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To all of my students at Notre Dame. The energy, enthusiasm, and experiences you bring to the classroom makes me a better teacher and writer.

—Mike

Acknowledgments

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About the Author

Mike Chapple, Ph.D., CySA+, is author of the best-selling *CISSP (ISC2) Certified Information Systems Security Professional Official Study Guide* (Sybex, 2024) and the *CISSP (ISC2) Official Practice Tests* (Sybex, 2024). He is an information technology professional with over 25 years of experience in higher education, the private sector, and government.

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Mike has written more than 50 books. He earned both his B.S. and Ph.D. degrees from Notre Dame in computer science and engineering. Mike also holds an M.S. in computer science from the University of Idaho and an MBA from Auburn University. Mike holds the Tech+, Cybersecurity Analyst+ (CySA+), Data+, Security+, Certified Information Security Manager (CISM), Certified Cloud Security Professional (CCSP), and Certified Information Systems Security Professional (CISSP) certifications.

Learn more about Mike and his other security certification materials at his website, `https://www.certmike.com`.

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Chris Crayton, **MCSE, CISSP, CASP+, PenTest+, CySA+, Cloud+, S+, N+, A+, ITF+** is a technical consultant, trainer, author, and industry-leading technical editor. He has worked as a computer technology and networking instructor, information security director, network administrator, network engineer, and PC specialist. Chris has served as technical editor and content contributor on numerous technical titles for several of the leading publishing companies. He has also been recognized with many professional and teaching awards.

Contents

Introduction

If you're preparing to take the Tech+ exam, you might find yourself overwhelmed with information. This exam covers a very broad range of topics, and it's possible to spend weeks studying each one of them. Fortunately, that's not necessary!

As part of the CertMike Get Certified series, this book is designed to help you focus on the specific knowledge that you'll need to pass the Tech+ exam. CompTIA publishes a detailed list of exam objectives, and this book is organized around those objectives. Each chapter clearly states the single objective that it covers and then, in a few pages, covers the material you need to know about that objective.

You'll find two important things at the end of each chapter: CertMike Exam Essentials and Practice Questions. The CertMike Exam Essentials distill the major points from the chapter into just a few bullet points. Reviewing these CertMike Exam Essentials is a great way to prepare yourself right before taking the exam.

I've also recorded an audio version of the CertMike Exam Essentials that you can access online at `www.wiley.com/go/sybextestprep` after registering and logging on. You can listen to the audio review when you're in the car, at the gym, or mowing the lawn!

Each chapter concludes with two practice questions that are designed to give you a taste of what it's like to take the exam. You'll find that they're written in the same style as the Tech+ exam questions and have very detailed explanations to help you understand the correct answer. Be sure to take your time and thoroughly study these questions.

Finally, the book's online test bank (`www.wiley.com/go/sybextestprep`) includes a full-length practice exam that you can use to assess your knowledge when you're ready to take the test. Good luck on the Tech+ exam!

NOTE

Don't just study the questions and answers! The questions on the actual exam will be different from the practice questions included in this book. The exam is designed to test your knowledge of a concept or objective, so use this book to learn the objectives behind the questions.

THE TECH+ EXAM

The Tech+ exam is designed to be a vendor-neutral certification for those seeking to enter the information technology field. CompTIA recommends this certification for three types of people:

- Students considering starting a career in information technology
- Professionals working in fields that require an understanding of information technology
- Sales, marketing, and operations professionals in IT-focused companies

The exam covers six major domains of knowledge:

1. IT Concepts and Terminology
2. Infrastructure
3. Applications and Software
4. Software Development Concepts
5. Data and Database Fundamentals
6. Security

These six areas include a range of topics, from installing printers to securing networks, while focusing heavily on the basic knowledge expected of all IT professionals. That's why CompTIA recommends the Tech+ certification for those in any IT-related field.

The Tech+ exam uses only standard multiple-choice questions. Unlike other CompTIA exams, you won't find performance-based questions (PBQs) on the Tech+ exam. This exam is designed to be straightforward and not to trick you. If you know the material in this book, you will pass the exam.

The exam costs $138 in the United States, with roughly equivalent prices in other locations around the globe. More details about the Tech+ exam and how to take it can be found at `www.comptia.org/certifications/tech`.

You'll have 60 minutes to take the exam and will be asked to answer up to 75 questions during that time period. Your exam will be scored on a scale ranging from 100 to 900, with a passing score of 650.

