

Index

All bold page numbers indicate definitions

A

- aBackspaceChar variable, 74
- AbeLincoln file, 592
- abstract classes, **461**–464, 478
 - abstract methods, 461, 468
 - data or methods for derived classes, 469
 - nonabstract methods, 461, 468
- abstract keyword, 461
- abstract methods, **398**, 413
 - abstract classes, 461, 468
 - interfaces, 466–469
 - overriding, 461
- AcceptButton property, 106
- accessibility, **273**–274, 302
- access keys, **566**, 585, 599
- access modifiers
 - classes, 356
 - properties, 365
- accessors, **364**, 413
- AccessSomeNames program, 680–683
- access specifiers, **111**, 130, 357
- ACCOUNTING constant, 166–167
- AccountNumber class, 471
- AccountNumber objects, 471
- AccountNum property, 528
- accumulated totals, **210**–211, 220
- ActiveLinkColor property, 555
- actual parameters, **282**, 303, 312
- add and assign shortcut operator (+=), **65**, 91, 211, 615, 624, 629
- AddBooks program, 395
- AddCheckDigit() method, 471
- AddDays() method, 578
- addition operator (+), 63, 392, 615
- add keyword, 15
- AddMonths() method, 578
- AddRangeObjectsDemo program, 573
- AddYears() method, 578
- AdvertisingMessage() method, 378
- ageOverMinimum variable, 170
- age variable, 158–160
- alert escape sequence (\a), 74
- aliases, **48**, 50, 90, 450
 - memory, 314
 - variables, 314–315
- alias keyword, 15
- AllowDrop property, 544
- Alt property, 640
- ambiguous methods, **333**–334, 345
- American Standard Code for Information Interchange (ASCII), **709**, 716
- AMethod() method, 334, 342–343
- ancestors, **428**, 477
- Anchor property, 544, 582
- AND operator (&&), **154**–156, 171, 173, 180, 237
 - combining with OR operator (||), 158–162
- anExceptionInstance object, 499
- Animal class, 428, 462–463, 466–467
- animal class, 354
- Animal parameter, 464
- anInt variable, 59
- annualIncome variable, 69
- annualSalary variable, 57
- anotherValue variable, 65
- answer variable, 506
- anUnsignedInt variable, 59
- AnyLegalClassName identifier, 16
- Append file mode, 666
- applicable methods, **329**, 345
- application classes, **13**, 40
- ApplicationException class, 492, 525
- applications
 - See also* programs
 - classes, 354
 - runnable, **13**
- application software, **2**, 38
- area field, 375
- Area property, 376
- args variable, 297
- ArgumentException class, 491
- arguments, **11**, 39, 246–247, 270, 281–284
 - constructors, 458–459
 - data types, 283–284
 - default, 285
 - method call, 276
 - named, **338**–342
 - passing by reference, 312
 - passing by value, 312
 - positional, **338**
 - strings, 11
 - unnamed, 337–338
- arithmetic
 - array elements, 233
 - numeric type conversion, 71–73
 - parentheses () in expressions, 64
 - ArithmeticException class, 491, 494
 - arithmetic operators, **63**–64, 91, 392
 - shortcut arithmetic operators, 64–66
- ArrayDemo1 program, 236
- ArrayDemo2 program, 250–252
- array elements, **228**, 260
- array of references, 397
- arrays, 29, **228**, 260, 675
 - accessing elements, 232–235
 - arithmetic on elements, 233
 - automatically altering value, 234
 - bool fields, 231
 - character fields, 231
 - comparing value to valid values in, 237
 - creation, 235–236
 - cycling through elements, 234–235
 - declaring, 228–232
 - default values, 231

- arrays (*continued*)
 - descending order elements, 398
 - duplicate values, 247
 - GUI programs, 258–259
 - identifiers, 229
 - increasing value of elements, 232
 - index, **228**
 - initializer list, **231**
 - initializing, 230–232
 - iteration variable, **234**
 - jagged, **256–257**
 - length, 233–234, 245
 - matching values in, 398
 - methods for manipulating, 245–249
 - multidimensional, **252–256**
 - naming, 229
 - navigating, 234–235
 - nondefault values for elements, 231
 - numbering elements, 229, 230
 - numeric fields, 231
 - one-dimensional, **252**
 - parallel arrays, **238**
 - passed by reference, **294**
 - passing to methods, 293–296
 - range match, 247
 - rectangular, **253**
 - reserving memory locations for, 229
 - resizing, 229, 234
 - reversing order of items, 249–250
 - searching with loops, 237–245
 - separating fields into strings, 672
 - serializable, 684
 - single-dimensional, **252**
 - size, 231
 - sorting, 246–248
 - subscripts, **228**, 230, 675
 - three-dimensional, 256
 - two-dimensional, **252**
 - usage, 235–236
 - values for elements, 228–232
 - variables, 228
 - zeroth element, 230
 - arrays of objects, 397–405
 - searching, 398–402
 - sorting, 398–402
 - Array.Sort() method, 403
 - ArrayTypeMismatchException class, 491
 - Artist class, 461
 - ASCII (American Standard Code for Information Interchange), **709**
 - decimal and binary values for characters, 710–712
 - assemblers, 3
 - assemblies, **356**, 412
 - assembly language, 3
 - assignment, **50**, 90
 - assignment operator (=), **50**, 90, 147–148, 171, 359–360, 615
 - right-associative, **705**
 - associativity, **64**, 91, **705–706**
 - aTabChar variable, 74
 - at runtime. *See* runtime
 - attributes, **5**, 7, 39, 355
 - associating information with code, 684
 - audio clips, 104
 - auto-implemented property, **368–369**, 373, 413
 - automatically generated code, 547–550
 - automatic properties, **368–369**, 413
 - Automobile class, 7–9
 - a variable, 278
 - aWorker object, 381, 389
- ## B
- BackColorChanged event, 632
 - BackColor property, 105–106, 109, 128, 544, 560, 565, 570, 572, 585, 589, 592, 594, 646
 - BackgroundImage property, 544
 - backing field, **365**, 413
 - backslash escape sequence (\), 74
 - backspace escape sequence (\b), 74
 - Bad command or file name* error message, 23
 - BaileysForm form, 561
 - balanceDue variable, 65
 - Balance property, 527–528
 - BankAccountBalanceAdjusted() method, 629–630
 - BankAccount class, 8, 527–528, 628–630
 - BankAccount object, 629–630
 - BankBalance form, 218
 - bankBalance variable, 72, 196
 - bankBal variable, 65, 203, 219
 - base class, **427**, 474–475, 477
 - abstract classes, 461
 - constructors, 456–460
 - derived classes, 443–448
 - implicit conversion, **448–449**
 - overriding members, 439–444
 - size, 427
 - base keyword, 458
 - base 2 numbers, 708
 - base 10 numbers, 707
 - BASE_PRICE constant, 567
 - base 16 shorthand notation, **74–75**, 92
 - base 16 system, **713**, 716
 - BASIC
 - array elements, 230
 - interpreters, 3
 - BedAndBreakfast form, 593–96
 - BedAndBreakfast program, 561–565
 - check boxes, 587–594
 - bedrooms variable, 254, 256
 - Begin member, 678
 - behaviors, **5**, 7, 39
 - bellAireCheckBox object, 587
 - BellAire form, 591
 - belleAireCheckBox_CheckedChanged() method, 591
 - BelleAire CheckBox object, 588
 - belleAireDescriptionLabel label, 589
 - BelleAireForm form, 588–589
 - belleAirePriceLabel label, 589
 - BelleAire Suite check box, 591, 597
 - betterness rules, **329**, 345
 - bigFont object, 553
 - biggerNum variable, 168
 - BillPatients() method, 431
 - binary files, **656**, 668, 697
 - binary form, 392
 - BinaryFormatter class, 684
 - BinaryFormatter objects, 683–687
 - sbinary numbering system, **708–709**, 716
 - base 2 numbers, 708
 - binary operators, **63**, 91, 168
 - left-associative, **705**
 - overloaded, 392–393
 - BinaryReader class, 668
 - binary search, **246–247**, 261
 - BinarySearchDemo program, 246
 - BinarySearch() method, 246–247, 250, 270
 - array of objects, 398–402
 - BinaryWriter class, 668
 - bin folder, 35
 - bits (binary digits), **708**, 714, 716
 - bitwise operators, **158**, 180
 - bitwise OR operator (|), 553
 - black box, **8**, 39, **271**, 302
 - block comments (*/* */*), **18**, 40
 - blocks, **144**, 180
 - aligning braces ({}), 145
 - exiting immediately, 241
 - if-else statements, 149
 - K & R style, 145
 - multiple statements, 144
 - single statement, 145
 - unreachable, **510**
 - blueButton button, 645
 - blueToolStripMenuItem_Click() method, 585–586
 - BMethod() method, 343
 - Bold property, 553
 - bonus parameter, 341

