

# Contents

Figures, Tables, and Listings    xv

## Preface

## About This Book    xxv

---

|                               |        |
|-------------------------------|--------|
| Format of a Typical Chapter   | xxvi   |
| Conventions Used in This Book | xxvi   |
| Special Fonts                 | xxvii  |
| Types of Notes                | xxvii  |
| Empty Strings                 | xxvii  |
| Assembly-Language Information | xxvii  |
| The Development Environment   | xxviii |

## Chapter 1

## Introduction to the Macintosh Toolbox    1-1

---

|  |      |
|--|------|
| Overview of the Macintosh Toolbox            | 1-4  |
| Events                                       | 1-5  |
| Menus  | 1-6  |
| Windows                                      | 1-6  |
| Controls                                     | 1-7  |
| Alert Boxes and Dialog Boxes                 | 1-8  |
| Icons and Other Interactions With the Finder | 1-10 |
| Resources                                    | 1-11 |
| Help Balloons                                | 1-14 |
| Copy and Paste                               | 1-14 |
| Related System Software Features             | 1-14 |
| Drawing on the Screen                        | 1-14 |
| Handling Text                                | 1-14 |
| Managing Files                               | 1-15 |
| Allocating Memory and Launching Processes    | 1-15 |
| Creating Publishers and Subscribers          | 1-15 |
| Communicating With Other Applications        | 1-16 |
| Designing Your Application                   | 1-16 |

## Chapter 2

## Event Manager    2-1

---

|                         |      |
|-------------------------|------|
| Introduction to Events  | 2-4  |
| Low-Level Events        | 2-8  |
| Operating-System Events | 2-10 |
| High-Level Events       | 2-13 |
| Priority of Events      | 2-15 |
| Switching Contexts      | 2-15 |

|  |       |
|--|-------|
| About the Event Manager                                  | 2-16  |
| Using the Event Manager                                  | 2-17  |
| Obtaining Information About Events                       | 2-18  |
| Processing Events  | 2-21  |
| Using the WaitNextEvent Function                         | 2-22  |
| Writing an Event Loop                                    | 2-24  |
| Setting the Event Mask                                   | 2-26  |
| Handling Events in a Dialog Box                          | 2-29  |
| Creating a Size Resource                                 | 2-30  |
| Handling Low-Level Events                                | 2-32  |
| Responding to Mouse Events                               | 2-33  |
| Responding to Keyboard Events                            | 2-38  |
| Scanning for a Cancel Event                              | 2-47  |
| Responding to Update Events                              | 2-48  |
| Responding to Activate Events                            | 2-51  |
| Responding to Disk-Inserted Events                       | 2-56  |
| Responding to Null Events                                | 2-58  |
| Handling Operating-System Events                         | 2-59  |
| Responding to Suspend and Resume Events                  | 2-61  |
| Responding to Mouse-Moved Events                         | 2-63  |
| Handling High-Level Events                               | 2-68  |
| Responding to Events From Other Applications             | 2-70  |
| Searching for a Specific High-Level Event                | 2-72  |
| Determining the Sender of a High-Level Event             | 2-73  |
| Sending High-Level Events                                | 2-74  |
| Requesting Return Receipts                               | 2-78  |
| Handling Apple Events                                    | 2-79  |
| Event Manager Reference                                  | 2-79  |
| Data Structures  | 2-80  |
| The Event Record   | 2-80  |
| The Target ID Record                                     | 2-82  |
| The High-Level Event Message Record                      | 2-83  |
| The Event Queue  | 2-84  |
| Event Manager Routines                                   | 2-85  |
| Receiving Events   | 2-85  |
| Sending Events   | 2-101 |
| Converting Process Serial Numbers and Port Names         | 2-106 |
| Reading the Mouse  | 2-109 |
| Reading the Keyboard                                     | 2-111 |
| Getting Timing Information                               | 2-113 |
| Application-Defined Routine                              | 2-115 |
| Filter Function for Searching the High-Level Event Queue | 2-115 |
| Resource   | 2-116 |
| The Size Resource  | 2-116 |
| Summary of the Event Manager                             | 2-121 |
| Pascal Summary   | 2-121 |
| Constants  | 2-121 |

