

Contents

Preface	xiii
Chapter 1: Introduction	1
Who Needs CL?	1
Who Has CL?	1
Capabilities of CL	2
Limitations of CL	2
Chapter 2: A First Look at CL	3
The Parts of a CL Procedure	3
<i>The PGM Command</i>	4
<i>The COPYRIGHT Command</i>	4
<i>The Declarations</i>	5
<i>Global MONMSG</i>	6
<i>The Body of a Procedure</i>	7
<i>The ENDPGM Command</i>	7
<i>The INCLUDE Command</i>	8
Entering the Source Code	8
Using SEU	9
<i>The Source Physical File</i>	9
<i>Starting SEU</i>	9
<i>Formatting the Statements with F4</i>	9
<i>Uppercase or Lowercase?</i>	14
<i>Positional Parameters or Keywords?</i>	14
<i>Continuing on the Next Line</i>	16
<i>Indented or Unindented?</i>	17
Compiling the Procedure	17
<i>The CRTBNDCL Command</i>	17
<i>Output of CRTBNDCL</i>	18
Executing the Program	18
Optional Components of a CL Procedure	19

<i>Blank Lines</i>	19
<i>Comment Lines</i>	20
<i>Comments on Command Lines</i>	21
Chapter 3: Constants and Variables	23
What Is a Constant?	23
<i>Character Constants</i>	23
<i>Decimal Constants</i>	25
<i>Integer Constants</i>	26
<i>Hexadecimal Constants</i>	26
<i>Logical Constants</i>	27
<i>The *NULL Constant</i>	27
What Are Variables?	28
<i>Declaring Variables</i>	28
Coding for Clarity	31
<i>Where Variables Can Be Used</i>	34
<i>Parameters</i>	36
Overlaid Variables	37
Pointer Variables	37
Based Variables	39
Chapter 4: Basic Operators and Functions	41
The CHGVAR Command	41
<i>Arithmetic Operators</i>	43
<i>Overlaid Variables</i>	46
<i>Concatenating Strings</i>	47
<i>Trim Functions</i>	49
<i>Case-Conversion Functions</i>	49
<i>Type-Conversion Functions</i>	50
<i>Data-Validation Functions</i>	54
<i>The %SCAN Function</i>	57
<i>Data-Description Functions</i>	58
<i>Simulating Arrays in CL</i>	61

<i>Binary Conversion</i>	61
<i>Expressions and Operator Hierarchy</i>	64
The CVTDAT Command	65
Chapter 5: Control Statements	69
The IF Command	69
<i>Simple Logical Expressions</i>	69
<i>Complex Logical Expressions</i>	71
The DO and ENDDO Commands	73
<i>Single-Level DO Groups</i>	73
<i>Nesting DO Groups</i>	74
<i>Nesting IF Commands</i>	75
The ELSE Command	76
<i>Using DO with ELSE</i>	77
The SELECT Command	79
The DOWHILE Command	80
The DOUNTIL Command	80
The DOFOR Command	81
The *DOSLTLVL Option	82
The LEAVE and ITERATE Commands	82
The GOTO Command	83
Subroutines	84
<i>The Syntax of Subroutines</i>	85
<i>The Subroutine Stack</i>	87
The CALL and CALLPRC Commands	87
<i>Passing Variables as Parameters</i>	88
<i>Passing Constants as Parameters</i>	90
The ENDPGM and RETURN Commands	91
The TFRCTL Command	91
Chapter 6: Message Management	93
What Is a Message?	93
Message Queues	93

<i>Permanent Message Queues</i>	94
<i>Job Message Queues</i>	94
Types of Messages	94
<i>New Versus Old</i>	95
<i>Purpose of the Message</i>	95
<i>Impromptu and Predefined Messages</i>	96
Using Predefined Messages	97
<i>Message Files</i>	97
<i>Message Descriptions</i>	98
The SNDPGMMSG Command	100
<i>What to Say in the Message</i>	100
<i>Who Should Get the Message</i>	101
<i>Type of Message</i>	104
<i>Getting the Reply</i>	105
<i>Message Key</i>	106
The SNDUSRMSG Command	107
<i>Sending Impromptu Messages</i>	107
<i>Sending Predefined Messages</i>	107
<i>Type of Message</i>	107
<i>Who Gets the Message</i>	108
<i>Receiving the Reply</i>	108
Messages That Can Be Monitored	110
<i>Parameters</i>	111
<i>Program-Level (Global) MONMSG</i>	112
<i>Command-Level MONMSG</i>	113
<i>Specific and Generic Monitoring</i>	114
The RCVMSG Command	116
<i>Get the Message from Where?</i>	116
<i>Which Message to Receive?</i>	117
<i>Message Received—Now What?</i>	120
<i>How Long to Wait?</i>	125
<i>Remove the Message Received?</i>	126
Other Message Management Commands	126

