WELCOME to the Fifth Edition of Fluency with Information Technology: Skills, Concepts, & Capabilities. This book teaches the foundational ideas of computing. Today’s students, having grown up in a world in which computers are ubiquitous, do not need instruction in the rudiments of computer usage. Intuitively, they know how to use computer applications, whether on a smart phone or laptop. But use is not understanding. Today’s students belong to a world that requires them to be “computational thinkers,” able to conceptualize how computation can be used effectively. Few students will work as programmers, but most will decide how to apply computation. And many will imagine new ways for computers to serve humanity. To be effective at these tasks, they must understand the fundamental ideas of computing. This is their book.

What’s New in This Edition?

I’m delighted with this fifth edition. It balances the contemporary computer experience familiar to students and about which there is much to say in terms of privacy, security, and research habits, with the fundamental ideas that make the technology possible. I’ve tried to connect these as tightly as possible. For example, the ease with which digital information is replicated relates directly to how computer technology has improved the world, how applications work, how certain tools can be used more expertly, how copyright protection has social and legal implications, and more. This is also true for algorithms, information, communication, and so forth. This is the message: These are fundamental ideas that students can understand; they have deep implications. Is there a new way to apply them?

Readers familiar with earlier versions of Fluency should take a close look at this fifth edition. It maintains the core “fluency vision,” while positioning the presentation squarely in the second decade of the 21st century. “Computer” means smart phone, tablet, laptop, and the virtual tools implemented on the WWW. Key contemporary topics such as the software stack, the touch metaphor, the “do not track” bit, Creative Commons, and so forth, are treated at an introductory class level.

Briefly, the four parts of Fluency have been updated as follows:

- **Part 1** has undergone a complete makeover. Chapter 1 “Defining IT,” Chapter 2 “Human-Computer Interface,” and Chapter 5 “Web” are new. Chapter 3 “Networking” and Chapter 4 “HTML” have been revised. Chapter 6 (formerly Chapter 7) “Debugging” has been updated with a new fully worked example. (The former Chapter 6 “Case Study of Online Research” has been eliminated, and the critical content such as “authoritativeness of sources” has been moved to Chapter 5.)

- In **Part 2**, Chapter 8 “Multimedia” received a complete makeover. Chapter 10 “Algorithmic Thinking” is new and brief, building on an introduction to the topic in Chapter 1, and a key algorithm from Chapter 5. The other chapters of Part 2 benefit from several important revisions.

- In **Part 3**, Chapter 11 “Social Implications” is mostly new, and Chapter 12 “Privacy and Security” is completely restructured: The RSA encryption material has been moved to Appendix B, and it has been replaced by an entirely new encryption treatment; viruses and worms have been moved to this chapter, and other valuable features—developing a personal security plan—have been retained. Chapter 16 the “iDiary Database” received a wholesale revision.

- Finally, in **Part 4**, Chapter 22, the artificial intelligence chapter, includes current coverage of IBM’s Watson. Only the JavaScript material has remained essentially unchanged.

The number of “Try It” exercises has tripled. The end-of-chapter Review Questions have been heavily revised; many new exercises have been added. Further resources are listed below.

### Computer Science Principles

Since the last edition of *Fluency*, there has been much conversation about a new course titled Computer Science Principles. This is welcome news because, like the *Fluency* vision (see next section), CS Principles is a concept-rich introduction to computing ideas intended for nonmajors. Indeed, depending on specific choices of the instructor, the two curricula overlap about 75–80 percent in terms of concepts and ideas. Both cover algorithms, data and metadata, programming, Internet fundamentals, security and privacy, AI, and so on. The difference is more on emphasis than on content. The courses have been described as “*Fluency* introduces computing ideas to enhance students’ abilities,” and “CS Principles introduces computing ideas for their scientific richness.” Whatever the details of a specific class, both are concept-rich courses that cover the same ideas. *Fluency* could be a useful adjunct for a CS Principles class.
What Is Fluency with Information Technology?

This book is inspired by a report from the National Research Council (NRC), *Being Fluent with Information Technology*. In that study, commissioned by the National Science Foundation, the committee asserted that traditional computer literacy does not have the “staying power” students need to keep pace with the rapid changes in IT. The study concluded that the educational “bar needs to be raised” if students’ knowledge is to evolve and adapt to that change. The recommended alternative, dubbed *fluency with information technology*, or FIT, was a package of skills, concepts, and capabilities wrapped in a project-oriented learning approach that ensures that the content is fully integrated. The goal is to help people become effective IT users immediately, and to prepare them for lifelong learning.

The Vision

This textbook largely implements the vision of the NRC committee in which they proposed a three-part content and recommended integrating that content by using projects.

Three-Part Content

To make students immediately effective and launch them on the path of lifelong learning, they need to learn three types of knowledge: Skills, Concepts, and Capabilities.

