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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
Exam Content Manual

Version 7.0

Visit ascm.org/ecmerrata for APICS CPIM Exam Content Manual errata.
Internet links cited in the bibliographic references can be found in a more usable format on the APICS website at ascm.org/cpim.

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The Association for Supply Chain Management (ASCM) is the global leader in end-to-end supply chain organizational transformation, innovation, and leadership. As the largest non-profit association for supply chain, we are an unbiased partner connecting people around the world to the newest insights and solutions on all aspects of supply chain. ASCM transforms enterprises and empowers people with industry-recognized, global standards - like APICS and SCOR - to optimize their supply chains, secure their competitive advantage, and positively impact the world.

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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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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 your continuing education in operations management.

For more than four decades, the APICS CPIM program has been recognized as the international standard for individual assessment in the field of operations management as it relates to transformation of products and services. However, CPIM is an ever-evolving body of knowledge. While many of the topics remain the same, the number of exams has changed over the years to where there are now two.

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 100,000 professionals have earned the APICS CPIM designation.

The mission of the APICS CPIM program is to be the premier professional certification for supply chain and operations management. The CPIM exams are designed to test individuals in the various concepts, methodologies, terminology, and integration of topics within the supply chain and operations management 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.

Because organizations operate in a changing and challenging international environment, the APICS 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.

The APICS CPIM program utilizes two exams in a progression from CPIM Part 1 – which covers the basics, including definitions and problem solving – to advanced CPIM Part 2 where we review these concepts in actions and how these affect the firm's ability to compete in the marketplace. It is strongly recommended that candidates complete CPIM Part 1 before tackling the more advanced topics in CPIM Part 2. If you follow this sequence of the two exams, you will increase your understanding and probability of success.

The following is a summary of each of the two APICS CPIM exams:

APICS CPIM Part 1

As the entry-level learning program, CPIM Part 1 introduces the material presented in depth in CPIM Part 2.

Part 1 introduces the definitions and concepts for planning and controlling the flow of products and services into, through, and out of an organization. Many of the concepts in Part 1 are expanded upon in Part 2. Part 1 explains fundamental relationships among the various activities that may occur in the supply chain network from suppliers to customers. This includes topics like demand management, plan supply, execute supply plan, inventory management, and continuous improvement /quality management and technologies.

APICS CPIM Part 2

CPIM Part 2 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 managing 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.

The APICS CPIM program will continue to evolve, incorporating relevant and current concepts and techniques into the body of knowledge. APICS CPIM is an outstanding educational program. ASCM relies on your comments and suggestions to maintain and improve the program for future candidates.

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 examinations. The objective of this manual is to outline the APICS CPIM exam body of knowledge, which is organized into two exams:

- CPIM Part 1
- CPIM Part 2

Test-takers who strive to earn their CPIM certification must pass both of these exams within three years to become certified. For more information on how to earn the CPIM, please visit the APICS Exam Handbook.

In this manual, each exam description 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. Each exam overview concludes with sample questions similar to those that appear on the examinations 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 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 outlined tools, processes, and techniques.

Sufficient references are given for each topic area that provide different approaches to material covered in each exam and different styles of presenting it. Reading periodicals, such as *SCM Now* magazine and the *SCM Impact* e-newsletter will also help you keep up to date about changes in the industry.

About the APICS CPIM Examinations

Each of the two APICS CPIM exams consist 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 each APICS CPIM exam.

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

Question Format

The questions on the CPIM exams 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 exams. For sample questions and an introduction to Technology Enhanced Items (TEIs) found in the CPIM Part 1 exam, please see the CPIM Part 1 Sample Questions section. CPIM Part 2 sample questions can be

found in the CPIM Part 2 Sample Questions section.

Taking the Test

Each 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 defined in the exam content manual.

When you begin each 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 stimulus material – such as a table, graph, or situation – 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. For technology enhanced items (TEIs) present in the CPIM Part 1 exam, the questions are designed to assess a candidate's higher-level thinking skills and problem-solving abilities. As a result, these questions require more interaction than selecting an answer from a set of four options; however, these TEIs will still have one and only one correct response.

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 to the difficult ones later. 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 exams scaled score range is 200 – 350.

200–299: Fail

300–350: Pass

The minimum passing score is 300. For each exam, candidates will receive a final exam score along with diagnostic information by topic area on their performance. All APICS exams use the above 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.

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 CPIM body of knowledge.

A current 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 to the ASCM corporate office. 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 teaching, and ASCM volunteer activities.

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

Studying for the APICS CPIM Exams

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

APICS CPIM References

Bibliography. The APICS CPIM Examination Subcommittees have identified a number of references for the APICS CPIM exams. These references are used by both the exam subcommittees 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 test preparation. For additional information on the APICS CPIM references visit the CPIM Exam References page on the 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.

CPIM Content Outlines. The content outlines for CPIM Part 1 and CPIM Part 2 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.

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 exams, candidates may discover multiple terms used to denote the same technique. Examples of this include “sales and operations planning” versus “production planning” and “master production schedule” versus “master schedule.” APICS 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 outline and key terminology section, 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

APICS 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 Systems

The APICS CPIM Learning Systems for CPIM Part 1 and CPIM Part 2 are comprehensive professional development and certification preparation programs. These self-directed programs combine print material and online interactive tools. This system is also offered in instructor-led formats.

The APICS CPIM Learning Systems do not "teach the tests" and in many areas *review* concepts but do not teach concepts. The APICS CPIM Learning Systems provide a thorough review of the subject matter, but they 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 Systems not covered by the exam; conversely, there will likely be some content in the exam not covered by the learning systems. 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 formats for CPIM Part 1 and CPIM Part 2 combine the APICS CPIM Learning Systems 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 APICS 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. 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 Subcommittees for content updates.

The JTA process is vital to all high-stakes certifications as it validates the existing body of knowledge (BOK) 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 vs. 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.

APICS 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 ASCM staff and a third-party vendor, creates the Learning Systems using the ECM and the recommended references.

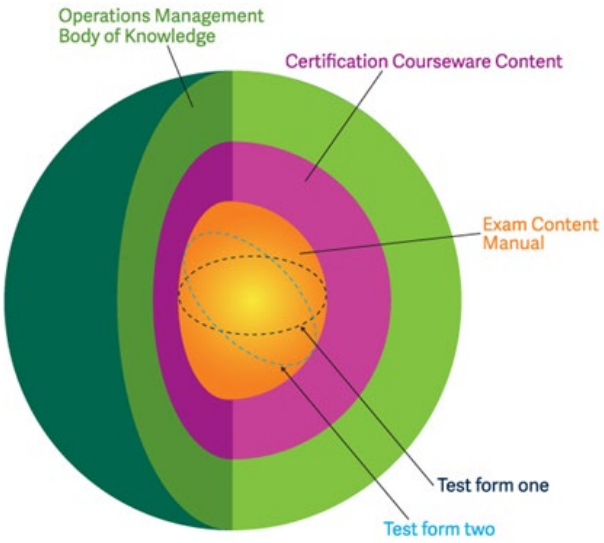
Courseware developers and/or instructors may believe that additional material needs to be taught or included to ensure understanding of the body of knowledge. They also may decide that a concept or term is adequately covered by the definitions in the *APICS Dictionary* or content outlines and not cover 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 certification designations. 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

The Importance of Certification Maintenance

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 lapse into suspension with additional points required to bring the certification back to an active status.

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 APICS 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
- 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.

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 ASCM Code of Ethics policy may result in sanctions up to and including decertification.