- bonus variable, 157
 - Book class, 377–379, 393–396
 - Book objects, 377–378, 396
 - Book parameter, 396
 - Book return type, 394
 - Boole, George, 68
 - bool data type, 48–49, 68–69, 91, 142, 288–289
 - Boolean expressions, 141–142
 - combining AND operator (&&) and OR operator (||), 158–162
 - compound, 154–156
 - negating, 169–170
 - side effects, **157**–158
 - Boolean fields, 381
 - Boolean logical AND operator (&), **157**–158, 180
 - Boolean logical inclusive OR operator (|), **157**–158, 180
 - boolean.Parse() method, 86
 - Boolean values, 140–141, 288–289
 - Boolean variables, **68**, 70, 91
 - comparison operators, **68**–69
 - naming, 68
 - BorderDemo1 program, 324–325
 - BorderDemo2 program, 327–328
 - Bottom property, 545
 - Bounds property, 545
 - Box class, 390
 - BreakfastOptionForm class, 595
 - BreakfastOptionForm form, 594–596
 - BreakfastOptionForm_Load() method, 595
 - break keyword, 164–165
 - break statements, 165, 241, 515
 - BUDGET2016 class, 16
 - Budget2016 class, 15
 - BudgetForm form, 106
 - bugs, **3**, 38
 - Build, Build Solution command, 27, 34
 - Build failed error message, 120
 - building variable, 256
 - Build Solution (Ctrl + Shift + B) keyboard shortcut, 27
 - built-in methods, 289
 - output parameter, 317–320
 - overloaded, 330
 - BusDriver class, 468
 - BusinessOffice class, 359
 - ButtonBase class, 565
 - button1 button, 108–110, 409–410, 547, 719
 - button2 button, 642–643
 - button2_Click() event, 643
 - button1_Click() event handler, 643
 - button1_Click() method, 111–112, 114, 118, 274
 - button2_Click() method, 111
 - Button() constructor, 549
 - Button control, 107–108, 114, 551
 - focus, 116
 - properties, 126
 - button1 object, 111
 - Button objects, 407–409, 474, 542–543, 549, 582, 608, 632–634, 642–643, 645, 688, 691, 693–694
 - Button property, 638
 - buttons, 107, 124–129, 176, 608–609
 - adding functionality, 109–112
 - Click() event, **611**, 642
 - clicking, 110–111
 - default event, 110
 - double-clicking, 634
 - focus, 645
 - functionality, 127–128
 - method executing when pressed, 109
 - naming, 108
 - positioning, 126
 - properties, 109
 - renaming, 111
 - resizing, 126, 594, 688, 691
 - summing numbers, 114
 - text, 547
 - b variable, 278
 - byte data type, **56**–57, 59, 71, 90
 - automatic conversions, 283
 - bytes, **657**, 697, **709**, 714, 716
- ## C
- C++, 5
 - compared to C# programming language, 10
 - declaring array variable, 228
 - function pointers, 613
 - CalcArea() method, 376
 - CalcPay() method, 286–288
 - CalcPay program, 287
 - CalcPhoneCallPrice() method, 290–292
 - calculatePayroll() method, 611
 - CalculateWithholdingTax() method, 5
 - CalendarForeColor property, 580
 - CalendarMonthBackground property, 580
 - calendar object, 578
 - called method, **270**, 302
 - calling, **5**, 12, 38, **270**, 302
 - calling method, **270**, 302
 - callLength variable, 292
 - call stack, **521**, 533
 - listing methods in, 521–525
 - tracing Exception objects through, 521–525
 - camel casing, **3**, 38
 - CancelButton property, 106
 - CanFocus property, 545
 - CanRead property, 665
 - CanSeek property, 665
 - CanSelect property, 545
 - CanWrite property, 665
 - Capture property, 545
 - Car class, 448
 - CarLoan class, 432–433, 446–447, 460
 - CarLoan() constructor, 460
 - CarLoan objects, 432, 446
 - Carpet class, 374, 376
 - Carpet objects, 375
 - carriage return escape sequence (\r), 74
 - case keyword, 164
 - case labels, **164**–165, 180
 - case sensitivity, 3
 - case structure. *See* switch structure
 - catch block, **498**–502, 505–512, 514–516, 519, 533, 668
 - break statement, 515
 - displaying information about exception, 503
 - e.Message, 524
 - Exception type, 499
 - multiple, 507, 509
 - rethrowing exceptions, **529**–531
 - return statement, 515
 - unreachable, **510**
 - WriteLine() method, 524
 - XxxException placeholder, 499
 - catch clause, 498
 - catching exceptions, 498–503, 505–506
 - multiple exceptions, 507–511
 - catch keyword, 498
 - catch() method, 499
 - Cat class, 462–463, 466–467
 - C# Code Editor, 716–718
 - code snippets, **719**
 - readability aids, 720
 - wavy underlines, 719
 - C# compiler, 24–25
 - cd (change directory) command, 31, 35
 - changeButton button, 608, 611
 - changeButton_Click() method, 609, 611–612
 - Changed event, 623–624
 - ChangedEventHandler delegate, 622–623
 - ChangedEventHandler event handler, 622
 - Changed field, 624

- Changed() method, 623
- changeLabel() method, 611
- changeOutputButton button, 128–129
- changeOutputButton_Click() method, 128
- character fields, initial values, 381
- characters, 56, 73–75, **662**, 698
 - array with subscripts, 232
 - ASCII (American Standard Code for Information Interchange), **709**, 710–712
 - assigning array to string, 231
 - base 16 shorthand notation, **74**–75
 - bits (binary digits), **708**–709
 - case sensitivity, 196
 - character set, **662**, 698
 - char variables, 74
 - EBCDIC (Extended Binary Coded Decimal Interchange Code), **709**
 - hexadecimal shorthand notation, **74**–75
 - nonprinting, **74**
 - numbers as, 73
 - sorting, 398
 - strings, 74
 - Unicode, **74**–75, **709**
- character set, **662**, 698
- char data type, 48, **56**, 71, 73–75, 90, 92, 671
 - automatic conversions, 284
- char variables, 74
- CheckBox control, 107
- check boxes, **565**–568, 587–594, 599
- checkBox1 object, 566
- checkBox2 object, 566
- CheckBox objects, 543, 565–568, 587–594
- check digits, 471
- CheckedChanged() method, 565, 591, 596
- checked list boxes, 572–576
- CheckedListBox objects, 543, 572–576
- Checked property, 565–568
- Child class, 468
- child class, **427**, 477
 - accessing parent class data, 435
 - inheriting from parent class, 430–431, 451
- CIS constant, 166–167
- CivilWarSoldier class, 469
- class access modifier, **356**, 412
- class body, 356–357
- class client, **355**, 412
- class definition, **356**, 412
- class diagrams, 426
- classes, 7, 12, 39, 354
 - abstract classes, **461**–464
 - access modifiers, 356
 - application classes, **13**
 - application programs, 354
 - class body, 356–357
 - class definition, **356**
 - class headers, 14, **356**
 - concrete class, **461**
 - constructors, 361
 - conventional names, 15
 - creation, 356–358, 370–373
 - curly braces ({}), 14, 21
 - declaring, 356
 - default constructor, **381**, 390, 456
 - destructors, **405**–407
 - enumerations, 81
 - extending, 429–431, 433–434
 - fields that are objects of other classes, 359
 - fragile, **438**
 - grouping, 12
 - help, 122
 - identifiers, 14–16, 356
 - illegal names, 16
 - implementing interfaces, 399, 468
 - inheritance, **8**, **424**–426, 461
 - instances, 7, 39, **354**, 405–407
 - instance variables, 356–358
 - instantiating objects, 354, 424
 - instantiation, **354**
 - methods, **270**, 276–277, 357–358
 - named behaviors for, 399
 - naming, 8, 14
 - non-application classes, **13**
 - objects, 377
 - overloaded constructors, 387–388
 - overloaded operators, 393
 - parameterless constructor, 382–383
 - private data fields, 357–358
 - properties, 39
 - repeatedly using from same namespace, 19–20
 - return type, 286
 - sealed classes, **470**
 - sorting methods, 271
 - static classes, 475
 - string holding name of, 452
 - unconventional names, 16
- class headers, 14, **356**, 412
- class keyword, 16, 356
- class user, **355**, 412
- clerk object, 431, 434
- Click delegate, 636
- Click event, 632–634, 638, 642–643, 646
- click event, **111**, 130, **611**, 648
- clickLocationLabel label, 638
- Click() method, 112, 122, 175–176, 270, 274, 299–300, 569, 585, 596, 633–634, 646
- ClickParameterInfo program, 299–300
- Clicks property, 638
- clients, **271**, 302
- Close() method, 693
- closing files, **663**, 676, 698
- Closing() method, 339–340
- COBOL, referring to array elements, 230
- code
 - attributes associating information with, 684
 - automatically generated, 547–550
 - catch block, **498**–499
 - correcting errors, 120–121
 - expanding or condensing, 104
 - line numbers, 121
 - locating line of, 548
 - reusable, 426
 - try block, **498**–499
- code bloat, **272**, 302
- CodeDomSerializerException class, 490
- code refactoring, **118**, 131
- code snippets, **719**, 720
- code window, 109
- color
 - background, 565
 - forms, 558–560
 - GUI applications, 560
 - source code, 720
- Color class, 558–560
- ComboBox class, 576
- combo boxes, 572–**576**, 599
- ComboBox objects, 543, 572–576
- command line, **23**, 29–30, 40
 - compiling and executing programs, 31–32
 - incorrect subdirectory or folder, 24
 - namespaces, 28
 - program comments, 36
 - running programs, 25
 - using statements, 28
- command prompt, **23**–25, 40
- commenting out statements, **17**, 40
- comments, 40, 549
 - block comments (*/* */*), **18**, 40
 - line comments (*//*), **18**, 40
 - programs, 36
 - XML-documentation format contents (< >), **18**
- CommissionEmployee class, 425–427, 429, 435–438, 443, 449, 456–458

- CommissionEmployee() constructor, 458
- CommissionEmployee objects, 430, 435
- commissionRate field, 425, 429, 435
- CommissionRate property, 435, 436
- commissionRate variable, 171–172
- Common Language Runtime exception classes, 492
- ComparableEmployeeArray program, 401–402
- Compare() method, 77–79
- CompareThreeNumbers project, 152–153
- CompareTo() method, 78–79, 398–402, 404
- comparison operators, **68**–69, 92
- compiler errors, 490
- compilers, **3**, 38
 - just in time (JIT), **22**
- compiling programs, 22–30
 - command prompt, 23–25
 - high-level programming languages, 3
 - IDE (Integrated Development Environment), 25–28
 - intermediate language (IL), 22
- completion mode, **717**–718, 720
- Component class, 474, 542–543
- composed delegates, 612, **615**–621, 648
- composition, **359**, 412
- compound Boolean expressions, 154–156
 - short-circuit evaluation, **156**–157
- compound expressions and if statements, 154–160
- ComputeGross() method, 341–342
- ComputePaycheck() method, 281
- computer files, **656**, 697
- computers
 - hardware, **2**
 - measuring storage, 714–716
- computer simulations, **6**, 39
- ComputeTotalPay() method, 341–342
- concatenating strings, **53**, 55, 90, 392
- concrete class, **461**, 478
- conditional AND operator (&&), **154**–156, 180
- conditional operator (?), **168**–169, 180
- right-associative, **705**
- conditional OR operator (||), **156**–157, 180
- Connelly, Marc, 542
- Consolas, 117
- console applications, 122–123
- Console class, 12, 19, 274, 474, 664
- Console.Error class, 664
- Console.In class, 664–665
- console input, 83–84
- Console.Out class, 664–665
- constants, **48**, 90
 - assigning value to, 81, 166
 - character values, 73
 - enumerations, **81**–83
 - floating-point constants, 553
 - floating-point numbers, 60
 - int data type, 57
 - int data type and implicit conversion, 72
 - methods, 278, 300
 - naming, 81
 - public access modifiers, 375
 - scope, **278**
 - subscripts, 233
 - unnamed, 48
- const field, 386
- const keyword, 80, 375
- const modifier, 386
- constructor initializer, **385**, 413
 - automatically generated, 361, 458
 - base class, 456–460
 - constructor initializer, **385**
 - controls, 549
 - default constructor, 361, **381**
 - derived class, 456–460
 - initial field values, 381
 - initializing variables, 457
 - objects, 456
 - overloading, 382–384
 - parameterless constructor, **382**
 - passing parameters to, 381–382
 - readonly modifier, 386
 - requiring arguments, 458–459
 - throwing exceptions, 528
 - user-created, 381
- ContainerControl class, 474
- ContainerControl objects, 583–584
- Container property, 545
- ContainsFocus property, 545
- contBreakfastButton RadioButton, 594, 596
- contextual keywords, **365**, 413
- ControlAdded event, 632
- Control class, 474, 542–543, 572
- Control objects, 542–543, 554
- Control property, 640
- ControlRemoved event, 632
- controls, **102**, 130, 542–546, 587, 599
 - aligning, 581
 - anchoring, 582, 584
 - check boxes, **565**–568, 587–594
 - checked list boxes, 572–576
 - combo boxes, 572–576
 - constructors, 549
 - dates and time, 577–580
 - default event, **554**–555
 - default font, 117
 - default names, 118
 - deleting, 108
 - docking, 584
 - double-clicking, 555
 - dragging onto forms, 108, 112, 547, 550
 - event handling, 632–636
 - event sender, **610**
 - focus, **116**, 549, **642**
 - fonts, 551–554
 - group boxes, 583–**584**
 - handling multiple events, 643–644
 - layout on form, 581–584
 - link label, **554**–557
 - list boxes, 572, **573**–576
 - listing, 107
 - locating, 581
 - managing multiple, 642–644
 - menu strips, 585–586
 - monthly calendar, 577–580
 - mouse events, 637–639
 - multiple, 114
 - naming, 118–119
 - panels, 583–**584**
 - picture boxes, **569**–571
 - predefined colors, 558–560
 - preventing conflicts, 549
 - properties, 611
 - protected properties, 544
 - public properties, 544–546
 - radio buttons, **565**–568, 594–596
 - relocating, 108
 - renaming, 118–119
 - snap lines, **581**
 - tab order, **116**
 - universal properties, 474
- control statement, **144**, 180
- ConversionWithParse program, 318
- ConversionWithTryParse program, 319
- Convert class, 84–86, 317
- ConvertEmployeeToString() method, 452
- Convert.ToInt32() method, 85, 288, 330, 517
- CountContributions program, 258–259
- counted loops, **195**, 220
- counter variable, 64–65
- Courier New, 117
- C programming language, 4
- C# programming language, 5, **9**–11, 39
 - case sensitivity, 3
- CreateDirectory() method, 660
- CreateEmployee class, 361