|                             |       |
|-----------------------------|-------|
| Data Types                  | 2-123 |
| Event Manager Routines      | 2-124 |
| Application-Defined Routine | 2-125 |
| C Summary                   | 2-126 |
| Constants                   | 2-126 |
| Data Types                  | 2-128 |
| Event Manager Routines      | 2-129 |
| Application-Defined Routine | 2-130 |
| Assembly-Language Summary   | 2-131 |
| Data Structures             | 2-131 |
| Trap Macros                 | 2-131 |
| Global Variables            | 2-132 |
| Result Codes                | 2-133 |

## Chapter 3

## Menu Manager 3-1

---

|  |      |
|--|------|
| Introduction to Menus  | 3-5  |
| Menu and Menu Bar Definition Routines                                      | 3-9  |
| The Menu Bar   | 3-9  |
| Menus  | 3-11 |
| Menu Items   | 3-12 |
| Groups of Menu Items   | 3-14 |
| Keyboard Equivalents for Menu Commands                                     | 3-16 |
| Menus Added Automatically by the Menu Manager                              | 3-19 |
| The Apple Menu   | 3-20 |
| The File Menu  | 3-22 |
| The Edit Menu  | 3-24 |
| The Font Menu  | 3-26 |
| The Size Menu  | 3-27 |
| The Help Menu  | 3-29 |
| The Keyboard Menu  | 3-32 |
| The Application Menu   | 3-33 |
| Pop-Up Menus   | 3-33 |
| Hierarchical Menus   | 3-38 |
| About the Menu Manager   | 3-39 |
| How the Menu Manager Maintains Information About Menus                     | 3-40 |
| How the Menu Manager Maintains Information About an Application's Menu Bar | 3-40 |
| Using the Menu Manager   | 3-41 |
| Creating a Menu  | 3-42 |
| Creating a Menu Resource   | 3-43 |
| Creating a Menu Bar Resource   | 3-49 |
| Setting Up Your Application's Menu Bar                                     | 3-50 |
| Creating a Hierarchical Menu   | 3-53 |
| Creating a Pop-Up Menu   | 3-56 |

|   |       |
|---|-------|
| Changing the Appearance of Items in a Menu                    | 3-57  |
| Enabling and Disabling Menu Items                             | 3-58  |
| Changing the Text of an Item                                  | 3-59  |
| Changing the Font Style of Menu Items                         | 3-60  |
| Changing the Mark of Menu Items                               | 3-61  |
| Changing the Icon or Script Code of Menu Items                | 3-62  |
| Adding Items to a Menu  | 3-64  |
| Adding Items to the Help Menu                                 | 3-67  |
| Adding Items to the Apple Menu                                | 3-68  |
| Adding Fonts to a Menu  | 3-69  |
| Handling User Choice of a Menu Command                        | 3-70  |
| Handling Mouse-Down Events in the Menu Bar                    | 3-72  |
| Adjusting the Menus of an Application                         | 3-73  |
| Determining if the User Chose a Keyboard Equivalent           | 3-77  |
| Responding When the User Chooses a Menu Item                  | 3-78  |
| Handling the Apple Menu                                       | 3-80  |
| Handling the Help Menu  | 3-81  |
| Handling a Size Menu  | 3-82  |
| Accessing Menus From a Dialog Box                             | 3-84  |
| Writing Your Own Menu Definition Procedure                    | 3-87  |
| Calculating the Dimensions of a Menu                          | 3-89  |
| Drawing Menu Items in a Menu                                  | 3-90  |
| Determining Whether the Cursor Is in an Enabled Menu Item     | 3-92  |
| Menu Manager Reference  | 3-95  |
| Data Structures   | 3-95  |
| The Menu Record   | 3-95  |
| Menu Manager Reference  | 3-96  |
| The Menu List   | 3-97  |
| The Menu Color Information Table Record                       | 3-98  |
| Menu Manager Routines   | 3-102 |
| Initializing the Menu Manager                                 | 3-103 |
| Creating Menus  | 3-105 |
| Adding Menus to and Removing Menus From the Current Menu List | 3-108 |
| Getting a Menu Bar Description From an 'MBAR' Resource        | 3-110 |
| Getting and Setting the Menu Bar                              | 3-112 |
| Drawing the Menu Bar  | 3-113 |
| Responding to the User's Choice of a Menu Command             | 3-114 |
| Getting a Handle to a Menu Record                             | 3-122 |
| Adding and Deleting Menu Items                                | 3-124 |
| Getting and Setting the Appearance of Menu Items              | 3-130 |
| Disposing of Menus  | 3-140 |
| Counting the Items in a Menu                                  | 3-140 |
| Highlighting the Menu Bar                                     | 3-141 |
| Recalculating Menu Dimensions                                 | 3-142 |
| Managing Entries in the Menu Color Information Table          | 3-143 |
| Application-Defined Routine                                   | 3-148 |
| The Menu Definition Procedure                                 | 3-148 |

