## 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

Summary
Try It Solutions
Review Questions
  Multiple Choice
  Short Answer
  Exercises
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
Interview with Ray Kurzweil

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

**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
# Table of Contents

## Exercises

### Chapter 19: Programming Functions Thinking Big

- Anatomy of a Function
  - Converting Some Temperatures
  - Making the Call
  - Definition Versus Call

- Forms and Functions
  - Writing Functions, Using Functions
    - Flipping Electronic Coins
    - The Body Mass Index Computation

- Customizing Pages
  - Creating Page Content
  - Customizing the Coin Flip

- Making a Web-Based Phone App
  - Design for Mobility
  - Referencing Functions
  - The Counter Assistants Structure
  - Better Applications
  - Recap: Two Reasons to Write Functions

- Social Functions
  - Using Other Peoples Code
  - Making a Comment

### Summary

### Try It Solutions

### Review Questions

- Multiple Choice
- Short Answer
- Exercises

### Chapter 20: Iteration Principles Once Is Not Enough

- Iteration: Play It Again, Sam
  - The for Loop Basic Syntax
  - How a for Loop Works

- JavaScript Rules for for Loops
  - The World-Famous Iteration
  - Why So Famous?
  - Avoiding Infinite Loops

- Experiments with Flipping Coins
  - One Trial of 100 Flips
  - Multiple Trials
  - A Diagram of Results
  - Nested Loops

### Indexing

- Index Syntax
- Index Origin

### Arrays
Table of Contents

Rules for Arrays
  Array Reference Syntax

Its Magic
  Setting Up the Array
  Structuring the Page

The Busy Animation
  Using a Timer to Initiate Animation
  Prefetching Images
  Redrawing an Image

Not So Busy Animation
  Three Key Ideas

Summary

Try It Solutions

Review Questions
  Multiple Choice
  Short Answer
  Exercises

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
    Unsolvable 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