CreateEmployee program, 361–362
 CreateEmployee2 program, 366
 Create file mode, 666
 CreateFileName program, 674–675
 Create() method, 658
 CreateNew file mode, 666
 CreateSomeEmployees program, 383–384
 CreateStudents2 class, 388
 CreateStudents.cs file, 372–373
 CreateStudents3 program, 403–405
 CreateText() method, 658
 CreateTwoBooks program, 379
 credits field, 439–441
 Credits property, 440–441
 csc (C Sharp compiler) command, 23–24, 35
 cs file extension, 22, 24, 656
 CSV (comma-separated values) files, 669, 698
 culture, 62, 91
 CultureInfoClass class, 62
 Currency format specifier, 61
 currency values, 62
 Current member, 678
 CursorChanged event, 632
 Cursor property, 545
 CustomFormat property, 580
 custStatus variable, 69

D

DailySpecial program, 177–178
 data, 657
 characters, 662
 data hierarchy, 662
 fields, 663
 files, 663
 formatting in GUI applications, 116–117
 organization, 662–663
 records, 663
 sequential access files, 668–671
 data files, 656, 697
 data hierarchy, 662, 698
 Data.txt file, 657
 data types, 48, 90
 arguments, 283–284
 betterness rules for conversion, 329
 bool data type, 68–69
 enumerations, 81–83
 explicitly overriding, 72
 floating-point data types, 59–62
 fully qualified name, 50
 implicit numeric conversions, 71–73

integral data types, 56–57
 intrinsic types, 48
 largest and smallest values, 48–49
 method names, 325
 numeric type conversion, 71–73
 objects, 359–360
 one-dimensional arrays, 253
 overloading operators, 392
 parameters, 281
 properties, 365
 return type, 286
 serializable, 684
 simple types, 48
 strings, 85–86
 two-dimensional arrays, 253
 type precedence, 71
 type-safe, 83
 unifying type, 71
 variables, 50, 57
 DateChanged() method, 577–578
 Date class, 359
 Date fields, 359
 dates, 577–580, 658
 DateTime objects, 578, 658
 DateTimePicker objects, 577–580, 658
 dayBox text box, 177
 DayOfWeek enumeration, 81–82
 dead code, 510, 533
 Debug, Start Without Debugging
 command, 27, 28, 34
 Debug folder, 35
 debugging programs, 3, 38
 debugging tools in IDE
 (Integrated Development Environment), 25
 Deciduous class, 428
 decimal data type, 48, 60, 71, 91
 Decimal format specifier, 61
 decimal numbering system, 707, 716
 base 10 numbers, 707
 decision making
 assignment operator (=), 171
 common errors, 171–174
 dual-alternative decisions, 149–151
 equal to operator (==), 171
 event-driven programs, 176
 flowcharts, 139
 GUI applications, 175–176
 if-else statements, 149–151
 if statements, 141–147
 NOT operator (!), 173–174
 AND operator (&&), 173
 OR operator (||), 173
 range checks, 171–172
 switch structure, 163–167

decision structure, 140, 180
 control statement, 144
 decrementing, 194, 220
 decrement operator (--), 91
 DeductTax() method, 275
 DeductUnionDues() method, 275
 default arguments, 285
 default case, 165
 default constructor, 361, 381, 390, 397, 413, 456
 default event, 554–555, 599
 default font, 117
 default keyword, 164
 DEFAULT_VALUE constant, 512
 default value of objects, 381, 413
 definite loops, 195, 199, 220
 del delegate, 612
 del1 delegate, 615
 del2 delegate, 615
 del3 delegate, 615
 delegate keyword, 613
 delegate objects, 621
 delegates, 611, 612, 648
 assigning to another delegate, 615
 combining, 615
 creation, 616–618
 declaring, 613
 encapsulating instance methods, 628–629
 encapsulating methods, 613
 passing reference to methods, 612, 614
 removing delegate from, 615
 user-declared events, 622–627
 Delete() method, 658, 660
 DELIM constant, 672
 delimiters, 669, 671, 688, 698
 DeliverBaby() method, 431
 deliverRadioButton_
 CheckedChanged() method, 567–568
 deluxeBreakfastButton RadioButton, 594, 596
 DemoAnimals program, 464
 DemoAnimals2 program, 464
 DemoBankAccountEvent class, 630
 DemoBankEvent program, 628–629
 DemoCarLoan program, 433–434
 DemoCarLoan2 program, 445–448
 DemoCarLoan3 program, 459–460
 DemoEmployeeDestructor
 program, 406
 DemoEmployees class, 430
 DemoEscapeSequences program, 76
 DemoExtensionMethod program, 471–472

- DemoLoan program, 432–433
 - DemoLogo program, 279–280
 - DemoObjectInitializer2 program, 391
 - DemoORAndAND file, 161–162
 - DemoProjectInitializer program, 389
 - de Morgan, Augustus, 170
 - DemoSalesperson program, 436–438
 - DemoSalesperson2 program, 444
 - DemoSalesperson3 program, 449
 - DemoSalesperson4 program, 456–457
 - DemoStudentEvent2 class, 626–627
 - DemoStudentEvent program, 625
 - DemoStudents program, 442
 - DemoVariables class, 58
 - DemoVariables.cs file, 58–59
 - DemoVariables2 program, 67–68
 - DemoVariables3 program, 70–71
 - DemoVariables project, 58–59
 - DemoWorking program, 467–468
 - denom variable, 508
 - department variable, 173
 - Depth property, 390
 - derived class, **427**, 461, 474–475, 477
 - abstract methods, 461
 - accessing base class methods and properties, 443–444
 - constructors, 456–460
 - extending, 427–428
 - implicit conversion to base class, **448–449**
 - inheritance, 435
 - overriding methods, 469
 - overriding virtual methods or property, 441–442
 - size, 427
 - using base class members, 445–448
 - visible methods or properties, **442**
 - deserialization, **684–687**, 698
 - Deserialize() method, 685
 - Designer.cs file, 104–105, 611
 - Designer screen, 591
 - design time, **115**, 130
 - destructors, **405–407**, 413
 - DetermineTaxRate() method, 522
 - Developer Command Prompt
 - command, 23
 - dinnerPrice variable, 208–209
 - dir (directory) command, 31, 35
 - directories, **657**, 660–661, 698
 - Directory class, 657, 660–661
 - DirectoryInformation program, 660–661
 - discountButton_Click() method, 175
 - Discount class, 617
 - DiscountDelegateDemo program, 616–618
 - DiscountDelegateDemo2 program, 619–621
 - DiscountDelegate object, 617, 619
 - discountRangeLowLimits array, 244–245
 - discounts array, 243
 - DismissedEmployee class, 426
 - DisplayArgs program, 297
 - DisplayCompanyLogo() method, 279–280
 - DisplayEmployeeData() method, 340, 362–363
 - DisplayEmployeeData program, 362–363
 - DisplayGreeting() method, 449
 - Display() method, 372–373, 388, 403, 443
 - DisplayNetPay() method, 275
 - DisplayObjectMessage() method, 450
 - displayOutputButton button, 126, 129
 - displayOutputButton_Click()
 - method, 128
 - DisplayParameter() method, 313
 - DisplayPrice() method, 518
 - DisplayReferenceParameter() method, 315–316
 - DisplaySalesTax() method, 281–285
 - DisplaySize() method, 336
 - DisplaySomeMoney program, 52
 - DisplayStrings() method, 320–321
 - DisplayWithBorder() method, 325–326
 - DisplayWithBorderUsingInt()
 - method, 325
 - Dispose() method, 690
 - Disposing property, 545
 - DiverseObjects program, 450–451
 - divide and assign shortcut operator (/=), 65
 - DivideByZeroException class, 494, 496, 501–503, 507–511
 - DivideByZeroException object, 493–494
 - DivisionBasedOnMajor class, 167
 - division by zero, 495–498
 - division operator (/), 63
 - dockable or floating windows, 107
 - Dock property, 545, 582
 - Doctor class, 431
 - documenting programs, 17–18
 - doesEmployeeHaveDependents
 - variable, 148
 - Dog class, 7–9, 427, 448, 462–463, 466–467
 - do keyword, 202
 - do loops, **202–204**, 210, 216, 220
 - DomesticPet class, 428
 - double array, 229, 252
 - Double class, 86, 354
 - double data type, 48, **59–60**, 71, 91, **229**, 287–289, 328–329, 333–334, 448, 669, 672
 - double quotation mark escape sequence (\"), 74
 - double variable, 288
 - do...while loop, **202**, 220
 - See also do loop
 - DragDrop event, 632
 - DragEnter event, 632
 - DragLeave event, 632
 - DragOver event, 632
 - dual-alternative decisions, **149–151**, 180
- ## E
- EARLIEST_YEAR constant, 446
 - EBCDIC (Extended Binary Coded Decimal Interchange Code), **709**
 - Ecma International web site, 10
 - elements, **228**, 260
 - accessing, 232–235
 - assigning values, 228–232
 - cycling through, 234–235
 - increasing value, 232
 - numbering, 229–230
 - passing single to method, 293–294
 - performing arithmetic on, 233
 - else-if statements, 172
 - e.Message, 524
 - empArray array, 397
 - empID parameter, 385
 - Employee class, 15, 356–361, 363, 366–369, 380–381, 383, 385–386, 388, 397, 400, 402, 406, 424–427, 429, 431, 434–436, 443, 449–454, 456–458, 465–467, 663, 669, 684–685, 687
 - Employee() constructor, 361, 381, 383, 397
 - EmployeeData.txt file, 672
 - Employee() method, 380
 - Employee objects, 358–359, 362, 364, 381, 397, 399–401, 406, 425, 430, 434, 452–453, 455, 668, 686
 - Employee parameter, 363, 449
 - empty body, **194**, 220
 - Empty field, 622
 - EnabledChanged event, 632
 - Enabled property, 109, 129, 545
 - encapsulating methods, 612
 - encapsulation, **8**, 39, 612
 - END constant, 670–371, 681
 - End member, 678