- **Skills** refers to proficiency with contemporary computer applications such as email, word processing, Web searches, and so forth. Skills make the technology immediately useful to students and give them practical experience on which to base other learning. The Skills component approximates traditional computer literacy content; that is, *Fluency includes* literacy.

- **Concepts** refers to the fundamental knowledge underpinning IT, such as computer functionality, digital representation of information, assessment of information authenticity, and so forth. Concepts provide the principles on which students will build new understanding as IT evolves.

- **Capabilities** refers to higher-level thinking processes such as problem solving, reasoning, complexity management, and troubleshooting. Capabilities embody modes of thinking that are essential to exploiting IT, but they apply broadly. Reasoning, problem solving, and so forth are standard components of education; their significance in IT makes them topics of emphasis in the *Fluency* approach.

For each component, the NRC report lists 10 recommended items, as shown in the accompanying table.
The NRC’s List of Top 10 Skills, Concepts, and Capabilities

**Fluency with Information Technology**

**Skills** [These are original; as the report stated, the skills list will change over time.—LS]

1. Set up a personal computer  
2. Use basic operating system facilities  
3. Use a word processor to create a document  
4. Use a graphics or artwork package to manipulate an image  
5. Connect a computer to the Internet  
6. Use the Internet to locate information  
7. Use a computer to communicate with others  
8. Use a spreadsheet to model a simple process  
9. Use a database to access information  
10. Use online help and instructional materials

**Concepts**

1. Fundamentals of computers  
2. Organization of information systems  
3. Fundamentals of networks  
4. Digital representation of information  
5. Structuring information  
6. Modeling and abstraction  
7. Algorithmic thinking and programming  
8. Universality  
9. Limitations of information technology  
10. Social impact of computers and technology

**Capabilities**

1. Engage in sustained reasoning  
2. Manage complexity  
3. Test a solution  
4. Find problems in a faulty use of IT  
5. Navigate a collection and assess quality of the information  
6. Collaborate using IT  
7. Communicate using IT about IT  
8. Expect the unexpected  
9. Anticipate technological change  
10. Think abstractly about IT
Projects

Skills, Concepts, and Capabilities represent different kinds of knowledge that are equal in their contribution to IT Fluency. They span separate dimensions of understanding. The overall strategy is to focus on the Skills instruction in the lab, the Concepts instruction in lecture/reading material, and the Capabilities instruction in lecture/lab demonstrations. The projects are opportunities to use the three kinds of knowledge for specific purposes. They illustrate IT as it is often applied in practice—to solve information processing tasks of a substantial nature.

A project is a multiweek assignment to achieve a specific IT goal. For example, a project might be to create a database to track medical patients in a walk-in clinic, and to give a presentation to convince an audience that patient privacy has been preserved. Students apply a variety of Skills such as using database design software, Web searches, and presentation facilities. They rely on their understanding of Concepts such as database keys, table structure, and the join query operator. And they use Capabilities such as reasoning, debugging, complexity management, testing, and others. The components are applied together to produce the final result, leading students to an integrated understanding of IT and preparing them for significant “real life” IT applications. The labs can be found on the book’s Web site, www.aw-bc.com/snyder.

Audience

This book is designed for freshmen “nontechies,” students who will not be majoring in science, engineering, or math. (“Techies” benefit too, but because “hot shots” can intimidate others, they should be discouraged from taking the class, or better, encouraged to join an accelerated track or honors section.) No mathematical skills are required beyond arithmetic. There are no prerequisites.

Chapter Dependencies

Fluency with Information Technology is organized so that it can be taught in a variety of ways. In addition to the preliminary material in Chapters 1 and 2, social issues in Chapters 11 and 12, and the wrap-up in Chapter 23, the overall structure of the book includes stand-alone chapters with few dependencies, as well as small chapter sequences devoted to a sustained topic. The sequences are as follows:

- Chapters 3, 4, and 5—networking, HTML, and information
- Chapters 7, 8, 9, and 10—data representations, computers, and algorithms
- Chapters 13, 14, 15, and 16—spreadsheets and database principles
- Chapters 17, 18, 19, and 20—programming in JavaScript

One effective way to use this design is to present one of the chapter sequences as the basis for a project assignment. Then, while the students are working on
the project—projects may span two or more weeks—material from stand-alone chapters is covered.

There are many sequences, but three stand out as especially effective to present the material:

- **Networking cycle.** The linear sequence of chapters is designed to begin with information and networking and progressively advance through computation and databases to JavaScript, where it returns to the networking theme. This is the basic Chapters 1 to 23 sequence, adjusted by local reordering to accommodate the timing of projects as needed.

- **Internet forward.** I teach *Fluency* in the 1–10, 17–21, 11–16, 22–23 order. This approach begins with information and HTML, progresses through to algorithms, then jumps to JavaScript to continue the Web page building theme, and finally wraps up with databases. The strategy is dictated largely by the logistics of teaching the class in a quarter (10 weeks), and is recommended for that situation.

