Table of Contents

Cover
Preface
Contents
Location of VideoNotes in the Text
Online Labs
Part 1: Becoming Skilled at Computing
  Part 1: Introduction
  Chapter 1: Defining Information Technology Terms of Endearment
    Computations Greatest Hits
    Digitizing Information
    Stored-Program Computers
    The Switch to Transistors
    Integrated Circuits
    Personal Computers
    The Internet
    HTTP and the World Wide Web
    Layered Software Development
    The Great Part of the Greatest Hits
  Terms of Endearment
    Tech Support
    Anchoring Knowledge
  Computers, Software, Algorithms
    Find the Computer
    Software
    Algorithms
  The Words for Ideas
    Abstract
    Generalize
    Operationally Attuned
    Mnemonic
  Summary
  Try It Solutions
  Review Questions
    Multiple Choice
    Short Answer
    Exercises
  Chapter 2: Exploring the Human-Computer Interface Face It, Its a Computer
    A Few Useful Concepts
      Feedback
      Consistent Interface
Table of Contents

New Instance
Perfect Reproduction
   An Exact Duplicate
Copying
What We See and What We Think
   Metaphors
   The Desktop
   The Touch Metaphor
   Relationship Between Metaphors
   Summary of Metaphors
Summary
Try It Solutions
Review Questions
   Multiple Choice
   Short Answer
   Exercises

Chapter 3: The Basics of Networking Making the Connection
Comparing Communication Types
   General Communication
   The Internets Communication Properties
   The Client/Server Structure
   Appearing to Stay Connected
The Medium of the Message
   The Name Game of Computer Addresses
   Following Protocol
   Far and Near: WAN and LAN
   Connecting Your Computer to the Internet
   Domains and the DNS
   DNS Summary
The World Wide Web
   Requesting a Web Page
   The Internet and the Web
   Describing a Web Page
File Structure
   Directory Hierarchy
   Organizing the Folder
Summary
Try It Solutions
Review Questions
   Multiple Choice
   Short Answer
   Exercises

Chapter 4: A Hypertext Markup Language Primer Marking Up with HTML
Marking Up with HTML
   Formatting with Tags
Table of Contents

Tags for Bold and Italic
Required Tags

Lab Practice I
Firefox
Text Editor
Hello, World!
Save This Page
Practicing in the Lab

Structuring Documents
Headings in HTML
HTML Format Versus Display Format
White Space
Attributes
Brackets in HTML: The Escape Symbol
Accent Marks in HTML

Lab Practice II
Compose and Check
Markup Validation Service

Get Into Style with CSS
A Place for Style
Styling Background and Paragraph
CSS Styling
Designing the Paradoxes Page

Marking Links and Images
Two Sides of a Hyperlink
Structure of the Image Tag

Referring to Files
Referring to Pages and Images

Span, Lists, Tables, and Boxes
Span
Lists Tags
Handling Tables
The Box Model

Cascading Style Sheets
Style in Many Places
Globally Speaking
The Cascade

Styling with Class
A class Attribute
An Alternate Class

Hovering Above Links
Navigation Bars

HTML Wrap-Up
Gradient Background
Easy Enough for a Computer

Summary
Table of Contents

Try It Solutions
Review Questions
  Multiple Choice
  Short Answer
  Exercises

Chapter 5: Locating Information on the WWW The Search for Truth
  Web Search Fundamentals
    How a Search Engine Works
    Multiword Searches
    Descriptive Terms
    Page Rank
  Advanced Searches
    The Logical Operator AND
    Complex Queries
    Combining Logical Operators
    Restricting Global Search
    Focused Searches
  Web Searching
    Selecting Search Terms
    The Anatomy of a Hit
    Using the Hit List
    Once You Find a Likely Page
    Searching Strategy Summary
    Bing Search
  Authoritative Information
    Don’t Believe Everything You Read
    Wikipedia
    What is Authoritative?
    Authoritative Sources
  Truth or Fiction?
    Site Analysis
    Tough Work
  Summary

