AutoCAD® 2021 INSTRUCTOR

James A. Leach
Shawna Lockhart

SDC PUBLICATIONS
Better Textbooks. Lower Prices.
www.SDCpublications.com

ACCESS CODE
UNIQUE CODE INSIDE

Visit the following websites to learn more about this book:

SDC Publications

amazon.com

Google books

BARNES&NOBLE

Table of Contents

CHAPTER 1 GETTING STARTED 1

CONCEPTS........2
- Coordinate Systems........2
- The CAD Database........3
- Angles in AutoCAD........3
- Draw True Size........3
- Plot to Scale........5

STARTING AUTOCAD........5
THE AutoCAD DRAWING EDITOR........6
- Beginning a Drawing........6
- Drafting & Annotation Workspace........7
- Command Entry Using the Keyboard........11
- Accelerator Keys (Control Key Sequences)..12
- Special Key Functions........12
- Mouse Buttons........12

COMMAND ENTRY........12
- Methods for Entering Commands........12
- Understanding the "Command Tables" in this Book........13
- Command Entry Methods Practice........13
- *Line*........13

DRAWING AIDS........15
- Status Bar........15
- Function Keys........20
- AutoCAD Text Window........20
- Model Space and Layouts........21

CUSTOMIZING THE AUTOCAD SCREEN........22
- Toolbars........22
- Ribbon........23
- Clean Screen........24
- Options........25

CHAPTER 2 WORKING WITH FILES 27

AutoCAD DRAWING FILES........28
- Naming Drawing Files........28
- Beginning and Saving a Drawing........28
- Accessing File Commands........28
- File Navigation Dialog Box Functions........29
- Windows Right-Click Shortcut Menus........30
- *New*........31

AUTOCAD FILE COMMANDS........31
- *Qnew*........32
- *Open*........33
- *Save*........35
- *Qsave*........35
- *Saveas*........35
- *Close*........37
- *Closeall*........37
- *Closeallother*........37
- *Exit*........37
- *Quit*........38
- *Partialopen*........38
- *Partiaload*........39
- *Recover*........40
- *Dwgprops*........40
- *SAVETIME*........41
- AutoCAD Backup Files........42
- Drawing Recovery........42
- AutoCAD Drawing File Management........43
- Using Other File Formats........43

CHAPTER 3 DRAW COMMAND CONCEPTS 45

AutoCAD OBJECTS........46
LOCATING THE DRAW COMMANDS........46
COORDINATE ENTRY........48
- Coordinate Formats and Types........48
- Coordinate Formats........48
- Coordinate Types........48
- Typical Combinations........48
- Three Methods of Coordinate Input........48
- Mouse Input........49
- Dynamic Input........49
- Command Line Input........50

PRACTICE USING THE THREE COORDINATE INPUT METHODS........50
- *Line*........50
- Using Mouse Input to Draw Lines and Circles...51
- *Circle*........51
- Using *Dynamic Input* to Draw Lines & Circles..53
- Using Command Line Input to Draw Lines & Circles........55
- Direct Distance Entry and Angle Override........57
- *Dynamic Input* Settings........57

POLAR TRACKING AND *POLAR SNAP*........58
- Polar Tracking........58
- *Polar Tracking* with Direct Distance Entry........59
- *Polar Tracking* Override........60

Polar Snap 60
DRAWING LINES USING *POLAR TRACKING* . 61
Using *Polar Tracking* and *Grid Snap* 61
Using *Polar Tracking* and *Dynamic Input* 62
Using *Polar Tracking*, *Polar Snap*, and *Dynamic Input* 63

CHAPTER 4 SELECTION SETS 69

MODIFY COMMAND CONCEPTS 70
SELECTION SETS 70
Selection Set Options 71
Selection Cycling 76
Select 76
NOUN/VERB SYNTAX 77
SELECTION SETS PRACTICE 77
Using *Erase* 78
Erase 78
Using *Move* 79
Move 79
Using *Copy* 80
Copy 80
Noun/Verb Command Syntax Practice 82

CHAPTER 5 HELPFUL COMMANDS 85

CONCEPTS 86
Help 86
Oops 88
U 88
Undo 88
Redo 90
Mredo 90
Regen 91

CHAPTER 6 BASIC DRAWING SETUP 93

STEPS FOR BASIC DRAWING SETUP 94
STARTUP OPTIONS 94
DRAWING TEMPLATES 95
Table of Basic Settings for the ACAD (Inch) Templates 96
Table of Basic Settings for the ACADISO (Metric) Templates 96
SETUP COMMANDS 97
Units 97
Keyboard Input of *Units* Values 98
Limits 99
Snap 101
Grid 103
Using *Snap* and *Grid* 104
Dsettings 104
INTRODUCTION TO LAYOUTS AND PRINTING 105
Model Tab and *Layout* Tabs 105
Why Set Up Layouts Before Drawing? 108
Printing and Plotting 108
Setting Layout Options and Plot Options 109