- **Traditional.** In this approach, the material is taught to parallel the time sequence of its creation. So, information representation and computers come well before networking. In this case, the order is 1–2, (22), 7–16, 3–6, 17–23. Chapter 22, which contains more philosophical content like the Turing test, Kasparov/Deep Blue chess tournament, and Watson, might optionally be presented early for its foundational content.

Each of these strategies has a compelling pedagogical justification. The one chosen depends more on the instructor’s taste and class logistics than on a need to present material in a specific order.

**Pedagogical Features**

- **Learning Objectives:** Each chapter opens with a list of the key concepts that readers should master after reading the chapter.

There are several boxed features that appear throughout the text to aid in students’ understanding of the material:

- **fluencyTIP** Practical hints and suggestions for everyday computer use
- **fluencyBIT** and **fluencyBYT** Interesting facts and statistics
- **fluencyALERT** Warnings and explanations of common mistakes
- **TRY IT** Short, in-chapter exercises with provided solutions
- **checkLIST** A useful list of steps for completing specific tasks

Throughout the text, notable material is distinguished by the following features:

- **fluencyFLASHBACK** A historical look at some of the major people and milestones in computing
Preface

⇒ Glossary  Important words and phrases are bold throughout the text, and a glossary of terms is included at the end of the book; glossary terms are bold in the book’s index
⇒ Answers  Solutions are provided to selected questions for the multiple-choice and short-answer sections
⇒ Appendix A: XHTML reference including a chart of Web-safe colors
⇒ Appendix B: RSA public key cryptosystem
⇒ Appendix C: The XML database and the XSL template style information for iDiary in Chapter 16.
⇒ Appendix D: JavaScript programming rules
⇒ Appendix E: Bean Counter Program: A complete JavaScript and HTML example
⇒ Appendix F: Memory Bank Page: A complete JavaScript and HTML example
⇒ Appendix G: Smooth Motion Application: A complete JavaScript and HTML example

Supplements

The Companion Website for Fluency with Information Technology is located at:

http://www.aw-bc.com/snyder

The following student supplements are available at the Website:

⇒ New for the 5th Edition, a set of 23 online labs (1 for each chapter in the book). The labs are designed to more fully explore (and test) students’ understanding of concepts in the book and how those issues or concepts apply to their lives. For example, in Chapter 1 (Defining Information Technology) the lab explores the conflicting interests of searchable, interconnected information and privacy. It directs students to a variety of Web-based resources that can help them understand what kinds of information they (and their devices) are sharing, which can be surprisingly personal and sometimes can even uniquely identify the user. Understanding the scope and type of information sharing that is happening helps reinforce the overall theme of understanding how things work “under the hood.” Visit the Companion Website for a full description of each lab.

⇒ Computer Skills Workbook by Sharon Scollard. This book covers the basics of Microsoft Office suite and includes 14 comprehensive labs on Excel, Word, PowerPoint, and other topics. In addition, instructors can now cover topics in the Computer Skills Workbook in a MyITLab course, Pearson’s online assessment and training application for Microsoft Office Applications and Computer Concepts. For more information, visit www.myitlab.com.

Preface

VideoNotes. VideoNotes are short, tutorial videos that enhance concepts presented in the textbook or present an example solution to an end-of-chapter exercise.

HTML sources, database designs, and JavaScript programs used in the textbook examples.

JavaScript reference card.

Glossary flashcards.

A downloadable workbook (PDF) on Alice and the Alice development environment.

The following instructor supplements are available to qualified instructors only. Please contact your local Pearson Education representative for information on how to access them (you can find your rep at www.pearsonhighered.com).

PowerPoint slides

Instructor’s Solutions Manual

Test Bank

Test Generator (available for use with Blackboard Learn, Blackboard CE/Vista, Moodle, Angel, Sakai, and D2L platforms)

Note to Students

Fluency is a somewhat unusual topic, making this a somewhat unusual book. I have one bit of advice to make it easier to learn this material.

Study Fluency steadily. If this book is successful, it will change the way you think, making you better at problem solving, better at reasoning, better at debugging, and so forth. These Capabilities are useful in IT and elsewhere in life, so they make learning Fluency worthwhile. But changing how you think won’t happen by putting the book under your pillow. It’ll take some studying. To learn Fluency you must apply good study habits: read the book, do the end-of-chapter exercises (answers to selected questions appear at the back of the book), begin your assignments early, ask questions, and so on. I think it’s a good idea if you spend some time online studying Fluency (instead of reading email) every day, because it takes time for the ideas to sink in. Students with good study habits tend to do well in Fluency class, and because it improves their problem-solving abilities, and more, they become even better students! It takes some discipline but it pays.

Finally, reading this book is enhanced by having a computer handy so you can try the examples. The files used are available at www.pearsonhighered.com/snyder. Good luck! Writing this book has truly been a pleasure. I hope reading it is equally enjoyable.
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—Larry Snyder, October 2012

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