- Enter event, 632
 - EnterInvoices program, 688–691
 - entryID variable, 247
 - entryString variable, 318, 320
 - enumerations, **81**–83, 92
 - assigning values to constants or variables, 82
 - data types, 81–83
 - GUI applications, 177–178
 - identifiers, 81
 - switch structures, 166–167
 - valid values, 82
 - enum keyword, 81
 - Environment.Exit() method, 515
 - e object, 610–611
 - Equals() method, 77, 79, 451
 - overloading, 453
 - overriding, 453–455
 - equal to operator (==), 69, 77, 147–148, 171
 - equivalency, testing for, 147–148
 - Error list, 103
 - error list, 120
 - error messages and IDE (Integrated Development Environment), 25
 - escape characters, 117
 - escape sequences, **74**, 76, 92
 - EventArgs argument, 610, 622, 629, 638
 - EventArgs class, 622
 - EventArgs.Empty instance, 623
 - EventArgs object, 629
 - EventArgs parameter, 623, 625, 637
 - EventDemo program, 609–612
 - event driven, **608**
 - event-driven programs, 648
 - decision making, 176
 - loops, 217
 - runtime, **176**
 - EventHandler delegate, 525–527
 - event handlers, **609**–612, 648
 - associating with multiple controls, 643–644
 - event receiver, **610**
 - names, 609
 - user-declared, 622–627
 - EventHandler statements, 636
 - event handling, 608–612
 - controls, 632–636
 - handling multiple events, 643–644
 - keyboard events, 639–641
 - mouse events, 637–639
 - event-handling methods, 121–122, 300
 - EventListener class, 624–627, 629–631
 - EventListener object, 630
 - event listeners, 629–631
 - event receiver, **610**, 648
 - events, **111**, 130, **608**, 648
 - associating method with multiple, 646–647
 - clicking objects and generating, 555
 - connecting to actions, 611–612
 - evoking, 648
 - firing, **608**, 648
 - generalizing method name, 643
 - invoking, **623**
 - listing, 634–635
 - raising, **608**, 648
 - triggering, **608**, 648
 - user-declared, 622–627
 - event sender, **610**, 648
 - event wiring, **611**–612, 648
 - Evergreen class, 427–428
 - evoking events, 648
 - exabytes, 715
 - Exception class, 490, 492, 494, 499, 502–503
 - extending, 525–527
 - subclass messages, 526
 - user-created, 525–528
 - exception handling, **490**–494, 505–506, 532, 668
 - object-oriented, 498–501
 - thrown from outside methods, 517–520
 - traditional *versus* object-oriented, 497–498
 - Exception objects, 494, 497–498, 500–501, 505, 514–515, 517, 525, 526
 - information about, 503, 521
 - tracing through call stack, 521–525
 - exceptions, **490**–494, 532
 - catching, 498–503, 505–506
 - catching multiple, 507–511
 - finally block, **514**–516
 - multiple, 510
 - propagating, **521**
 - purposely causing, 495–497
 - rethrowing, **529**–531
 - throwing, 498–503, 505–506, 519, 528–529
 - unhandled, 318, 515–516
 - ExceptionsOnPurpose.exe file, 496
 - ExceptionsOnPurpose program, 495–497
 - ExceptionsOnPurpose2 program, 505–506
 - ExceptionsOnPurpose3 program, 511–512
 - Exception types, 499, 502, 507, 509–510, 525, 528
 - executing programs, 22–30
 - execution-time errors, 490
 - .exe files, 25, 656
 - Exists() method, 658, 660
 - explicit cast, **72**, 92
 - explicitly overriding data types, **72**, 92
 - exposing, **665**, 698
 - Extended Binary Coded Decimal Interchange Code (EBCDIC), **709**, 716
 - extended class, **427**, 477
 - eXtensible Markup Language. *See* XML (eXtensible Markup Language)
 - extension methods, **470**–472, 478
- ## F
- fault tolerant, **494**, 533
 - favoriteButton button, 645
 - fields, **355**, 412, **663**, 698
 - abstract classes, 461
 - access specifiers, 357
 - converting to text, 683
 - delimiters, **669**
 - inheritance, 428
 - initial values, 381
 - private access, 367, 373–374
 - protected access, **436**–438
 - public access, 374–376
 - retrieving values, 364
 - separating into array of strings, 672
 - setting, 364
 - static, 375
 - fields array, 672
 - File, Exit command, 35
 - File, Save All command, 34
 - FileAccess enumeration, 666
 - FileAccess.Read member, 671
 - FileAccess.ReadWrite member, 671
 - File class, 657–659
 - FileInfo class, 658
 - filenames, 24, 688
 - File objects, 682
 - file position pointer, **677**, 698
 - files, **656**, 663, 697
 - accessing information about, 658–659
 - binary files, **656**
 - closing, 515–516, **663**, 676, 698
 - creation, 674–675
 - creation time, 657
 - CSV (comma-separated values) files, **669**
 - data files, **656**
 - data organization, 662–663
 - defining characteristics, 669

- directories, **657**
- file position pointer, **677**
- folders, **657**
- key field, **663**
- last-modified time, **657**
- listing, 104–105
- names, **657**
- opening, **663**, **698**
- path, **657**
- permanent storage devices, **656**
- priming read, **670**
- random access files, **663**
- reading from, **657**, **676–677**, **697**
- record delimiter, **669**
- sequential access files, **663**
- size, **657**
- sorting methods, **271**
- storing, **657**
- text files, **656**
- text input and output, **665**
- writing to, **657**, **698**
- FileStatistics program, **659**
- FileStream class, **665–666**, **685**, **689**
- FileStream file, **666**
- FileStream objects, **666**, **668–669**, **671**, **674–676**, **692**
- finally block, **514–516**, **533**
- FindEmployees program, **678–679**
- FindPriceWithForLoop program, **239**
- FindPriceWithWhileLoop program, **242**
- fingerprints, **455**
- firing events, **608**, **648**
- FirstClass class, **12–16**
- FirstClass console application, **11–13**
- firstDel delegate, **613**, **615**, **617**, **619**
- firstName variable, **76**
- fixed-pitch fonts, **117**, **131**
- Fixed-point format specifier, **61**
- float argument, **552**
- Float class, **354**
- float data type, **59**, **71**, **91**, **284**, **552**
- floating-point constants, **553**
- floating-point data types, **59–62**
 - decimal data type, **60**
 - double data type, **59**
 - float data type, **59**
- floating-point numbers, **59–62**, **90**
 - constants, **60**
 - dividing by zero, **492**
 - formatting, **60–62**
 - significant digits, **59**
 - standard numeric format strings, **60–61**
- floor variable, **254**, **256**
- flowcharts, **138**, **179**
 - decision making, **139**
 - decision structure, **140**
 - parallelograms, **142**
 - sequence structure, **138**
- focus, **116**, **130**, **549**, **642**, **648**
- Focused property, **545**
- folders, **657**, **660–661**, **698**
- FontChanged event, **632**
- Font class, **551–554**
- Font() constructor, **552**
- Font dialog box, **563**
- Font objects, **553–554**
- Font property, **105**, **109**, **117**, **128**, **544–545**, **547**, **549**, **551**, **563**, **570**, **585**, **590**, **592**, **594**, **633**
- fonts
 - bold, **553**
 - changing, **117**
 - controls, **551–554**
 - default, **117**
 - fixed-pitch, **117**, **131**
 - GUI applications, **560**
 - labels, **590**
 - Microsoft Sans Serif, **552**, **563**
 - monospaced, **117**, **131**
 - names, **552**
 - proportional, **117**, **131**
 - resizing, **563**
 - selecting, **551**
 - sizes, **552**
 - styles, **553**
 - underlined, **553**
- FontStyle enumeration, **81**, **553**
- Font window, **551**
- foreach statements, **234–235**
- ForeColorChanged event, **632**
- ForeColor property, **105–106**, **109**, **128**, **544–545**, **560**
- for keyword, **199**
- for loops, **199–201**, **216**, **220**, **660**
 - comparing value to valid values in array, **237**
 - displaying integers 1 through 10, **199**
 - exiting early, **241**
 - improving efficiency, **240–241**
 - loop body, **199**, **200**
 - loop control variable, **199**, **214**
 - navigating arrays, **234–235**
 - nested, **204**, **206**
 - order of execution, **208**
 - searching arrays, **238–240**
- formal parameters, **282**, **303**, **312**
- FormatException class, **491**, **496**, **511**, **517**
- FormatException object, **513**
- Format property, **580**
- format specifiers, **61**, **91**
- format strings, **53–54**, **90**, **116**
 - alignment and field size, **55**
 - displaying number as, **62**
 - length, **56**
- Form class, **105**, **216–218**, **258**, **473–474**
- Form1 class, **410**, **473**, **646**
- Form1.cs[Design] tab, **129**, **565**, **591**, **593**, **646**
- Form.cs file, **638**
- Form1.cs file, **104**, **593**, **596**, **640**, **646**
- Form1.cs node, **104–105**
- Form Designer, **103**, **109**, **114**
 - dragging controls, **547**
 - form name, **105**
 - unwanted event-handling methods, **121**
- Form1.Designer.cs file, **104**, **409**, **547**, **564**, **693**
- form feed escape sequence (`\f`), **74**
- Form1 file, **104**
- Form1 form, **105**, **547**, **639**, **691**
- Form1_KeyUp() method, **640**
- Form objects, **407–408**, **473**, **542**, **560–565**, **569–570**, **574**, **577**, **585**, **589**, **591**, **608**, **633**, **640**, **688**, **691**
 - layout, **581–584**
 - properties, **550**
- forms, **102**, **130**
 - background color, **565**
 - buttons, **107–112**, **124–129**, **126**, **176**, **608–609**
 - check boxes, **565–568**, **587–594**
 - checked list boxes, **572–576**
 - color, **558–560**
 - combo boxes, **572–576**
 - controls, **102**, **542–546**, **633**
 - creation, **102–106**
 - date and time, **577–580**
 - default event, **555**
 - default names, **118**
 - deleting controls, **108**
 - dragging controls onto, **108**, **112**, **547**, **550**
 - failing to close before reexecuting program, **121**
 - labels, **112–115**, **124–129**, **560–565**, **589**, **640**
 - layout, **581–584**
 - list boxes, **572**, **573–576**
 - maximum and minimum size, **583**
 - menu strips, **585–586**
 - modifying, **105**
 - monthly calendar, **577–580**
 - multiple controls, **114**