CHAPTER 7 OBJECT SNAP AND OBJECT SNAP TRACKING 113

CAD ACCURACY 114
OBJECT SNAP 114
OBJECT SNAP MODES 115
Acquisition Object Snap Modes 118
Object Snap Modifiers 120
OBJECT SNAP SINGLE POINT SELECTION .. 121
Object Snaps (Single Point) 121
OBJECT SNAP RUNNING MODE 123
Running Object Snap Modes 123
Osnap 123
Running Object Snap Toggle 124
Running Object Snap Override 124
Object Snap Options 124
OBJECT SNAP TRACKING 127
To Use Object Snap Tracking: 128
Object Snap Tracking with Polar Tracking 128
Object Snap Tracking Settings 130

CHAPTER 8 DRAW COMMANDS I 137

CONCEPTS 138
Draw Commands—Simple and Complex 138
Draw Command Access 138
COMMANDS 139
Line 139
Circle 140
Arc 142
Use Arcs or Circles? 146
Point 147
Ptype 147

Pline 148
Pline Arc Segments....150

CHAPTER 9 MODIFY COMMANDS I 155

CONCEPTS....156
COMMANDS 157
Erase 157
Move....158
Rotate....159
Scale 161
Stretch....162
Lengthen 163
Trim....165
Extend 168
Trim and *Extend* Shift-Select Option 169
Break....169
Join....171
Copy 172
Mirror....173
Offset....174
Array....176
Arrayrect....177
Creating and Editing Arrays Using Grips....178
Arraypolar....178
Arraypath....181
Fillet....183
Chamfer....185

CHAPTER 10 VIEWING COMMANDS 199

CONCEPTS....200
ZOOM AND *PAN* WITH THE MOUSE WHEEL .201
Zoom and *Pan*....201
Zoom with the Mouse Wheel....201
Pan with the Mouse Wheel....202
Zoom 203
Pan 207
Zoom and *Pan* with *Undo* and *Redo* 208
Viewback....208
Viewforward....208
View....208
Viewres....210
Ucsicon 211
Viewgo 212
Qvdrawing 212
Vports....213

CHAPTER 11 LAYERS & OBJECT PROPERTIES 219

CONCEPTS....220
Assigning Colors, Linetypes, Lineweights, and Transparency....220
Object Properties 221
Plot Styles 221
LAYERS AND LAYER PROPERTIES CONTROLS.. 222
Layer Drop-Down List....222
Layer....222
Layer Properties Manager Layer List 223
Color, Linetype, Lineweight, & Other Properties. 225
Layer Filters....227
Displaying an Object's Properties and Visibility Settings 229
Laymcur....230
Layerp 230
Layerstate....230
OBJECT-SPECIFIC PROPERTIES CONTROLS ..233
Linetype....233
Linetype Drop-Down List 235
Lweight....235
Lineweight Drop-Down List....236
Color....237
Color Drop-Down List 238
True Color and *Color Books* 238
Setbylayer....239
CONTROLLING LINETYPE SCALE 240
LTSCALE....240
CELTSCALE....241
CHANGING OBJECT PROPERTIES....242
Properties Panel....242
Properties....243
Matchprop 243
Laymch....244
Laycur....245
Layiso 245
Layuniso 247
Copytolayer 247
Laywalk....248
Layfrz....251
Laythw 252

Layoff......252
Layon......252
Laylck......253
Layulk......253
Layvpi......253
Laymrg......254
Laydel......255

CHAPTER 12 ADVANCED DRAWING SETUP 261

CONCEPTS......262
STEPS FOR DRAWING SETUP......262
USING & CREATING TEMPLATE DRAWINGS......266
Using Template Drawings......266
Table of Standard AutoCAD Templates......267
Creating Template Drawings......268
Additional Advanced Drawing Setup Concepts......269
Steps for Drawing Setup Using Annotative Objects......269