Bibliography and References for CPIM Part 1 and Part 2

All test candidates should familiarize themselves with the following references for the CPIM exams. The recommended references pertaining to the diagnostic 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 in the online ASCM Member Benefits section of members' My Account page.

	References	Author(s)	Part 1	Part 2
1	*APICS Dictionary, 16th ed., 2019*	APICS	X	X
2	*Accelerate: Building Strategic Agility for a Faster-Moving World, 2014*	Kotter, John P.		X
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		X
4	*Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies, 3rd ed., 2007*	Simchi-Levi, David, Philip Kaminsky, and Edith Simchi-Levi		X
5	*Distribution Planning and Control: Managing in the Era of Supply Chain Management, 3rd ed., 2015*	Ross, David Frederick		X
6	*GRI Standards*	Global Reporting Initiative		X
7	*Introduction to Materials Management, 8th ed., 2017*	Chapman, Stephen N., J. R. Tony Arnold, Ann K. Gatewood, and Lloyd M. Clive	X	X
8	*Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System, 3rd ed., 2015*	Dennis, Pascal	X	X
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		X
10	*Managing Quality: Integrating the Supply Chain, 6th ed., 2017*	Foster, S. Thomas		X
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	X	X
12	*Operations Strategy, 5th ed., 2017*	Slack, Nigel, and Michael Lewis		X

	References	Author(s)	Part 1	Part 2
13	*Technology in Supply Chain Management and Logistics: Current Practice and Future Applications, 2019*	Pagano, Anthony M., and Matthew Liotine	X	X
14	*United Nations Global Compact: Corporate Sustainability in the World Economy*, 2014	UN Global Compact	X	
15	*United Nations Global Compact Management Model: Framework for Implementation*, 2010	Deloitte Touche Tohmatsu	X	

Content outline. The content outline for each exam provides an overview of the major topics included in that module. Each major topic is denoted by a Roman numeral and is followed by a list of the references that are particularly relevant to that topic.

Note: At the end of each major section in the CPIM Part 1 and CPIM Part 2 content outlines 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)" means the reference, *Introduction to Materials Management, 8th edition, 2017*. Chapters 4, 8, 11, 14, and 16 of that reference contain content relevant to that subject matter.

APICS Dictionary. The *APICS Dictionary*, 16th edition is an essential publication that applies to the exam content manual and exams. Within the profession, terminology varies among industries, companies, and the academic community. Each exam uses standard terminology as defined in the *APICS Dictionary*. Recognizing the terms and understanding their definitions are essential.

The *APICS Dictionary* is available from the APICS Bookstore. Other references can be found on the CPIM Exam References page.

Key Terminology

An understanding of the following list of terms is recommended. This list is intended to be thorough but not exhaustive. The candidate is also expected to be familiar with the definitions of terms identified in the content outlines. 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" versus "production planning" and "master production schedule" versus "master schedule." APICS and the certification exam subcommittees have attempted to provide consistency across both 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

Key Terminology	Part 1	Part 2
action message		x
advance ship notice (ASN)	x	
advanced planning and scheduling (APS)	x	
advanced planning system (APS)		x
allocation		x
alternate operation		x
andon	x	
anticipation inventories	x	
assignable cause		x
available inventory	x	
available-to-promise (ATP)	x	
average cost per unit		x
average inventory	x	
back scheduling	x	
backorder	x	x
backward scheduling		x
balance sheet	x	x
balancing operations		x
bar code	x	
batch	x	
big data	x	
bill of material (BOM)	x	
bill of resources		x
block scheduling		x

Key Terminology	Part 1	Part 2
bottom-up replanning		x
break-even point	x	
bucketless system		x
buffer management	x	
bullwhip effect	x	
business process reengineering (BPR)		x
by-product		x
capable-to-promise (CTP)	x	
capacity available	x	
capacity control		x
capacity management	x	
capacity planning	x	
capacity-constrained resource (CCR)		x
carbon footprint		x
carrying cost	x	
cash conversion cycle		x
cash flow	x	
cause-and-effect diagram	x	
central point scheduling		x
centralized inventory control	x	
changeover costs		x
chase production method	x	x
circular economy		x
closed-loop MRP	x	

CPIM Key Terminology

Key Terminology	Part 1	Part 2
collaborative planning, forecasting, and replenishment (CPFR)		x
common causes		x
competitive advantage		x
configure-to-order (CTO)*	x	x
consignment	x	
constraint	x	
consuming the forecast		x
continuous process improvement (CPI)	x	
continuous production	x	x
continuous replenishment	x	
contribution margin		x
control chart	x	
control limit	x	
cost of poor quality	x	
count point		x
critical path method (CPM)	x	x
critical ratio		x
critical-to-quality characteristics (CTQs)		x
cross-docking	x	
cumulative available-to-promise		x
current ratio		x
customer relationship management (CRM)	x	
cycle stock	x	
cycle time	x	x
data governance	x	
decentralized inventory control	x	
decision support system (DSS)		x
decomposition		x
decoupling inventory	x	
delivery lead time	x	
demand filter		x
demand lead time	x	
demand shaping		x
demonstrated capacity	x	

Key Terminology	Part 1	Part 2
design for manufacture and assembly (DFMA)		x
direct costs		x
direct labor	x	
direct material	x	
discrete available-to-promise		x
discrete manufacturing	x	
discrete order picking	x	
distribution center	x	
distribution warehouse	x	
downtime		x
drum schedule	x	
drum-buffer-rope (DBR)	x	
early supplier involvement (ESI)		x
echelon		x
economic order quantity (EOQ)	x	
electronic data interchange (EDI)	x	
employee empowerment	x	
employee involvement (EI)	x	x
enterprise resources planning (ERP)		x
explode	x	
external failure costs	x	
external setup time	x	x
field service	x	
finished goods inventory	x	
finite forward scheduling	x	
finite loading	x	
firm planned order (FPO)	x	
five Ss	x	
five whys	x	
fixed order quantity	x	
fixed overhead	x	
fixed-location storage	x	
fixed-position manufacturing	x	
floor stocks		x
flow processing	x	

CPIM Key Terminology

Key Terminology	Part 1	Part 2
flow shop	x	
flowchart	x	
fluctuation inventory	x	
forecast consumption		x
forward flow scheduling		x
forward scheduling	x	x
functional layout	x	
functional product		x
Gantt chart	x	
gateway work center		x
gemba	x	
gemba walk		x
general and administrative expenses (G&A)	x	
global measurements		x
global trade identification number (GTIN)		x
green reverse logistics	x	
gross margin	x	
gross requirement	x	
group technology (GT)		x
hazmat		x
hedge		x
hedge inventory	x	
heijunka	x	
histogram	x	
horizontal dependency		x
horizontally integrated firm		x
hoshin planning	x	
house of quality (HOQ)		x
hybrid production method		x
idle capacity	x	x
idle time		x
income statement	x	x
incoterms	x	
indented bill of material	x	
infinite loading	x	
intangible costs		x
intermittent production	x	

Key Terminology	Part 1	Part 2
intermodal transport	x	
internal failure costs	x	
internal setup time	x	x
International Organization for Standardization (ISO)		x
interoperation time		x
interplant demand	x	
inventory accounting		x
inventory adjustment	x	
inventory buffer	x	
inventory control	x	
inventory ordering system	x	
inventory turnover	x	
jidoka	x	
job costing	x	
job shop scheduling	x	
just in time (JIT)		x
kaizen	x	x
kit		x
landed cost		x
leading indicator	x	
lead-time offset	x	
lean production	x	
lean six sigma	x	x
least changeover cost		x
level of service	x	
level production method	x	x
level schedule	x	
liabilities	x	
life cycle costing		x
lifetime buy*		x
Little's Law		x
load	x	
load leveling	x	
local measures		x
lot-for-lot (L4L)	x	
lot-size inventory	x	
low-level code	x	
make-or-buy decision	x	x