<i>RMVMSG (Remove Messages)</i>	127
<i>SNDRPY (Send Reply)</i>	129
<i>SNDMSG (Send Message)</i>	129
<i>SNDBRKMSG (Send Break Message)</i>	130
DSPMSG and WRKMSG	131
<i>CLRMSGQ (Clear Message Queue)</i>	133
The System Reply List	133
<i>Purpose of the System Reply List</i>	134
<i>Using the System Reply List</i>	134
<i>Pitfalls</i>	134
Message Subfiles	134
<i>The Display File</i>	135
<i>The CL Program</i>	138
Chapter 7: Interprogram and Intermodule Communications	143
Using Parameters	143
<i>Parameter Variables</i>	144
<i>Parameter Constants</i>	145
<i>Limitations</i>	145
Using Data Areas	146
<i>The CRTDTAARA and DLTDTAARA Commands</i>	146
<i>The CHGDTAARA, RTVDTAARA, and DSPDTAARA Commands</i>	147
<i>Special Data Areas</i>	148
Using Switches	149
<i>Turning Switches On and Off</i>	149
<i>Testing the Switches</i>	149
<i>Using the Switches</i>	150
Using Messages	151
<i>Another Look at SNDPGMMSG</i>	151
<i>Another Look at RCVMSG</i>	152
Using Data Queues	153
<i>Types of Data Queues</i>	153
<i>The CRTDTAQ and DLTDTAQ Commands</i>	153

<i>Sending, Receiving, and Clearing Data Queues</i>	154
<i>Retrieving Data Queue Description</i>	158
<i>Receiving from Data Queue Without Deletion</i>	160
<i>Utility Commands</i>	162
<i>Advantages of Data Queues</i>	163
<i>Disadvantages of Data Queues</i>	164
Chapter 8: Job and System Interface	165
Library List Support	165
Retrieving System Values	167
Changing System Values	170
The RTVJOBA and CHGJOB Commands	170
The RTVUSRPRF, CHGUSRPRF, and CHGPRF Commands	173
The RTVNETA Command	174
Summary of the Retrieve (RTV) Commands	175
Chapter 9: Using Files	177
Record-By-Record Processing of a File	177
<i>The DCLF Command</i>	177
<i>The RCVF, WAIT, and ENDRCV Commands</i>	178
<i>RCVF and Random Input</i>	179
<i>The SNDF and SNDRCVF Commands</i>	181
<i>The CLOSE Command</i>	183
Processing a File as a Whole	183
<i>Creating and Deleting Files</i>	183
<i>Processing Database File Members</i>	184
<i>The OVRxxx F and DLTOVR Commands</i>	185
Sorting with OPNQRYF	187
Capturing Output Using QTEMP	189
<i>Using Permanent Work Files</i>	190
<i>Using Outfiles</i>	191
<i>Capturing OUTPUT(*PRINT)</i>	194

SQL Support	195
<i>RUNSQL</i>	196
Chapter 10: Using Quotes	197
Using Quotes in CL	197
Embedded Quotes	198
<i>Expressions, Character Strings, and Command Strings</i>	199
<i>Multiple Quotes</i>	199
<i>Using an &QUOTE Variable</i>	200
Chapter 11: Managing Objects	203
Creating Objects: The CRTxxx Commands	203
Deleting Objects: The DLTxxx Commands	204
Checking Existence: The CHKOBJ Command	205
Retrieving Description: The RTVOBJD Command	207
Retrieving Description: The RTVMBRD Command	209
Creating Duplicates: The CRTDUPOBJ Command	210
Manipulating Objects: MOVOBJ, CHGOBJD, and RNMOBJ	211
Allocating: The ALCOBJ Command	212
Chapter 12: Batch Job Processing	217
The Concept of Batch Processing	217
Job Queues	217
<i>The SBMJOB Command</i>	218
<i>An Unexpected Problem with SBMJOB</i>	220
<i>Working with Submitted Jobs</i>	223
<i>The QSYSOPR Message Queue</i>	223
<i>Self-Submitting Programs</i>	224
Chapter 13: Advanced Topics	229
How to Code Selective Prompting	229
<i>A Common Mistake</i>	230
<i>Making the Prompt Selective</i>	232
<i>Notes</i>	233

