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EXAM CONTENT MANUAL

CPIM

CERTIFIED IN PLANNING AND INVENTORY MANAGEMENT

APICS

ASCM ASSOCIATION FOR SUPPLY CHAIN MANAGEMENT

APICS Certified in Planning and Inventory Management (CPIM®) Exam Content Manual

Version 8.0

ASCM staff has taken care to ensure that the contents of this exam content manual are accurate and up to date at the time of publication. However, any corrections can be found on the ASCM website at ascm.org/ecmerrata.

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©2022 APICS, Inc.

8430 West Bryn Mawr Avenue
Suite 1000
Chicago, IL 60631-3439 USA
Phone: 1-800-444-2742 or +1-773-867-1777
Fax: +1-773-639-3000

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Acknowledgments

ASCM would like to extend our gratitude to the following subject matter experts for their voluntary contributions, time commitment, expertise, and passion to the continued development of the CPIM program.

Certification Committee Chair

- William Leedale, CPIM-F, CIRM, CSCP, CLTD

CPIM Part 1 Exam Subcommittee Members

- Tricia Kerns, EdD, MBA, LSSBB, CPIM, CLTD (Chair)
- Staffan Cederstrand, CPIM
- Lawrence Ettkin, Ph.D., CPIM-F
- Lori Jones, CPIM
- Julius Oni, CPIM
- Eric Schaudt, CPIM-F, CSCP, SCOR-P, CLTD, GLA
- William Thurston, CPIM-F, CIRM, CSCP-F, PMP

CPIM Part 2 Exam Subcommittee Members

- Andrea Prud'homme, Ph.D., CPIM-F, CIRM, CSCP, CLTD (Chair)
- Lu Li, CPIM
- Murray Olsen, CPIM-F, CIRM, CQA, CMQ/OE, CSSGB
- Robert Pinchot, CPIM, CSCP
- Jaap Stumphius, CPIM-F, CSCP, CLTD
- Sam Terzich, CPIM
- Rosemary Van Treeck, CPIM, CIRM, CSCP
- Thorsten Zedel, CPIM

CPIM JTA Task Force Members

- Jessica Crawford, CPIM
- Oswaldo D'Andrea Neto
- Melissa de Souza Rosa Nogueira
- Jeffrey Dilorenzo, CPIM, CSCP
- Mathurin Django, CSCP, PMP
- Eva Mata, CPIM, CSCP, CLTD, DDLP
- Robert L Rice
- Michael Snyder, CPIM-F, CIRM, CSCP-F, CLTD
- Marina Witwer

We would also like to thank the ASCM Corporate Members for their support in the advancement and education of supply chain and operations management.

ASCM relies on the support of volunteers to maintain the quality and prestige of the APICS certification programs.

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Table of Contents

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Letter to Candidates

Dear Candidate:

Thank you for choosing the Certified in Planning and Inventory Management (CPIM) program to assist you in your career development and continuing education in supply chain management.

For almost 50 years, the CPIM program has been recognized as the international standard for individual assessment in the field of supply chain management as it relates to the transformation of products and services. However, CPIM is an ever-evolving body of knowledge. While many of the topics remain the same, there are several new topics that have come into the body of knowledge in recent years including some planning methods for differing products and services. Although there is no single "one-size-fits-all" planning method for all products and services, we believe that the CPIM program's comprehensive content and expansive body of knowledge will help you discover the best approaches for each unique environment.

Since CPIM was implemented by APICS in 1973, it has continued to provide a standard for individuals to evaluate their knowledge of this ever-evolving field. APICS has administered more than 1 million exams in over 100 countries, and more than 115,000 professionals have earned the APICS CPIM designation.

The mission of the CPIM program is to be the premier professional certification for supply chain and operations management. The CPIM exam is designed to test individuals in the various concepts, methodologies, terminology, and integration of topics within the supply chain and operations functions. ASCM has worked to ensure that CPIM exams are consistently reliable and that the highest professional standards are used to develop and administer the program. ASCM and the CPIM Exam Subcommittee strive to ensure you have a credential that is valuable to you both now and in the future.

Because organizations operate in a changing and challenging international supply chain environment, the ASCM body of knowledge continues to grow and include recognized concepts and tools for improved organizational competitiveness and effectiveness. The CPIM Exam Content Manual (ECM) is regularly updated to reflect changes in the body of knowledge by surveying the industry to validate how the industry is evolving to meet the rigorous needs of today's supply chain professionals and assist candidates in their understanding of the scope of how their jobs fit into their company's operations management. It is interesting to note that the supply chain industry is getting a lot of attention in mainstream media. It is now becoming obvious that a well-designed supply chain offers some resilience and a poorly designed one can cripple an organization, if not the economy, at a macro level.

The APICS CPIM program utilizes one exam where we see these concepts in action and how these affect the firm's ability to compete in the marketplace and how it can help or hurt national and international economies.

The following is a summary of the APICS CPIM exam:

CPIM combines key concepts from the field of operations management. It details eight domains of operations management. These include: align the supply chain to support the business strategy, conduct sales and operations planning to support strategy, plan and manage demand, plan and manage supply, and plan and manage one of the largest components of working capital for any company: inventory. To this we add: plan, manage, and execute detailed schedules; plan and manage distribution; and manage quality, continuous improvement, and technology.

APICS CPIM is an outstanding educational program that will continue to evolve, incorporating relevant and current concepts and techniques into the body of knowledge.

We wish you success in your pursuit of CPIM certification.

William R. Leedale, CPIM-F, CIRM, CSCP, CLTD
Certification Committee Chair

Introduction

This exam content manual (ECM) provides guidance for individuals preparing for the CPIM certification examination. The objective of this manual is to outline the APICS CPIM body of knowledge.

The CPIM body of knowledge section of this manual begins with a statement on the scope of the subject matter, followed by a descriptive outline of the content. Key terminology and a bibliography of suggested references are also provided. The exam overview concludes with sample questions similar to those that appear on the examination along with the correct answers for the sample questions and brief explanations as to why they are correct.

The recommended procedure for mastering the subject matter is to:

- review the content outline, which defines the scope of the material, and
- study each topic area using the suggested references.

At the end of each major section of the content outline is a list of the references that apply to the topics in that section. The first number indicates the sequence number for the reference in the Bibliography section, and the numbers in parentheses indicate the relevant chapter(s) within that reference.

Candidates should understand the definitions of the key terminology and the application of the outlined tools, processes, and techniques.

Sufficient references are given for each topic area that provides different approaches to material covered in each exam and different styles of presenting it. Reading periodicals including SCM Now Impact, the ASCM Insights blog, and ASCM research reports, as well as listening to podcasts, such as ASCM's The Rebound, will help you keep up-to-date about industry trends.

About the APICS CPIM Examination

The APICS CPIM exam consists of 150 questions, of which 20 are pre-test questions that do not contribute to the total score but are used for statistical purposes only. Pre-test questions are continuously introduced and evaluated statistically, as part of an industry best practice for certification program exam development. Pre-test questions appear similar to the scored questions and are randomly distributed throughout the exam. Candidates should answer all exam questions. There is a 3 ½ hour time limit for the exam.

For more information regarding testing and registration policies and procedures, please visit ascm.org/CPIM and the APICS Exam Handbook.

Question Format

The questions on the CPIM exam are intended to test a candidate's understanding of the CPIM body of knowledge. The questions frequently require the candidate to select the best of four choices or complete a calculation based on the information given. They may also ask the candidate to illustrate their understanding of a concept, process, or procedure. These questions may require the examinee to make finer or more in-depth distinctions than the exercises or items presented in a course. It is helpful to understand the various formats of questions on the examination. Practice questions can be found in the Sample Questions section of this ECM.

Taking the Test

The test is designed to evaluate a candidate's knowledge of the subject matter. Therefore, the key to success is a thorough understanding of the subject matter. All questions are based on the current CPIM body of knowledge as represented by the exam content manual.

When you begin the exam, read the directions carefully. Be sure you understand the directions

before you begin to answer any questions. Read each question carefully and thoroughly. If a question includes a table or graph, be sure to study it before answering the question. Avoid assuming that information is not provided, assuming that you know what is being asked without reading the question completely, or "second-guessing" the question. Every effort has been made to avoid misleading wording and to provide sufficient information for each question.

Choose the best answer from the choices given. Care has also been taken to avoid misleading choices. Do not look for hidden tricks or exceptions to the norm. For each multiple-choice question, one and only one of the answer choices represents the correct answer.

Once you begin the test, approach the questions in order, but do not spend too much time on those that are unfamiliar or seem difficult to you. Go on to the other questions and return later to the ones that are difficult for you. If you have some knowledge about a particular question, you may be able to eliminate one or more choices as incorrect. Your score on the test will be based on the number of questions you answer correctly with no penalty for incorrect answers; therefore, it is to your advantage to guess rather than not answer a question. Avoid changing an answer unless you are absolutely certain that you marked the wrong answer.

Interpreting Test Scores

Scoring is based on your correct responses. There is no penalty for incorrect answers. The omission of an answer will be counted the same as an incorrect answer.

The CPIM exam scaled score range is 200 – 350.