CPIM Key Terminology

Key Terminology	Part 1	Part 2
managerial accounting		x
manufacturing calendar	x	
manufacturing execution systems (MES)		x
manufacturing lead time	x	
manufacturing order	x	
manufacturing philosophy	x	
manufacturing resource planning (MRP II)	x	
mass customization	x	
master data*	x	
master data management (MDM)*	x	
master planning	x	
master schedule	x	
materials handling	x	
materials management	x	
mean absolute deviation (MAD)	x	
min-max system	x	
mixed-model production	x	
mixed-model scheduling	x	
modular bill of material		x
modular design strategy		x
modularization	x	
move time	x	
muda (waste)	x	x
multilevel bill of material	x	
multilevel master schedule		x
multisourcing	x	
mura	x	
muri	x	
net requirements	x	
nongovernmental organization (NGO)		x
one less at a time		x
one-piece flow	x	x
on-hand balance	x	
on-time schedule performance	x	
open order	x	

Key Terminology	Part 1	Part 2
operating expense	x	
operation overlapping		x
operational performance measurements		x
operations management	x	
operations scheduling		x
operator flexibility	x	
opportunity cost		x
option overplanning		x
order entry	x	
order picking	x	
order point	x	
order policy		x
order promising	x	
order qualifiers	x	
order winners	x	
ordering cost	x	
outlier		x
outsourcing	x	
overall equipment effectiveness (OEE)		x
overhead	x	
overhead allocation		x
overlapped schedule	x	
overstated master production schedule		x
owner's equity	x	
P:D ratio		x
pacemaker	x	
parent item	x	
Pareto's law	x	x
participative design/engineering	x	
pegging	x	
perceived quality		x
performance objectives		x
performance standard	x	
period order quantity	x	
periodic replenishment	x	
perishability		x

CPIM Key Terminology

Key Terminology	Part 1	Part 2
perpetual inventory record	x	
personal protective equipment (PPE)*		x
phantom bill of material		x
physical supply	x	
picking list	x	
pickup and delivery costs	x	
pipeline stock	x	
plan-do-check-action (PDCA)	x	
planned order	x	
planned order receipt	x	
planned order release	x	
planning bill of material	x	x
planning horizon	x	
point of sale (POS)	x	
point-of-use inventory		x
poka-yoke (mistake-proof)		x
postponement	x	
prevention costs	x	
preventive maintenance	x	
priority control	x	
priority planning	x	
problem-solving storyboard		x
process batch	x	
process flexibility	x	
process flow diagram	x	
procurement	x	
procurement lead time	x	
product differentiation	x	
product family	x	x
product layout	x	
product mix	x	x
product positioning		x
product road map*		x
production activity control (PAC)	x	x
production line	x	
production plan	x	
production planning	x	

Key Terminology	Part 1	Part 2
productive capacity	x	
productivity	x	
product-mix flexibility		x
profit margin	x	
project management	x	
projected available balance	x	
protective capacity	x	
protective inventory	x	
protective packaging	x	
pull system	x	
purchasing lead time	x	
push system	x	
pyramid forecasting		x
quality at the source	x	
quality circle		x
quality control	x	
quality costs	x	
quality function deployment (QFD)	x	
quantity discount	x	
quick changeover	x	
radio frequency identification (RFID)	x	
random variation	x	
random-location storage	x	
rated capacity	x	
receiving	x	
record accuracy	x	
remanufacturing	x	
reorder quantity	x	
repetitive manufacturing	x	
replenishment lead time	x	
request for quote (RFQ)	x	
requirements explosion	x	
resource planning	x	x
resource-limited scheduling		x
reverse logistics	x	
risk management	x	
risk pooling		x

CPIM Key Terminology

Key Terminology	Part 1	Part 2
root cause analysis	x	x
rough-cut capacity planning (RCCP)	x	
run time	x	x
sales plan	x	
sawtooth diagram	x	
scatter chart	x	
scatterplot	x	
scheduled receipt	x	
scrap factor		x
seasonal inventory	x	
seasonality	x	
self-directed work team		x
semifinished goods		x
service level agreement (SLA)		x
service parts	x	
setup	x	
setup costs		x
setup time	x	x
Shingo's seven wastes	x	x
simulation		x
single-level bill of material	x	
single-minute exchange of die (SMED)		x
single-source supplier	x	
six sigma	x	
smoothing constant		x
specific identification		x
split lot	x	
spread	x	
standard time	x	
start date	x	
statistical process control (SPC)	x	
stock keeping unit (SKU)	x	
stockout costs	x	
stockout percentage	x	
store	x	
strategic drivers		x

Key Terminology	Part 1	Part 2
strategic plan	x	
strategic sourcing		x
subcontracting	x	
substitution		x
sunk cost		x
super bill of material		x
supplier certification	x	
supplier lead time	x	
supplier partnership	x	
supplier relationship management (SRM)	x	
supplier scheduling		x
supply chain management	x	
surge capacity		x
terminal-handling charges	x	
terminals	x	
theory of constraints (TOC)	x	
theory of constraints (TOC) accounting	x	
third-party logistics (3PL)	x	
throughput	x	
throughput time		x
time bucket	x	
time buffer	x	x
time fence	x	
time standard		x
time-phased order point (TPOP)	x	
tolerance	x	
total cost curve	x	
total cost of ownership (TCO)	x	
total line-haul cost	x	
total productive maintenance (TPM)	x	
total quality control (TQC)		x
total quality management (TQM)	x	
traceability	x	
tracking signal	x	
transaction channel	x	

CPIM Key Terminology

Key Terminology	Part 1	Part 2
transportation	x	
transportation inventory	x	
trend	x	
triple bottom line (TBL)		x
truckload (TL) carriers	x	
two-bin inventory system	x	
two-level master schedule		x
U-lines	x	
UN Global Compact Management Model	x	
uniform plant loading	x	
unit cost	x	
unit load	x	
unit of measure	x	
United Nations Global Compact	x	
unitization	x	
upstream	x	
utilization	x	
value added	x	
value analysis	x	
value chain analysis	x	
value stream	x	
value stream mapping	x	
variable cost	x	
variance	x	
velocity	x	
vertical dependency		x
visual review system	x	
voice of the customer (VOC)	x	
wait time	x	
wall-to-wall inventory	x	
warehousing	x	
ways	x	
what-if analysis	x	
where-used list	x	
work cell	x	
work center	x	
work order	x	

Key Terminology	Part 1	Part 2
yield	x	x

Supplemental Glossary

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

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 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.

APICS Certified in Planning and Inventory Management Part 1

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Scope of the Subject Matter

Please read the introductory material in this manual for essential information pertaining to the exam. The entry-level concepts in this Exam Content Manual contain essential information to prepare for the CPIM exams. The subject matter of CPIM Part 1 is an introductory overview of CPIM Part 2, which covers many of the same topics in greater depth.

This exam includes the following six major subject areas: Supply Chain Overview, Fundamentals of Demand Management, Plan Supply, Execute Supply Plan, Inventory Management, and Continuous Improvement/Quality Management and Technologies. The concepts included in CPIM Part 1 apply to manufacturing and service organizations.

Supply Chain Overview includes basic business-wide concepts included in the definition of supply chain management along with various perspectives to meet competitive priorities. Marketing strategies, as well as sales and operation planning, are included along with coverage of the various manufacturing environments and various supply chain processes and layouts. The fundamentals of product costs and ways to measure performance and achieve sustainable supply chains complete this section.