CHAPTER 13 LAYOUTS AND VIEWPORTS 273

CONCEPTS......274
Paper Space and Model Space......274
Layouts......274
Viewports......275
Layouts and Viewports Example......277
Guidelines for Using Layouts and Viewports......280
Layoutwizard......281
Layout......283
Inserting Layouts with AutoCAD DesignCenter......285
Setting Up the Layout......285
Options......286
Pagesetup......287
Psetupin......288
USING VIEWPORTS IN PAPER SPACE......289
Vports......289
Qvlayout......292
Scaling the Display of Viewport Geometry......293
Locking Viewport Geometry......295
Linetype Scale in Viewports—*PSLTSCALE*......295
Vpmax......296
Vpmin......297
Scalelistedit......297
Chspace......298
Adv. Applications of Paper Space Viewports......299

CHAPTER 14 PRINTING AND PLOTTING 309

CONCEPTS......310
TYPICAL STEPS TO PLOTTING......310
PRINTING, PLOTTING, & SAVING PAGE SETUPS......311
Plot......311
-Plot......316
Viewplotdetails......316
Pagesetup......317
Plot Dialog Box or the *Page Setup Manager*?......319
PLOTTING TO SCALE......320
Preview......320
Standard Paper Sizes......321
Calculating the Drawing Scale Factor......321
Guidelines for Plotting Model Space to Scale......322
Guidelines for Plotting Layouts to Scale......322
TABLES OF *LIMITS* SETTINGS......323
Examples for Plotting to Scale......329
CONFIGURING PLOTTERS AND PRINTERS......330
Plotting Components......330
Plottermanager......330
Add-A-Plotter Wizard......331
Plotter Configuration Editor......332

CHAPTER 15 DRAW COMMANDS II 337

CONCEPTS......338
COMMANDS......338
Xline......338
Ray......340
Polygon......341
Rectang......342
Donut......343
Spline......344
Ellipse......346
Divide......348
Measure......349
Mline......350
Multiline Style Dialog Box......352
Mlstyle......352
Multiline Style Dialog Box......353
Multiline Styles Example......354
Editing Multilines......355
Sketch......355
Solid......357

Boundary ... 357
Region ... 358
Wipeout ... 360
Revcloud ... 360

CHAPTER 16 MODIFY COMMANDS II 367

CONCEPTS ... 368
COMMANDS ... 368
Considerations for Changing Basic Properties of Objects ... 369
Properties ... 370
Dblclkedit ... 373
Matchprop ... 374
Object Properties Drop-Down Lists ... 375
Quick Properties ... 376
Chprop ... 376
Change ... 376
Explode ... 377
Align ... 378
Pedit ... 379
Vertex Editing ... 382
Editing *Plines* with Grips ... 384
Editing *Spline* Fit Data Points ... 385
Splinedit ... 385
Editing *Spline* Control Vertices ... 387
Editing *Splines* with Grips ... 388
Reverse ... 389
Blend ... 389
Arrayedit ... 390
Mledit ... 392
Overkill ... 396
Boolean Commands ... 397
Union ... 398
Subtract ... 398
Intersect ... 399
Modifying *Revclouds* ... 400

CHAPTER 17 INQUIRY COMMANDS 407

CONCEPTS ... 408
COMMANDS ... 408
Status ... 408
List ... 409
Measuregeom ... 410
Id ... 413
Time 413
Setvar ... 414
Sysvarmonitor ... 415
Massprop ... 416

CHAPTER 18 TEXT AND TABLES 419

CONCEPTS ... 420
TEXT CREATION COMMANDS ... 422
Text ... 422
Mtext ... 425
Bullets and Lists ... 432
Creating Stacked Text ... 432
Creating Columns ... 433
Calculating Text Height for Scaled Drawings 434
Spacetrans ... 435
Txt2mtxt ... 436
Style ... 437
Annotative Text ... 440
Importing External Text into AutoCAD ... 443
External Text Editor for *Multiline Text* ... 443
Format Codes for Creating *Multiline* Text in External Text Editors ... 444
Textedit ... 446
Mtedit ... 446
Properties ... 446
Spell ... 447
Find ... 448
Find/Replace in the *Text Editor* tab ... 450
Scaletext ... 450
Justifytext ... 452
Qtext ... 453
TEXTFILL ... 454
Substituting Fonts ... 454
TEXT FIELDS AND TABLES ... 455
Text Fields ... 455
Field ... 456
Creating and Editing Tables ... 457
Updatefield ... 457
Table ... 458
Tablestyle ... 459
The *Table Cell* Editor ... 461
Tabledit ... 461
Editing Tables with Grips ... 463
Editing Tables with the *Properties* Palette ... 463

