b>24</b>	<b>b</b>	<b>a</b>	
<b>25</b>	<b>c</b>	<b>d</b>	

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Bibliography**

When addressing the subject of *logistics chain management*, one should become familiar not only with the available literature in this field, but with some of the subject areas that are closely aligned with the area of logistics chain management. "Logistics," by nature, is highly *interdisciplinary* and acquiring knowledge in related areas is essential if one is to progress and successfully accomplish the objectives specified herein. With this in mind, this bibliography has been developed to cover selected references in each of the following areas:

- G.1. Logistics, Supply Chain Management and Supportability.
- G.2. Systems, Systems Analysis, and Systems Engineering.
- G.3. Human Factors and Safety Engineering.
- G.4. Production, Manufacturing, Quality Control and Assurance.
- G.5. Operations Research and Operations Management.
- G.6. Engineering Economy and Life-Cycle Cost Analysis.
- G.7. Management and Supporting Areas.

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**G.1. Logistics, Supply Chain Management and Supportability**

1. Ayers, J.B., *Handbook of Supply Chain Management*, Saint Lucie Press, 2000 (ISBN 1574442732).
2. Ballou, R.H., *Business Logistics Management: Planning, Organizing, and Controlling the Supply Chain*, 4th Ed., Prentice Hall, Upper Saddle River, NJ, 1998 (ISBN 0137956592).
3. Blanchard, B.S., *Logistics Engineering and Management*, 6th Ed., Prentice Hall, Upper Saddle River, NJ, 2004 (ISBN 0-13-142915-9).
4. Bowersox, D.J. and D.J. Closs, *Logistical Management: The Integrated Supply Chain Process*, McGraw Hill, New York, NY, 1996 (ISBN 0070068836).
5. Chopra, S. and P. Meindl, *Supply Chain Management*, 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 2003 (ISBN 013101028X).
6. Council of Supply Chain Management Professionals (CSCMP), *Logistics Comment*, CSCMP Newsletter, 2805 Butterfield Rd., Suite 200, Oak Brook, IL 60523.
7. Council of Supply Chain Management Professionals (CSCMP), *Annual Conference Proceedings*, CSCML, 2805 Butterfield Rd., Suite 200, Oak Brook, IL 60523.
8. Council of Supply Chain Management Professionals (CSCMP), *Journal of Business Logistics*, CSCMP, 805 Butterfield Rd., Suite 200, Oak Brook, IL 60523.

9. Coyle, J.J., E.J. Bardi, and R.A. Novack, *Transportation*, 5th Ed., South-Western Publisher, St. Paul, MN, 2000 (ISBN 0538881801).
10. Coyle, J.J., E.J. Bardi, and C.J. Langley, *The Management of Business Logistics*, 7th Ed., South-Western Publisher, Mason, OH, 2003 (ISBN 032007515).
11. DOD, *Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint*, Department of Defense, Washington DC, 2003.
12. Frazelle, E.H., *Supply Chain Strategy: The Logistics of Supply Chain Management*, McGraw-Hill, New York, NY, 2002 (ISBN 0-07-137599-6).
13. Jones, J.V., *Integrated Logistics Support Handbook*, Special Reprint Ed., McGraw-Hill, New York, NY, 1998 (ISBN 0070331391).
14. Langford, J.W., *Logistics: Principles and Applications*, McGraw-Hill, New York, NY, 1995 (ISBN 007036415X).
15. MIL-HDBK-502, *Department of Defense Handbook on Acquisition Logistics*, Department of Defense, Washington, D.C., 1997.
16. MIL-PRF-49506, Performance Specification, *Logistics Management Information*, Department of Defense, Washington, D.C. (latest edition)..
17. Reliability Analysis Center (RAC), *Supportability Toolkit*, RAC, 201 Mill St., Rome, NY 13440-6916, 2005.
18. Reed Business Information, *Supply Chain Management Review*, Reed Elsevier, Inc., 360 Park Ave. South, New York, NY (bi-monthly publication).
19. SOLE - The International Society of Logistics, *Logistics Spectrum*, Quarterly Journal, SOLE, 8100 Professional Place, Suite 111, Hyattsville, MD 20785-2350 (ISSN 00245852).
20. SOLE-The International Society of Logistics, *SOLEtter*, Bi-Monthly Newsletter, SOLE, 8100 Professional Place, Suite 111, Hyattsville, MD 20785.
21. SOLE-The International Society of Logistics, *Annual Symposium Proceedings*, SOLE, 8100 Professional Place, Suite 111, Hyattsville, MD 20785.
22. U.S. Air Force, *Air Force Journal of Logistics*, Quarterly Journal, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