Chapter 6: An Introduction to Debugging To Err Is Human
  Precision: The High Standards of Computing
    Be Accurate
    Be Observant
  Debugging: What’s the Problem?
    Debugging in Everyday Life
    Debugging in Information Technology
# Table of Contents

- Whose Problem is It?
  - Using the Computer to Debug
- A Dialog About Debugging
- Debugging Recap
- Fixing HTML Bugs: A Case Study
  - Look At the Page Closely
  - Focusing the Search
  - Nearly Perfect
  - Debugging the JJK Page: A Postmortem
- No Printer Output: A Classic Scenario
  - Applying the Debugging Strategy
  - Pressing On
  - The Print Queue
  - Calling Tech Support?
- Ensuring the Reliability of Software
  - Safety-Critical Applications
  - Fail-Soft and Fail-Safe Software
- Community Debugging
- Summary
- Try It Solutions
- Review Questions
  - Multiple Choice
  - Short Answer
  - Exercises

- Interview with Vinton G. Cerf

# Part 2: Algorithms and Digitizing Information

## Part 2: Introduction

### Chapter 7: Representing Information Digitally Bits and the Why of Bytes

- Digitizing Discrete Information
  - Limitation of Digits
  - Alternative Representations
  - Symbols, Briefly
  - Ordering Symbols

- Information Representation
  - Beyond the Physical World
  - Memory
  - Bits in Computer Memory

- Binary and Hex
  - Binary
  - Hex
  - Changing Hex Digits to Bits and Back Again

- Digitizing Numbers in Binary
  - Binary Numbers Compared with Decimal Numbers

- Digitizing Text
# Table of Contents

Assigning Symbols
Extended ASCII: An 8-Bit Code
ASCII Coding of Phone Numbers
Advantages of Long Encodings
NATO Broadcast Alphabet
Bar Codes

UTF-8

The Metadata and the OED
  Properties of Data
  Using Tags for Metadata
  Structure Tags
  Sample OED Entry
  Why Byte?

Summary

Try It Solutions

Review Questions
  Multiple Choice
  Short Answer
  Exercises

Chapter 8: Representing Multimedia Digitally Light, Sound, Magic

Digitizing Color
  Color and the Mystery of Light
  Yellow = R + G?
  Green Paint = Blue + Yellow
  Making a Big Display
  Thinking About Intensities
  Black and White Colors
  Decimal to Binary
  Lighten Up: Changing Colors by Addition
  To Increase Intensity: Add in Binary
  Lighter Still: Adding with Carry Digits

Computing on Representations
  Old Photographs
  Increasing Brightness and Contrast
  Binary Addition
  Contrast
  Adding Color
  Summary of Digital Color

Digitizing Sound
  Analog to Digital
  Advantages of Digital Sound

Digital Images and Video
  Image Compression
  JPEG
  MPEG Compression Scheme

Optical Character Recognition
Table of Contents

OCR Technology
Multimedia Challenges
   The Challenge of Latency
   The Challenge of Bandwidth
Bits Are It
   Bits: The Universal Medium
   Bits: Bias-Free
   Bits Are Not Necessarily Binary Numbers
Summary
Try It Solutions
Review Questions
   Multiple Choice
   Short Answer
   Exercises
Chapter 9: Principles of Computer Operations Following Instructions
   Theres an App for That
   The Usual Suspects
Software Isn’t So Hard
   Deciding On What to Do
   Software Layers
Instruction Execution Engine
   The Fetch/Execute Cycle
   Anatomy of a Computer
   Input Unit and Output Unit
   Machine Instructions
The Program Counter: The PCs PC
   Address of the Next Instruction
   Branch and Jump Instructions
Instruction Execution
   Stepping Through ADD
   The Clocks Ticking
   Many, Many Simple Operations
Translation
   Assembly Language
   Compiling
Integrated Circuits
   Miniaturization
   Integration
   Photolithography
How Semiconductor Technology Works
   Field Effect
   Semiconducting Elements
   Field Effect Transistors
   Implementing ALU Operations
Combining the Ideas
## Table of Contents