Importing and Exporting Tables....................464
Table Breaks..465
Text Fields and Calculations in Tables..........465
Text Attributes..468

CHAPTER 19 GRIP EDITING 475

CONCEPTS..476
GRIPS FEATURES...476
Activating Grips on Objects..........................477
Cold and Hot Grips......................................477
GRIPS System Variable Settings 478
Grips Menus..478
Grip Editing Options 479
Shift to Turn on *Ortho* 481
Auxiliary Grid..481
Editing Dimensions......................................481
Multifunctional Grips....................................482
GUIDELINES FOR USING GRIPS...................482
GRIPS SETTINGS 483
Point Specification Precedence....................484
More Grips...485

CHAPTER 20 ADVANCED SELECTION SETS 489

CONCEPTS..490
SELECTION SET VARIABLES..........................490
Changing the Settings..................................490
Options...491
OBJECT SELECTION TOOLS AND FILTERS ..493
Selall..493
Selectsimiliar...493
Hideobjects...494
Unisolateobjects..495
Isolateobjects 495
Qselect 495
Filter 498
OBJECT GROUPS..501
Group 502
Groupedit..503
Ungroup..503
Group Examples...504
Classicgroup..505
Changing Properties of a Group 507

CHAPTER 21 BLOCKS, DESIGNCENTER, AND TOOL PALETTES 513

CONCEPTS..514
COMMANDS 516
Block..516
Block Color, Linetype, and *Lineweight* Settings ..517
Insert 518
–Insert 519
Minsert 520
*-Insert with ** 521
Explode 521
Xplode 522
Wblock...523
Redefining Blocks and the Block Editor 525
Base 525
Bedit 526
Blocks Search Path 528
Purge...528
Rename..530
Setbylayer...531
Adcenter...532
DesignCenter Options..................................533
To Open a Drawing from DesignCenter........537
To *Insert* a *Block* Using DesignCenter..........538
TOOL PALETTES...540
Toolpalettes 540
Creating and Managing Tool Palettes...542

CHAPTER 22 BLOCK ATTRIBUTES AND DATA LINKS 551

CONCEPTS..552
CREATING ATTRIBUTES 552
Creating & Inserting Block Attributes............552
Attdef..553
Saving the Attributed Block 557
Inserting Attributed Blocks............................557
The *ATTDIA* Variable 558
The *ATTREQ* Variable 558
DISPLAYING AND EDITING ATTRIBUTES 558
Attdisp 558
Attedit 559

Multiple Attedit 560
Eattedit 560
Properties 561
Find 562
-Attedit 563
Global and Individual Editing Example 565
Battman 569
Attredef 571
Refedit, Properties, and *Refclose* 572
The Block Editor 573
Grip Editing Attribute Location 574
EXTRACTING ATTRIBUTES 574
Attsync 574
Eattext 575
Updating Attribute Data 579
Datalink 580
Data Link Examples 581
Datalinkupdate 583

CHAPTER 23 INTERNET TOOLS AND COLLABORATION 589

CONCEPTS 590
Browser 591
Autodesk App Store 592
Inetlocation 592
USING HYPERLINKS 594
Open from/Save to Web & Mobile 594
Hyperlink 594
HYPERLINKBASE 596
Selecturl 596
Transmitting Drawings 597
Etransmit 597
Transmittal Setups 598
Modify Transmittal Setup Dialog Box 598
CREATING .DWF AND .PDF FILES 600
Raster Files and Vector Files 601
Creating .DWF and .PDF Files with ePlot and Export 601
Exportpdf 602
Exportdwf 603
ePlot Options 604
Creating .DWF and .PDF Files with *Publish* 604
Publish 604
IMPORTING .PDF FILES 607
Import 607
Pdfimport 610
Importing SHX Fonts from .PDF Files 611
PDFSHXTEXT 611
Suggested Steps for Scaling and Importing .PDF Files 612
Considerations for Importing and Exporting .PDF Files 613
VIEWING .DWF AND .PDF FILES 614
Autodesk Design Review 614
DWF Underlay and *PDF Underlay* in AutoCAD ..616
Dwfattach 616
Dwfclip 618
To Detach a DWF or PDF Underlay 619
Viewing URLs (Hyperlinks) in a DWF Image 619
Dwflayers 619
COLLABORATING AND MARKUP TOOLS 620
The Markup Tools 620
The Markup Process 620
Shared Views 621
Shareview 621
Marking Up a Shared View 624
Markups from Autodesk Design Review 625
Opendwfmarkup 625
Markup 625
DRAWING COMPARE 626
Compare 626
DRAWING HISTORY 628
DWGHISTORY 628