200–299: Fail

300–350: Pass

The minimum passing score is 300. Candidates will receive a final exam score along with diagnostic information by topic area on their performance. All APICS exams use this scale for communicating scores to candidates. Using a scale is a testing industry best practice and allows scores to be represented consistently across different forms or versions of the same exam. This accounts for variances in difficulty across different exam forms and ensures fairness and accurate reporting to candidates. For more information on Scaled Scoring, please see the following document.

Studying for the APICS CPIM Exam

APICS offers several resources to help individuals prepare for the APICS CPIM exam.

APICS CPIM References

CPIM Content Outline. The CPIM content outline provided in this ECM should be considered a primary resource for exam preparation. It provides an overview of the major topics included in the exam, as well as a list of the concepts relevant to that topic.

Bibliography. The APICS CPIM Examination Subcommittee have identified a number of references for the APICS CPIM exam. These references are used by both the exam subcommittee and the CPIM Courseware Subcommittee in the development of exam questions and preparation materials. These are listed in the Bibliography section of this manual. All of the references contain excellent material that will assist in understanding the body of knowledge and preparing for the test. For additional information on the APICS CPIM references, visit the CPIM Exam References page on the ASCM website.

A candidate may discover that the material covered in the chapters of one reference duplicates material covered in another reference. Both sources are included as references to allow candidates some discretion in selecting test preparation materials that they find most accessible and understandable.

In deciding if a single reference is sufficient, candidates should assess their own level of knowledge against both the descriptive exam specifications and the detailed topic list in the content outline. If there are any areas of weakness, the candidate should consult other references as part of the test preparation process.

APICS Dictionary. The *APICS Dictionary* is an essential reference to the exam content manual and APICS exams. Within the profession, terminology varies among industries, companies, and the academic community. The exam uses standard terminology as defined in the *APICS Dictionary.* Recognizing the terms and understanding their definitions are essential.

Terminology

In studying for the APICS CPIM certification exam, candidates may discover multiple terms used to denote the same technique. Examples of this include "sales and operations planning (S&OP)" versus "production planning" and "master production schedule (MPS)" versus "master schedule." ASCM and the certification exam subcommittees have worked to provide consistency with preferred terminology. However, synonyms are often used by authors in the various references used to compile the body of knowledge. Candidates are encouraged to be familiar with all terms and concepts listed within the Content Outline and Key Terminology sections of this manual, using the *APICS Dictionary* as the primary guide for definitions.

Additional Resources for APICS CPIM Candidates

In addition to the cited references, it may be helpful for you to pursue chapter-sponsored courses, college courses, ASCM workshops, self-study courses, or courses offered by the ASCM network of international partners as a means of learning the body of knowledge tested in the certification program. A wide variety of courses and materials are available. As with any investment, you should research various learning options before choosing one.

APICS CPIM Learning System

The APICS CPIM Learning System is a comprehensive professional development and certification preparation program. This self-directed program combines print material and online interactive tools. This system is also offered in instructor-led formats.

The APICS CPIM Learning System does not "teach the tests" and in many areas *reviews* concepts but does not teach concepts. The APICS CPIM Learning System provides a thorough review of the subject matter, but it should not be used without the most current APICS CPIM Exam Content Manual (ECM) as a means to direct the candidate's study. There will likely be some content in the APICS CPIM Learning System not covered by the exam; conversely, there will likely be some content in the exam not covered by the learning system. No CPIM exam questions are derived from the learning system. Thus, it is essential for candidates to use the current ECM in their studies.

APICS CPIM Instructor-Led Review Courses and Educational Programs

The instructor-led format combines the APICS CPIM Learning System's print and online components with the leadership of a qualified instructor; peer collaboration; networking; and a structured, set schedule to keep participants on track. Learn more about APICS recognized instructors at apics.org/recognizedinstructors or find local ASCM partners that provide APICS CPIM courses at ascm.org/learning-opportunities.

ASCM also offers a variety of educational programs. For a complete list of learning opportunities and resources, please visit ascm.org.

Job Task Analysis

The subject matter in the CPIM exam content outline is created and validated by means of a job task analysis (JTA) study. A JTA is a process of creating a survey to analyze which tasks within a specific role are most important. They are used in the credentialing industry to create and validate certification programs and their content by ensuring that the respective bodies of knowledge are applicable and up to date with current industry standards and trends.

In following testing industry standards and best practices, ASCM regularly conducts a JTA for each of its certifications. For the CPIM program, this process involves bringing together a task force of industry-specific professionals that represent a diverse skill set in inventory management, demand planning, materials management, master planning, and sales and operations planning (S&OP). These professionals, under the guidance of a third-party psychometrician, work to identify the knowledge, skills, and tasks deemed important in the practice of planning and inventory management. These inputs are then used to create a survey that is distributed to supply chain professionals globally to validate the content identified by the task force. The results of this industry-wide survey are then analyzed by the task force, resulting in a recommendation to the CPIM Exam Subcommittee for content updates.

The JTA process is vital to all high-stakes certifications as it validates the existing body of knowledge and identifies new topic areas and content that is at the cutting edge of the industry. The last JTA update for the CPIM program took place in 2019. This update was based on the results of a survey that was responded to by over 2,600 industry professionals, representing a diverse mix of job functions, industries, organization sizes, work experience, and countries of residence.

Exam Content versus Courseware

Certification has a very different purpose than education. It is to determine whether a candidate meets a minimum set of requirements in relation to a body of knowledge. Certification exams test an individual's knowledge and ability to apply that knowledge to specific situations. Exam questions frequently require the candidate to select the best of the four choices or complete a calculation based on the information given. They may also ask the candidate to illustrate their understanding of a concept, process, or procedure. While some exam questions may simply ask the candidate to demonstrate their recollection of knowledge from the content outline, they will more often require the candidate to apply the body of knowledge by evaluating and/or analyzing a scenario and determining the best solution. These questions will frequently require the candidate to make finer distinctions than the exercises or items presented in a review course.

ASCM uses a rigorous process for creating its certification exams and courseware. Exams and courseware study materials are developed separately to maintain the integrity of the exam process.

APICS exam subcommittees define the contents of the exam content manual (ECM), which determines the areas that will be tested in APICS certification exams. The ECM defines the body of knowledge that can be tested, and every exam question is linked to the ECM content. The APICS exam subcommittees also select the references that will be used for exam development. Additionally, the exam subcommittees work with ASCM staff in the creation and maintenance of exam forms.

A separate courseware subcommittee, in conjunction with a courseware task force, ASCM staff, and a third-party vendor, create the learning systems using the ECM and recommended references.

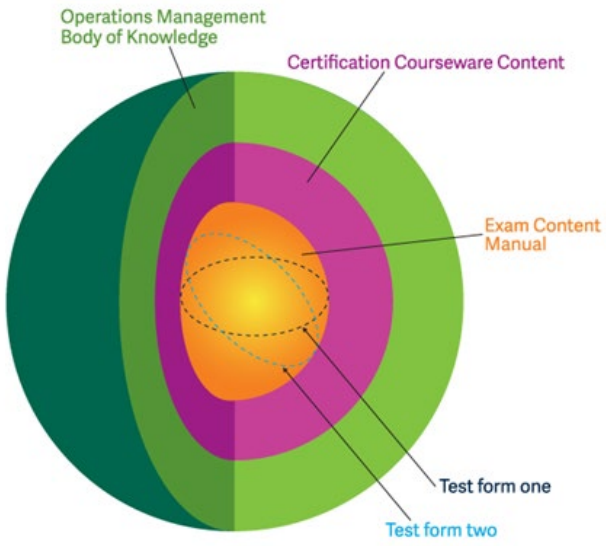
Courseware developers and/or instructors may believe that additional material needs to be taught or included to ensure understanding of the body of knowledge. They also may decide that a concept or term is adequately covered by the definitions in the *APICS Dictionary* or content outlines and not cover it in the course. These differences sometimes lead candidates to perceive a disconnect between the courseware and the exam when, in fact, they are both covering the same body of knowledge.

Question and answer sets for APICS exams are written by exam subcommittee members and other volunteers who are subject matter experts and who have earned APICS certifications. The exam subcommittees must identify the specific entry in the ECM that is being tested and one or more of the references listed in the ECM that support the correct answer. All exam questions and answers are reviewed and typically revised by APICS exam subcommittee members. Exam subcommittees, ASCM Test Development staff, and a third-party exam development contractor all review the potential test questions for correctness of form, spelling, and grammar.

A potential test question will be reviewed multiple times before it actually appears on an exam. Potential test questions initially appear on exams in what is referred to as pre-test status in order to collect statistics on the questions. It is not until a question is deemed to be statistically valid that it will appear as a scored question on an exam and count towards a test-taker's exam score and result.

Because each test form has a limited number of questions, it samples representative areas of the body of knowledge as defined by the ECM. While each test form is different, all areas tested are contained within the body of knowledge as defined by the ECM.

The following graphic is representative of the relationship between the Operations Management Body of Knowledge (OMBOK), courseware / learning systems, ECMs, and different exam forms.



APICS CPIM Certification Maintenance: Continuing Professional Development

To promote professional growth and lifelong learning, ASCM requires certification maintenance every five years with the first five-year cycle beginning on the date the certification is earned.