Fundamentals of Demand Management encompasses recognizing and managing all demands for products or services. Demand management includes several major activities, all of which are primarily market driven and include identifying all product and service demand in the defined markets. Demand management includes forecasting, as well as possible segmenting of markets, classifying customers, and identifying demand.

Plan Supply includes principles and techniques of master scheduling. The master scheduling process creates a master production schedule (MPS) based on input from the sales and operation plan, the external environment, and the internal environment. The process includes material requirements planning (MRP) and then capacity requirements planning (CRP) leading to the final assembly scheduling.

Execute Supply Plan includes buy and make decisions. Buy decisions require an understanding of sourcing, which includes supplier selection and certification along with the purchasing process to procure goods and services. Make decisions include an understanding of routing and dispatching within the production process along with managing routing and utilization in batch processing.

Inventory Management requires an understanding of the function of stocks or items needed to support the production process of the supply chain. An understanding of determining order quantity and various replenishment methods, as well as tracking inventory and managing distribution inventory, is critical to supply chain functionality. Understanding inventory in forward supply chains, as well as in reverse supply chain logistics of managing returns and recycling, is also important.

Continuous Improvement/Quality Management and Technologies is the final section and includes principles of continuous improvement techniques as well as principles for maintaining technology systems and supporting technology implementation. Considerations for emerging technologies that support supply chain processes are also included in this section.

The successful candidate will have a thorough understanding of the basic concepts of supply chain management and be able to apply all key terms, principles, and techniques contained within the six subject areas.

APICS CPIM Part 1 Content 7.0

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

Diagnostic part	Main topic	Percentage of exam
I	Supply Chain Overview	17%
II	Fundamentals of Demand Management	10%
III	Plan Supply	10%
IV	Execute Supply Plan	24%
V	Inventory Management	30%
VI	Continuous Improvement / Quality Management and Technologies	9%

Content Outline

I. Supply Chain Overview

A supply chain is a global network used to deliver products and services, from raw materials to finished goods, to end consumers through a flow of information, physical distribution, and cash. A supply chain consists of retailers, distributors, warehouses, and suppliers participating in the production, delivery, and sale of a product or service to the consumer.

The supply chain satisfies the market strategy through a variety of business functions. Critical factors include product volume and variety, customer service level, lead times, customization, product life cycle, costs, and strategy.

A. Operational Objectives to Meet Competitive Priorities

1. Operating environment
   a. Customer expectations
   b. Government regulations
   c. Economic conditions
   d. Global and domestic competitors
2. Business strategy and supply chain planning
   a. Company vision, mission, and values
   b. Alignment with all functional strategies
   c. Planning of strategic buffers

B. Marketing Strategies

1. Four Ps (product, price, place, and promotion)
2. Distribution channels
3. Market segmentation

C. Fundamentals of Sales and Operations Planning (S&OP)

Sales and operations planning is a process to develop tactical plans that provide management the ability to execute business plans and strategies to achieve competitive advantage in the following steps:

1. Update the sales forecasting reports
2. Demand planning phase
3. Supply planning phase
4. Pre - S&OP meeting
5. Executive meeting

D. Manufacturing Strategies

1. Make-to-stock (MTS)
2. Assemble-to-order (ATO)
3. Configure-to-order (CTO)
4. Make-to-order (MTO)
5. Engineer-to-order (ETO)
6. Remanufacture

E. Manufacturing Processes and Layouts

1. Processes include:
   a. Flow
   b. Intermittent production/job shop
   c. Project
2. Layouts include:
   a. Continuous
   b. Repetitive
   c. Product
   d. Process/functional
   e. Cellular
   f. Fixed-position/project

F. Product Costs

1. Landed cost
2. Standard cost

G. Key Performance Indicators (KPIs) and Metrics

1. Strategic
2. Tactical
3. Operational

H. Sustainable and Socially Responsible Supply Chains

1. Ethical
2. Social
3. Sustainable
4. Financial
5. Legal
6. Regulatory

References: 1; 7 (chapters 1-3, 6-7, 9, 13-16); 8 (chapters 2-3, 5); 11 (chapters 1-3, 5, 13, 15, 17); 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. Fundamentals of Demand Management

Demand management is the function of recognizing and managing all demands for products or services. Demand management includes several major activities, all of which are primarily market-driven and include identifying all product and service demand in the defined markets. Demand management includes forecasting but also involves possible segmenting of markets, classifying customers, and identifying demand.

A. Determine Customer Needs, Specifications, and Features and Create a Product Roadmap

1. Identifying and synchronizing market demand
2. Setting and making priorities and delivery promises
3. Collaborative planning, forecasting, and replenishment (CPFR)

B. Product Management

The impact on product management of the operating environment depends on customer expectations, cumulative lead times, inventory, sustainability, product design, and product life cycles.

1. Product development principles
   a. Product specifications and design
   b. Product life cycle management (PLM)
2. Review marketing plan
   a. Promotion types
   b. Impact on demand

C. Review Demand Types and Sources

1. Independent demand
2. Dependent demand

D. Forecast Demand

1. Principles of forecasting
2. Demand characteristics
3. Forecasting techniques
   a. Qualitative
   b. Quantitative
   c. Intrinsic
   d. Extrinsic
4. Forecast error measurement
   a. Bias
   b. Variability
5. Monitor and respond to demand variation
6. Review and/or revise forecast

References: 1; 7 (chapters 4, 8, 11, 14, 16); 11 (chapters 1, 3-4, 7, 8, 14, 16)

III. Plan Supply

Master scheduling process creates a master production schedule (MPS) based on input from the sales and operation plan, the external environment, and the internal environment.

A. Create master production schedule (MPS)
B. Determine rough-cut capacity requirements
C. Create material requirements plan
D. Perform capacity requirements planning (CRP)
E. Create final assembly schedule (FAS)
F. Closing the loop

References: 1; 7 (chapters 2-5); 11 (chapters 7-8, 10, 14)

IV. Execute Supply Plan

A. Buy

Sourcing is the process of identifying a company that provides a needed good or service. These decisions normally are based on supplier cost and capability by comparison to producing the product in-house. These decisions include supplier selection, certification, agreements, and partnerships, including vendor-managed inventory (VMI). Total acquisition costs must be considered.

1. Establish external supply
2. Purchase/procure goods and services
   a. The purchasing process begins with any of the following signals: purchase requisition, material requirements planning (MRP) output, Kanban signals, and/or buffer.
   b. Order processing includes defining terms and conditions, purchase order release, monitoring supplier performance, authorizing supplier to ship, receipt of goods, invoice approval, and purchase order closeout.
3. Respond to supply disruptions/ changes
   a. Supply chain conflicts and risks exist among trading partners and must be identified, analyzed, and addressed. Some examples include disruption of supply, synchronizing supply with demand, minimizing inventory investment, maximizing customer service, and managing total cost.
   b. An important part of execution and control is focusing on quality assurance by measuring quality, monitoring process variation, and improving process control.
4. Measure supplier performance

B. Make

This activity is the function of routing and dispatching the work to be accomplished through the production facility.

1. Flow processes
   a. Calculate takt time
   b. Authorize backflush/inventory release
2. Batch processes
   a. Determine production rate or flow rate
   b. Create production schedule, including downtime

c. Create labor schedule and determine staffing
d. Create dispatch/priority list and create work sequence to improve efficiency
e. Monitor utilization/capacity cushion
f. Manage material routing
g. Manage queues
h. Manage bottlenecks
i. Plan for non-standard demand (examples include samples, tests, engineering prototypes)
j. Manage exceptions
k. Create input/output control (I/O)

References: 1; 7 (chapters 1, 4-8, 14-15); 8 (chapters 4, 5); 11 (chapters 10-13, 17)

V. Inventory Management

Those stocks or items used to support production (raw materials and work in process (WIP) items), supporting activities (maintenance, repair, and operating supplies), customer service (finished goods and spare parts), and specialized inventory.