CHAPTER 24 MULTIVIEW DRAWING 633

CONCEPTS 634
PROJECTION AND ALIGNMENT OF VIEWS .634
Using *Ortho* and *Object Snap* to Draw Projection Lines 634
Using *Polar Tracking* to Draw Projection Lines 635
Using *Object Snap Tracking* to Draw Projection Lines Aligned with *Object Snap* Points 636
Using *Xline* and *Ray* for Construction Lines .638
Using *Offset* for Construction of Views 638
Realignment of Views Using *Polar Snap* and *Polar Tracking* 639

USING CONSTRUCTION LAYERS 639
USING LINETYPES 640
Drawing With Hidden & Center Linetypes 641
Managing Linetypes, Lineweights, and Colors...642
ASSOCIATIVE CENTERLINES & CENTERMARKS..644
Associative Centerlines & Centermarks 644
Centerline 644
Centermark 645
Modifying *Centerlines* and *Centermarks* 646
Grips...646
Properties..647
Centerdisassociate......................................648
Centerreassociate 648
Centermark and *Centerline* System Variables ..649
Centerreset..649
CREATING FILLETS, ROUNDS, & RUNOUTS... 651
GUIDELINES FOR CREATING A TYPICAL THREE-VIEW DRAWING 653

CHAPTER 25 PICTORIAL DRAWINGS 661

CONCEPTS..662
Types of Pictorial Drawings 662
Pictorial Drawings Are 2D Drawings.............663
ISOMETRIC DRAWING IN AUTOCAD 664
Snap 664
Isometric Ellipses 666
Ellipse..666
Creating an Isometric Drawing 668
Dimensioning Isometric Drawings in AutoCAD .670
OBLIQUE DRAWING IN AUTOCAD..................670
Isometric Drawing...672
Oblique Drawing...674

CHAPTER 26 SECTION VIEWS 675

CONCEPTS..676
DEFINING HATCH PATTERNS AND HATCH BOUNDARIES 676
Steps for Creating a Section View Using the *Hatch* Command 677
Hatch...678
Pattern Panel..679
Properties Panel...680
Boundaries Panel (Selecting the Hatch Area)...681
Origin Panel...683
Options Panel 683
Hatch and Gradient Dialog Box 685
Gradient Hatches 686
-*Hatch* Command Line Options 687
Creating Tool Palettes...................................691
Toolpalettes 691
EDITING HATCH PATTERNS & BOUNDARIES...693
Hatchedit 693
Using Grips with Hatch Patterns 694
Using *Trim* with Hatch Patterns 694
Object Selection Features of Hatch Patterns ...694
Solid *Hatch* Fills...695
Draworder..696
Texttofront..696

CHAPTER 27 AUXILIARY VIEWS 703

CONCEPTS..704
CONSTRUCTING AN AUXILIARY VIEW 704
Setting Up the Principal Views 704
Using *Snap Rotate* and *Ortho* 705
Rotating *Snap* Back to the Original Position.706
Using *Polar Tracking*.....................................708
Using the *Offset* Command 709
Offset...710
Using the *Xline* and *Ray* Commands............711
Xline 711
Ray 711
Constructing Full Auxiliary Views 712
Reorienting the User Coordinate System.....713

CHAPTER 28 DIMENSIONING 717

CONCEPTS..718
Dimension Components 718
Dimension Placement 718
Associativity...719
Accessing Dimension Commands 719
DIMENSION DRAWING COMMANDS..............720
Dim 720
Dimlinear 720
Dimaligned 723
Dimbaseline...724
Dimcontinue 725
Dimspace 726

Dimangular 727
Dimdiameter 728
Dimradius 729
Dim 731
Dimjogline 735
Dimjogged 736
Dimarc 736
Dimcenter 737
Dimbreak 738
Leader 739
Qleader 740
Mleader 743
Mleaderstyle 744
Mleaderedit 747
Mleaderalign 748
Mleadercollect 749
Dimordinate 750
Qdim 752
Tolerance 755
Editing Feature Control Frames 757
Basic Dimensions 757
GDT-Related Dimension Variables 758
Geometric Dimensioning and Tolerancing Example 758
Diminspect 762
EDITING DIMENSIONS 763
Grip Editing Dimensions 763
Multifunctional Grips 765
Exploding Associative Dimensions 766
Dimension Editing Commands 766
Dimtedit 766
Dimedit 767
Properties 768
Customizing Dimensioning Text 769
Associative Dimensions 770
Dimreassociate 772
Dimdisassociate 773
DIMENSIONING VARIABLES INTRODUCTION ... 774
Dimregen 774