CPIM-certified individuals are required to collect 75 certification maintenance points (or 100 points for CPIM Fellows) in these five-year intervals to keep their certification active for an additional five years. If they do not submit their maintenance points via the APICS certification maintenance application by the maintenance due date, their certification will be placed into suspended status. The individual will then have 90-days to submit their maintenance application. If an individual does not maintain their certification, they will lose their certification and will be required to retake and pass all necessary exams again.

The Importance of Certification Maintenance

Maintaining your APICS CPIM certification demonstrates one's commitment to achieving the highest level of professional development and standards of excellence.

The APICS CPIM certification maintenance program upholds both the objectives of the APICS CPIM program and the ASCM vision to promote lifelong learning. This flexible program recognizes that individuals are at various levels in their careers, come from many industries, have different educational needs and career goals, and have varying access to continuing education. Thus, requirements for maintaining certification can be met through multiple sources and a variety of professional development activities. These sources and activities are intended to help prepare for the challenges ahead and maintain a professional edge by:

- preserving the currency of hard-earned certification credentials,
- expanding your knowledge of the latest industry practices,
- exploring new technology solutions
- reinforcing skills,
- improving job performance,
- demonstrating commitment to excellence, and
- increasing competitive advantage.

In order to ensure that CPIM-certified individuals remain up to date on industry trends and are committed to continued professional growth, certification maintenance is required for their certification to remain active.

For complete details on how to maintain your APICS CPIM designation, please visit ascm.org/maintenance.

APICS Certified in Planning and Inventory Management Fellow (CPIM-F)

The distinguishing characteristic of a Certified in Planning and Inventory Management Fellow (CPIM-F) is the willingness to share acquired knowledge with others through presenting, teaching, publishing, and participating in ASCM volunteer activities. This knowledge sharing must take place above and beyond a candidate's normal job duties and be directly related to the APICS body of knowledge.
An active CPIM certification is required to be eligible for CPIM-F status. To obtain the APICS CPIM-F designation, an application form must be completed and submitted online with the sufficient number of points via the APICS Fellow application. Points are awarded based on the following criteria: APICS certifications earned (with additional points for fellow-level exam scoring of 320 or greater on an APICS certification exam), presentations, published works, classroom instruction, and non-paid ASCM volunteer activities.

To apply for the CPIM-F certification, please visit ascm.org/fellow.

ASCM Code of Ethics

When you begin the exam registration process, you will be asked to pledge to abide by the ASCM Code of Ethics. Once certified, you pledge to continue your education to increase your contribution to the supply chain management profession. After achieving the APICS CPIM designation, you pledge also to share your knowledge with others by participating in ASCM research and educational activities at local, district, national, and international levels.

The ASCM Code of Ethics is as follows:

- Maintain exemplary standards of professional conduct;
- Do not misrepresent your qualifications, experience, or education to ASCM or others you serve in a professional capacity;
- Respect and do not violate the United States Copyright of all ASCM materials, including but not limited to courseware; magazine articles and other ASCM publications; APICS conference presentations; and CPIM, CSCP, CLTD, and SCOR-P examination resources. In this same spirit, you must not violate the copyright of other organizations and individuals in your professional capacity;
- Do not engage in or sanction any exploitation of one's membership, company, or profession;
- Encourage and cooperate in the interchange of knowledge and techniques for the mutual benefit of the profession;
- In your professional capacity, respect the fundamental rights and dignity of all individuals. You must demonstrate sensitivity to cultural, individual, and role differences, including those due to age, gender, race, ethnicity, national origin, religion, sexual orientation, disability, language, and socio-economic status;
- In your professional capacity, do not engage in behavior that is harassing or demeaning to others based on factors, including but not limited to age, gender, race, ethnicity, national origin, religion, sexual orientation, disability, language, or socio-economic status;
- Adhere to this Code of Conduct and its application to your professional work. Lack of awareness or misunderstanding of an ethical standard is not itself a defense to a charge of unethical conduct;
- Contact the Ethics Committee when uncertain whether a particular situation or course of action violates the Code of Conduct; and
- Do not become the subject of public disrepute, contempt, or scandal that affects your image or goodwill.

Failure to abide by the ASCM Code of Ethics may result in sanctions up to and including decertification.

Bibliography and References for CPIM

All test candidates should familiarize themselves with the following references for the CPIM exam. The recommended references pertaining to the content area are listed at the end of each section of the content outline. The references listed below can also be found online on the CPIM Exam References page. A complimentary digital copy of the *APICS Dictionary* is available to ASCM members on the online ASCM Member Benefits page. It can also be accessed on the Courses & Downloads section of members' My Account page.

	References	Author(s)
1	*APICS Dictionary, 16th ed., 2019*	APICS
2	*Accelerate: Building Strategic Agility for a Faster-Moving World, 2014*	Kotter, John P.
3	*Crafting & Executing Strategy: The Quest for Competitive Advantage: Concepts and Cases, 22nd ed., 2019*	Thompson, Arthur A., Margaret A. Peteraf, John E. Gamble, and A. J. Strickland III
4	*Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies, 3rd ed., 2008*	Simchi-Levi, David, Philip Kaminsky, and Edith Simchi-Levi
5	*Distribution Planning and Control: Managing in the Era of Supply Chain Management, 3rd ed., 2015*	Ross, David Frederick
6	*GRI Standards*	Global Reporting Initiative
7	*Introduction to Materials Management, 8th ed., 2017*	Chapman, Stephen N., J. R. Tony Arnold, Ann K. Gatewood, and Lloyd M. Clive
8	*Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System, 3rd ed., 2015*	Dennis, Pascal
9	*Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental and Economic Impacts, 2nd ed., 2014*	Epstein, Marc J., and Adriana Rejc Buhovac
10	*Managing Quality: Integrating the Supply Chain, 6th ed., 2017*	Foster, S. Thomas
11	*Manufacturing Planning and Control for Supply Chain Management, The CPIM Reference, 2nd ed., 2018*	Jacobs, F. Robert, William L. Berry, D. Clay Whybark, and Thomas E. Vollmann
12	*Operations Strategy, 5th ed., 2017*	Slack, Nigel, and Michael Lewis
13	*Technology in Supply Chain Management and Logistics: Current Practice and Future Applications, 2019*	Pagano, Anthony M., and Matthew Liotine
14	*United Nations Global Compact: Guide to Corporate Sustainability, 2015*	UN Global Compact
15	*United Nations Global Compact Management Model: Framework for Implementation, 2010*	Deloitte Touche Tohmatsu

Note: At the end of each major section in the CPIM content outline is a list of the references that apply to the topics within that section. The first number indicates the sequence number for the references designated in each subject area within the content outline. For example, "7 (chapters 4, 8, 11, 14, 16)" refers to the reference, *Introduction to Materials Management, 8th edition, 2017*, and chapters 4, 8, 11, 14, and 16 of that reference contain content relevant to that subject matter.

APICS Certified in Planning and Inventory Management

CPIM Exam Subcommittee

Part 1 Contributors
Tricia Kerns, EdD, MBA, LSSBB, CPIM, CLTD
Governors State University
Staffan Cederstrand, CPIM
Nexter Enterprise Applications AB
Lori Jones, CPIM
Rolls-Royce
Julius Oni, CPIM
De-Havilland Aircraft of Canada
Eric Schaudt, CPIM-F, CSCP, SCOR-P, CLTD, GLA
Northrop Grumman
William S. Thurston, CPIM-F, CIRM, CSCP-F, PMP
Strategic Information Group

Part 2 Contributors
Andrea M. Prud'homme, Ph.D., CPIM-F, CIRM, CSCP, CLTD
The Ohio State University
Lu Li, CPIM
Bang Energy
Robert Pinchot, CPIM, CSCP
DuPont Specialty Products, USA
Jaap Stumphius, CPIM-F, CSCP, CLTD
Telio Nederland
Sam Terzich, CPIM
Myers-Holum, Inc.
Thorsten Zedel, CPIM
Heraeus

Scope of the Subject Matter

Please read the introductory material in this manual for essential information pertaining to the exam. This exam includes eight major subject areas, as described below. The concepts included in these subject areas apply to manufacturing and service organizations.

As mentioned previously, the CPIM version 8.0 subject matter was validated during the 2019 job task analysis (JTA), which was also used to support the previous CPIM version 7.0 Part 1 and Part 2 program. Using this same subject matter validation, the CPIM Part 1 and Part 2 version 7.0 outlines were combined into one comprehensive outline during the 2023 CPIM Reconfiguration. As with the other APICS certifications, the CPIM program now utilizes a one-exam format.

It is important to note that while Part 1 version 7.0 was geared toward assessing foundational CPIM knowledge and basic terminology, Part 2 version 7.0 focused on assessing a candidate's in-depth understanding of these concepts through critical thinking and application of knowledge in real-world scenarios. A foundational understanding of concepts that were previously included in Part 1 version 7.0 is still required, as these concepts have been integrated into the new combined version 8.0 outline and key terms of this exam content manual (ECM).