A. Plan inventory investment and days of supply

1. Inventory targets
2. Functions of inventory
3. Basic accounting
4. Inventory valuation methods
5. Lead time

B. Determine safety stock

1. Establish service levels
2. Manage inventory costs and tradeoffs

C. Determine item segmentation (for example, ABC classification)

D. Determine order quantity and item replenishment method

1. Push and pull methods (for example, Kanban)
2. Demand patterns
3. Product costs, preparation costs, and holding costs
4. Lot size formulas and calculations

E. Track in-transit inventory and monitor inventory location and quantities

1. Raw materials
2. Work in process (WIP)
3. Finished goods

F. Track inventory throughout the supply chain

1. Point of origin
2. Final customer
3. Special handling
4. Chain of ownership
5. Recall guidelines
6. Maintain lot control and serial numbers

G. Maintenance, repair, and operating (MRO) inventories

H. Manage returns, reworks, reclamation, recycle, reuse, remanufacture, and product disposition

I. Manage inventory accuracy audit program

1. Cycle count/physical inventory
2. Inventory classification
3. Types of inventory

J. Monitor inventory turns

1. Cost of goods sold (COGS)
2. Inventory turns calculations

K. Address inventory loss

1. Shrinkage
2. Scrap
3. Theft
4. Shelf life
5. Obsolescence
6. Damage

L. Inventory loss strategies

1. Company policy
2. Mitigation

M. Plan and manage distribution inventory

1. Distribution requirements planning (DRP)
2. Distribution network
3. Demand
4. Supply
5. Current inventory levels
6. Transit times
7. Item master
8. Backlog

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

VI. Continuous Improvement /Quality Management and Technologies

A. Continuous Improvement

1. Conduct benchmarking
2. Identify and eliminate waste and reduce variation
3. Identify and implement process improvements and utilize appropriate quality tools
4. Conduct supplier audit
5. Support sustainability (environmental, financial, social)
6. Manage master data

B. Information, Process, and Emerging Technology

1. Develop technology systems requirements and specifications
2. Support technology implementation
3. Maintain technology systems
   a. Information technology (examples include enterprise resource planning (ERP), product life cycle management (PLM), data analytics)
   b. Process technology (examples include robotics, additive manufacturing/3D printing, machine learning)
   c. Emerging technology (examples include internet of things, blockchain, artificial/adaptive intelligence (AI))

References: 1; 7 (chapters 7, 15, 16, 25); 8 (chapters 2, 5); 11 (chapter 2); 13 (chapters 2, 4, 5, 8-9)

Key Terminology

An understanding of the list of terms in the Key Terminology section of this document is strongly recommended. The list is intended to be thorough but not exhaustive. The candidate is also expected to be familiar with the definitions of terms identified in the content outline. Definitions of these terms can be found in the *APICS Dictionary*, 16th edition.

Bibliography

All test candidates should familiarize themselves with the references for this exam. The recommended references pertaining to the diagnostic areas are listed at the end of each section of the content outline. The first number indicates the sequence number for the reference in the Bibliography section and the numbers in parenthesis indicate the relevant chapters within that reference. The text, *Introduction to Materials Management*, covers the majority of the material for the CPIM Part 1 exam. The other references provide coverage of some of the topic areas and can enhance candidates' understanding of the body of knowledge. The *APICS Dictionary*, 16th edition is available from the APICS Bookstore. Other references can be found on the CPIM Exam References page.

CPIM Part 1 Sample Questions

The following eight multiple-choice questions and four technology enhanced item (TEI) question examples 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 44-45.

1. The shipping buffer in the drum-buffer-rope scheduling process serves which of the following functions?

   (A) It is used to create the master production schedule.
   (B) It provides protection for the order due date.
   (C) It provides protection to the constraint.
   (D) It is used to release work to the floor.

2. Which of the following statements is best used to understand a company's ability to pay its bills?

   (A) Cash flow
   (B) Income
   (C) Balance sheet
   (D) Market-share

3. 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.

4. Intrinsic forecast data should be based on which of the following considerations?

   (A) Judgment, intuition, and informed opinions
   (B) Economic indicators
   (C) Shipment history
   (D) Sales history

5. Which of the following approaches represents the longest planning range in capacity management?

   (A) Capacity requirements plan
   (B) Resource plan
   (C) Rough-cut capacity plan
   (D) Input/output control (I/O)

6. An order of 10 components requires 16 standard hours. How much time should be allocated if the work center has an efficiency of 80% and a utilization of 80%?

   (A) 22.40 hours
   (B) 10.24 hours
   (C) 16.00 hours
   (D) 25.00 hours

7. The primary objective of a random-location storage system is to improve:

   (A) distribution.
   (B) kitting.
   (C) access to stock.
   (D) use of space.

8. Which of the following inventory functions creates independence between supply and the use of material?

   (A) Cycle
   (B) Transit
   (C) Decoupling
   (D) Hedge

Technology Enhanced Items (TEIs)

Technology enhanced items (TEIs) are exam question and answer sets that include specialized interactions for collecting exam question response data. Different types of TEI's include items with multiple responses (select all that apply), building lists / ordering processes, fill in the blank, and drag and drop.

The following examples were created to familiarize exam candidates with the format of technology enhanced items (TEIs) that can be found on the CPIM Part 1 exam.

Example 1: Fill in the Blank

Average Inventory	Current Inventory	Retained Earnings	Annual Cost of Goods Sold
$200,000	$400,000	$300,000	$800,000

Given the data above, the inventory turnover is _____ times. Please round answer to the nearest whole number.

Example 2: Unordered List

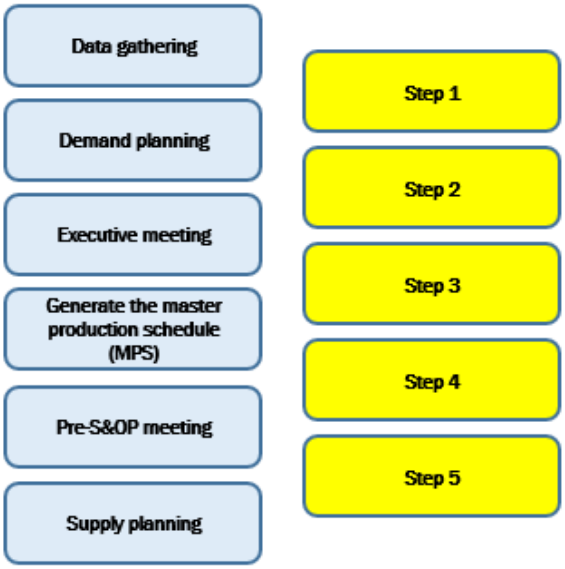
Which of the following documents must be in agreement before payment is made to the supplier? Select all that apply.

- ❑ Bill of lading
- ❑ Customs documentation
- ❑ Invoice
- ❑ Packing list
- ❑ Purchase order
- ❑ Purchase requisition
- ❑ Receiving report

Example 3: Ordered List with Drag and Drop

Please use the drag and drop functionality to answer the following question.