CHAPTER 29 DIMENSION STYLES AND VARIABLES 779

CONCEPTS 780
Dimension Variables 780
Dimension Styles 781
Dimension Style Families 781
Dimension Style Overrides 782
DIMENSION STYLES 783
Dimstyle or Ddim 783
-Dimstyle 787
DIMENSION VARIABLES 788
Changing Dimension Variables Using the Dialog Box Method 789
Lines Tab 789
Dimension Lines Section (*Lines* Tab) 789
Extension Line Section (*Lines* Tab) 791
Symbols and Arrows Tab 792
Arrowheads Section (*Symbols and Arrows* Tab) 792
Other Sections (*Symbols and Arrows* Tab) .. 793
Text Tab 794
Text Appearance Section (*Text* Tab) 795
Text Placement Section (*Text* Tab) 796
Text Alignment Section (*Text* Tab) 797
Fit Tab 797
Scale for Dimension Features Section (*Fit* Tab) .. 798
Fit Options Section (*Fit* Tab) 798
Text Placement Section (*Fit* Tab) 800
Fine Tuning Section (*Fit* Tab) 800
Primary Units Tab 801
Linear Dimensions Section (*Primary Units* Tab) 802
Measurement Scale Section (*Primary Units* Tab) . 803
Zero Suppression Section (*Primary Units* Tab) .. 804
Angular Dimensions Section (*Primary Units* Tab) .. 804
Alternate Units Tab 804
Alternate Unit Section (*Alternate Units* Tab) 805
Zero Suppression Section (*Alternate Units* Tab) . 806
Placement Section (*Alternate Units* Tab) 806
Tolerances Tab 806
Tolerance Format Section (*Tolerances* Tab) 806
Alternate Unit Tolerance Section (*Tolerances* Tab) . 808
DIMCONTINUEMODE 808

Changing Dimension Variables Using the Command Line Format 808
Dim... (variable name) 808
DIMASSOC (Associative Dimensions) 809
MODIFYING EXISTING DIMENSIONS 810
Modifying a Dimension Style 810
Creating Dimension Style Overrides and Using *-Dimstyle*, *Apply* (*Update)* 811
Properties 811
-Dimstyle 811
Apply 811
Dimoverride 812
Matchprop 813
Dimension Right-Click Menu 814
GUIDELINES FOR NON-ANNOTATIVE DIMENSIONING IN AUTOCAD 815
Strategy 1. Dimensioning a Single Drawing 815
Strategy 2. Creating Dimension Styles as Part of Template Drawings 817
Optional Method for Fixed Dimension Text Height in Template Drawings 817
DIMENSIONING IN PAPER SPACE LAYOUTS .818
When to Dimension in Paper Space 819
Procedure for Dimensioning in Paper Space819
DIMENSIONING ISOMETRIC DRAWINGS 823

CHAPTER 30 XREFERENCES 831

CONCEPTS 832
An *Xref* Example 836
CREATING AND USING *XREFS* 838
Xref **or** *External-references* 839
Dependent Objects and Names 844
Evaluating New Layers 846
VISRETAIN/VISRETAINMODE/XREFOVERRIDE...848
Evaluating and Reconciling Layers 849
Xattach 849
Xbind 849
Adcenter 850
Xclip 852
XCLIPFRAME 853
Demand Loading 854
INDEXCTL 855
XLOADCTL 856
XLOADPATH 856
XREFOVERRIDE 857
EDITING FOR *XREFS* AND *BLOCKS* 858
Xopen 858
In-Place *Xref* and *Block* Editing 859
Refedit 860
Using -*Refedit* at the Command Line 862
Refset 862
Refclose 863
XEDIT 863
XFADECTL 864
XREFNOTIFY 864
PROJECTNAME 865
Reference Manager 867
XREFCTL 867