## **G.2. Systems, Systems Analysis, and Systems Engineering**

1. ANSI/GEIA EIA-632, *Processes for Engineering a System*, Electronic Industries Alliance (EIA), Arlington, VA, September 2003
2. Blanchard, B.S., *System Engineering Management*, 3rd Ed., John Wiley & Sons, Hoboken, NJ, 2004 (ISBN 0471190861).
3. Blanchard, B.S. and W.J. Fabrycky, *Systems Engineering and Analysis*, 3rd Ed., Prentice Hall, Upper Saddle River, NJ, 1998 (ISBN 0131350471).
4. Boyd, D.W., *Systems Analysis and Modeling: A Macro-Micro Approach With Multidisciplinary Applications*, Academic Press, San Diego, CA, 2001 (ISBN 0121218511).
5. Buede, D.M., *The Engineering Design of Systems: Models and Methods*, John Wiley & Sons, Hoboken, NJ, 2000 (ISBN 0-471-28225-1).

6. Collen, A. and W.W Gasparski (Editors), *Design and Systems*, Transaction Publishers, New Brunswick, NJ, 1995 (ISBN 1560001879).
7. DAU, *Systems Engineering Fundamentals*, Defense Acquisition University (DAU) Press, Fort Belvoir, VA 22060-5565, December 2000.
8. Eisner, H., *Essentials of Project and Systems Engineering Management*, 2nd Ed., John Wiley & Sons, Hoboken, NJ, 2002 (ISBN 0471148466).
9. GEIA EIA-731-1, *Systems Engineering Capability Maturity Model (SECM)*, Electronic Industries Alliance (EIA), Arlington, VA, August 2002.
10. GEIA EIA-731-2, *Systems Engineering Capability Model Appraisal Method*, Electronic Industries Alliance (EIA), Arlington, VA, August 2002.
11. Grady, J.O., *System Engineering Deployment*, CRC Press, Boca Raton, FL, 2000 (ISBN 0-8493-7839-7).
12. IEEE 1220-1998, *Standard for Application and Management of the Systems Engineering Process*, Institute of Electrical and Electronics Engineers (IEEE), 345 East 47th St., New York, NY 10017, 1998.
13. IEEE 1233-1998, *IEEE Guide for Developing System Requirements Specifications*, Institute of Electrical and Electronics Engineers (IEEE), 345 East 47th St., New York, NY 10017, 1998 (ISBN 0738103373).
14. INCOSE-The International Council on Systems Engineering, *Systems Engineering*, Quarterly Journal, published by John Wiley & Sons, Hoboken, NJ,
15. INCOSE-The International Council on Systems Engineering, *INSIGHT*, Quarterly Newsletter, INCOSE, 2150 N. 107th St., Suite 205, Seattle, WA 98133-9009.
16. INCOSE-TP-2003-016-02, *Systems Engineering Handbook*, International Council on Systems Engineering (INCOSE), 2150 N. 107th St., Suite 205, Seattle, WA WA 98133-9009, Version 2a, June 2004.
17. ISO/IEC-15288, *Systems Engineering - Systems Life-Cycle Processes*, 2002.
18. ISO/IEC-19760, *A Guide for the Application of ISO/IEC-15288 System Life-Cycle Processes*, 2004.
19. Kossiakoff, A. and W. Sweet, *Systems Engineering: Principles and Practice*, John Wiley & Sons, Hoboken, NJ, 2003 (ISBN 0471234435).
20. Maier, M.W. and E. Rechtin, *The Art of Systems Architecting*, 2nd Ed., CRC Press, Boca Raton, FL, 2000 (ISBN 0849378362).
21. Martin, J.N., *Systems Engineering Guidebook: A Process for Developing Systems and Products*, CRC Press, Boca Raton, FL, 1996 (ISBN 0849378370).
22. Pugh, S., *Total Design: Integrated Methods for Successful Product Engineering*, Addison-Wesley Publishing, Reading, MA, 1991 (ISBN 0-201-41639-5).
23. Sage, A.P., *Systems Engineering*, John Wiley & Sons, Hoboken, NJ, 1992 1992 (ISBN 0471536393).
24. Sage, A.P. and W.B. Rouse (Editors), *Handbook of Systems Engineering and Management*, John Wiley & Sons, Hoboken, NJ, 1999 (ISBN 0471154059).
25. Sage, A.P. and J.E. Armstrong, *Introduction to Systems Engineering*, John Wiley & Sons, Hoboken, NJ, 2000 (ISBN 0-471-02766-9).
26. Sandquist, G.M., *Introduction to System Science*, Prentice Hall, Upper Saddle River, NJ, 1885 (ISBN 013498692X).
27. Young, R.R., *Effective Requirements Practices*, Addison-Wesley Publishing, Reading, MA, 2001 (ISBN 0-201-70912-0).