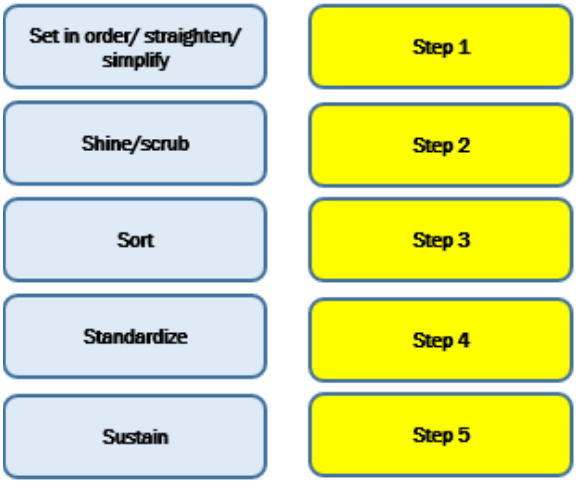
From the following options, please select the sales and operations planning (S&OP) steps involved in the monthly planning cycle and place them in the correct order.



Example 4: Ordered List with Drag and Drop

Please use the drag and drop functionality to answer the following question.

Place the 5S steps in the proper sequence for implementation.



APICS Certified in Planning and Inventory Management Part 2

CPIM Part 2 Exam Subcommittee

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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 this is the CPIM Part 2, it is expected that a candidate is familiar with the subject matter of the CPIM Part 1. The CPIM Part 2 exam will test at a deeper level of understanding and be focused on application of the subject matter.

Align the supply chain to support the business strategy 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 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 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, considering the trade-offs of available choices.

Plan and manage demand 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 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 to support customer demand. Items that are purchased require development of external supply sources that may represent a range of supplier relationships and oversight methods. An important part of managing supply is 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 or service's life cycle.

Plan and manage inventory 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 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 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 includes the principles and techniques used to design a distribution network considering various investment, cost and service trade-offs, and competitive priorities. Creation of distribution plans supports strategic goals, service of customer orders, and both out-bound and in-bound material flows.

Manage quality, continuous improvement, and technology includes the principles and techniques used to assess the quality of goods and services and to assess, understand, and correct deficiencies as appropriate. Evaluating products, services, and processes and improving efficiency, effectiveness, and productivity through the use of a variety of tools supporting organizational goals and market expectations. Use of appropriate technology tools supports quality and continuous improvement.

The successful candidate will have a thorough understanding of all key terms, principles, and techniques contained within the eight subject areas and will be able to apply them, analyze situations, determine which approaches are applicable, and recognize when to escalate issues.

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

Diagnostic part	Main topic	Percentage of exam
I	Align the Supply Chain to Support the Business Strategy	22%
II	Conduct Sales and Operations Planning (S&OP) to Support Strategy	10%
III	Plan and Manage Demand	9%
IV	Plan and Manage Supply	16%
V	Plan and Manage Inventory	14%
VI	Plan, Manage, and Execute Detailed Schedules	12%
VII	Plan and Manage Distribution	3%
VIII	Manage Quality, Continuous Improvement, and Technology	14%

Content 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, 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 competitive priorities (examples include: cost, quality, delivery, and flexibility)
   c. Evaluate key customer segments
   d. Incorporate key customer requirements as appropriate for the corporate and business unit strategy
   e. Determine the firm's order winners and qualifiers
   f. 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 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 cost-volume profit analysis, break-even analysis, target income volume, and sales mix analysis to manage costs and profitability
4. Establish lead and lag capacity strategies
5. Support marketing strategies (Four Ps – product, price, promotion, and place)
6. 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), remanufacturing)
7. 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, job shop, batch, mass customization, assembly line, repetitive, 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, 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 flow)
2. Use appropriate operational metrics (examples include: customer service levels, order fill rate)
3. Apply KPI tools (examples include: KPI trees, maturity assessment, SCOR metrics, 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: prevention, mitigation, response, recovery, and resiliency)
4. Use appropriate risk management tools and guidance (examples include: failure modes and effects analysis (FMEA) and ISO risk management standards)

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 sustainability goals
2. Identification, reporting, and verification of sustainability metrics
3. Review sustainability guidelines (examples include: Global Reporting Initiative (GRI), ISO sustainability standards, 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)

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 (examples include: manufacturing and services)
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, 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), obsolescence)

3. Develop and validate a production plan to support the firm's strategic choices
4. Evaluate the resource plan to support aggregate supply plan
5. Review strategic buffers
    a. Identify bottlenecks
    b. Identify other critical resource constraints and supply chain risks
    c. Determine types (examples include: lead time, inventory, capacity), size, and location of buffers

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, temporary suppliers)
    b. Adjust demand (examples include: adjusting lead time, influencing demand, substitutions, complimentary 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 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. Maintain effective customer communications
5. Determine and monitor metrics of order delivery performance

B. Understand marketing and product management considerations

1. Influence demand to better align with supply
2. Manage product configuration and product changes
    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. Review marketing promotions
    a. Evaluate the impact on demand including potential product / service cannibalization
    b. Manage the promotion life cycle

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 and interval and a level of aggregation for forecasting purposes
5. Apply qualitative techniques to create forecasts (examples include: historical analogy, grassroots forecasting, panel consensus, executive opinions, Delphi method, sales force polling, and consumer surveys)
6. Apply quantitative techniques to create forecasts
    a. Use time series analysis (examples include: moving average, weighted moving average, seasonal indexes, trend projections, exponential smoothing)
    b. Use output from associative techniques (examples include: linear regression, leading indicators)

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

1. Evaluate forecast performance compared to actual demand
2. Measure forecast error using appropriate 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), tracking signals)
3. Collaborate with customers and suppliers to improve forecast accuracy
4. 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. Review the role of master scheduling in the planning and control hierarchy
2. Evaluate the impact of different business environments, including manufacturing and services, 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 in the bill of material (BOM) where the MPS should be developed based on production strategies (examples include: finished goods, sub-assemblies, and raw materials)
    b. Review customer order promising (examples include: 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. 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. Manage the consequences of an unrealistic master schedule
6. Measure actual performance against the master schedule

B. Perform rough-cut capacity planning (RCCP)

1. Review 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 MRP input and data sources
   a. Define inventory data as required to support the material planning process (examples include: item description, current usage rates, stock 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 (BOM) to calculate multilevel time-phased requirements and create long-range and short-range material plans that support company and supplier needs
3. Use the MRP time-phased grid to display gross requirements, scheduled receipts, projected available, net requirements, planned order receipts, and planned order releases
4. Make decisions to facilitate material planning, establish priorities, review exceptions, resolve conflicts through pegging relationships, and support other decisions and productivity measures based on the type of environment and product life cycles
5. Monitor system feedback mechanisms to enable the appropriate actions necessary to balance supply and demand
6. Use various safety policies to minimize the impact of uncertainty on the planning process
7. Engage closed-loop integration with master planning, final assembly, and configuration processes to ensure material availability matches 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 customer order promising (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. Manage the consequences of an unrealistic FAS
4. Measure actual performance against the FAS

E. Create and manage supplier relationships

1. Identify capable suppliers and undertake appropriate certifications
2. Develop various supplier relationships (examples include: partnership, strategic alliance, joint venture, contract manufacturing, sub-contracting, and transactional)
3. Review supplier selection alternatives (examples include: sole, single, multiple sourcing, domestic and foreign providers, and special services)
4. Include relevant supply chain links (examples include: retail, distribution, and transportation companies)
5. Engage in environmentally responsible purchasing to minimize the impact of the supply chain on the environment

6. Review the effect of procurement planning, new product introduction (NPI), and engineering change control on supply performance
7. Measure supplier performance using appropriate methods (examples include: balanced scorecard, price-based metrics, time-based metrics, cost-based metrics, quality-based metrics)