CHAPTER 31 OBJECT LINKING AND EMBEDDING (OLE) 875

CONCEPTS 876
Cut and Paste Between AutoCAD Drawings .. 876
Cut and Paste Between Applications (OLE) .. 877
The Windows Clipboard 879
OLE RELATED COMMANDS 880
Copyclip 881
Copybase 882
Copylink 882
Cutclip 883
Pasteclip 883
Pasteorig 885
Pasteblock 885
Pastespec 886
Insertobj 888
Pasteashyperlink 889
MANAGING OLE OBJECTS 890
Olelinks 890
OLE Right-Click Shortcut Menu 891
Olescale 891
Oleopen 891
Other AutoCAD Commands with OLE Objects ..892
OLE-RELATED SYSTEM VARIABLES 893
MSOLESCALE 893
OLEHIDE 893
OLEQUALITY 893
OLESTARTUP 893

CHAPTER 32 ADV. LAYOUTS, ANNOTATIVE OBJECTS, & PLOTTING 897

- CONCEPTS 898
- ADVANCED LAYOUTS 898
  - Layer Visibility for Viewports 899
  - *Layer* 900
  - *Vplayer* 902
  - Layer Property Overrides 905
  - Linetype Scale in Viewports 908
  - *Psltscale* 908
  - Dimensioning in Paper Space 910
  - The "Reverse Method" for Calculating Drawing Scale Factor 912
  - Steps for Calculating the Drawing Scale Factor by the "Reverse Method" 913
- ANNOTATIVE OBJECTS 914
  - Setting Annotation Scale and Viewport Scale 914
  - Creating and Displaying Annotative Objects in Multiple Viewports 916
  - *SELECTIONANNODISPLAY* 918
  - Adding and Deleting Scale Representations for Annotative Objects 918
  - *Objectscale* 918
  - Adjusting Positions for Individual Annotative Object Scale Representations 920
  - *ANNOALLVISIBLE* 922
  - *Annoreset* 922
  - *Annoupdate* 923
  - *SAVEFIDELITY* 924
  - Linetype Scales for Annotative Drawings 924
  - *MSLTSCALE* 925
  - Applications for Multiple Viewports 926
  - Using Two Layouts to Plot the Same Geometry at Different Scales 926
  - Using Two Viewports to Display the Same Geometry at Different Scales 928
  - Using One Layout to Plot *Xref* Drawings in Multiple Viewports at Different Scales 930
- PLOT STYLE TABLES AND PLOT STYLES 931
  - Difference between a Plot Style and a Plot Style Table? 932
  - Color-Dependent and Named Plot Style Tables 934
  - Attaching a Plot Style Table to a Layout 935
  - Creating a Plot Style Table 936
  - *Stylesmanager* 936
  - Editing Plot Styles 937
  - Assigning Named Plot Styles to Objects 939
  - *Plotstyle* 941
  - Named Plot Style Table Example 942
  - *Convertpstyles* 944
- PLOT STAMPING 945
  - *Convertctb* 945
  - *Plotstamp* 945

CHAPTER 33 3D BASICS, NAVIGATION, AND VISUAL STYLES 957

- SETTING UP AUTOCAD TO DRAW IN 3D 958
  - Setting Up a Workspace 958
  - Activating the ACAD3D or ACADISO3D Drawing Template 959
- TYPES OF 3D MODELS 960
  - Wireframe Models 960
  - Surface Models 961
  - Solid Models 962
- 3D COORDINATE ENTRY 963
  - 3D Coordinate Entry Formats 964
- COORDINATE SYSTEMS 969
  - The World Coordinate System (WCS) and WCS Icon 970
  - User Coordinate Systems (UCS) and Icons 970
  - The Right-Hand Rule 972
  - *Ucsicon* 972
- 3D NAVIGATION AND VIEW COMMANDS 974
  - *Pan* 975
  - *Zoom* 976
  - *Navvcube* 976
  - 3D Orbit Commands 980
  - *3Dorbit* 981
  - *3Dforbit* 982
  - *3Dcorbit* 984
  - *PERSPECTIVE* 984
  - *3Ddistance* 985
  - View Presets 986
  - *View* 988
  - Adjusting the Amount of Perspective 990
  - *3Dclip* 991
  - *Camera* 992
  - Editing Camera Settings 994

3Dswivel 995
Navswheel 995
SteeringWheel Shortcut Menu 996
SteeringWheel Navigation Tools 997
SteeringWheel Settings 999
-Vpoint 1000
Vpoint 1001
Plan 1002
Grid 1002
Vports 1003
VISUAL STYLES 1005
Default Visual Styles 1006
Vscurrent 1006
Face Settings 1010
Shadow Settings 1012
Edge Effects 1013
Visualstyles 1014
Named Views and Viewports 1019
Graphics Performance Tuning 1021
Shade, SHADEDIF, SHADEDGE 1023
Render 1023
Printing 3D Models 1023