**G.3. Human Factors and Safety Engineering**

1. Bahr, N.J., *System Safety Engineering and Risk Assessment: A Practical Approach*, Taylor & Francis, New York, NY, 1997 (ISBN 1560324163).
2. Booher, H.R., *Handbook of Human Systems Integration*, Wiley-Interscience, Hoboken, NJ, 2003 (ISBN 0471020532).
3. Chapanis, A., *Human Factors in Systems Engineering*, John Wiley & Sons, Hoboken, NJ, 1996 (ISBN 0-471-13782-0)
4. GEIA HEB 1, *Human Engineering - Principles and Practices*, Government Electronics and Information Technology Association (GEIA), June 2002.
5. Kroemer, K.H.E., H.J. Kroemer, and K.E. Kroemer-Elbert, *Ergonomics*, 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 2001 (ISBN 0137524781).
6. Roland, H.E. and B. Moriarity, *System Safety Engineering and Management*, 2nd Ed., John Wiley & Sons, Hoboken, NJ, 1990 (ISBN 0471618160).
7. Salvendy, G. (Editor), *Handbook of Human Factors and Ergonomics*, 2nd Ed., John Wiley & Sons, Hoboken, NJ, 1997 (ISBN 0471116904).
8. Sanders, M.S. and E.J. McCormick, *Human Factors in Engineering and Design*, 7th Ed., McGraw-Hill, New York, NY, 1993 (ISBN 007054901X).
9. Wickens, C.D., J. Lee, Y.D. Liu, and S. Gordon-Becker, *An Introduction to Human Factors Engineering*, Prentice Hall, Upper Saddle River, NJ, 2003 (ISBN 0131837362).
10. Wickens, C.D., and J.G. Hollands, *Engineering Psychology and Human Performance*, 3rd Ed., Prentice-Hall, Upper Saddle River, NJ, 1999 (ISBN 0321047117).

**G.4. Production, Manufacturing, Quality Control and Assurance**

1. Breyfogle, F.W., J.M. Cupello, and B. Meadows, *Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy that Yields Bottom-Line Success*, John Wiley & Sons, Hoboken, NJ, 2000 (ISBN 0471396737).
2. Cohen, L., *Quality Function Deployment: How to Make QFD Work for You*, Addison-Wesley, Reading, MA, 1995 (ISBN 0201633302).
3. Evans, J.R. and J.W. Dean, *Total Quality Management, Organization, and Strategy*, 3rd Ed., Thomson/South-Western, Mason, OH, 2002 (ISBN 0324178719).
4. Fowlkes, W.Y. and C.M. Creveling, *Engineering Methods for Robust Design: Using Taguchi Methods in Technology and Product*, Addison-Wesley, Reading, MA, 1995 (ISBN 0201633671).
5. Fryman, M., *Quality and Process Improvement*, Delmar Learning Publishers, New York, NY, 2001 (ISBN 0766828727).
6. Gaal, A., *ISO 9001:2000 for Small Business: Implementing Process Approach in Quality Management*, St. Lucie Press, Boca Raton, FL, 2001 (ISBN 1574443070).
7. George, M., D. Rowlands, and W. Kastle, *What is Lean Six Sigma*, McGraw Hill, New York, NY, 2004 (ISBN 0-07-142668-X).