### Chapter 10: Algorithmic Thinking

**What's the Plan?**

- Algorithms
  - Writing One Letter at a Time
  - Homemade Algorithms
  - Many Questions; Fewer Questions
  - Writing Algorithms
  - Algorithms Versus Programs
  - Experience with Algorithms
  - Textbook Examples of Algorithms
  - Algorithms Versus Heuristic Processes
  - Inventing Algorithms

- Algorithms: A Basic Concept
  - A Definition

- A Closer Look
  - Query Evaluation
  - Intersecting Lists
  - A Familiar Solution
  - How Not to Match
  - Different Solutions

- Doing the Right Thing
  - A Strategy
  - Explaining Why IAL Works
  - Summary on Correctness

### Summary

- Try It Solutions
- Review Questions
  - Multiple Choice
  - Short Answer
  - Exercises

### Part 3: Data and Information

#### Chapter 11: Social Implications of IT

**Computers in Polite Society**

- The Power of the Crowd
  - Crowdsourcing
  - Be a Martian
  - Foldit
  - Civic Participation
  - Freerice
  - Kickstarter

- Out on Good Behavior
Table of Contents

Netiquette
Specific Guidelines for Email
Please, Don't Be Offended

Expect the Unexpected
The Onion
Suspicious Activity

Creating Good Passwords
The Role of Passwords
How Passwords Work
Poor Passwords
Creating Quality Passwords
Easy to Remember
Hard to Guess
Managing Passwords

Spam
Controlling Spam

Scams
Nigerian Widow Scam
Phishing
The End of the Phishing Story

Protecting Intellectual Property
Licensing of Software
Open Source Software
Copyright on the Web
Violating the Copyright Law

Creative Commons
Allow Copying and Distribution
What to Keep, What to Give
Creative Commons Summary

Summary

Try It Solutions

Review Questions
Multiple Choice
Short Answer
Exercises

Chapter 12: Privacy and Digital Security Shhh, It's a Secret

Privacy and Technology
Modern Devices and Privacy
Information Sources and Uses
Controlling the Use of Information

A Privacy Definition

Enjoying the Benefits of Privacy
Voluntary Disclosure

Fair Information Practices
OECD Fair Information Practices
Table of Contents

Is There No Privacy?
  Who is Protected?
  Business as Usual
  Targeted by Target
  Government, as Usual

Tracking
  Online Tracking
  Cell Phones

Cookies
  Appearing To Stay Connected
  The Right to Be Forgotten
  Identity Theft

Digital Security
  Understanding the Problem
  Terms and Jargon
  What Does Malware Do?

Prevention
  Play It Safe
  Safe Computing Checklist
  Oops, Now I've Done It!
  Plan of Action

Encryption
  The Key to Encryption
  Keys
  Encrypting Example
  Private Key Encryption
  Public Key Encryption
  The Genius of PKC
  The Take-Home Message
  Factoring is Hard
  Back to the Coffee Shop

Redundancy Is Very, Very, Very Good
  Protecting Your Data
  Backups and Recovery

Summary

Try It Solutions

Review Questions
  Multiple Choice
  Short Answer
  Exercises

Chapter 13: The Basics of Spreadsheets Fill-in-the-Blank Computing

Arranging Information
  An Array of Cells
  Sorting the Data
  Adding More Data to the List

Computing with Spreadsheets
Table of Contents

Writing a Formula
Repeating a Formula
Transforming Formulas: Relative Versus Absolute
Cell Formats
Functions
Finding the Maximum
Displaying Hidden Columns
Charts