|   |       |
|---|-------|
| Resources                                 | 3-151 |
| The Menu Resource                         | 3-151 |
| The Menu Bar Resource                     | 3-155 |
| The Menu Color Information Table Resource | 3-155 |
| The Menu Definition Procedure Resource    | 3-157 |
| Summary of the Menu Manager               | 3-158 |
| Pascal Summary                            | 3-158 |
| Constants                                 | 3-158 |
| Data Types                                | 3-158 |
| Menu Manager Routines                     | 3-159 |
| Application-Defined Routine               | 3-162 |
| C Summary                                 | 3-162 |
| Constants                                 | 3-162 |
| Data Types                                | 3-163 |
| Menu Manager Routines                     | 3-164 |
| Application-Defined Routine               | 3-166 |
| Assembly-Language Summary                 | 3-167 |
| Data Structures                           | 3-167 |
| Global Variables                          | 3-167 |
| Result Codes                              | 3-167 |

## Chapter 4

## Window Manager 4-1

---

|  |      |
|--|------|
| Introduction to Windows                      | 4-4  |
| Active and Inactive Windows                  | 4-6  |
| Types of Windows                             | 4-8  |
| Window Regions                               | 4-12 |
| Dialog Boxes and Alert Boxes                 | 4-13 |
| Controls                                     | 4-14 |
| Windows on the Desktop                       | 4-15 |
| About the Window Manager                     | 4-16 |
| Graphics Ports                               | 4-17 |
| Window Records                               | 4-19 |
| Color Windows                                | 4-20 |
| Events in Windows                            | 4-21 |
| Using the Window Manager                     | 4-22 |
| Managing Multiple Windows                    | 4-23 |
| Creating a Window                            | 4-25 |
| Defining a Window Resource                   | 4-25 |
| Creating a Window From a Resource            | 4-27 |
| Positioning a Document Window on the Desktop | 4-30 |
| Drawing the Window Contents                  | 4-39 |
| Updating the Content Region                  | 4-40 |
| Maintaining the Update Region                | 4-41 |
| Handling Events in Windows                   | 4-41 |
| Handling Mouse Events in Windows             | 4-42 |

|   |       |
|---|-------|
| Handling Keyboard Events in Windows                 | 4-47  |
| Handling Update Events                              | 4-48  |
| Handling Activate Events                            | 4-50  |
| Moving a Window                                     | 4-53  |
| Zooming a Window                                    | 4-53  |
| Resizing a Window                                   | 4-57  |
| Closing a Window                                    | 4-60  |
| Hiding and Showing a Window                         | 4-62  |
| Window Manager Reference                            | 4-64  |
| Window Manager Reference                            | 4-65  |
| Data Structures                                     | 4-65  |
| The Color Window Record                             | 4-65  |
| The Window Record                                   | 4-69  |
| The Window State Data Record                        | 4-70  |
| The Window Color Table Record                       | 4-71  |
| The Auxiliary Window Record                         | 4-73  |
| The Window List                                     | 4-74  |
| Window Manager Routines                             | 4-74  |
| Initializing the Window Manager                     | 4-74  |
| Creating Windows                                    | 4-75  |
| Naming Windows                                      | 4-85  |
| Displaying Windows                                  | 4-86  |
| Retrieving Window Information                       | 4-91  |
| Moving Windows                                      | 4-94  |
| Resizing Windows                                    | 4-99  |
| Zooming Windows                                     | 4-101 |
| Closing and Deallocating Windows                    | 4-103 |
| Maintaining the Update Region                       | 4-106 |
| Setting and Retrieving Other Window Characteristics | 4-109 |
| Manipulating the Desktop                            | 4-112 |
| Manipulating Window Color Information               | 4-114 |
| Low-Level Routines                                  | 4-116 |
| Application-Defined Routine                         | 4-120 |
| The Window Definition Function                      | 4-120 |
| Resources   | 4-124 |
| The Window Resource                                 | 4-124 |
| The Window Definition Function Resource             | 4-127 |
| The Window Color Table Resource                     | 4-127 |
| Summary of the Window Manager                       | 4-130 |
| Pascal Summary                                      | 4-130 |
| Constants   | 4-130 |
| Data Types  | 4-132 |
| Window Manager Routines                             | 4-134 |
| Application-Defined Routine                         | 4-136 |
| C Summary   | 4-137 |
| Constants   | 4-137 |
| Data Types  | 4-139 |