Although the scope of the CPIM program remains the same, the depth of the knowledge is aligned more closely with the previous Part 2 exam content outline. The CPIM version 8.0 ECM follows the format of the previous Part 2 version 7.0 content outline. One notable difference is that many previous Part 1 and Part 2 key concepts and terminology are now integrated and detailed within the body of the content outline. This change makes the content outline more comprehensive and explicit in expected knowledge, which further emphasizes the program's focus on application- and scenario-based knowledge, rather than basic definitions and terminology memorization. When reviewing the exam content outline, we highly recommend that candidates carefully review topics that are new or unfamiliar, as there is a strong assumption that the candidate has experience and/or knowledge of basic methodologies related to planning and inventory management.

The subject matter is organized into eight main content areas:

Align the Supply Chain to Support the Business Strategy

This section includes principles and techniques to understand the business environment in which an organization operates, to align business and functional strategies, and to make decisions to support competitive advantage in the short and long term. This involves choices about resources, processes, technologies, and facility layouts, including their inherent trade-offs and how these choices may change in support of different product/service life cycle stages. Supporting the long-term sustainability of the organization and adjustment to changing conditions requires monitoring key performance indicators (KPIs) and managing risk.

Conduct Sales and Operations Planning (S&OP) to Support Strategy

This section includes the principles and techniques used to facilitate communication and decision-making among various parts of an organization to support business strategies. This includes the evaluation of supply and demand at an aggregate level and reconciliation of product/service portfolios, demand, supply, and financial plans while considering the trade-offs of available choices.

Plan and Manage Demand

This section includes the principles and techniques used to understand the markets in which an organization chooses to operate, the customer needs and expectations within those markets, and how those needs and expectations align with the organization's resources and business strategies. This involves understanding various sources of demand, generating forecasts using appropriate tools, and systematically monitoring and adjusting to actual demand performance versus expectations.

Plan and Manage Supply

This section includes the principles and techniques used to create, manage, and maintain a master schedule of independent items and the capacity plan required to implement the schedule. These plans are used to create, manage, and maintain the material requirements plan for dependent make and buy items, as well as the final assembly schedule (FAS) to support customer demand. Items that are purchased require the development of external supply sources that may represent a range of supplier relationships and oversight methods. An important part of managing supply is the consideration of trade-offs, material costs, and risk to ensure continuity of supply and support competitive priorities and supply chain strategy. Choices and decisions may vary across a product's or service's life cycle.

Plan and Manage Inventory

This section includes the principles and techniques needed to manage inventory in support of the organization's resource availability, business and functional strategies, and tactical planning. Decisions regarding types, volumes, replenishment methods, and material handling impact inventory investments and availability. Inherent in inventory management is the consideration of trade-offs between service and cost. Included here is the storage and tracking of inventory, as well as processes to manage inventory returns for proper disposition.

Plan, Manage, and Execute Detailed Schedules

This section includes the principles and techniques used to implement the material and capacity plans. This involves understanding and managing workflow in consideration of specific capacity and inventory resources to facilitate the timing and routing through processes, including the adjustment of schedules, queues, and work prioritization to meet demand and service and inventory goals.

Plan and Manage Distribution

This section includes the principles and techniques used to design a distribution network considering the various investment, cost and service trade-offs, and competitive priorities. This section also includes the

creation of distribution plans to support strategic goals, service of customer orders, and both outbound and inbound material flows.

Manage Quality, Continuous Improvement, and Technology

This section includes the principles and techniques used to evaluate products, services, and processes and improve their efficiency, effectiveness, and productivity through the use of a variety of tools that support organizational goals and market expectations. This section also includes the use of appropriate technology tools and the consideration of emerging technologies that support the supply chain processes.

Exam Percentage by Content Area

The following table identifies the eight main content areas of the exam. The relative importance of these topics varies among industries, but the figures show the percentage designated for each content area.

Main Content Area	Percentage of Exam
I. Align the Supply Chain to Support the Business Strategy	15%
II. Conduct Sales and Operations Planning (S&OP) to Support Strategy	9%
III. Plan and Manage Demand	9%
IV. Plan and Manage Supply	16%
V. Plan and Manage Inventory	19%
VI. Plan, Manage, and Execute Detailed Schedules	16%
VII. Plan and Manage Distribution	5%
VIII. Manage Quality, Continuous Improvement, and Technology	11%

Content Outline

The content outline provides an overview of the major content areas assessed on the CPIM exam. Each of the eight main content areas is denoted by a Roman numeral. When possible, specific concepts or processes are listed throughout the outline, typically included in parentheticals preceded by the phrase "examples include." It is important to note that these examples are not exhaustive lists; terms and concepts found on the exam include but are not limited to the examples listed in the outline. Additional concepts or processes may appear on the exam if they fall within the content area; though, they may not be explicitly shown in the "examples include" lists.

At the end of each major section in the CPIM content outline is a list of the references that apply to the topics within that content area. The first number corresponds to the sequence number for the ECM references, as shown in the table within the Bibliography section on page 10. The specific chapter(s) within that particular reference that support content found within the main content area of the outline can be found in the subsequent parentheses. For example, "7 (chapters 4, 8, 11, 14, 16)" refers to the reference, *Introduction to Materials Management, 8th edition, 2017*, and chapters 4, 8, 11, 14, and 16 of that reference contain content relevant to the subject matter within that section of the outline.

I. Align the Supply Chain to Support the Business Strategy

A. Understand the business environment and develop corporate strategy

1. Know and analyze the business environment
   a. Scan the external environment
   b. Perform an industry analysis (examples include: five-force model, industry standards, and benchmarking)
   c. Perform an internal analysis to identify capabilities and core competencies
   d. Perform a value chain analysis to identify and support activities that create customer value
   e. Perform a SWOT analysis
2. Develop and implement corporate and business unit strategies to align

resources and create lasting competitive advantage
   a. Define corporate mission, vision, and values
   b. Establish product and service differentiation and competitive priorities (examples include: availability, cost, quality, delivery, and flexibility)
   c. Determine the firm's order winners and qualifiers
   d. Evaluate key customer segments and incorporate requirements as appropriate for the corporate and business unit strategy
   e. Consider vertical and horizontal integration alternatives

B. Develop, align, and implement functional and operational strategies

1. Determine operations strategy to utilize core competencies and available resources, manage cost, and support company policies, as well as support regulatory and intellectual property guidelines
2. Determine technology choices (examples include: levels of automation, cloud, and agile) to improve efficiency, costs, and organizational capabilities
3. Perform make-buy analysis to assess costs, capacity availability, quality, and other considerations
4. Establish chase, level, hybrid, and subcontracting production strategies
5. Establish lead and lag capacity strategies
6. Support marketing strategies (Four Ps – product, price, promotion, and place)
7. Determine the push-pull boundary and the manufacturing environment to align with strategy (examples include: make-to-stock (MTS), assemble-to-order (ATO) / configure-to-order (CTO), make-to-order (MTO), engineer-to-order (ETO), and remanufacturing)
8. Align the facilities strategy with manufacturing/service strategies

C. Design processes and layouts to align with strategic goals

1. Examine the trade-offs of process choices within the product-process matrix (examples include: project, fixed-position, job shop, batch, mass customization, assembly line, repetitive, intermittent, discrete, and continuous flow)
2. Examine trade-offs within the service decision (examples include: degree of contact, opportunity for sales, and production efficiency)
3. Determine layout to support product and service design decisions (examples include: fixed position, process/functional layout, cellular/product focus, and assembly line)
4. Align process choices and layouts with product/service life cycles

D. Define and monitor key performance indicators (KPIs) to evaluate performance in relation to the organization's strategic goals

1. Use appropriate financial metrics (examples include: cash-to-cash cycle time, cash conversion cycle, and cash flow)
2. Use appropriate operational metrics (examples include: customer service levels, order fill rate, and stockout percentage)
3. Apply KPI tools (examples include: KPI trees, maturity assessment, SCOR metrics, and balanced scorecard)
4. Review sales and operations planning (S&OP) process effectiveness

E. Identify and manage supply chain risks (examples include: supply disruption, financial, environmental, physical, political, cyber, intellectual property, and branding)

1. Use supply chain mapping and event monitoring for risk identification within

regulatory requirements to support different levels of risk tolerance
2. Assess the probabilities, timing, and impact of potential supply chain failures
3. Perform risk management activities (examples include: risk prevention, mitigation, recovery, pooling, and resiliency)
4. Use appropriate risk management tools and guidance (examples include: failure modes and effects analysis (FMEA) and ISO risk management standards)
5. Comply with security (examples include: physical and cyber) requirements/regulations

F. Manage capital equipment and facilities

1. Review capital budgeting goals and performance
2. Implement total productive maintenance (TPM)
3. Comply with health, safety, and environment requirements/regulations

G. Define and support sustainability goals (environmental, financial, social)

1. Identify impact and implement mitigation plans to support triple bottom line (TBL) and sustainability goals
2. Identify, report, and verify sustainability metrics
3. Review sustainability guidelines (examples include: Global Reporting Initiative (GRI), ISO sustainability standards, and United Nations (UN) Global Compact)
4. Use safety and environmental standards to control and protect the organization and environment