8. Gradel, T.E. and B.R. Allenby, *Industrial Ecology*, 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 2003 (ISBN 0130467138).
9. Juran, J.M. and G.A. Blanton (Editors), *Juran's Quality Control Handbook*, 5th Ed., McGraw-Hill, New York, NY, 1999 (ISBN 007034003X).
10. Hoyle, D., *ISO 9000 Quality Systems Development Handbook: A Systems Engineering Approach*, Butterworth-Heinemann, New York, NY, 1998 (ISBN 0750625627).
11. ISO 9000, *Quality Management Systems - Fundamentals and Vocabulary*, International Organization for Standards (ISO), December 2000.
12. ISO 9001, *Quality Management Systems - Requirements*, International Organization for Standards (ISO), December 2000.
13. ISO 9004, *Quality Management Systems - Guidelines for Performance Improvements*, International Organization for Standards (ISO), December 2000.
14. ISO 14001, *Environmental Management Systems -- Specific Guidance for Use*, International Organization for Standards (ISO), September 1996.
15. *Journal of Industrial Ecology*, published by the International Society for Industrial Ecology (ISIE), MIT Press, Cambridge, MA (ISSN 1088-1980).
16. Lowenthal, J.N., *Six Sigma Project Management: A Pocket Guide*, ASQ Quality Press, Milwaukee, WI, 2001 (ISBN 0873895193).
17. Madu, C.N. (Ed.), *Handbook of Environmentally Conscious Manufacturing*, Kluwer Academic Publishers, New York, NY, 2001 (ISBN 0792384490).
18. McMahon, C. and J. Browne, *CADCAM: Principles, Practice and Manufacturing Management*, 2nd Ed., Addison-Wesley, Reading, MA, 1998 (ISBN 0201178192).
19. Montgomery, D.C., *Introduction to Statistical Quality Control*, 5th Ed., John Wiley & Sons, Hoboken, NJ, 2005.
20. Moody, J.A., W.L. Chapman, F.D. Van Voorhees, and A.T. Bahill, *Metrics and Case Studies for Evaluating Engineering Designs*, Prentice Hall, Upper Saddle River, NJ, 1997 (ISBN 0137398719).
21. Reliability Analysis Center (RAC), *Quality Toolkit*, RAC, 201 Mill St, Rome, NY 13440-6916 (ISBN 0-9712853-7-3)
22. Revelle, J.B., J.W. Moran, and C. Cox, *The QFD Handbook*, John Wiley & Sons, Hoboken, NJ, 1997 (ISBN 0471173819).
23. Revelle, J.B., *Manufacturing Handbook of Best Practices: An Innovation, Productivity, and Quality Focus*, St. Lucie Press, Boca Raton, FL, 2001 (ISBN 1574443003).
24. Roy, R.K., *Design of Experiments Using the Taguchi Approach: 16 Steps to Product and Process Improvement*, John Wiley & Sons, Hoboken, NJ, 2001 (ISBN 0471361011).
25. Smith, G.M., *Statistical Process Control and Quality Improvement*, 4th Ed., Prentice Hall, Upper Saddle River, NJ, 2001 (ISBN 0130255637).
26. Swamidass, P.M. (Ed.), *Innovations in Competitive Manufacturing*, American Management Association (AMACOM), Boston, MA, 2002 (ISBN 0-7923-7896-2).

**G.5. Operations Research and Operations Management**

1. Fabrycky, W.J., P.M. Ghare, and P.E. Torgersen, *Applied Operations Research and Management Science*, Prentice Hall, Upper Saddle River, NJ, 1984 (ISBN 013041459X).
2. Hall, R.W., *Queuing Methods for Service and Manufacturing*, Prentice Hall, Upper Saddle River, NJ, 2001.
3. Hillier, F.S. and G.J. Lieberman, *Introduction to Operations Research*, 6th Ed., McGraw-Hill, New York, NY, 1995 (ISBN 0078414474).
4. Krajewski, L.J. and L.P. Ritzman, *Operations Management: Strategy and Analysis*, 5th Ed., Addison-Wesley, Reading, MA, 1998 (ISBN 0201331187).
5. Peck, L.G. and R.N. Hazelwood, *Finite Queuing Tables*, John Wiley & Sons, Hoboken, NJ, 1958.
6. Russell, R.S. and B.W. Taylor, *Operations Management*, 4th Ed., Prentice Hall, Upper Saddle River, NJ, 2002 (ISBN 0130348341).
7. Stevenson, W.J., *Operations Management*, 8th Ed., McGraw-Hill, Boston, MA, 2005 (ISBN 0 072869089).
8. Taha, H.A., *Operations Research: An Introduction*, 6th Ed., Prentice Hall, Upper Saddle River, NJ, 1996 (ISBN 0132729156).