|                             |       |
|-----------------------------|-------|
| Window Manager Routines     | 4-140 |
| Application-Defined Routine | 4-143 |
| Assembly-Language Summary   | 4-144 |
| Data Types                  | 4-144 |
| Global Variables            | 4-145 |

## Chapter 5

## Control Manager 5-1

---

|   |       |
|---|-------|
| Introduction to Controls  | 5-4   |
| Buttons   | 5-5   |
| Checkboxes  | 5-5   |
| Radio Buttons   | 5-6   |
| Pop-Up Menus  | 5-6   |
| Scroll Bars   | 5-7   |
| Other Controls  | 5-11  |
| Active and Inactive Controls                                    | 5-11  |
| The Control Definition Function                                 | 5-14  |
| About the Control Manager                                       | 5-14  |
| Using the Control Manager                                       | 5-15  |
| Creating and Displaying a Control                               | 5-15  |
| Creating a Button, Checkbox, or Radio Button                    | 5-17  |
| Creating Scroll Bars  | 5-21  |
| Creating a Pop-Up Menu  | 5-25  |
| Updating a Control  | 5-29  |
| Responding to Mouse Events in a Control                         | 5-30  |
| Determining a Mouse-Down Event in a Control                     | 5-31  |
| Tracking the Cursor in a Control                                | 5-35  |
| Determining and Changing Control Settings                       | 5-37  |
| Scrolling Through a Document                                    | 5-43  |
| Scrolling in Response to Events in the Scroll Box               | 5-53  |
| Scrolling in Response to Events in Scroll Arrows and Gray Areas | 5-57  |
| Drawing a Scrolled Document Inside a Window                     | 5-62  |
| Moving and Resizing Scroll Bars                                 | 5-65  |
| Defining Your Own Control Definition Function                   | 5-71  |
| Control Manager Reference                                       | 5-72  |
| Data Structures   | 5-72  |
| Control Manager Reference                                       | 5-73  |
| The Control Record  | 5-73  |
| The Auxiliary Control Record                                    | 5-76  |
| The Pop-Up Menu Private Data Record                             | 5-77  |
| The Control Color Table Record                                  | 5-77  |
| Control Manager Routines  | 5-80  |
| Creating Controls   | 5-81  |
| Drawing Controls  | 5-85  |
| Handling Mouse Events in Controls                               | 5-88  |
| Changing Control Settings and Display                           | 5-93  |
| Determining Control Values                                      | 5-102 |

|   |       |
|---|-------|
| Removing Controls                             | 5-108 |
| Application-Defined Routines                  | 5-109 |
| Defining Your Own Control Definition Function | 5-109 |
| Defining Your Own Action Procedures           | 5-115 |
| Resources                                     | 5-117 |
| The Control Resource                          | 5-118 |
| The Control Color Table Resource              | 5-121 |
| The Control Definition Function               | 5-123 |
| Summary of the Control Manager                | 5-124 |
| Pascal Summary                                | 5-124 |
| Constants                                     | 5-124 |
| Data Types                                    | 5-126 |
| Control Manager Routines                      | 5-127 |
| Application-Defined Routines                  | 5-129 |
| C Summary                                     | 5-129 |
| Constants                                     | 5-129 |
| Data Types                                    | 5-131 |
| Control Manager Routines                      | 5-132 |
| Application-Defined Routines                  | 5-134 |
| Assembly-Language Summary                     | 5-134 |
| Data Structures                               | 5-134 |
| Global Variables                              | 5-135 |