CHAPTER 34 USER COORDINATE SYSTEMS 1033

CONCEPTS 1034
CREATING AND MANAGING USER COORDINATE SYSTEMS 1034
Ucs 1035
Dducsp 1041
Ucsman 1042
ViewCube *UCS* Drop-Down List 1043
UCS SYSTEM VARIABLES 1044
Ucsbase 1044
Ucsview 1044
UcsOrtho 1044
Ucsfollow 1046
Ucsvp 1046
UCS3DPERPDISPLAYSETTING 1047
UCS3DPARADISPLAYSETTING 1047
UCSSELECTMODE 1047
Ucsaxisang 1047
USER COORDINATE SYSTEMS AND 3D MODELING 1048
Dynamic User Coordinate Systems 1048

CHAPTER 35 SOLID MODELING CONSTRUCTION 1051

CONCEPTS 1052
Solid Model Construction Process 1052
Solid Primitives Commands 1052
Dynamic User Coordinate Systems 1053
Commands to Move, Rotate, Mirror, and Scale Solids 1053
Boolean Operations 1053
SOLID PRIMITIVES COMMANDS 1055
Box 1056
Cone 1057
Cylinder 1059
Wedge 1060
Sphere 1061
Torus 1062
Pyramid 1063
Polysolid 1064
Extrude 1066
Revolve 1068
Sweep 1069
Loft 1071
DYNAMIC USER COORDINATE SYSTEMS.. 1074
COMMANDS TO MOVE, ROTATE, MIRROR, AND SCALE SOLIDS 1075
Move 1076
3Dalign 1077
3Dmove 1078
3Dscale 1080
3Drotate 1080
Mirror3D 1082
3Darray 1084
BOOLEAN OPERATION COMMANDS 1087
Union 1087
Subtract 1088
Intersect 1089
Chamfer 1090
Fillet 1092
DESIGN EFFICIENCY 1093

CHAPTER 36 SOLID MODEL EDITING 1105

CONCEPTS....1106
EDITING PRIMITIVES USING THE *PROPERTIES* PALETTE....1106
  Editing *Properties* of Individual Primitives....1106
  Composite Solid Subobject Selection....1108
  Editing *Properties* of Composite Solids....1109
EDITING SOLIDS USING GRIPS AND GIZMOS....1109
  Move, Rotate, and Scale Gizmos....1115
  Grip Editing Composite Solids....1117
  Subobjects and Selection....1118
  Grip Editing Faces, Edges, and Vertices....1119
  Selecting Overlapping Subobjects....1123
  History Settings....1123
SOLIDS EDITING COMMANDS....1125
  Solidedit....1126
  Face Options....1127
  Edge Options....1134
  Body Options....1135
  Slice....1138
  Presspull....1139
  Sectionplane....1141
  Sectionplane Contextual Tab....1145
  Section Settings Dialog Box....1147
  Interfere....1147
  Imprint....1149
  Massprop....1150
USING SOLIDS DATA....1150
  Stlout....1151
  3Dprint....1152
  Acisin....1152
  Acisout....1152

CHAPTER 37 2D DRAWINGS FROM 3D MODELS 1159

CONCEPTS....1160
COMMANDS....1161
  Viewbase....1161
  Viewbase Options....1165
  Viewedit....1167
  Drawing View Editing....1168
  Viewproj....1169
  Viewstd....1170
  Viewsection....1171
  Section View Examples....1173
  Viewsectionstyle....1177
  Modify Section View Style and *New Section View Style* Dialog Boxes....1178
  Section View Style and *Detail View Style* Issues....1181
  Viewcomponent....1182
  Viewdetail....1183
  Viewdetailstyle....1185
  Modify Detail View Style and *New Detail View Style* Dialog Boxes....1186
  Viewupdate....1188
  Viewupdateauto....1190
  Viewsymbolsketch....1190
  Creating Auxiliary Views Using *Viewsection*....1191
  Dimensioning a Documentation Drawing....1193

APPENDIX A....1201

APPENDIX A....1202
  AutoCAD 2021 Command Alias List Sorted by Command....1202

APPENDIX B....1207

APPENDIX B....1208
  BUTTONS AND SPECIAL KEYS....1208
  Mouse and Digitizing Puck Buttons....1208
  Function (F) Keys....1208
  Control Key Sequences (Accelerator Keys)....1209
  Special Key Functions....1210
  List of Drawing Exercise File Names (when files were created or changed)....1228