References: 1; 2 (chapters 1-9); 3 (chapters 1-8, 10-12); 4; (chapters 2, 6-8, 10-12); 5 (chapters 1-4, 7, 12); 6; 7 (chapters 1-2, 14, 16); 9 (chapters 1-10); 10 (chapters 3-6, 9); 11 (chapters 1, 3, 7, 14-17); 12 (chapters 1-2, 4-10); 13 (chapters 1-2, 8, 10); 14; 15

Note: *The first number indicates the sequence number for the reference in the bibliography section, and the numbers in parentheses indicate the relevant chapters within that reference.*

II. Conduct Sales and Operations Planning (S&OP) to Support Strategy

A. Understand the role of the S&OP process in the organization

1. Review the role of S&OP in the planning and control hierarchy
2. Understand the impact of different business environments on the S&OP process
3. Evaluate the involvement of various levels of management and their roles in the S&OP process
4. Identify the planning horizon and the appropriate aggregation level
5. Implement the steps of the S&OP process
6. Review the various inputs and outputs of each of the S&OP steps

B. Review aggregate demand plan

1. Review product portfolio, new product introduction (NPI), life cycle stages, and competitive priorities
2. Review demand from all sources (examples include: market, customer base, forecast, open customer orders, service requirements, safety/buffer stock, and internal requirements)

C. Review aggregate supply plan

1. Review key supply capabilities
   a. Review external supply base, supply footprint, and capacities, and evaluate risks
   b. Review internal supply capacities, inventory status, and inventory targets
2. Incorporate product life cycle considerations into the supply plan

(examples include: new product introductions (NPI) and obsolescence)
3. Develop and validate a production plan to support the firm's strategic choices
4. Evaluate the resource plan to support the aggregate supply plan
5. Review strategic buffers
   a. Identify bottlenecks, capacity-constrained resources (CCR), and supply chain risks
   b. Evaluate types, sizes, and locations of buffers, such as lead time, inventory, and capacity

D. Reconcile portfolio, demand, supply, and financial plans

1. Review different methods for balancing supply and demand
   a. Adjust supply (examples include: overtime, outsourcing, agility, flexibility, and temporary suppliers)
   b. Adjust demand (examples include: lead time adjustment, demand shaping, substitutions, and complementary products)
2. Evaluate trade-offs related to different volume/mix combinations
3. Evaluate alternative supply and demand plans and associated risks
4. Assess the financial implications of the plan
5. Review trade-offs between customer service levels, inventory, and backlog levels

References: 1; 2 (chapter 1); 4 (chapters 6, 8, 11); 5 (chapters 6-7); 7 (chapters 2, 5, 7-8); 9 (chapters 2-3); 10 (chapters 4-6); 11 (chapters 3-7, 10-11); 12 (chapters 1-5, 7)

III. Plan and Manage Demand

A. Determine customer needs and specifications

1. Segment customers based on their needs, business unit strategies, and required capabilities
2. Engage in customer relationship management (CRM) based on segmentation
3. Set customer service policies, safety stock levels, and performance targets
4. Determine appropriate use of point-of-sale (POS) data and collaborative planning, forecasting, and replenishment (CPFR)
5. Maintain effective customer communications using appropriate tools
6. Determine and monitor order delivery performance metrics

B. Understand marketing and product management considerations

1. Influence demand to better align with supply
2. Manage product configuration, product changes, and product life cycles
   a. Utilize quality systems and tools (examples include: quality function deployment (QFD), voice of the customer (VOC), concurrent engineering, modular design, and feature postponement)
   b. Manage engineering changes, effectivity plans, and revision control
   c. Manage the relationship between the manufacturing environment and product structure
3. Evaluate and manage the impact of marketing promotions on demand including potential product/service cannibalization

C. Review sources of demand

1. Review demand channels (examples include: retail, wholesale, distributor, e-commerce, business-to-business (B2B), and business-to-consumer (B2C))
2. Determine independent demand (examples include: forecast, customer orders, service or warranty, samples, testing, distribution or warehouse

requirements, inter-company or inter-plant orders, rework, and donations)
3. Determine dependent demand

D. Generate demand forecast

1. Understand demand forecasting concepts
2. Review the relationship between the purpose of the forecast and required timeliness and accuracy of the data
3. Review management considerations and trade-offs related to forecast method selection
4. Select a time horizon, time buckets, and a level of aggregation for forecasting purposes
5. Apply qualitative techniques to create forecasts (examples include: historical analogy, panel consensus, executive opinions, Delphi method, sales force polling, and consumer surveys)
6. Apply quantitative techniques to create forecasts
   a. Apply time series decomposition (level, trend, seasonality, and random variation)
   b. Use time series analysis (examples include: moving average, weighted moving average, and exponential smoothing)
   c. Use output from associative techniques (examples include: linear regression and leading indicators)

E. Monitor forecast performance and respond to demand variation or changes

1. Evaluate forecast performance using appropriate forecast error metrics (examples include: bias, cumulative forecast error (CFE), mean forecast error (MFE), mean percent error (MPE), mean absolute deviation (MAD), mean absolute percent error (MAPE), demand filters, and tracking signals)
2. Collaborate with customers and suppliers to improve forecast accuracy
3. Mitigate the bullwhip effect

References: 1; 4 (chapters 5, 11); 5 (chapters 5-6, 10); 7 (chapters 4, 8, 14); 9 (chapter 4); 10 (chapters 5, 7-8); 11 (chapters 3-4)

IV. Plan and Manage Supply

A. Create the master schedule

1. Understand the role of master scheduling in the planning and control hierarchy
2. Evaluate the impact of different business environments and strategies on the master scheduling process
3. Identify sources of independent demand to be considered in the master scheduling process
4. Create the master production schedule (MPS)
   a. Determine the level(s) in the bill of material (BOM) where the MPS should be developed based on production strategies (examples include: finished goods, subassemblies, and raw materials)
   b. Review the allocation of resources for customer order promising and order entry (examples include: discrete or cumulative available-to-promise (ATP), and capable-to-promise (CTP))
   c. Determine sources and timing of dependent demand
   d. Review current internal and external sources of supply
5. Apply planning bills to perform two-level or multilevel master scheduling
6. Use and maintain the master schedule
   a. Plan and coordinate changes in inventory levels, backlog, capacity, customer orders, time fences, product and process designs, and incoming supplies into the master schedule
   b. Maintain the integrity of the master schedule when supply or demand changes
   c. Measure actual performance against the master schedule

B. Perform rough-cut capacity planning (RCCP)

1. Review bill of resources to determine capacity requirements and the impact of the RCCP on supply
2. Identify and manage critical work centers to support the MPS
3. Develop work center efficiency and utilization goals and monitor performance
4. Incorporate maintenance schedules in capacity planning

C. Manage the material requirements plan

1. Check relevant material requirements plan input and data sources
   a. Define item master data and inventory data as required to support the material planning process (examples include: item description, current usage rates, scrap/yield factor, on-hand balances, and historical demand)
   b. Use MPS data to describe types, quantities, sources, priorities, customer orders, forecasts, and time phasing of product demand
   c. Define engineering data for product structure and parent/component relationships (examples include: information on part interdependencies, lead times, and engineering changes)
2. Utilize bills of material (BOMs) to calculate multilevel time-phased requirements and create long-range and short-range material plans that support company needs and supplier constraints
3. Use the MRP time-phased record to calculate and display gross requirements, scheduled receipts, projected available balances, net requirements, planned order receipts, planned order releases, and firm planned orders (FPO)
4. Make decisions to facilitate material planning, establish priorities, review exceptions, resolve conflicts through pegging relationships, support other decisions and productivity measures based on the type of environment and product life cycles, and implement bottom-up replanning as needed
5. Monitor system feedback mechanisms, such as action messages, to enable the appropriate adjustments necessary to balance supply and demand
6. Manage closed-loop integration with master planning, final assembly, and configuration processes to monitor material availability with demand quantities, timing, and priorities

D. Create final assembly schedule (FAS)

1. Identify sources of demand to be considered in the FAS
2. Create the FAS to support the demand plan
   a. Review the allocation of resources for customer order promising (examples include: available-to-promise (ATP) and capable-to-promise (CTP))
   b. Review current internal and external sources of supply
3. Use and maintain the FAS
   a. Plan and coordinate changes in inventory levels, backlog, capacity, major customer orders, time fences, product and process designs, and incoming supplies into the FAS
   b. Maintain the integrity of the FAS when supply or demand changes
   c. Measure actual performance against the FAS

E. Create and manage supplier relationships

1. Identify capable suppliers and undertake appropriate certifications
2. Review supplier selection alternatives (examples include: sole, single, and multisourcing; domestic and foreign providers; and special services)
3. Develop various supplier relationships (examples include: partnership,

strategic alliance, joint venture, contract manufacturing, sub-contracting, and transactional)
4. Perform supplier relationship management (SRM)
5. Include relevant supply chain links (examples include: retail, distribution, and transportation companies)
6. Engage in environmentally responsible purchasing
7. Apply procurement planning, new product introduction (NPI), and engineering change control to improve supply performance
8. Measure supplier performance using appropriate methods (examples include: balanced scorecard, price-based metrics, time-based metrics, cost-based metrics, and quality-based metrics)