## Chapter 6

## Dialog Manager 6-1

---

|  |      |
|--|------|
| Introduction to Alerts and Dialog Boxes              | 6-6  |
| Types of Alerts                                      | 6-8  |
| Types of Dialog Boxes                                | 6-9  |
| Modal Dialog Boxes                                   | 6-10 |
| Movable Modal Dialog Boxes                           | 6-11 |
| Modeless Dialog Boxes                                | 6-12 |
| Items in Alert and Dialog Boxes                      | 6-13 |
| Events in Alert and Dialog Boxes                     | 6-14 |
| Alert Boxes, Dialog Boxes, and the Window Manager    | 6-15 |
| About the Dialog Manager                             | 6-16 |
| Using the Dialog Manager                             | 6-17 |
| Creating Alert Sounds and Alert Boxes                | 6-18 |
| Creating Dialog Boxes                                | 6-23 |
| Providing Items for Alert and Dialog Boxes           | 6-26 |
| Item Types   | 6-30 |
| Display Rectangles                                   | 6-32 |
| Enabled and Disabled Items                           | 6-36 |
| Resource IDs for Items                               | 6-36 |
| Titles for Buttons, Checkboxes, and Radio Buttons    | 6-37 |
| Text Strings for Static Text and Editable Text Items | 6-40 |
| Pop-Up Menus as Items                                | 6-42 |



|  |       |
|--|-------|
| Keyboard Navigation Among Items  | 6-44  |
| Manipulating Items   | 6-44  |
| Changing Static Text   | 6-46  |
| Getting Text From Editable Text Items  | 6-48  |
| Adding Items to an Existing Dialog Box   | 6-51  |
| Using an Application-Defined Item to Draw the Bold Outline<br>for a Default Button     | 6-56  |
| Using the Dialog Manager   | 6-61  |
| Using the Dialog Manager   | 6-61  |
| Displaying Alert and Dialog Boxes  | 6-61  |
| Positioning Alert and Dialog Boxes   | 6-62  |
| Deactivating Windows Behind Alert and Modal Dialog Boxes                               | 6-64  |
| Displaying Modeless Dialog Boxes   | 6-66  |
| Adjusting Menus for Modal Dialog Boxes   | 6-68  |
| Adjusting Menus for Movable Modal and Modeless Dialog Boxes                            | 6-73  |
| Displaying Multiple Alert and Dialog Boxes   | 6-74  |
| Displaying Alert and Dialog Boxes From the Background                                  | 6-74  |
| Including Color in Your Alert and Dialog Boxes   | 6-75  |
| Handling Events in Alert and Dialog Boxes  | 6-77  |
| Responding to Events in Controls   | 6-78  |
| Responding to Events in Editable Text Items  | 6-79  |
| Responding to Events in Alert Boxes  | 6-81  |
| Responding to Events in Modal Dialog Boxes   | 6-82  |
| Writing an Event Filter Function for Alert and Modal Dialog<br>Boxes                   | 6-86  |
| Responding to Mouse Events in Modeless and<br>Movable Modal Dialog Boxes               | 6-89  |
| Responding to Keyboard Events in Modeless and<br>Movable Modal Dialog Boxes            | 6-94  |
| Responding to Activate and Update Events in Modeless and Movable<br>Modal Dialog Boxes | 6-97  |
| Closing Dialog Boxes   | 6-100 |
| Dialog Manager Reference   | 6-101 |
| Data Structure   | 6-101 |
| The Dialog Record  | 6-101 |
| Dialog Manager Routines  | 6-102 |
| Initializing the Dialog Manager  | 6-103 |
| Creating Alerts  | 6-105 |
| Creating and Disposing of Dialog Boxes   | 6-113 |
| Manipulating Items in Alert and Dialog Boxes   | 6-120 |
| Handling Text in Alert and Dialog Boxes  | 6-129 |
| Handling Events in Dialog Boxes  | 6-135 |
| Application-Defined Routines   | 6-143 |
| Resources  | 6-147 |
| The Dialog Resource  | 6-148 |
| The Alert Resource   | 6-150 |
| The Item List Resource   | 6-151 |