- forms (*continued*)
- naming, 102, 105, 118–119, 125
 - nonstatic methods, 300
 - picture boxes, **569**–571
 - properties, 105, 125
 - radio buttons, **565**–568, 594–596
 - reading data from text files, 691–696
 - relocating controls, 108
 - renaming, 106
 - resizing, 633, 645
 - saving, 126
 - strings, 106
 - text, 551–554
 - text boxes, **113**–115, 176
- FormWithALabelAndAButton program, 547–550
- forward declarations, 10
- fragile, **438**, 477
- Frame property, 555
- fullBreakButton RadioButton, 594, 596
- fully qualified name, **274**, 303
- function pointers, 613
- functions, 5
- G**
- gallonsOfGas variable, 499–500, 502
- garbage, **211**, 220
- General format specifier, 61
- get accessors, **364**–368, 373, 413, 429, 446, 452
- GetCreationTime() method, 658, 660
- GetData() method, 403–404
- GetDirectories() method, 660
- GetEmployeeIndentification() method, 452
- GetFiles() method, 660
- GetGreeting() method, 429, 443–444
- GetHashCode() method, 451, 454–455
- get keyword, 15
- GetLastAccessTime() method, 658, 660
- GetLastWriteTime() method, 658, 660
- GetLength() method, 296
- GetPrice() method, 288
- GetSelected() method, 575
- getter, **365**, 413
- GetType() method, 451–452, 454, 503
- get variable, 365
- gigabytes, **657**, 697, 715–716
- global keyword, 15
- Goodbye() method, 613, 615
- GotFocus event, 632
- governing type, **164**, 180
- gpa field, 623
- Gpa property, 624
- gradePointAverage field, 371
- GradePointAverage property, 372–373
- graphical control elements, **542**, 599
- graphical user interfaces. *See* GUIs (graphical user interfaces)
- graphics, displaying, 569–571
- Greater than operator (>), 69
- Greater than or equal to operator (>=), 69
- Greeting class, 613
- Greeting2 class, 615
- GreetingDelegate() delegate, 613
- Greeting program, 614
- Greeting2 program, 615–616
- greetingsButton button, 216
- greetingsButton_Click() method, 216–217
- greeting variable, 444
- GreetMethod() method, 613
- gross parameter, 341–342
- grossPay variable, 287
- gross variable, 287
- GroupBox class, 584
- group boxes, 583–**584**, 599
- Grow() method, 428
- GUI applications
- arrays, 258–259
 - automatically generated methods, 299–300
 - closing, 115
 - colors, 560
 - controls, 542–546
 - correcting errors, 120–121
 - deciding to use, 122–123
 - decision making, 175–176
 - enumeration, 177–178
 - event driven, **608**
 - event handling, 632–636
 - event-handling methods, 122
 - executing, 115
 - failing to close form before reexecuting, 121
 - fonts, 560
 - formatting data, 116–117
 - if-else statements, 175
 - if statements, 175
 - inheritance, 473–475
 - keyboard events, 639–641
 - logical errors, 121
 - loops, 216–219
 - Main() method, 110–111
 - memory, 122
 - methods, 299–300
 - mouse event handling, 637–639
 - objects, 407–410
 - scope, 300
 - switch structures, 175, 177–178
 - text file creation, 688–691
- GUI objects, 542
- events, **111**
- GUIs (graphical user interfaces), **6**, **39**
- objects, 6, 102
 - switching between visual environment and code, 109
- H**
- hardware, **2**, 38
- has-a relationship, **359**, 412
- HasChildren property, 545
- hash codes, **455**, 478
- HeartSurgeon class, 431
- heatingBill variable, 48
- Height property, 106, 390, 544–545
- Hello class, 21–22
- HelloClass program, 270, 277
- Hello.cs program, 21–22, 31, 35
- Hello.exe file, 31–32, 35
- HelloForm form, 125
- helloLabel label, 127–128, 586, 608
- Hello() method, 613, 615
- Hello namespace, 33
- Hello project, 32
- HelloVisualWorld project, 124–129
- Help documentation, 122
- HelpRequested event, 632
- hexadecimal, 92
- Hexadecimal format specifier, 61
- hexadecimal numbering system, **713**–714, 716
- base 16 system, **713**
- hexadecimal shorthand notation, **74**–75
- hidden or visible windows, 107
- hide, **441**, 477
- HIGH constant, 147
- high-level programming languages, **2**–3, 38
- horizontal tab escape sequence (\t), 74
- hot keys, 566
- hours parameter, 341
- hoursWorked variable, 4, 69
- I**
- IAttackable interface, 468–469
- IComparable interface, 399–400, 404
- IDE (Integrated Development Environment), **22**–**23**, 29–30, 40
- automatically generated code, 25, 29, 547–550, 564–565

- changing properties of multiple objects, 553
- colors of code, 25, 30
- compiling and executing program, 32–36
- compiling code, 25–28
- correcting errors, 30
- debugging tools, 25
- double-clicking controls, 633
- Error list, 103
- error messages, 25, 27
- executing program, 115
- Form Designer, 103
- forms, 102–106, 124–129
- information about methods, 330
- menu bar, **25**, 103
- menu options, 27
- naming project, 26, 103
- New Project window, 103
- Properties window, 103
- shortcuts, 27
- Solution Explorer, 103
- syntax errors, 27
- text editors and, 28–29
- Toolbox tab, 103
- using statements, 29
- View menu, 103–104
- identifiers, **4**, 28, 38
 - arrays, 229
 - classes, 356
 - enumerations, 81
 - methods, 275–276
 - names, 14–16
 - objects, 359–360
 - parameters, 281
 - @ prefix, 14
 - properties, 365
 - selecting, 14–16
 - text editors, 28
 - variables, 50
 - verbatim identifiers, **14**
- idNumber field, 357–358, 361–367, 371, 386, 400–402, 404, 406
- IdNumber property, 364–369, 372–373, 385, 388–389, 404
- idNumbers array, 246–247
- idNum field, 424–425, 429, 434–435, 623
- IdNum property, 434, 452–454, 624
- if-else statements, **149**–153, 180
 - blocks, 149
 - failing to block set of statements, 171
 - GUI applications, 175
 - nested, 151, 172
 - if statements, **141**, 180, 288, 497, 591, 593, 619
 - assignment operator (=), 147–148
 - Boolean expressions, 141–142
 - combining AND operator (&&) and OR operator (||), 158–162
 - comparing variable to valid values, 237
 - compound expressions, 154–160
 - conditional AND operator (&&), **154**–156
 - conditional OR operator (||), **156**–157
 - as control statement, **144**
 - equal to operator (==), 147–148
 - evaluated expression, 141
 - failing to block set of statements, 171
 - GUI applications, 175
 - indenting, 143–144
 - methods returning value, 142
 - nested, **145**–146, 155, 163
 - range checks, 171–172
 - semicolon (;) incorrectly placed in, 143, 171
- IL. *See* intermediate language (IL)
- Illustrator class, 461
- Image property, 569–570, 592
- images, 104
- immutable, **79**, 92
- implementation hiding, **271**, 282, 302
 - compromising, 340–341
- implicit cast, **71**, 92, 329
- implicit conversions, **71**–73, 92, 329, **448**–449, 477
- implicitly, **71**, 92
- implicit parameter, **366**, 413
- implicit reference conversions, **448**–449, 477
- INCHES_IN_A_FOOT constant, 81
- #include files, 10
- incrementing, **194**, 220
- indefinite loops, **195**, 199, 220
- indenting programs, 12
- index, **228**
- indexes, 261
- IndexOutOfRangeException class, 233, 491, 507, 509–510, 518–519, 528
- inFile file, 677
- infinite loops, **191**, 194, 220
- Infinity value, 492
- information hiding, **357**, 412, 434, 438
- inheritance, **8**, 39, **424**–426, 461, 477
 - ancestors, **428**
 - base class, **427**
 - child class, **427**
 - derived class, **427**, 435
 - extended class, **427**
 - extending classes, 429–431, 433–434
 - fields, 428
 - GUI applications, 473–475
 - implicit reference conversions, **448**–449
 - methods, 428
 - multiple inheritance, 10, **465**
 - parent-child relationship, 427
 - parent class, **427**
 - reusable code, 426
 - saving time, 426
 - subclasses, **427**, 465
 - superclass, **427**
 - terminology, 427–428
 - transitive, **428**
- initialization, **50**, 90
- InitializeComponent() method, 409, 547–550, 573
- initializer list, **231**, 261
- inner loop, **204**, 220
- InputMethodDemo program, 316
- InputMethod() method, 316
- input streams, 665
- instance methods, 78, **355**, 400, 412
 - delegate encapsulating, 628–629
 - objects, 361
 - public access specifier, 357
 - this reference, 378
- instances, **7**, 39, **354**, 412
 - destroying, 405–407
- instance variables, **355**–358, 377, 412
 - serializable, 684
- instantiate, **354**, 412
- instantiation, **354**, 412
- Int32 class, 354, 470–472, 474
- int data type, 48, **56**–57, 59, 71–72, 90, 328–329, 333–334, 552, 668, 672
 - alias, 50
 - automatic conversions, 283
- integers, **57**, 90
 - dividing by zero, 492–493, 508
 - division, 63–64
 - remainder operation, 63
 - return type, 298
 - sorting, 398
 - subscripts, 230
- Integer.TryParse() method, 513
- integer variables, 67
- integral data types, **56**–57, 90
- Integrated Development Environment. *See* IDE (Integrated Development Environment)
- IntelliSense, **717**, 720
 - completion mode, **717**–718
 - information about methods, 330
 - parameter information, 719
 - Quick Info ToolTip, 718