F. Purchase/procure goods and services

1. Apply methods of procuring and requesting materials and services (examples include: contracts, kanbans, blanket orders, supplier scheduling, electronic data interchange (EDI), continuous replenishment, purchase orders, consignment, pricing agreements, vendor-managed inventory (VMI), outsourcing, and e-commerce)
2. Select appropriate delivery methods (examples include: modes of transportation, third- or fourth-party logistics (3PL or 4PL), cross-docking, point-of-use delivery, and direct shipment)
3. Use supplier participation in decision-making (examples include: product design, quality requirements, related technology, sustainable business practices, and accounting processes)
4. Define goals and benefits of the various supplier relationships (examples include: improvements in technology, inventory levels, customer service, quality, lead times, visibility, cost, impacts on the environment, damage and loss prevention, continuous improvement, access to new markets, and time to market)
5. Apply a supplier rating system to encompass quantitative measures (examples include: cost, on-time delivery, product quality, and environmental impact) and qualitative measures (examples include: social performance, workforce diversity, human rights, labor, and anticorruption)
6. Understand effective communication techniques, cultural differences, commercial versus government interests, and information technology (IT)
7. Use data necessary for collaboration (examples include: risk assessments, technical and quality specifications, engineering changes, supply chain inventories, and future demand)

G. Monitor and manage product costs

1. Determine the different types of product costs (examples include: direct, indirect, overhead, fixed, variable, and landed costs, as well as total cost of ownership (TCO))
2. Apply appropriate costing methods that determine the cost of producing a product (examples include: absorption, variable, job, and activity-based costing (ABC)) to compare actual to planned, budgeted, or standard costs
3. Review variances in cost through inventory valuation and an analysis of obsolescence, scrap/yield, rework, repairs, returns, and defective output
4. Measure costs related to quality (examples include: prevention, appraisal, internal failure, and external failure costs)

H. Manage changes and supply disruptions

1. Re-plan order priorities to respond to supply and demand changes
2. Revise lead time, lot size, safety stock quantity, kanban quantity, cycle times,

and other parameters to reflect product life cycles, current conditions, and company strategy
3. Utilize what-if analysis and simulation to evaluate potential changes to the existing material plan
4. Monitor the status of buffers

I. Conduct product life cycle management (PLM)

1. Develop new product introduction (NPI) schedule
   a. Apply design for manufacture and assembly (DFMA) and modularization
   b. Review constraints that may impact the NPI schedule
   c. Create a prototype schedule in consideration of supply and demand plans
2. Develop an end-of-life plan
   a. Review product obsolescence timing and inventory impact
   b. Review lifetime and minimum order quantity requirements from suppliers and for customers

References: 1; 4 (chapters 4, 9, 11); 5 (chapters 3, 6-7, 9, 11, 14); 7 (chapters 3-5, 7, 9, 14-15); 8 (chapters 2, 5); 9 (chapters 4, 8); 10 (chapter 9); 11 (chapters 7-10, 13-14, 16-17); 12 (chapter 5)

V. Plan and Manage Inventory

A. Inventory planning

1. Determine target inventory levels to support service and financial goals
   a. Review the impact of sourcing risks (examples include: financial, political, transportation, and environmental) on inventory planning decisions
   b. Understand the trade-offs in stocking levels, customer service, environmental impact, and inventory accuracy targets in different business environments
   c. Determine centralized versus decentralized inventory management strategies
2. Understand the types and classifications of inventory
   a. Identify the types of inventory (examples include: raw materials, work in process (WIP), semifinished goods, finished goods, floor stock, and maintenance, repair, and operating (MRO) supplies)
   b. Determine the classifications of inventory (examples include: cycle stock, lot-size, seasonal, anticipation, hedge, decoupling, consignment, in-transit (pipeline), point-of-use, service part, vendor-managed inventory (VMI), excess, obsolete, and scrap)
3. Determine item segmentation (examples include: ABC classification, perishability, hazardous materials, special handling, supply risk, and customer risk)

B. Inventory management

1. Determine appropriate push or pull item replenishment method (examples include: material requirements planning (MRP), reorder point (ROP), periodic review, visual review system, min-max system, two-bin inventory system, and kanban systems)
2. Based on order policy, determine lot size and order quantities, considering cost and service trade-offs, by using appropriate dynamic techniques (examples include: least total cost, least unit cost, lot-for-lot (L4L), and period order quantity) or fixed techniques (examples include: economic order quantity (EOQ) and fixed order quantity)
3. Determine safety stock or days of supply needs based on inventory costs and customer service level objectives
4. Manage maintenance, repair, and overhaul (MRO) inventories based on various inputs (examples include:

mean time between failure (MTBF), mean time to repair (MTTR), mean time for failure (MTFF), forecasts, and sales history)
5. Manage inventory requiring special handling to comply with regulations, environmental standards, and protocols of materials handling, personal protective equipment (PPE), and safety

C. Monitor and manage inventory costs

1. Review and manage the elements of total carrying costs, total ordering costs, total stockout costs, and their trade-offs
2. Review inventory valuation methods (examples include: first in, first out (FIFO); last in, first out (LIFO); average cost system; and transfer pricing)
3. Review projected or standard cost versus actual cost
4. Measure and review inventory metrics (examples include: inventory turns and days of supply)

D. Inventory control

1. Manage inventory locations and quantities considering the trade-offs of different storage methods, flow and material handling options, and transaction management (examples include: stock location systems, automated storage/retrieval systems (AS/RS), vendor-managed inventory (VMI), and consignment)
2. Monitor inventory accuracy to support business objectives (examples include: audit programs, physical inventory, cycle counting, and spot inventory checks)
3. Address and reduce inventory inaccuracy and loss
    a. Review and reduce sources of inventory inaccuracy (examples include: put-away and picking errors, bill of material (BOM) errors, registration errors, transaction and data entry errors, and mislabeling)
    b. Review and reduce sources of loss (examples include: shrinkage, scrap, theft, shelf life, and damage)
4. Utilize appropriate inventory traceability throughout the supply chain from point of origin to final destination
    a. Develop and monitor the proper identification of inventory (examples include: country of origin declaration, documentation requirements, and traceability of inventory movement) using appropriate tracking techniques (examples include: bar coding and radio frequency identification (RFID) tagging)
    b. Ensure adherence to traceability standards (examples include: ISO traceability standards and global trade identification number (GTIN))
    c. Maintain lot control and serial numbers
    d. Adhere to product recall guidelines
5. Track in-transit inventory
    a. Create and monitor advance ship notice (ASN) and delivery information
    b. Implement and manage shipment tracking technology (examples include: satellite and internet of things (IoT))

E. Manage returns and product disposition

1. Develop, manage, and review the disposition process to support sustainability, quality, and supply goals
    a. Review the waste hierarchy (examples include: reduce, reuse, remanufacture, recycle, recover, and disposal)
    b. Review the circular economy implications (examples include: company rules, regulations, environmental standards, product

costs, ownership, lead times, and material handling)
2. Develop and manage reverse logistics processes around the waste hierarchy, considering company acceptance guidelines, regulatory requirements, recall guidelines, and customer expectations

References: 1; 4 (chapters 2, 6, 15); 5 (chapters 6-9, 12); 7 (chapters 1, 7, 9-13, 15); 8 (chapter 5); 11 (chapters 10, 12-13, 16)

VI. Plan, Manage, and Execute Detailed Schedules

A. Plan detailed schedules

1. Determine production or flow rate
   a. Determine the elements of lead time, including queue, setup, run, wait, and move times
   b. Calculate load from all sources, such as planned and released orders, repetitive schedules, past-due orders, rework orders, and work in process (WIP), including process and setup times
   c. Evaluate throughput by measuring efficiency, utilization, productivity, takt time, cycle time, and input/output control (I/O)
   d. Manage schedules and throughput in various industries
2. Create work sequences to improve efficiency, resolve supply and demand imbalances, and consider time fence policies and the manufacturing calendar
   a. Utilize appropriate tools to create efficient schedules in a push environment (examples include: time standard, priority control, dispatch list, setup matrix, lot splitting, overlapped schedule, alternate operations or routings, and sequencing rules)
   b. Utilize appropriate tools to create an efficient pull environment (examples include: mixed-model scheduling, rate-based scheduling, synchronization, balancing operations, and line balancing)
3. Manage bottlenecks utilizing theory of constraints (TOC) techniques (examples include: improve flow, couple and decouple operations as needed, and elevate the bottleneck as appropriate)
4. Plan non-standard demand
   a. Identify the impact of unplanned or non-standard work (examples include: samples, tests, and engineering prototypes) and quality problems on resources
   b. Assess impacts of industry-specific conditions on resources (examples include: remanufacturing, by-products, co-products, and recycled material)

B. Create production and service schedules

1. Evaluate theoretical, demonstrated, available, and rated capacity
2. Recognize industry specific demand and capacity characteristics to manage loads
3. Create the load on capacity using appropriate operations scheduling techniques (examples include: infinite and finite capacity planning, constraint-based finite scheduling, and load balancing)
4. Apply appropriate simulation and modeling techniques to assess viability of various options or opportunities
5. Manage various methods of balancing capacity and load (examples include: rescheduling, splitting orders, modifying order quantities, outsourcing, workforce development, and changing capacity through workforce changes)
6. Determine and maintain safety capacity and capacity cushions as appropriate for the business environment
7. Load operations and adjust capacity to accommodate process variability and planned downtime