F. Purchase/procure goods and services

1. Apply methods of procuring materials and services (examples include: contracts, kanbans, blanket orders, purchase orders, consignment, pricing agreements, vendor-managed inventory (VMI), outsourcing, and e-commerce)
2. Select appropriate delivery methods (examples include: traditional modes of transportation, third- or fourth-party logistics (3PL or 4PL), cross-docking, point-of-use delivery, and direct shipment)
3. Use supplier participation (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, value-chain forecasting, 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
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. Apply appropriate costing methods that determine the cost of producing a product (examples include: absorption, variable, activity-based costing (ABC), and job costing) to compare actual to planned, budgeted, or standard costs
2. Review variances in cost through inventory valuation and an analysis of obsolescence, scrap, rework, repairs, returns, and defective output
3. Measure costs related to quality, including internal and external failure, appraisal, and prevention costs
4. Eliminate non-value-added activities

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 viable alternatives before changing the existing material plan
4. Monitor buffer status

I. Conduct product life cycle management (PLM)

1. Develop new product introduction (NPI) schedule
    a. Create a prototype schedule in consideration of supply and demand plans

b. Review supply constraints that may impact the NPI schedule
2. Develop an end-of-life plan
   a. Review lifetime buy quantities and timing
   b. Review obsolescence timing
   c. Review 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
2. Understand the types and classifications of inventory (examples include: raw materials; work in process (WIP); finished goods; maintenance, repair, and operating (MRO) supplies; returned goods; excess; inactive; obsolete; scrap; distressed; and perishable inventory)
3. Determine item segmentation (examples include: ABC classification, perishability, hazardous materials, special handling, supply risk, customer risk)

B. Inventory management

1. Determine 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. Use appropriate dynamic techniques (examples include: least total cost, least unit cost, lot-for-lot (L4L), period order quantity) or fixed techniques (examples include: economic order quantity (EOQ) and fixed order quantity) to determine lot size and order quantities, considering cost and service trade-offs
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 special inventory (examples include: temperature-controlled, hazardous materials) to comply with regulations, environmental standards, and protocols of material 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 stock-out costs, and their trade-offs
2. Review inventory valuation methods (examples include: first in, first out (FIFO); last in, first out (LIFO); transfer pricing)
3. Review projected or standard cost versus actual cost variances
4. Measure and review inventory metrics (examples include: inventory turns and days of supply)

D. Inventory control

1. Manage inventory location 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, damage)
4. Utilize 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, GS1-GTS2)
    c. Maintain lot control and serial numbers for purchased items and make items
    d. Adhere to product recall guidelines
5. Track in-transit inventory
    a. Create and monitor advanced ship notices (ASN) and delivery information
    b. Implement and manage shipment tracking technology (examples include: satellite, internet of things (IoT))

E. Manage returns and product disposition

1. Review the waste hierarchy and circular economy implications (examples include: company rules, regulations, environmental standards, product costs, ownership, lead times, material handling)
2. Develop and manage reverse logistics processes around the waste hierarchy, considering company acceptance guidelines, regulatory requirements, recall guidelines, and customer expectations
3. Develop, manage, and review the disposition process to support sustainability, quality, and supply goals

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 rates or flow rate
    a. Calculate load from planned and released orders, repetitive schedules, past-due orders, rework orders, and work in process (WIP)
    b. Evaluate throughput by measuring efficiency, utilization, productivity, takt time, cycle time, and input/output control (I/O) metrics
    c. Manage schedules and throughput in various industries, including service
2. Create work sequences to improve efficiency, resolve supply and demand imbalances, and consider time fence policies
    a. Utilize appropriate tools to create efficient schedules in a push environment (examples include: priority schedule, setup matrix, alternate routings, and sequencing rules)

b. Utilize appropriate tools to create an efficient pull environment (examples include: mixed-model scheduling, rate-based scheduling, synchronization, 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, engineering prototypes) and quality problems on resources
   b. Assess impacts of industry-specific conditions on resources (examples include: remanufacturing, byproducts, co-products, and recycled material)

B. Create production schedules

1. Evaluate the availability of theoretical, demonstrated, and rated capacity
2. Recognize service industry specific capacity characteristics to manage loads (examples include: variable arrival rates and variable processing times)
3. Create a capacity load using scheduling techniques (examples include: infinite and finite capacity planning, constraint-based finite scheduling, and load balancing)
4. Undertake simulation and modeling techniques to assess viability of various options or opportunities
5. Review 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 in environments that must accommodate unplanned load
7. Load operations and adjust for capacity reductions or increases 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 and determine staffing based on HR policies, labor pool, labor skills matrix, and consider outsourcing and contract labor

C. Implement and manage detailed schedules

1. Issue production orders as scheduled
2. Assign labor schedules for service industries
3. Measure actual capacity performance to the plan
4. Manage material routing
   a. Evaluate the size of process batches and transfer batches to support production and inventory plans
   b. Review equipment and labor status, maintenance schedules, and their impact on the plan
   c. Determine when alternate routings should be utilized
5. Manage the size of queues
   a. Review input/output analysis (I/O), capacity load, and open orders
   b. Determine and implement prioritization rules
6. Manage exceptions to maintain valid plans; evaluate variances to standard performance; and determine performance process stability, process capability, and theoretical and demonstrated capacity
7. Manage the control process through established standards and procedures in support of the organization's goals and bottom line, including the use of relevant and measurable performance measures.

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. Review risk management plans and sustainability considerations
3. Develop the distribution plan
   a. Develop a distribution location-specific product forecast
   b. Develop the replenishment planning parameters for stock keeping units (SKU) within the distribution network
   c. Undertake time-phased planning logic for distribution requirements planning (DRP)
4. Review distribution plans and master schedules to support the sales and operations plan (S&OP)
5. Review inventory levels and locations required within the distribution channel to support supply and demand plans
6. Monitor key performance indicators (KPIs) of the distribution network (examples include: on-time delivery, lead time, inventory turns, safety stock levels, stock-outs, and customer satisfaction)

B. Manage customer orders

1. Monitor inventory availability and lead time in support of marketing and customer service level goals
2. Monitor open customer orders to meet on-time delivery goals
3. Expedite past due customer orders, considering cost and service tradeoffs

C. Manage reverse logistics

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

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
2. Review cost of quality (examples include: prevention cost, appraisal cost, internal failure cost, and external failure cost)
3. Review processes and outputs utilizing appropriate quality tools (examples include: basic seven tools of quality (B7) and seven new tools of quality (N7))
   a. Identify potential process problems proactively
   b. Identify the root cause of an existing problem
4. Undertake internal and external benchmarking for process improvement

B. Manage continuous improvement

1. Utilize lean concepts and undertake process improvements (examples include: eliminate waste, improve throughput, and reduce inventory)
2. Utilize lean tools (examples include: pull systems, scrum, kanban, takt time, standardized work, leveling workload, total production maintenance (TPM))
3. Improve relationship performance with customers and suppliers (examples include: collaboration technologies, voice of the customer (VOC), supplier certification, and supplier feedback)
4. Conduct value stream mapping (VSM) 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); define, measure, analyze, improve, control (DMAIC); and six sigma)
8. Monitor process performance and reduce variation using statistical process control (SPC) methods (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
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 (chapters 8); 10 (chapters 1-8, 10-15); 11 (chapters 13); 12 (chapters 3, 6-7); 13 (chapters 1-10)

Key Terminology

An understanding of the list of terms in the key terminology section of this document is strongly recommended. The list is intended to be thorough but not exhaustive. The candidate is also expected to be familiar with the definitions of terms identified in the content outline. Definitions of these terms can be found in the *APICS Dictionary*, 16th edition.