- IntelliSense (*continued*)
 - suggestion mode, **718**
 - using statements, 719
 - InteractiveAddition file, 87–88
 - interactive programs, **83**–84, 92
 - InteractiveSalesTax program, 86
 - interestRate variable, 65
 - interface keyword, 466
 - interfaces, **8**, 39, **102**, 130, **398**, 413, 465, **466**, 478
 - abstract methods, 466–469, 468
 - classes implementing, 468
 - creation, 466
 - deciding which to use, 122–123
 - methods, 399
 - names, 399, 466
 - polymorphism, 399, 469
 - intermediate language (IL), **22**, 40
 - internal access modifier, 356
 - internal class, 412
 - internal field modifier, 357
 - internal keyword, 356
 - interpreters, 3
 - int.Parse() method, 86
 - intrinsic types, **48**, 90, 471
 - int variables, 68
 - InvalidCastException class, 491
 - InvalidDataException class, 491
 - InvalidOperationException class, 491
 - InvalidPrinterException class, 490–491
 - invoking, **5**, 12, 38, **270**, 302
 - invoking events, **623**
 - invoking object, **361**, 413
 - IOException class, 490–491, 515–516, 668
 - IPlayable interface, 468
 - isDiscountProvided variable, 69
 - IsDisposed property, 545
 - isGoodItem variable, 519
 - isLocalCustomer() method, 289
 - isPreferredCustomer() method, 288–289
 - isProjectUnderBudget variable, 149
 - isSixMore variable, 70
 - IssueInvitations() method, 355
 - isValidIDNumber variable, 141
 - isValidItem variable, 238, 242
 - Italic property, 553
 - itemOrdered variable, 237–238, 240–241
 - itemPriceAsString variable, 84–85
 - itemPrice variable, 240–241
 - Items.Count property, 575
 - Items property, 572–573
 - iterations, **190**, 220
 - iteration variable, **234**, 261
 - IWorkable interface, 466–469
- J**
- jagged arrays, **256**–257, 261, 296
 - Java, 5, 10
 - ban on passing functions, 613
 - declaring array variable, 228
 - just in time (JIT) compiler, **22**, 40
- K**
- Kaufman, George, 542
 - Kernighan, Brian, 145
 - keyboard
 - event handling, 639–641
 - making selection from, 566
 - KeyChar property, 640
 - KeyCode property, 640
 - KeyData property, 640
 - KeyDemo program, 641
 - KeyDown event, 632, 639
 - key event, 648
 - KeyEventArgs class, 640
 - KeyEventArgs parameter, 639
 - KeyEventHandler delegate, 639
 - key events, **639**
 - key field, **663**, 698
 - KeyPress event, 632, 639
 - KeyPressEventArgs class, 640
 - KeyPressEventArgs parameter, 639
 - KeyPressEventHandler delegate, 639
 - KeyUp event, 633, 639–641
 - KeyUp() method, 640
 - KeyValue property, 640
 - keywords, **2**, 13, 38
 - contextual, **365**
 - kilobytes, **657**, 697, 715–716
- L**
- label1_Click() method, 121, 555
 - Label() constructor, 549
 - Label control, 107, **112**–115, 547, 551
 - label1 label, 112, 121, 547, 549, 555, 582
 - label2 label, 582
 - Label objects, 474, 549, 560, 562–567, 570, 575, 582, 589–590, 594, 608, 633, 635, 640, 642–643, 688, 691
 - labels, **112**, 122, 124–130, 589, 640
 - adding to form, 560–565
 - anchoring, 582
 - empty, 113–114
 - fonts, 117, 590
 - multiple lines of text, 112
 - names, 112
 - positioning, 562
 - properties, 560–565
 - resizing, 112, 562
 - responses to clicks, 638
 - text, 112–113
 - lastName field, 371
 - LastName property, 372–373
 - Leave event, 633
 - LeavesTurnColor() method, 428
 - left-associative, **705**–706
 - leftOver variable, 326
 - Left property, 545
 - length field, 375
 - Length property, 79, 233–234, 241, 324, 376, 665, 686
 - Less than operator (<), 69
 - Less than or equal to operator (<=), 69
 - letterButton_Click() method, 643
 - lexically, **78**, 92
 - LIMIT constant, 191–192, 194, 200
 - lincolnCheckBox_CheckChanged() method, 593
 - lincolnCheckBox object, 587, 588
 - LincolnForm form, 592
 - Lincoln Room check box, 593, 597
 - line comments (//), **18**, 40
 - LinkClicked() method, 555–577, 633
 - LinkColor property, 555
 - link label, **554**–557, 599
 - LinkLabel class, 554–557
 - linklabel1_LinkClicked() method, 557
 - linklabel2_LinkClicked() method, 557
 - linkLabel1 object, 556
 - linkLabel2 object, 556
 - LinkLabel objects, 543, 555–556, 633
 - LinkVisited property, 555, 557
 - list boxes, 572, **573**, 599
 - automatically selecting item, 576
 - displaying items in columns, 574
 - items selected in, 576
 - number of items in, 575
 - objects added to, 573
 - position of item in list, 575
 - resizing, 574
 - selections, 574
 - user-selected items, 575
 - ListBox objects, 543, 572–576, 632
 - ListControl class, 572
 - literal characters, 74
 - literal constants, **48**
 - literal strings, **11**, 30, 39
 - Load() method, 555, 574
 - loanAmount field, 446–447
 - LoanAmount property, 446–447
 - Loan class, 432–434, 445, 447, 460
 - Loan() constructor, 460
 - Loan objects, 432–434
 - local, **278**
 - local variable, 303

- LocalVariableDemo program, 278
 - LocationChanged event, 633
 - Location property, 126, 409, 545, 549, 561–563, 572, 581, 611
 - logic, **3**, 38
 - logical errors, 3
 - GUI applications, 121
 - logical operators, 392
 - logical OR operator (`|`), 553
 - logic-planning tools, 138–141
 - Logo, 4
 - long data type, **56**, 59, 71–72, 90
 - automatic conversions, 283
 - loop body, **190**, 220
 - do loops, 202–203
 - executing at least one time, 202
 - for loops, 199–200
 - loop control variables, **191**, 196, 220
 - altering by user input, 195
 - decrementing, **194**
 - incrementing, **194**, 214
 - initializing, 199
 - partially altering, 196
 - starting value, 199
 - step value, **199**
 - testing, 199
 - updating, 199
 - while loops, 199
 - loop fusion, **214**, 220
 - LoopingBankBalGUI program, 218
 - LoopingBankBal program, 195–196
 - LoopingBankBal2 program, 205
 - loops, **190**, 220
 - accumulated totals, **210**–211
 - arithmetic performed only once, 213
 - avoiding unnecessary operations, 212–213
 - combining, 214
 - counted loops, **195**
 - declaring variable outside, 213
 - define loops, **195**
 - do loops, **202**–204
 - empty body, **194**
 - event-driven programs, 217
 - expressions, 213–214
 - GUI programs, 216–219
 - improving efficiency, 240–241
 - improving performance, 212–216
 - indefinite loops, **195**
 - infinite, **191**, 194
 - iterations, **190**
 - loop body, **190**
 - loop fusion, **214**
 - for loops, **199**–201
 - nested, 204–209, 292
 - not executing, 202
 - performing arithmetic on array elements, 233
 - placing common items first in, 241
 - posttest, **204**
 - prefix and postfix incrementing, 214–216
 - pretest, **204**
 - repeating instructions, 190
 - searching arrays, 237–245
 - sentinal value, **196**
 - short-circuit operators evaluation order, 213–214
 - while loops, **190**–198
 - LostFocus event, 633
 - lower camel casing, **3**, 38
 - LOWEST_INVALID_NUM constant, 446
 - LOW_QUANTITY constant, 161
 - LOWRATE constant, 208
- ## M
- machine language, 2–3, 38
 - magic number, **671**, 698
 - Main() method, 12–13, 21, 26, 28–29, 33, 58, 68, 70, 87, 88, 110–111, 122, 270, 272, 277–280, 291–292, 294, 297–298, 315–316, 323, 341–342, 354, 361, 372, 375, 383, 388, 403, 406, 430, 432–433, 507–508, 524, 529, 613, 617–619, 630, 674–676
 - majorListBox object, 573
 - majorListBox_SelectedIndexChanged() method, 575
 - MakeAppointment() method, 11
 - MakeDeposit() method, 631
 - Make property, 447
 - MakeWithdrawal() method, 631
 - Mammal class, 448
 - mandatory parameters, **312**–313, 344
 - ManyButtons program, 645–647
 - ManyHellosGUI program, 217
 - Maple class, 428
 - Margin property, 545
 - MarsAlien class, 469
 - MarshalByRefObject class, 474, 542
 - Math class, 289
 - Math.PI constant, 375
 - Math.Pow() method, 63
 - matrix, 253
 - MaxDate property, 577
 - MAXDINNER constant, 208
 - MaximumSize property, 583
 - MAXRATE constant, 208
 - MaxSelectionCount property, 577
 - mealButton button, 594, 596
 - measuring storage, 714–716
 - megabytes, **657**, 697, 715
 - MemberAccessException class, 491
 - memory
 - aliases, 314
 - limited, 57
 - measuring storage, 714–716
 - random access memory (RAM), **656**
 - volatile, **656**
 - menu bar, **25**, 40
 - MenuStrip objects, 585–586
 - menu strips, 585–586, 599
 - messageLabel label, 578
 - Message property, 503, 505, 509, 521, 526
 - MethodA() method, 521, 529
 - MethodB() method, 521, 529
 - method body, **12**–13, 39, 276, 302
 - MethodC() method, 521, 529
 - method declaration, **272**, 302
 - method definition, **272**, 302
 - MethodGetsArray() method, 294–296
 - MethodGetsOneInt() method, 294
 - method header, **12**–13, 39, **272**, 276, 297–298, 302
 - Method1() method, 337–338
 - Method2() method, 338–339
 - MethodN() method, 274
 - methods, **5**, 38, **270**, 302, 357–358
 - abstract classes, 461
 - abstract methods, **398**
 - accessibility, **273**–274
 - ambiguous, **333**–334
 - applicable, **329**
 - arguments, **11**, 39, 246–247, 270, 276, 281–284
 - arrays, 293–296
 - automatically generated, 299–300
 - betterness rules, **329**
 - built-in, 289
 - called method, **270**
 - calling, **5**, 12, **270**, 279–280
 - calling method, **270**
 - clients, **271**
 - constants, 278, 300
 - constructors, **380**–386
 - curly braces (`{}`), 12
 - default arguments, 285
 - delegates, 612–613
 - derived class accessing, 443–444
 - encapsulating, 612
 - event handlers, **609**–612
 - event-handling, 121, 300
 - event receiver, **610**
 - exception handling thrown from outside methods, 517–520