Using QCMDCHK	234
<i>Calling QCMDCHK</i>	234
<i>Selective Prompting and QCMDCHK</i>	235
Using QCMDEXC	236
<i>Why Bother with QCMDEXC in CL?</i>	237
<i>Commands Not Allowed</i>	239
Using QCLSCAN	239
<i>Calling QCLSCAN</i>	240
Using QDCXLATE	242
<i>Standard Translations</i>	242
Using DLYJOB	243
<i>DLYJOB with DLY</i>	244
<i>DLYJOB with RSMTIME</i>	244
Using RCLRSC and RCLACTGRP	244
Retrieving CL Source	245
<i>The RTVCLSRC Command</i>	245
Chapter 14: Security Considerations	247
Securing the *PGM Object	247
<i>An Example</i>	247
<i>Securing an Object</i>	248
<i>Take Care of *PUBLIC</i>	248
Authority	249
<i>Ownership</i>	249
<i>Adopting Authority</i>	249
<i>Another Example</i>	250
<i>Adopted Authority from Other Programs in the Call Stack</i>	251
<i>Other Risks of Adopted Authority</i>	251
Command Lines	252
<i>Limited Capabilities</i>	252
<i>Pros and Cons of Command Lines</i>	253
<i>When Command Lines Appear</i>	253

Chapter 15: Sign-on Programs	255
Using Job Descriptions	255
What Job Descriptions Cannot Do	256
Sample Sign-On Program	256
Chapter 16: Debugging	265
The STRDBG Command	265
The ENDDBG Command	266
Debugging Views	266
An Example Interactive Debugging Session	266
Debugging in Source View	270
Other Important Debugger Commands	275
Summary of Debugger Commands	275
Debugging in List View	276
Debugging in Statement View	277
<i>Encrypting the *LIST View</i>	278
<i>OPM Programs and the ILE Debugger</i>	279
Debugging Another Job	279
The DMPCLPGM Command	285
Chapter 17: CL and the Integrated Language Environment	289
Types of Object Code	289
Binding	289
<i>Binding by Copy</i>	290
<i>Binding by Reference</i>	291
<i>The Dynamic Call</i>	291
Compilation	292
<i>CRTCLMOD</i>	292
<i>CRTSRVPGM</i>	292
<i>CRTPGM</i>	293
<i>CRTBNDCL</i>	293
Activation Groups	293
<i>The Default Activation Group</i>	294

<i>ACTGRP(identifier)</i>	294
<i>ACTGRP(*NEW)</i>	294
<i>ACTGRP(*CALLER)</i>	294
<i>Destroying Activation Groups</i>	295
Parameter Descriptions	295
<i>PGM: Program Name</i>	296
<i>SRCFILE: Source File Name</i>	296
<i>SRCMBR: Source Member Name</i>	296
<i>TEXT: Text Description</i>	296
<i>DFTACTGRP: Default Activation Group</i>	297
<i>OPTION: Compiler Listing Options</i>	297
<i>USRPRF: Assumed User Profile</i>	297
<i>LOG: Log Commands</i>	298
<i>REPLACE: Replace Existing Program</i>	298
<i>TGTRLS: Target Release</i>	298
<i>AUT: Public Authority</i>	299
<i>SRTSEQ: Sort Sequence</i>	299
<i>LANGID: Language ID</i>	299
<i>DBGVIEW: Debugging View</i>	300
<i>ENBPFCOL: Enable Performance Collection</i>	300
<i>ACTGRP: Activation Group Name</i>	300
<i>OPTIMIZE: Optimization</i>	300
Appendix A: Some Utility Commands	301
Appendix B: CL Coding Style	401
Appendix C: Sample Sign-on Program	433
Appendix D: The Original Program Model	437
Index	439