Bibliography

All test candidates should familiarize themselves with the references for this exam. The recommended references pertaining to the diagnostic areas are listed at the end of each section of the content outline. The first number indicates the sequence number for the reference in the Bibliography section and the numbers in parenthesis indicate the relevant chapters within that reference.

The *APICS Dictionary* is available from the APICS Bookstore. Other references can be found on the CPIM Exam References page.

CPIM Part 2 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 46-47.

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

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

2. In a distribution environment, which of the following 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

3. Cause-and-effect analyses are made with the help of which of the following?

   (A) Fishbone chart
   (B) Statistical process control (SPC) method
   (C) Critical path method (CPM)
   (D) Pareto analysis

Use the information below to answer question 4.

Lead time: 2	Lot size: 30
Demand time fence: 3	On hand: 15
Planning time fence: 7	Safety stock: 6

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					
Master production schedule	30		30		

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

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

5. Given the following purchase cost data for product Z:

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

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

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

6. Which of the following is a significant factor 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 make-to-order organization competing on delivery speed would consider which of the following to be 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

8. Which of the following measures is a key indicator of a firm's asset utilization?

   (A) Profit margin
   (B) Current ratio
   (C) Inventory turnover
   (D) Cost of goods sold (COGS)

9. Which of the following is an advantage of using a lag capacity strategy approach in implementing operations strategy?

   (A) High facility utilization rate
   (B) Revenue maximization
   (C) Reaction to short-term demand changes
   (D) Product mix flexibility

10.

The MRP Grid										
Technique Order quantity / Lot Size – lot-for-lot (L4L) On hand: 500 Safety stock: 0 Allocated quantity: 0 Low-level code: 0 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									

The chart shows the gross requirements for an item in a material requirements planning system. Stock on hand is 500, and there is nothing on order. The item has a lead time of four periods and is being ordered lot-for-lot. Which of the following would be the correct planned order release for the item?

(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.

CPIM Part 1

1. B (IA2c) A shipping buffer prevents missed due dates. A is incorrect because the drum is the rate of production set by the system's constraint. C is incorrect because a constraint buffer is used to buffer the constraint. D is incorrect because the rope is the communications process for releasing work.

2. A (IH4) A cash flow statement shows the flow of cash and its timing into and out of an organization. B is incorrect because an income statement shows profit and loss over a period of time. C is incorrect because a balance sheet shows the resources owned, the debts owed and the owner's equity at a given point in time. D is incorrect because a market share report indicates how well a firm is doing in the market.

3. C (IID1) 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 independent demand items. D is incorrect because forecasts are more accurate for near-term periods.

4. D (IID3) Intrinsic forecast data is based on interior factors, such as sales history. A and B are incorrect because these are extrinsic data. C is incorrect because shipment history may not show the actual demand if the product was unavailable for shipment.

5. B (IC3) Resource planning is long-range capacity planning completed at the production plan level. A is incorrect because capacity requirements planning is done at the MRP level. C is incorrect because rough-cut capacity planning is done at the master schedule level. D is incorrect because input/output control (I/O) is completed during execution of the plan and is the shortest planning range.

6. D (IVB2) To calculate how much actual time will be needed to complete 16 standard hours of work, divide the capacity required by the efficiency times the utilization (actual time = capacity required / (efficiency) (utilization) (actual time = 16 / (80%) (80%). A is incorrect because it was incorrectly calculated by multiplying the 16 hours required by 40 percent (the difference in the capacity and utilization from 100 percent) and adding the amount to the 16 hours required ((16 × 40% = 6.4), then (16 + 6.4 = 22.4)). B is incorrect because it was incorrectly calculated by multiplying efficiency and utilization and then multiplying the required standard hours (80% × 80% = .64, then .64 × 16 = 10.24). C is incorrect because it is the standard hours required and does not consider the efficiency and utilization of the operation.

7. D (VM4) Random-location storage enables parts to be placed in any space that is empty. This method often required less storage space than a fixed-location storage method. A is incorrect because distribution is the activities associated with the movement of material from the manufacturer to the customer. B is incorrect because kitting is the process of constructing and staging kits. C is incorrect because access to stock is usually an advantage of fixed-location storage.

8. C (VI2) Decoupling creates independence between supply and use of material. A is incorrect because it is lot size inventory. B is incorrect because it is inventory in transit between locations. D is incorrect because hedge is a form of inventory buildup to buffer

against some event that may not happen.

Answers to Sample Questions

Technology Enhanced Items (TEIs)

1. (VJ2) The inventory turnover is 4 times. A frequently used method to compute inventory turnover is to divide the annual cost of goods sold by the average inventory level.

2. (IVB4) The answer is invoice, purchase order, receiving report. The purchase order, receiving report and the invoice should be consistent regarding items and quantities so that the items and quantities the supplier will be paid for are consistent with the items and quantities that were ordered and received. The bill of lading, packing list and customs documentation can be seen as information related to the transport of the goods and not impacting the invoice approval. The purchase requisition precedes the purchase order and is not required for invoice approval.

3. (IC) The answer is data gathering, demand planning, supply planning, pre-S&OP meeting, executive meeting. The S&OP five-step process can be summarized as data gathering, demand planning, supply planning, pre-S&OP meeting and executive meeting. The step “Generate the master production schedule (MPS)” is not part of the process.

4. (IE1) The answer is sort, set in order/ straighten/simplify, shine/scrub, standardize, sustain. Five terms beginning with “S” used to create a workplace suitable for lean production: sort, simplify, scrub, standardize, sustain. Sort means to separate needed items from unneeded ones and remove the latter. Simplify means to neatly arrange items for use. Scrub means clean up the work area. Standardize means to sort, simplify and scrub daily. Sustain means to always follow the first four Ss. Sometimes referred to by the Japanese equivalents: seiri, seiton, seiso, seiketsu and shitsuke

Answers to Sample Questions

Note: References to the content outline appear in parentheses.

CPIM Part 2

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

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

3. A (VIIIA) - The fishbone chart is a diagram of the possible causes of a problem. The causes are determined with the aid of brainstorming techniques. Statistical process control (B) focuses on the continuous monitoring of a process. The critical path method (C) is a technique used to plan and control the activities of a project. Pareto analysis (D) is a technique to rank order the relative frequency of occurrences.

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

5. C (VC) - A is incorrect because it uses the cost of inventory after January 10, but the inventory is used on January 8. B is incorrect because it is the FIFO cost of the product. C is correct because this is the weighted average on January 8. D is incorrect because this is the last cost paid for each item.

6. B (VB) - 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 work-in-process (WIP) level, but does not determine the total WIP level. The takt time (D) determines the rate at which the process needs to operate. It does not determine the WIP level.

7. D (IB) - 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 impact on the cost but not the delivery. Answer C also does not impact product delivery.

8. C (ID) – Inventory turnover (cost of sales/inventory level) is one of the principal measures of a company's asset utilization. Answer A is a profitability measure (net income/sales). Answer B is a liquidity measure (current assets/current liabilities). Answer D does not address asset utilization.

9. A (IB) - The strategy avoids the wasteful provision of excess staff that occurs with a lead capacity plan. Answer B is incorrect because you could miss revenue due to capacity shortage. Answer C is incorrect because it is harder to react to short-term demand increases. Answer D is incorrect because it is harder to be flexible with high utilization rates.

10. A (IVC)

The MRP Grid

Technique
Order quantity / Lot Size – lot-for-lot (L4L)
On hand: 500
Safety stock: 0
Allocated quantity: 0
Low-level code: 0
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.

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