- methods (*continued*)
 - extension methods, **470–472**
 - fully qualified name, **274**
 - GUI applications, 299–300
 - identifiers, 275–276
 - implementation hiding, **271**
 - inheritance, 428
 - instance methods, 78, **355**
 - instructions executed by, 12
 - interfaces, **8, 399**
 - invoking, **5, 12, 270**
 - jagged arrays, 296
 - listing in call stack, 521–525
 - local variables, **278**
 - mandatory parameters, **312–313**
 - manipulating arrays, 245–249
 - method body, **12–13, 39**
 - method declaration, **272**
 - method definition, **272**
 - method header, **12–13, 39, 272**
 - multidimensional arrays, 296
 - multiple-argument, 284–285
 - multiple events, 646–647
 - named arguments, **338–342**
 - names, 12, 275–276
 - nested method calls, **288**
 - nonstatic, **274–275, 300**
 - no parameters, 272–278
 - no return value, 272–278
 - not returning value, 13
 - objects, 8, 355, 362–363, 612–622
 - optional parameters, **312, 314–321, 335–342**
 - orphaned, **121, 131**
 - output parameters, **314, 316–320**
 - overloading, **323–332, 399**
 - overload resolution, **329**
 - overriding, **399, 441**
 - parameter arrays, **314, 320–321**
 - parameter list, **276**
 - parameters, **276, 281, 290–292, 303, 312–313**
 - Pascal casing, 5
 - passing by reference, 317
 - passing single element to, 293–294
 - placing in classes, 276–277
 - polymorphism, **9**
 - positional arguments, **338**
 - private access, 111, **273–274**
 - private access modifiers, 374–376
 - public access, **273**
 - public access modifiers, 373–374
 - recursive, **448**
 - reference parameters, **314, 315–316, 322–323**
 - returning Boolean value, 288–289
 - returning value, 142, 247, 275, 286–292
 - return type, **275, 286, 317**
 - reusable, 272
 - signature, **324**
 - single-argument, 281–284
 - static, 78, 111, **274–275, 282, 358**
 - storing, 271, 378
 - this reference, **378–380**
 - throwing exception and not catching it, 521
 - unnamed arguments, 337–338
 - valid and invalid declarations, 337
 - value parameters, **312–313**
 - variables, 278, 300
 - virtual methods, **441**
 - visible, **442**
 - void, 294
 - which outside classes can use, 111
 - MethodS() method, 274
 - method's type, **275, 303**
 - MethodThatAcceptsArray() method, 296
 - MethodWithItsOwnA() method, 278
 - Microsoft Sans Serif, 117, 552, 563
 - Microsoft Visual Studio. *See* Visual Studio
 - Microsoft Web site, 9
 - Microsoft.WindowsCE.Forms.
 - DocumentList class, 543
 - MilesPerGallon program, 492–493
 - MilesPerGallon2 program, 500–502
 - MilesPerGallon3 program, 502–503
 - MilesPerGallon4 program, 504
 - MinDate property, 577, 579
 - MINIMUM_LOAN constant, 445
 - MinimumSize property, 583
 - mission critical, **494, 532**
 - M1() method, 612, 615
 - M2() method, 612, 615
 - modal window, **591, 599**
 - ModifierKeys property, 546
 - modulus operator, 63
 - monetary values, 60
 - money variable, 72, 234
 - monospaced fonts, **117, 131**
 - MonthCalendar objects, 577–580, 658
 - MonthlyBoldedDates property, 577
 - monthly calendar, 577–580
 - MOTTO constant, 375
 - MouseButtons property, 546
 - MouseClicked delegate, 639
 - MouseClicked event, 637–639, 638
 - mouse click triggering default event, 554
 - MouseDoubleClick event, 637
 - MouseDown event, 633, 637–638
 - MouseEnter delegate, 636
 - MouseEnter event, 633, 635, 637
 - MouseEventArgs class, 637–638
 - MouseEventArgs object, 611
 - MouseEventArgs parameter, 637–638
 - MouseEventHandler delegate, 637
 - mouse events, 637–639
 - MouseHover event, 633, 637
 - MouseLeave event, 633, 637
 - MouseMove event, 633, 637
 - MousePosition property, 546
 - MouseUp event, 633, 637
 - MouseWheel event, 633
 - Move event, 633
 - Move() method, 658, 660
 - Movie Discount form, 175
 - mpg variable, 499–500
 - MSDN library, 122
 - MultiColumn property, 572, 574
 - multidimensional arrays, **252–256, 261, 296**
 - MultiExtended member, 574
 - multifile assembly, **271, 302**
 - multiple-argument methods, 284–285
 - multiple inheritance, 10, **465, 478**
 - multiply and assign shortcut operator (*=), 65
 - MultiSimple member, 574
 - myAge variable, 50–51
 - myAssistant object, 359–361, 364
 - myBook.AdvertisingMessage() method, 378
 - myCar class, 448
 - myChef object, 365–366
 - myDel delegate, 613
 - myDog class, 448
 - myGraduationParty identifier, 355
 - myInteger class, 359
 - MyMethod() method, 329, 612
 - myMoney variable, 116
 - myPetDogFifi object, 428
 - myScores array, 231, 233–234
 - myString variable, 84
- ## N
- named arguments, **338–343, 345**
 - named constants, **80–81, 92, 375, 671**
 - named instances, 552
 - named variables, 59
 - name field, 439–441
 - Name property, 106, 108–109, 113, 118–119, 125, 409, 440–441, 452, 462, 464, 546–547, 549, 556, 561, 573, 592, 594, 608, 611, 665, 688

- namespace-dot-class-dot-method
 - format, 12
 - namespaces, **12**, 39
 - built-in, 28
 - curly braces ({}), 28
 - declaration, 28
 - repeatedly using class, 19–20
 - user-created, 28
 - using clause, **19**
 - using directive, **19**
 - Names.txt file, 674–675, 680
 - NegativeBalanceException class, 526
 - nested
 - if-else statements, 151, 172
 - if statements, **145**–146, 155, 163, 180
 - nested loops, 204–209, 292
 - inner loop, **204**
 - outer loop, **204**, 206
 - nested method calls, **288**, 303
 - .NET framework culture settings, 62
 - new field modifier, 357
 - New Item window, 588
 - new keyword, 229, 441, 444
 - newline escape sequence (\n), 74
 - “Newline in constant” error message, 56
 - new line (\n), 662
 - new operator, **229**, 360
 - New Project command, 32
 - New Project window, 32, 103, 124, 561
 - nibbles, **709**, 716
 - nodes, **104**, 130
 - no fall-through rule, 165
 - nonabstract methods, 461, 468
 - non-application classes, **13**
 - None member, 574
 - nonprinting characters escape
 - sequence, **74**
 - nonstatic methods, **274**–275, 303
 - nonstatic variables, 358
 - nonvolatile, 697
 - Notepad, 21, 557
 - Not equal to operator (!=), 69, 77
 - NotImplementedException class, 491
 - NOT operator (!), **169**–170, 173–174, 181
 - null escape sequence (\0), 74
 - NullReferenceException class, 491, 694–695
 - Number format specifier, 61
 - numbering systems
 - binary numbering system, **708**–709
 - decimal numbering system, **707**
 - hexadecimal numbering system, **713**–714
 - numberOfDependents variable, 57
 - number parameter, 315
 - numbers
 - aligning, 117
 - as characters, 73
 - converting strings to, 86–87, 317–320
 - converting to string, 61–62
 - division, 63
 - summing, 114
 - number variable, 147, 191–194, 316, 512–513
 - numDependents variable, 148
 - numeric fields, 381
 - numeric type conversion, 71–73
 - numeric variables, 57
 - numOfItems variable, 243–245
 - numPages field, 377
 - num1 variable, 153
 - num2 variable, 153
 - num3 variable, 153
- O**
- Oak class, 428
 - Object class, 399, 450–456, 474, 542
 - Object constructor, 456
 - object destructors, 10
 - object initializers, **388**–391
 - object keyword, 450
 - object-oriented approach, **6**, 39
 - object-oriented exception-handling
 - methods, 498–501
 - versus* traditional exception-handling methods, 497–498
 - object-oriented programming
 - languages, 7–9
 - object-oriented programming (OOP), 4, 5–6, 38
 - Object parameter, 399, 454
 - objects, 5–6, 10, 39, 354, 377, **450**–455, 478
 - allocating memory, 360
 - arithmetic symbols, 392
 - arrays, 230
 - attributes, **5**, 7, 39, 355
 - behaviors, **5**, 7, 39
 - comparing, 453–454
 - computer simulations, 6
 - constructors, 456
 - creation, 359–363, 370–373
 - data types, 359–360
 - default value, **381**
 - deserialization, **684**–687
 - encapsulation, **8**
 - events, 555
 - fingerprints, 455
 - GUI applications, 407–410
 - GUIs (graphical user interfaces), 6, 102
 - identifiers, 359–360
 - instance methods, 361
 - instantiate, **354**, 424
 - interacting with, 608
 - interfaces, **8**
 - methods, 8, 355
 - names, 359–360, 566
 - passing to methods, 362–363
 - properties, 7
 - reading from text files, 684
 - reference equality, **453**–454
 - referencing methods, 612–622
 - serializable, 684–685
 - serialization, **684**–687
 - state, **5**, 39, 355
 - type or class, 452
 - uniquely identifying, 455
 - using within another object, 359
 - writing to text files, 684
 - obj folder, 35
 - Obstetrician class, 431
 - okButton button, 299, 547
 - okButton_Click() method, 111, 258, 299
 - oldEnough variable, 170
 - OnBalanceAdjusted event handler, 629
 - OnBalanceAdjusted() method, 629
 - OnChanged() method, 623
 - OneButtonTwoEvents program, 635
 - one-dimensional arrays, **252**–253, 261
 - jagged arrays, **256**–257
 - One member, 574
 - oneVal variable, 294
 - Open file mode, 666, 676
 - opening files, **663**, 698
 - OpenOrCreate file mode, 666
 - operands, **63**, 91
 - implicitly converting, **71**
 - Operate() method, 439
 - operating system error message, 23–24
 - OperationAbortedException class, 491
 - OperationCanceledException class, 491
 - operator*() method, 396
 - operator+() method, 393–394
 - operator-() method, 396
 - operator precedence, **64**, 91, **705**–706
 - operators
 - associativity, **705**
 - overloading, 392–396
 - precedence, **64**, 91, **705**–706
 - OptionalParameterDemo program, 336
 - optional parameters, **312**, 335–342, 344
 - output parameters, **314**, 316–320
 - parameter arrays, **314**, 320–321
 - reference parameters, **314**–315
 - unnamed arguments, 337–338

order of operation, **64**, 91
 OR operator (||), **156**–157, 171, 173, 180, 237
 combining with AND operator (&&), 158–162
 orphaned methods, **121**, 131
 outer loop, **204**, 206, 220
 outFile file, 685, 690
 outFile object, 666
 out keyword, 314, 317, 319
 OutOfMemoryException class, 491
 out of scope, **200**, 220
 out parameters, 404, 512–513
 output
 displaying onscreen, 11–12
 ending with carriage return, 669
 programs producing, 11–13
 outputLabel label, 567
 outputLabel variable, 216, 219
 output parameters, **314**, 316–320, 344
 output streams, 665
 overloaded binary operators, 392
 overloaded constructors, 387–388, 553, 665–666
 overloaded operators, 393
 OverloadedTriples program, 331–332
 overloaded unary operators, 392
 overloading, **323**, 345
 constructors, 382–384
 operators, 392–396
 overloading methods, 323–332, 399
 ambiguous methods, **333**–334
 betterness rules, **329**
 overload resolution, **329**
 parameter lists, 328
 overload resolution, **329**, 345
 named arguments, 342–343
 unnamed arguments, 342–343
 override keyword, **461**, 463, 478
 override modifier, 441
 overrides, **399**, 413
 overriding
 abstract methods, 461
 base class members, 439–444
 methods, 441