**G.6. Engineering Economy and Life-Cycle Cost Analysis**

1. Blank, L. and A. Tarquin, *Engineering Economy*, 5th Ed., McGraw-Hill, New York, NY, 2002 (ISBN 0-07-243234-9)
2. Canada, J.R., W.G. Sullivan, and J.A. White, *Capital Investment Analysis for Engineering and Management*, 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 1996 (ISBN 0133110362).
3. Fabrycky, W.J., G.J. Thuesen, and D. Verma, *Economic Decision Analysis*, Prentice Hall, Upper Saddle River, NJ, 1998 (ISBN 0133702499).
4. Fisher, G.H., *Cost Considerations in Systems Analysis*, American Elsevier Publishing Co., New York, NY, 1971 (ISBN 0444000879).
5. Hicks, D.T., *Activity-Based Costing: Making it Work for Small and Mid-Sized Companies*, 2nd Ed., John Wiley & Sons, Hoboken, NJ, 1998 (ISBN 0471249599).
6. Thuesen G.J. and W.J. Fabrycky, *Engineering Economy*, 9th Ed., Prentice Hall, Upper Saddle River, NJ, 2001 (ISBN 0-13-028128-X).

**G.7. Management and Supporting Areas**

1. ANSI/GEIA EIA 649-A, *National Consensus Standard for Configuration Management*, Electronic Industries Alliance (EIA), Arlington, VA April 2004.
2. Camp, R.C., *Business Process Benchmarking: Finding and Implementing Best Practices*, Quality Resources, Milwaukee, WI, 1995 (ISBN 0873892968).
3. Chapman, C. and S. Ward, *Project Risk Management: Processes, Techniques, and Insights*, John Wiley & Sons, Hoboken, NJ, 2003 (ISBN 0470853557).

4. Cleland, D.I., *Project Management: Strategic Design and Implementation*, 3rd Ed., McGraw-Hill, New York, NY, 1998 (ISBN 007012020X).
5. Corbitt, R.A., *Standard Handbook of Environmental Engineering*, McGraw-Hill, New York, NY, 1999 (ISBN 0-07-013160-0).
6. DOD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs*, Office of the Secretary of Defense, The Pentagon, Washington, DC 20301, April 5, 2002.
7. Defense Acquisition University (DAU), *Program Manager*, published bi-monthly, DAU Press, Fort Belvoir, VA 22060-5565 (ISSN 0199-7114).
8. Gibson, J.L., J.H. Donnelly, J.M. Ivancevich, and R. Konopaske, *Organizations: Behavior, Structure, and Processes*, McGraw-Hill/Irwin, New York, NY, 2003 (ISBN 0-07-252409-X).
9. Gordon, J.R. and S.R. Gordon, *Information Systems: A Management Approach*, 2nd Ed., Dryden Press, New York, NY, 1998 (ISBN 0030224691).
10. Haimes, Y.Y., *Risk Modeling, Assessment, and Management*, John Wiley & Sons, Hoboken, NJ, 1998 (ISBN 0-471-24005-2).
11. Hall, E.M., *Managing Risk*, Addison-Wesley Publisher, Reading, MA, 1998 (ISBN 0-201-25592-8).
12. Kerzner, H., *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 7th Ed., John Wiley & Sons, Hoboken, NJ, 2000 (ISBN 0471288357).
13. Lewis, J.P., *Fundamentals of Project Management*, 2nd Ed., AMACOM, New York, NY, 2002 (ISBN 0814478352).
14. Magrab, E.B., *Integrated Product and Process Design and Development: The Product Realization Process*, CRC Press, Boca Raton, FL, 1997 (ISBN 0849384834).