8. Manage constraints and balance flow using process flow scheduling in process industries in either batch or continuous mode
9. Create labor schedules; determine staffing based on human resources (HR) policies, labor pool, labor skills matrix; and consider outsourcing and contract labor

C. Implement and manage detailed schedules

1. Release manufacturing and service orders and issue materials as scheduled
2. Measure actual capacity performance to the plan
3. Manage material routing
   a. Evaluate the size of process batches and transfer batches to support production and inventory plans
   b. Review equipment and labor statuses, work orders, preventive maintenance schedules, and their impact on the plan
   c. Determine when alternate operations or routings should be utilized
4. Manage the size of queues
   a. Review input/output analysis (I/O), capacity, load, and open orders
   b. Determine and implement prioritization rules
5. Manage exceptions to maintain valid plans; evaluate variances to standard performance; and determine performance process stability, process capability, and theoretical and demonstrated capacity
6. Manage the control process through established standards and procedures in support of the organization's goals
7. Authorize backflush/inventory release

D. Schedule incoming materials

1. Generate supplier authorization to ship on blanket purchase orders
2. Authorize vendor-managed inventory (VMI) with key suppliers

References: 1; 4 (chapters 3, 6); 7 (chapters 5-6, 12-13, 15); 8 (chapter 8); 11 (chapters 10-13, 17); 12 (chapters 4, 9-10)

VII. Plan and Manage Distribution

A. Plan distribution

1. Determine network configuration trade-offs (examples include: total costs, inventory investment, customer service, lead time, and inbound and outbound transportation costs)
2. Develop the distribution plan
   a. Develop a distribution location-specific product forecast
   b. Develop the replenishment planning parameters for stock keeping units (SKUs) within the distribution network
   c. Undertake time-phased planning logic for distribution requirements planning (DRP)
3. Review distribution plans and master schedules to support the sales and operations planning (S&OP) decisions
4. Review inventory levels and locations required within the distribution network to support supply and demand plans
5. Monitor key performance indicators (KPIs) of the distribution network (examples include: level of service, on-time schedule performance, lead time, inventory turns, safety stock levels, stockouts, and customer satisfaction)

B. Manage customer orders

1. Monitor inventory availability and lead time in support of sales, marketing, and customer service level goals
2. Monitor open customer orders (backlog) to meet on-time delivery goals
3. Expedite past due customer orders (backorders) considering resource

availability, and cost and service tradeoffs

C. Manage reverse logistics

1. Review reverse logistics needs as part of the distribution network design
2. Consider the use of alternate providers to meet reverse logistics needs (examples include: third-party logistics providers (3PL) and bricks-and-mortar locations for returns)
3. Develop policies around the waste product hierarchy

References: 1; 4 (chapters 2, 7-10, 12); 5 (chapters 1-4, 7, 9-10, 12-15); 7 (chapters 8, 11-13); 11; (chapters 3, 7, 14-16); 12 (chapters 1, 4)

VIII. Manage Quality, Continuous Improvement, and Technology

A. Manage quality

1. Consider the impact of processes and their outputs on internal and external customers, and on corporate sustainability goals
2. Review costs related to quality
3. Review processes and outputs utilizing appropriate quality tools (examples include: basic seven tools of quality (B7) and seven new tools of quality (N7)) to identify process problems and their root causes
4. Undertake internal and external benchmarking for process improvement

B. Manage continuous improvement

1. Utilize lean concepts and undertake process improvements (examples include: kaizen events, reduction of waste and non-value-added activities, throughput improvement, process flexibility, inventory reduction, and one-piece flow)
2. Utilize lean tools (examples include: pull systems, scrum, kanban, takt time, standardized work, leveling workload, total productive maintenance (TPM), single-minute exchange of die (SMED), quick changeover)
3. Improve relationships with customers and suppliers (examples include: voice of the customer (VOC), supplier audit and certification, and supplier feedback)
4. Conduct value stream mapping to better understand processes
5. Utilize A3 problem solving to manage process improvement projects
6. Improve workflow and work area design (examples include: five Ss (5s), automation, visual management, andon, and layouts)
7. Undertake structured problem-solving processes (examples include: plan-do-check-act (PDCA) and six sigma)
8. Monitor process performance and reduce variation using statistical process control (SPC) methods to manage common, assignable, and special cause variation (examples include: P charts, X-bar charts, R charts, and capability indices)

C. Manage technology

1. Develop technology systems requirements or specifications to support company goals
   a. Determine current and ideal state utilizing appropriate tools (examples include: flowcharts, benchmarking, and process mapping)
   b. Identify gaps, system limitations, costs, process knowledge needed, and human resource (HR) policies to be considered
2. Support technology implementation
   a. Demonstrate need for ideal state to be achieved, consider tradeoffs and resource availability, assign ownership, and utilize project management tools

    b. Perform group problem-solving exercises and computer simulations
3. Maintain technology systems
    a. Emphasize the necessity of testing and use of restrictions
    b. Determine impacts and use tradeoffs to minimize risks
    c. Develop prioritization techniques and communication skills
    d. Manage integrity of master data
4. Adopt emerging technologies as appropriate for competitive advantage (examples include: artificial intelligence (AI), Internet of Things (IoT), 3D printing, augmented reality, robotic process automation (RPA), and machine learning)

References: 1; 2 (chapters 2, 6); 4 (chapter 14); 5 (chapters 8-9, 15); 7 (chapters 15-16); 8 (chapters 1-9); 9 (chapter 8); 10 (chapters 1-8, 10-15); 11 (chapter 13); 12 (chapters 3, 6-7); 13 (chapters 1-10)

Key Terminology

An understanding of the following list of terms is recommended. The candidate is also expected to be familiar with the definitions of all terms, tasks, and examples included in the content outline. Definitions of these terms can be found in the *APICS Dictionary, 16th edition*. Definitions for those terms followed by an asterisk (*) below are included in the supplemental glossary listed below the key terms.

In studying for the APICS CPIM certification, candidates may discover multiple terms used to denote the same technique. Examples of this include “sales and operations planning (S&OP)” versus “production planning” and “master production schedule (MPS)” versus “master schedule.” ASCM and the certification exam subcommittees have attempted to provide consistency across all exams with recognized and preferred terminology. However, synonyms are often used by authors in the various references used to compile the body of knowledge.

CPIM Key Terminology

back scheduling	idle capacity
big data	idle time
blockchain	indented bill of material
block scheduling	intangible costs
break-even analysis	internal setup time
carbon footprint	International Organization for Standardization (ISO)
carbon handprint*	interoperation time
configure-to-order (CTO)*	inventory turnover
cost-volume-profit analysis	job shop scheduling
count point	kit
critical ratio	level schedule
critical-to-quality characteristics (CTQs)	lifetime buy*
decision support system (DSS)	life cycle costing
define-measure-analyze-improve-control (DMAIC)	Little's Law
demand shaping	low-level code
echelon	manufacturing execution systems (MES)
enterprise resources planning (ERP)	manufacturing order
external setup time	master data*
forward scheduling	master data management (MDM)*
gateway work center	modular bill of material
general and administrative expenses (G&A)	multilevel bill of material
group technology (GT)	operations management
hazmat	opportunity cost
hedge	option overplanning
horizontal dependency	outlier

CPIM Key Terminology

overall equipment effectiveness (OEE)
overhead allocation
pacemaker
Pareto's law
performance standard
periodic replenishment
personal protective equipment (PPE)*
phantom bill of material
picking list
planning bill of material
poka-yoke (mistake-proof)
priority planning
product family
product road map*
production activity control (PAC)
productive capacity
protective capacity
pyramid forecasting
robotic process automation (RPA)*
sales mix
Shingo's seven wastes
single-level bill of material
slack
standard time
strategic sourcing
super bill of material
surge capacity
time bucket
time-phased order point (TPOP)
total quality management (TQM)
U-lines
velocity
vertical dependency
where-used list

Supplemental Glossary

The following key terms are not found in the *APICS Dictionary, 16th edition*, so definitions have been provided below.

Carbon handprint - A measure of how much carbon emissions have been avoided by a person, organization, building, or operation by replacing baseline solutions with more environmentally responsible ones.

Configure-to-order (CTO) - A production environment where a good or service is determined at order entry by customers who select from a pre-defined list of features, options, and attributes. The key components (bulk, semi-finished, intermediate, subassembly, fabricated, purchased, packing, and so on) used in the assembly or finishing process may be planned and usually stocked in anticipation of a customer order or only after receipt of the customer order. Receipt of a customer order initiates assembly of the customized product. This strategy is useful where a large number of end products (based on the selection of options and accessories) can be configured from common components. Syn: assemble-to-order (ATO). See: make-to-order (MTO), make-to-stock (MTS).

Lifetime buy - A process for purchasing potential discontinued components or products to support the remaining life cycle of a product.

Master data - An enterprise's essential core data consisting of basic information needed across the enterprise to conduct business. Master data describes the core entities of the enterprise including products, customers, suppliers, sites, and chart of accounts.

Master data management (MDM) - A discipline in which business and information technology (IT) work together to ensure the uniformity, accuracy, completeness, relevancy, integrity, and accountability of the enterprise's shared master data.