NOTE

CompTIA frequently does what is called *item seeding*, which is the practice of including unscored questions on exams. It does so to gather psychometric data, which is then used when developing new versions of the exam. Before you take the exam, you will be told that your exam may include these unscored questions. So, if you come across a question that does not appear to map to any of the exam objectives—or for that matter, does not appear to belong in the exam—it is likely a seeded question. You never really know whether or not a question is seeded, however, so always make your best effort to answer every question.

Taking the Exam

Once you are fully prepared to take the exam, you can visit the CompTIA website to purchase your exam voucher:

`https://store.comptia.org`

Currently, CompTIA offers two options for taking the exam: an in-person exam at a testing center and an at-home exam that you take on your own computer.

TIP

This book includes a coupon that you may use to save 10 percent on your CompTIA exam registration.

In-Person Exams

CompTIA partners with Pearson VUE's testing centers, so your next step will be to locate a testing center near you. In the United States, you can do this based on your address or your ZIP code, while non-U.S. test takers may find it easier to enter their city and country. You can search for a test center near you at the Pearson Vue website, where you will need to navigate to "Find a test center":

`www.pearsonvue.com/comptia`

Now that you know where you'd like to take the exam, simply set up a Pearson VUE testing account and schedule an exam on their site.

On the day of the test, take two forms of identification, and make sure to show up with plenty of time before the exam starts. Remember that you will not be able to take your notes, electronic devices (including smartphones and watches), or other materials in with you.

At-Home Exams

CompTIA began offering online exam proctoring in 2020 in response to the coronavirus pandemic. Candidates using this approach will take the exam at their home or office and be proctored over a webcam by a remote proctor.

Due to the rapidly changing nature of the at-home testing experience, candidates wishing to pursue this option should check the CompTIA website for the latest details.

After the Tech+ Exam

Once you have taken the exam, you will be notified of your score immediately, so you'll know if you passed the test right away. You should keep track of your score report with your exam registration records and the email address you used to register for the exam.

After you earn the Tech+ certification, you're certified for life! Unlike many other CompTIA certifications that must be renewed on a periodic basis, the Tech+ certification is permanent and remains with you throughout your career.

Many people who earn the Tech+ credential use it as a steppingstone to earning other certifications in their areas of interest. Those interested in technical support roles pursue the A+ certification, those interested in networking work toward the Network+ credential, and the Security+ certification is a gateway to a career in cybersecurity.

WHAT DOES THIS BOOK COVER?

This book covers everything you need to know to pass the Tech+ exam. It is organized into six parts, each corresponding to one of the six Tech+ domains.

Part I: IT Concepts and Terminology

Chapter 1: Computing Basics

Chapter 2: Notational Systems

Chapter 3: Units of Measure

Chapter 4: Troubleshooting

CertMike Get Certified Series Elements

Each book in the CertMike Get Certified series uses a number of common elements to help you prepare. These include the following:

Exam Tips Throughout each chapter, I've sprinkled practical exam tips that help focus your reading on topics that are particularly confusing or important to understand for the exam.

CertMike Exam Essentials The exam essentials focus on major exam topics and critical knowledge that you should take into the test. The exam essentials focus on the exam objectives provided by CompTIA.

Practice Questions Two questions at the end of each chapter help you assess your knowledge and if you are ready to take the exam based on your knowledge of that chapter's topics.

Practice Exam and Audio Review

This book comes with online study tools: a practice exam and audio review to help you prepare for the exam.

> **NOTE**
>
> Go to `www.wiley.com/go/sybextestprep` to register and gain access to the online study tools.

Practice Exam

The book includes a practice exam. You can test your knowledge of the Tech+ objectives that are covered in the chapters in their entirety or randomized. It's your choice!

Audio Review

I've recorded an audio review where I read each of the 40 sets of CertMike Exam Essentials. This review provides a helpful recap of the main topics covered on the exam, which you can listen to while you're commuting, working out, or relaxing.

NOTE

Like all exams, the Tech+ certification from CompTIA is updated periodically and may eventually be retired or replaced. At some point after CompTIA is no longer offering this exam, the old editions of our books and online tools will be retired. If you have purchased this book after the exam was retired, or are attempting to register in the Sybex online learning environment after the exam was retired, please know that we make no guarantees that this exam's online Sybex tools will be available once the exam is no longer available.

EXAM FC0-U71 EXAM OBJECTIVES

CompTIA goes to great lengths to ensure that its certification programs accurately reflect the IT industry's best practices. They do this by establishing committees for each of its exam programs. Each committee consists of a small group of IT professionals, training providers, and publishers who are responsible for establishing the exam's baseline competency level and who determine the appropriate target-audience level.