Daily Spreadsheets
Time Zone Cheat Sheet
Solving a Problem of Personal Interest
Getting Started, Then Filling In
Finish Up
Pizza Discount Table
A Plan
The Requirements
Absolute References
Relative References
Paying Off a Loan

Importing Data
Tab-Delimited Data
Arranging Columns

Summary
Try It Solutions
Review Questions
  True/False
  Multiple Choice
  Short Answer
  Exercises

Chapter 14: Advanced Spreadsheets for Planning What If Thinking Helps

Designing a Spreadsheet
  The Trip
  Design Guidelines
  Initial Spreadsheet: Applying the Rules

Conditional Formatting
  Cell Value is Specifications
  Formula is Specifications
  Distinguish Between the United States and Canada

Conditional Formulas
  Figuring the Amount Paid
  Cost in One Currency

Naming: Symbolic Reference
  Defining Names
  Applying Names
  Make Assumptions Explicit

What If Analysis
**Table of Contents**

- Direct Experimentation
- Scenarios
- Analyzing a Model

**Analyzing Data Using Filtering**
- Auto Filtering Technique
- Advanced Filtering Technique
- Filtering on Multiple Criteria

**Summary**

**Try It Solutions**

**Review Questions**
- Multiple Choice
- Short Answer
- Exercises

**Chapter 15: Introduction to Database Concepts**

- A Table with a View
- Differences Between Tables and Databases
  - Comparing Tables
  - The Databases Advantage

- XML: A Language for Metadata Tags
  - An Example from Tahiti
  - Expanding the Use of XML
  - Attributes in XML
  - Effective Design with XML Tags
  - The XML Tree

- Tables and Entities
  - Entities
  - Properties of Entities
  - Every One Is Different

- The Science of Tables
  - Relational Database Tables
  - Computing with Tables
  - Ask Any Question
  - Summarizing the Science

- SQL: The Language of Databases
- Structure of a Database
  - Physical and Logical Databases

**Summary**

**Try It Solutions**

**Review Questions**
- Multiple Choice
- Short Answer
- Exercises

**Chapter 16: A Case Study in Database Organization**

- The iDiary Database
  - Thinking About a Personal Database
    - Regular Versus Irregular Data
    - Physical Versus Logical
Table of Contents

The iDiary
A Preliminary Exercise
   Travels Database
   Displaying the Travels with XSL
The iDiary Database
   Getting Started
   Creating a First Entry (August 11)
   Thinking About the Nature of Things
   Developing Tags and Templates
Using the iDiary Daily
   Archiving Photos
   Hiding Information
   Entering Data into the Database
Summary
Try It Solutions
Review Questions
   Multiple Choice
   Short Answer
   Exercises
Interview with Alan Kay

Part 4: Problem Solving
Part 4: Introduction
Chapter 17: Fundamental Concepts Expressed in JavaScript Get with the Program
   Overview: Programming Concepts
   Names, Values, and Variables
      Names Have Changing Values
      Names in a Program Are Called Variables
      Identifiers and Their Rules
      A Variable Declaration Statement
      The Statement Terminator
      Rules for Declaring Variables
   Three Basic Data Types of JavaScript
      Rules for Writing Numbers
      Strings
      Boolean Values
   The Assignment Statement
      Assignment Symbol
      Interpreting an Assignment Statement
      Three Key Points About Assignment
   Lab Practice
      Scratchpad Hello, World
   An Expression and Its Syntax
      Arithmetic Operators
      Relational Operators
      Logical Operators
# Table of Contents

A Conditional Statement
- if Statements and Their Flow of Control
- Compound Statements
- if/else Statements
- Nested if/else Statements

The Espresso Program
- The Logic of a Double Tall Latte

Summary

Try It Solutions

Review Questions
- Multiple Choice
- Short Answer
- Exercises

Chapter 18: A JavaScript Program The Bean Counter

Preliminaries
- Background for the UI
  - Review of HTML Basics
  - Interacting with a UI
  - Three Input Elements