|                                 |       |
|---------------------------------|-------|
| The Dialog Color Table Resource | 6-156 |
| The Alert Color Table Resource  | 6-157 |
| The Item Color Table Resource   | 6-158 |
| Summary of the Dialog Manager   | 6-165 |
| Pascal Summary                  | 6-165 |
| Constants                       | 6-165 |
| Data Types                      | 6-166 |
| Dialog Manager Routines         | 6-166 |
| Application-Defined Routines    | 6-168 |
| C Summary                       | 6-168 |
| Constants                       | 6-168 |
| Data Types                      | 6-169 |
| Dialog Manager Routines         | 6-170 |
| Application-Defined Routines    | 6-172 |
| Assembly-Language Summary       | 6-172 |
| Data Structures                 | 6-172 |
| Global Variables                | 6-172 |

## Chapter 7

## Finder Interface 7-1

---

|  |      |
|--|------|
| Introduction to the Finder Interface   | 7-3  |
| About the Finder Interface   | 7-6  |
| Using the Finder Interface   | 7-6  |
| Giving a Signature to Your Application and a Creator and a File Type to Your Documents | 7-8  |
| Creating Icons for the Finder  | 7-11 |
| Creating Customized Document Icons   | 7-17 |
| Creating File Reference Resources  | 7-18 |
| Creating a Bundle Resource   | 7-20 |
| How and When the Finder Launches Your Application                                      | 7-25 |
| Displaying Messages When the Finder Can't Find Your Application                        | 7-27 |
| Providing Version Resources  | 7-31 |
| Using Finder Information in the Catalog File   | 7-32 |
| Supporting Stationery Pads   | 7-34 |
| Distributing Fonts, Sounds, and Other Movable Resources                                | 7-36 |
| Providing Balloon Help for Nondocument Icons   | 7-38 |
| Using Aliases  | 7-39 |
| Using the System Folder and Its Related Directories                                    | 7-41 |
| The Desktop Database   | 7-45 |
| Finder Interface Reference   | 7-46 |
| Data Structures  | 7-46 |
| File Information Record  | 7-47 |
| Extended File Information Record   | 7-49 |
| Directory Information Record   | 7-50 |
| Extended Directory Information Record  | 7-50 |

|  |      |
|--|------|
| Routines                               | 7-51 |
| Resolving Alias Files                  | 7-51 |
| Finding Directories                    | 7-53 |
| Resources                              | 7-56 |
| The Signature Resource                 | 7-57 |
| The Icon List Resource                 | 7-57 |
| The Small Icon List Resource           | 7-58 |
| The Large 4-Bit Color Icon Resource    | 7-59 |
| The Small 4-Bit Color Icon Resource    | 7-60 |
| The Large 8-Bit Color Icon Resource    | 7-61 |
| The Small 8-Bit Color Icon Resource    | 7-62 |
| The Icon Resource                      | 7-63 |
| The Color Icon Resource                | 7-64 |
| The File Reference Resource            | 7-64 |
| The Bundle Resource                    | 7-65 |
| The Missing-Application Name String    | 7-68 |
| The Application-Missing Message String | 7-68 |
| The Version Resource                   | 7-69 |
| Summary of the Finder Interface        | 7-71 |
| Pascal Summary                         | 7-71 |
| Constants                              | 7-71 |
| Data Types                             | 7-73 |
| Routines                               | 7-74 |
| C Summary                              | 7-74 |
| Constants                              | 7-74 |
| Data Types                             | 7-76 |
| Routines                               | 7-77 |
| Assembly-Language Summary              | 7-77 |
| Data Structures                        | 7-77 |
| Result Codes                           | 7-78 |

---

## Glossary    GL-1

---

## Index    IN-1

---