Personal protective equipment (PPE) - Items worn by a user to protect against or minimize exposure to hazards or risks, including physical impact, electricity, heat, chemicals, biohazards, and airborne particulate matter.

Product road map - A plan that communicates the product portfolio of offerings and product lifecycles over time. The product road map serves to detail product offerings, product manufacturing, and execution plans, and it should tie to customer expectations and marketing plans.

Robotic process automation (RPA) - The use of software robots (also referred to as "bots") to emulate human execution of repetitive, pre-defined business processes.

Sample Questions

The following ten questions are similar in format and content to the questions on the exam. These questions are intended for practice and to illustrate the way questions are structured. The degree of success you have in answering these questions is not related to your potential for success on the actual exam and should not be interpreted as such.

Read each question, select an answer, and check your response with the explanation on pages 33-34.

1. A make-to-order (MTO) organization competing on delivery speed would consider which of the following factors to have a significant impact on its competitive position?

   (A) Relocation of suppliers
   (B) Increased labor costs
   (C) Outsourcing of customer service
   (D) Shifts in customer demand

2. Which of the following statements about forecasting is true?

   (A) Forecasts are more accurate for individual products.
   (B) Forecasts are most useful for items with dependent demand.
   (C) Forecasts should include an estimate of error.
   (D) Forecasts typically are more accurate when projected over a longer period.

3. Improving the performance of a constraint in a job shop environment will:

   (A) reduce work-in-process (WIP) inventory.
   (B) adjust the load of non-bottleneck operations.
   (C) increase the cycle time.
   (D) increase production throughput.

4. Use the following purchase cost data for product Z to answer the question below.

   0 units on hand (December 27)
   100 units at $10 = $1,000 (received on December 28)
   10 units at $11 = $110 (received on January 3)
   10 units at $8 = $80 (received on January 10)

   If this company is using a weighted average costing method and 100 units were sold on January 8, what is the cost per unit for the sale?

   (A) $8.00
   (B) $9.17
   (C) $10.00
   (D) $10.09

5. The forecast interval would typically be longest for forecasts used as inputs to which of the following processes?

   (A) Business planning
   (B) Final assembly scheduling
   (C) Sales and operations planning (S&OP)
   (D) Master production scheduling

6. Which of the following factors is significant in determining the level of work-in-process (WIP) inventory when a pull system is employed?

   (A) Number of open shop orders
   (B) Quantity of parts represented by each signal
   (C) Number of workstations in the process
   (D) Takt time required for the process

7. A manufacturing facility is considering adopting cellular flow. Which of the following factors is most important to consider?

   (A) Availability of shipping methods
   (B) Maturity of the product line
   (C) Distance to the supplier
   (D) Stability of the production schedule

8. In a distribution environment, which of the following outcomes will occur if the planner fails to address exception messages during the planning cycles?

   (A) Planned orders are not converted on time.
   (B) Replenishment lead times are incorrect.
   (C) The statistical order point is increased.
   (D) The planning horizon is too short.

9. Use the information below to answer the question.

Lead time: 2 weeks	Lot size: 30 units
Demand time fence (DTF): 3 days	On hand: 15 units
Planning time fence: 7 days	Safety stock: 6 units

Period	1	2	3	4	5
Forecast	10	22	20	24	28
Customer orders	5	26	15	6	30
Projected available balance					
Available-to-promise (ATP)					
Master production schedule (MPS)	30		30		

For the master schedule, what is the available-to-promise (ATP) for Period 4 if the discrete method is used?

(A) 22 units
(B) 24 units
(C) 35 units
(D) 37 units

10. The chart below shows the gross requirements for an item in a material requirements planning (MRP) system. Stock on hand is 500 units, and there are no current scheduled receipts. The item has a lead time of four periods and is being ordered lot-for-lot (L4L). What would be the correct planned order release(s) for the item?

The MRP Grid

Technique
Order quantity / lot size – lot-for-lot (L4L)
On hand: 500
Safety stock: 0
Allocated quantity: 0
Low-level code: 3
Lead time: 4

			Periods							
			1	2	3	4	5	6	7	8
x	Gross requirements			100		300	200		400	
	Scheduled receipts									
	Projected available	500		400		100				
	Net requirements									
	Planned order receipts									
	Planned order releases									

(A) 100 in Period 1, 400 in Period 3
(B) 100 in Period 4, 400 in Period 6
(C) 100 in Period 5, 400 in Period 7
(D) 500 in Period 5

Answers to Sample Questions

Note: References to the content outline appear in parentheses.

1. D (I.B) - As customer demand shifts, the organization may find itself with capacity in excess or less than required. Answer A would impact the amount of inventory the company keeps, but it should not have an impact on the delivery speed. Answer B would have an impact on the cost but not the delivery. Answer C also does not impact product delivery.

2. C (III.D) – Forecasts are usually wrong; therefore, every forecast should include an estimate of error. A is incorrect because forecasts are more accurate for families or groups. B is incorrect because forecasts are not used for dependent demand items. D is incorrect because forecasts are more accurate for near-term periods.

3. D (VI.A) – According to the theory of constraints (TOC), D is the best answer since improving the throughput of the bottleneck improves the throughput of the total system. C is wrong because cycle time should be decreased, not increased, in order to improve throughput. The increased production throughput will increase the load on some non-bottleneck operations (B), but this is a secondary effect and not an adjustment. Improving the performance of the constraint may have effects on work-in-process (WIP) inventory (A), but this may go either way.

4. D (V.C) – D is correct because this is the weighted average on January 8. A is incorrect because this is the last cost paid for each item. B is incorrect because it uses the cost of inventory after January 10, but the inventory is used on January 8. C is incorrect because it is the first in, first out (FIFO) cost of the product.

5. A (III.D) - Business planning is performed at the highest level of aggregation and over the longest horizon, and it would typically be done for fiscal quarters or years. Answers B, C, and D refer to processes that would have shorter horizons and intervals.

6. B (V.A) - The level of work-in-process (WIP) inventory when a pull signal is employed is a function of the number of pull signals and the quantity represented by each pull signal. A, C, and D are incorrect. Shop orders (A) are characteristic of a push system and are not relevant in a pull system. The number of workstations (C) in the process determines the minimum WIP level, but it does not determine the total WIP level. The takt time (D) determines the rate at which the process needs to operate, but it does not determine the WIP level.

7. D (VIII.B) - D is correct because cellular manufacturing layout works best when the production schedule is stable. An unstable production schedule will cause disruptions to flow, especially in a cellular manufacturing strategy. A is incorrect because shipping methods are not related to the manufacturing layout. B is incorrect because a mature product line does not ensure that one has a stable production schedule. C is incorrect because one can implement a cellular flow strategy regardless of where suppliers are located; raw material inventory in front of the cell can buffer against long lead times from the supplier.

8. A (VII.A) - Answer A is a direct result of failing to address exception messages. Answers B, C, and D refer to system parameters that exception messages would not address.

9. B (IV.A) - Available-to-promise (ATP) for Period 4 is based on a newly planned master production schedule (MPS) of 30 units for that period, less the customer orders of 6 units for that period. Because another MPS of 30 units will occur in Period 5, demand for that period is not considered by the ATP for Period 4. Based on the explanation for the calculation for discrete ATP, Answers A, C, and D are incorrect.

10. A (IV.C) – A is correct because more supply is needed based upon the net requirements. In this case, 100 more units are needed in Period 5. There are 100 units left over from Period 4, but that is 100 units less than the gross requirements of 200 units in Period 5. Given the L4L lot size, the net requirement quantity is suggested as the planned order receipt in Period 5, and with a 4-period lead time, the corresponding planned order release is suggested for Period 1. This will bring the projected available in Period 5 to 0 units, which is acceptable when there is no safety stock requirement. Using the same logic, the net requirement of 400 units in Period 7 leads to a planned order release in Period 3.

    B is incorrect because the lead time is 4 periods, not 1 period. C is incorrect because the question asks for the planned order release timing, not the planned order receipts. D is incorrect in two ways. With a L4L lot size, the planned order receipt is the current period's net requirement, and additional supply should not be ordered. Also, the question asks for the planned order release, not the planned order receipt.

The MRP Grid

<u>Technique</u>
Order quantity / lot size – lot-for-lot (L4L)
On hand: 500
Safety stock: 0
Allocated quantity: 0
Low-level code: 3
Lead time: 4

			Periods							
			1	2	3	4	5	6	7	8
X	Gross requirements			100		300	200		400	
	Scheduled receipts									
	Projected available	500		400		100				
	Net requirements						100		400	
	Planned order receipts						100		400	
	Planned order releases		100		400					

Thank you for your interest in the APICS CPIM certification program. For any questions regarding the content found in this Exam Content Manual, please contact ASCM customer relations at 1-800-444-2742 or 1-773-867-1777 or support@ascm.org.

About APICS and ASCM

For more than 60 years, APICS certifications and training have demonstrated a commitment to global supply chain excellence – achieved one person at a time. APICS CPIM, CSCP and CLTD are now part of the Association for Supply Chain Management (ASCM), the largest non-profit association for supply chain professionals. ASCM is proud to offer the globally recognized certification programs you've come to trust.

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