Creating the Graphical User Interface
1. Create a Button Table
2. Delete Two Buttons
3. Insert Text Box
4. Label the Buttons
5. Primp the Interface

Event-Based Programming
- The onclick Event Handler
- Click Event
- Shots Button
- Size and Drink Buttons
- Clear Button and Initializations
- Referencing Data Across Inputs

Critiquing the Bean Counter
- Numbers Versus Money
- Organization
- Feedback
- Application

Bean Counter Recap
- Program and Test
- Assess the Program Design

Summary

Try It Solutions

Review Questions
- Multiple Choice
- Short Answer
Chapter 21: A Case Study in Algorithmic Problem Solving The Smooth Motion Application

The Smooth Motion Application
How the Smooth Motion Application Should Work

Planning Smooth Motion
Apply the Decomposition Principle
List the Tasks
Decide on a Problem-Solving Strategy

Build the Basic Web Page UI
The Structural Page
The Structural Page Heading

Animate the Grid
First Analysis
Second Analysis
Subtask: Define and Organize the Frames
Subtask: Define and Place Initial Images
Subtask: Prefetch the Frame Images
Subtask: Set Timer and Build Timer Event Handler

The Best Laid Plans . . .

Build Controls
Sense the Keys
Subtask: Define and Organize the Frames
Subtask: Place the Initial Images
Subtask: Prefetch the Frames
Subtask: Build the Event Handlers
Combine the Subtasks

Staircase Detection
Subtask: Recognizing the Staircase
Table of Contents

Subtask: Recognizing Continuity
Assemble Overall Design
Primp the Design
    Assessment and Retrospective
Summary
Try It Solutions
Review Questions
    Multiple Choice
    Short Answer
    Exercises

Chapter 22: Limits to Computation Computers Can Do Almost{ Everything, Nothing}
Can Computers Think?
    The Turing Test
    Passing the Test
Acting Intelligently?
    Playing Chess
    A Game Tree
    Using the Game Tree Tactically
    Using Database Knowledge
    Using Parallel Computation
    The Deep Blue Matches
    Interpreting the Outcome of the Matches
Watson
    Computer Versus Humans
    Technical Challenge
    Summary on Watson
Acting Creatively?
    Creativity as a Spectrum
    What Part of Creativity is Algorithmic?
The Universality Principle
    Universal Information Processor
    Practical Consequences of the Universality Principle
More Work, Slower Speed
    Comparing IAL with NAL
Are Best Algorithms All Fast?
    NP-Complete Problems
    Unsolvables Problems
Summary
Try It Solutions
Review Questions
    Multiple Choice
    Short Answer
    Exercises

Chapter 23: A Fluency Summary Click to Close
Table of Contents

Two Big Computing Ideas
   Information Structuring
   Strategies for Nonalgorithmic Tasks
Fluency: Less Is More
Lifelong IT Learning
   Pursuing New Uses
   Asking for Help
   Noticing New Technology
Shifting for Yourself
Try It Solutions
Review Questions
   Multiple Choice
   Short Answer
   Exercises
Interview with David Ferrucci

Appendix

Appendix A: HTML5 Reference
   Required HTML Tags
   HTML Tags
   Worked Example: D.C. Trip Page

Appendix B: RSA Public Key Cryptosystem
   Choosing a Key
   Encrypting a Message
   The Decryption Method
   Summarizing the RSA System

Appendix C: iDiary: Tags and Templates
   XML Database File iDiary.xml
   XSL file iDiarySS.xsl

Appendix D: JavaScript Programming Rules
   Program Structure
   Data Types
   Variables and Declarations
   Expressions
   Arrays and Indexes
   Statements
   Functions
   Guidelines

Appendix E: The Bean Counter Program

Appendix F: myApps Page

Appendix G: Smooth Motion Program

Glossary
Table of Contents

Answers to Selected Questions
Index
Credits