Once these factors are determined, CompTIA shares this information with a group of hand-selected subject matter experts (SMEs). These folks are the true brainpower behind the certification program. The SMEs review the committee's findings, refine them, and shape them into the objectives that follow this section. CompTIA calls this process a job-task analysis (JTA).

Finally, CompTIA conducts a survey to ensure that the objectives and weightings truly reflect job requirements. Only then can the SMEs go to work writing the hundreds of questions needed for the exam. Even so, they have to go back to the drawing board for further refinements in many cases before the exam is ready to go live in its final state. Rest assured that the content you're about to learn will serve you long after you take the exam.

CompTIA also publishes relative weightings for each of the exam's objectives. The following table lists the six Tech+ objective domains and the extent to which they are represented on the exam.

Domain	% of Exam
1.0 IT Concepts and Terminology	13%
2.0 Infrastructure	24%
3.0 Applications and Software	18%
4.0 Software Development Concepts	13%
5.0 Data and Database Fundamentals	13%
6.0 Security	19%

FC0-U71 CERTIFICATION EXAM OBJECTIVE MAP

Objective	Chapter(s)
1.0 IT Concepts and Terminology	
1.1 Explain the basics of computing	1
1.2 Identify notational systems	2
1.3 Compare and contrast common units of measure	3
1.4 Explain the troubleshooting methodology	4
2.0 Infrastructure	
2.1 Explain common computing devices and their purposes	5
2.2 Explain the purpose of common internal computing components	6
2.3 Compare and contrast storage types	7
2.4 Given a scenario, install and configure common peripheral devices	8
2.5 Compare and contrast common types of input/output device interfaces	9

Objective	Chapter(s)
2.6 Compare and contrast virtualization and cloud technologies	10
2.7 Compare and contrast Internet service types	11
2.8 Identify basic networking concepts	12, 13, 14
2.9 Explain the basic capabilities of a small wireless network	15
3.0 Applications and Software	
3.1 Identify components of an OS	16, 17, 18
3.2 Explain the purpose of operating systems	19
3.3 Explain the purpose and proper use of software	20
3.4 Given a scenario, configure and use web browser features	21
3.5 Identify common uses of artificial intelligence (AI)	22
4.0 Software Development Concepts	
4.1 Compare and contrast programming language categories	23
4.2 Identify fundamental data types and their characteristics	24
4.3 Explain the purpose and use of programming concepts	25
4.4 Identify programming organizational techniques and logic concepts	26, 27
5.0 Data and Database Fundamentals	
5.1 Explain the value of data and information	28
5.2 Explain database concepts and the purpose of a database	29
5.3 Compare and contrast various database structures	30
5.4 Explain basic data backup concepts	31

Objective	Chapter(s)
6.0 Security	
6.1 Explain fundamental security concepts and frameworks	32, 33, 34
6.2 Explain methods to secure devices and security best practices	33, 35, 36, 37
6.3 Explain password best practices	38
6.4 Identify common use cases for encryption	39
6.5 Given a scenario, configure security settings for a small wireless network	40

NOTE

Exam objectives are subject to change at any time without prior notice and at CompTIA's discretion. Please visit CompTIA's website (`www.comptia.org`) for the most current listing of exam objectives.

HOW TO CONTACT THE PUBLISHER

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PART I

Domain 1.0: IT Concepts and Terminology

IT Concepts and Terminology is the first domain of CompTIA's Tech+ exam. It provides the foundational knowledge that anyone in information technology needs to understand as they begin their careers. This domain has four objectives:

1.1 Explain the basics of computing
1.2 Identify notational systems
1.3 Compare and contrast common units of measure
1.4 Explain the troubleshooting methodology

Questions from this domain make up 13% of the questions on the Tech+ exam, so you should expect to see approximately 10 questions on your test covering the material in this part.

CHAPTER 1

Computing Basics

Objective 1.1: Explain the basics of computing

Computers perform four basic operations on data: They accept *input* from users and devices, *process* data by performing calculations and other operations, *store* data obtained from input and processing, and provide *output* of their results.

In this chapter, you'll learn everything you need to know about Tech+ objective 1.1, including the following topics:

- **Input**
- **Processing**
- **Output**
- **Storage**

COMPUTER ACTIONS

Any computing device performs four basic operations: obtaining input, storing data, processing data, and providing output. This is true whether you're dealing with a laptop or desktop computer, a server, a smartphone, a tablet, or another specialized computing device.

Input

Input is when we provide information to the device to help us do our work. Input often comes from users, and we provide that input in a variety of ways. If we're using a laptop or desktop computer, we might provide input by typing on the keyboard or moving and clicking the mouse. On a tablet or smartphone, we're used to interacting by tapping or swiping on the screen or by using our voices.

Input doesn't have to come directly from a person. Computers can also receive input from other computers, from stored data, or even from sensors. For example, the thermostat in your home is a computer. It receives input from a built-in thermometer that tells it the current temperature in your home. It also receives input from residents when they change the temperature setting on the thermostat screen.

Processing

Processing is when the computer analyzes data and performs operations on it. For example, if the computer calculates the total amount of a customer order by adding together the prices of individual products and computing taxes and discounts, that's an example of processing.

Computers can also process data in other ways. When a computer manipulates an image file, plays a video file stored on disk, or predicts the weather, all of those actions are examples of processing.

In most computer systems, processing is done by a special chip inside the computer called the *central processing unit (CPU)*. We'll cover CPUs and other ways of processing data in Chapter 6, "Internal Computing Components."

Output

For a computer to be useful to us, it needs some way to provide us with *output*. Output is simply the computer reporting back to us on the results of its processing.

Output can come in many forms. The simplest form of output is simply showing the results of processing data on the screen, where we can read it. We can also use a printer to create a paper record of output.

Output can also come in other forms. Instead of providing us with the output of its calculations for us to read, a computer might use output to provide instructions to another device on how it should perform.

Storage

When a computer receives input, it can do two different things with that input: It can store the data directly or it might perform some processing on that data (discussed in the next section) and then store it.

Storage mechanisms allow computers to maintain data that they will need later. Computers can store data in two different ways. They might keep some data stored in memory, where the computer can quickly access it on a temporary basis, or they might write the data to a hard drive, cloud storage service, or other storage location where it may be kept more permanently.

EXAM TIP

You should be prepared to answer exam questions asking you to read the description of an action and classify it as one of the four basic computing actions. Know the differences between input, storage, processing, and output.

Tying It All Together

Let's tie that all together by returning to the thermostat example from earlier.

Input

A thermostat is a computer that receives input from two different sources. You might provide input to the thermostat by telling it the temperature you'd like to have in your home. You might set your thermostat to 74 degrees Fahrenheit. The thermostat also receives input from its built-in thermometer, telling it the actual temperature in your home, which might be 77 degrees on a warm day.

Processing

The thermostat then performs some processing on that input. Basically, it asks the question, is the current temperature lower than the desired temperature, equal to the desired temperature, or above the desired temperature?

Output

The thermostat provides some output in the form of instructions to other devices. If the current temperature is lower than our desired temperature, that means that your house is too cool and the thermostat tells the furnace to turn on and generate heat. If it's too warm in the house, the thermostat turns on the air conditioning to cool down the temperature.

These four actions—input, processing, storage, and output—are the basic activities carried out by any computing system. For example, think about the computer that you use most often. It likely has the following:

- Input devices, including a keyboard, mouse/trackpad, microphone, and video camera/webcam
- Processing capability in its CPU
- Storage capacity in memory and a hard disk drive (HDD) or solid-state drive (SSD)
- An output device, such as a display or printer

Storage

The thermostat might store the current temperature in memory so that it can later show you data on the temperature in your house over time.

CERTMIKE EXAM ESSENTIALS

- Computers receive input from a variety of sources, including directly from users and from other devices.
- After receiving input, computers may perform processing on that input to perform computation or decision-making. They may then store the original data and/or processed data in memory or on disk.
- Computers provide output in the form of data displayed to end users on monitors or printers as well as in the form of commands sent to other devices.

Practice Question 1

You are assisting a manager who is trying to print a PDF report saved on their laptop for distribution to their employees at a staff meeting in a few hours. The manager is frustrated because the printer keeps jamming, preventing them from printing the report.

What basic computing action is causing this problem?

A. Input
B. Processing
C. Output
D. Storage

Practice Question 2

You are working with a front desk technician at a hotel and troubleshooting an issue that guests are having with the hotel's check-in kiosks. The kiosks use a touchscreen to interact with guests. The touchscreens are correctly displaying information, but when users tap buttons on the screen, the device does not respond.

What basic computing action is causing this problem?

A. Input
B. Processing
C. Output
D. Storage