P

Painter class, 461
 Panel class, 584
 panels, 583–**584**, 599
 parallel arrays, **238**, 243–244, 261
 parameter arrays, **314**, 320–321, 344
 ParameterDemo1 program, 313
 parameterless constructor, **382**–283, 413
 parameter lists, **276**, 303
 Main() method, 297–298
 optional parameters, 335–342
 overloading methods, 328
 parameters, **276**, 290–292
 actual, **282**
 data types, 281
 formal, **282**
 identifiers, 281
 implicit parameter, **366**
 mandatory, **312**–313
 method header, 276
 methods, 303
 optional, **312**, 314–321, 335–342
 passing to constructors, 381–382
 value, 282
 ParamsDemo program, 321
 params keyword, 314, 320
 Parent class, 468
 parent class, **427**, 477
 child class, 430–431, 435
 hiding properties in, **441**
 Parent property, 546
 parse, 92
 Parse() methods, 84, 86–87, 317
 partial keyword, 15
 PartTimeEmployee class, 426
 Party objects, 355
 Pascal casing, **5**, 38
 PassArrayElement program, 293–294
 passed by reference, **294**, 303, 312, 317
 passed by value, 312
 PassEntireArray program, 295–296
 Patent class, 465
 path, **657**, 688, 698
 PathTooLongException class, 490
 payment variable, 65
 payRate array, 234
 PayRate property, 381
 payRate variable, 65, 173
 PayrollApplication class, 275
 payrollDay variable, 82
 pay variable, 4
 pepperoniCheckBox object, 566
 Percent format specifier, 61
 PerformLayout() method, 549
 permanent storage, 657
 permanent storage devices, **656**, 697
 persistent storage, **657**, 698
 petabytes, 715
 PhoneCall program, 290–292
 picture boxes, **569**–571, 599
 pictureBox1 object, 572
 PictureBox objects, 569–571, 592
 Play() method, 439
 pointers, 10
 Pointer tool, 590
 polymorphism, **9**, 39, 439–444
 interfaces, 399, 469
 Poodle class, 427
 Poodle object, 428
 positional arguments, **338**, 345
 Position property, 665, 686
 postfix decrement operator (--), 66
 postfix increment operator (++), 66
 65–66, 91, 193
 loops, 214–216
 posttest loops, **204**, 220
 Pow() method, 289
 precedence, **705**–706
 precision specifier, **61**, 91
 PreferredDiscount() method, 617, 621
 prefix decrement operator (--), 66
 prefix increment operator (++), 66
 65–66, 91, 193
 loops, 214–216
 PrefixPostfixComparison program, 215
 pretest loops, **204**, 220
 Preview Changes dialog box, 119
 price field, 377
 priceLabel label, 594–596
 PriceListApplication1 program, 518–519
 PriceListApplication2 program, 519–520
 PriceListApplication3 program, 523
 PriceList class, 518–519, 522
 PriceList.DisplayPrice() method, 523–524
 priceOfCall variable, 291
 price parameter, 379
 prices array, 238, 242
 price variable, 288
 priming read, **670**, 698
 private access, **273**–274, 276, 303
 private access modifiers, 356, 373–376
 private class, 412
 private field, 436
 private keyword, 111
 private methods, 111
 private modifier, 273–274, 357
 procedural programming, 4–6
 procedural programs, **4**–5, 38
 procedures, 5, 8, 498
 Product class, 465
 Program class, 28, 33
 program comments, **17**–18, 40
 See also comments
 Program.cs file, 104, 110

- programming
 - high-level programming languages, 2–3
 - logic, 3
 - object-oriented programming (OOP), 4–6
 - procedural, 4–6
 - programming languages
 - assemblers, 3
 - camel casing, 3
 - command prompt, 24
 - high-level programming languages, 2–3
 - IDE (Integrated Development Environment), 27
 - interpreters, 3
 - keywords, 2
 - lower camel casing, 3
 - semi-compiled, 22
 - syntax, 3
 - syntax errors, 3
 - vocabulary, 3
 - programs, 2, 38
 - See also* GUI applications
 - alternative courses, 612
 - blocks, 144–145
 - bugs, 3
 - code bloat, 272
 - code refactoring, 118
 - command line, 25
 - command-line arguments, 297
 - comments, 36
 - compilers, 3
 - compiling, 22–30
 - debugging, 3
 - deciding environment to use, 29–30
 - decision making, 138–141
 - design time, 115
 - documenting, 17–18
 - events, 608
 - exceptions, 490–494
 - executing, 22–30
 - failing to close form before reexecuting, 121
 - fault tolerant, 494
 - flowcharts, 138
 - forcing to contain error, 492–494
 - IDE (Integrated Development Environment), 22
 - indenting, 12
 - interactive, 83–84
 - interface, 102
 - intermediate language (IL), 22
 - keywords, 13
 - logic, 3
 - logical errors, 3
 - logic-planning tools, 138–141
 - machine language, 3
 - magic number, 671
 - Main() method, 12, 13
 - multifile assembly, 271
 - namespace-dot-class-dot-method format, 12
 - output, 11–13
 - pseudocode, 138
 - reusable modules, 6
 - robustness, 494
 - running other programs in, 557
 - runtime, 115, 608
 - saving, 22
 - self-documenting, 340
 - source code, 22
 - starting point, 12
 - statements, 18
 - terminating, 515
 - text editors, 22
 - text editors *versus* IDE (Integrated Development Environment), 28–29
 - user input, 87–88
 - whitespace, 12–13
 - projects
 - closing, 127
 - forms, 105
 - listing files, 104–105
 - naming, 103
 - saving, 103
 - prompt, 84, 92
 - propagating exceptions, 521, 533
 - properties, 7, 39, 364, 413, 547, 611
 - access modifiers, 365
 - accessors, 364
 - auto-implemented property, 368–369
 - automatic properties, 368–369
 - backing field, 365
 - buttons, 109, 126
 - creation, 363–369
 - curly braces ({}), 365
 - data types, 365
 - declaring, 365
 - derived classes, 443–444
 - description, 105
 - expanding or condensing, 106
 - forms, 125
 - get accessors, 364–367
 - identifiers, 365
 - listing of, 105
 - naming, 365
 - not passed as ref or out parameter, 367
 - parent class, 441
 - protecting private data, 364
 - read from, 365
 - read-only, 546
 - readonly property, 365
 - read/write, 567
 - retrieving field values, 364
 - set accessors, 364–367
 - setting fields, 364, 549
 - sorting, 105–106
 - value acting like keyword, 365
 - as variable, 366
 - visible, 442
 - written to, 365
 - Properties folder, 35
 - Properties window, 103, 109, 121, 125, 546–547, 551, 561
 - form name, 105
 - listing events, 634–635
 - properties, 105–106, 635
 - proportional fonts, 117, 131
 - protected access, 436–438, 477
 - protected access modifier, 356, 434–438
 - protected field modifier, 357
 - pseudocode, 138, 179
 - public access, 273, 298, 303
 - public access modifiers, 356, 373–376
 - public class, 412
 - public keyword, 289
 - public modifier, 273–274, 357
 - public set accessor, 436
 - purchase variable, 212
 - PushButtonControl class, 15
- ## Q
- Quick Info ToolTip, 718
 - Quicksort algorithm, 248
- ## R
- RadioButton objects, 543, 565–568, 584, 594–596
 - radio buttons, 565–568, 594–596, 599
 - group boxes, 584
 - selected by default, 568
 - raising events, 608, 648
 - RAM. *See* random access memory (RAM)
 - random access files, 663
 - random access memory (RAM), 656, 697
 - range checks, 171–172, 181
 - range match, 243–245, 247, 261
 - RankException class, 491
 - RATE constant, 440
 - rateLabel label, 563
 - rate parameter, 341
 - rate variable, 65, 292

rating variable, 158–160
 Read access, 676
 reading from files, **657**, 676–677, 697
 sequential access files, 671–673, 677
 ReadLine() method, 83–85, 122,
 270, 286, 288–289, 317, 665,
 667, 672
 Read member, 666
 Read() method, 84, 665
 ReadNameFile program, 676–677
 readonly field, 386
 readonly modifier, 357, 386
 readonly property, **365**
 read-only property, 369, 413
 read-only variables, **235**, 261
 ReadSequentialFile program,
 672–673, 677
 ReadWrite member, 666
 read/write properties, 567
 record delimiter, 669, 672
 recordIn string, 672
 records, **663**, 698
 rectangular arrays, **253**, 261
 recursive, 477
 recursive methods, **448**
 redButton button, 645
 redButton_Click() method, 646
 reference equality, **453**–454, 478
 reference parameters, **314**–317,
 322–323, 344
 reference types, **360**, 412
 ref keyword, 314–315, 317
 Regular property, 553
 Release folder, 35
 remainder (modulus) operator (%), 63
 remove keyword, 15
 Rename command, 118–119
 RentFinder program, 255
 rents array, 254, 256
 RepairValve() method, 431
 reportButton button, 112
 reserved keywords, 14–15, 30
 Resize event, 633
 response variable, 196, 202
 result variable, 289
 ResumeLayout() method, 549
 ReThrowDemo program, 530–531
 rethrowing exceptions, **529**–531, 533
 return statement, **287**, 303
 catch block, 515
 switch structure, 164
 return type, **275**, 286, 303, 317
 reusable code, 426
 ReverseArray program, 249
 Reverse() method, 249–252, 270, 294
 right-associative, **705**–706

Right property, 546
 Ritchie, Dennis, 145
 robustness, **494**, 533
 root class, **450**, 478
 root directory, **657**, 698
 Round trip format specifier, 61
 rules for betterness, 342
 runnable, **13**, 40
 runtime, **115**, 130, **176**, 181, **608**,
 612, 648
 runtime errors, 490

S

salary field, 381, 424–425, 429,
 434–436
 Salary property, 381, 385, 389, 435
 saleAmountForYear variable, 157–158
 saleAmount variable, **145**–146, 155,
 171–172, 281–282, 285,
 617–618
 sales array, 229–230, 253
 salesArray array, 229
 salesCode variable, 173–174
 salesList array, 229
 salesperson object, 429
 salesTable array, 229
 sal parameter, 385
 SatisfyGraduationRequirements()
 method, 439
 sausageCheckBox_CheckedChanged()
 method, 567
 sausageCheckBox object, 566–567
 Save All (Ctrl + Shift + S) keyboard
 shortcut, 34
 SaveMoney frame, 572
 saving programs, 22
 sbyte data type, **56**–57, 59, 71, 90
 automatic conversions, 283
 ScholarshipStudent class, 441,
 450–451
 Scientific format specifier, 61
 scientific notation, **60**, 91
 scope, **278**, 303
 GUI applications, 300
 scores array, 250–252
 score variable, 86, 318–319
 screen, displaying output, 11–12
 ScrollableControl class, 474
 Sculptor class, 461
 sealed classes, **470**, 478
 Search command, 23
 searching arrays
 arrays of objects, 398–402
 binary search, **246**–247
 for loops, 238–240

with loops, 237–245
 parallel arrays, **238**
 range match, **243**–245
 sequential search, **238**
 while loops, 241–242
 secondDel delegate, 613, 615, 617, 619
 seekEmp object, 401–402
 Seek() method, 675, 677–683
 SeekOrigin enumeration, 677–678
 SelectedIndexChanged() method, 572
 SelectedIndex property, 572
 SelectedIndices property, 572
 SelectedItem property, 572–573, 575
 SelectedItems property, 572, 576
 SelectionEnd property, 577–578
 SelectionMode enumeration, 574
 SelectionMode property, 572, 574
 SelectionRange property, 577
 SelectionStart property, 577–578
 Select Resource window, 570, 592
 self-documenting, **340**, 345
 self-documenting statements, **81**, 92
 semantic errors, 38
 semicolon (;) expected error
 message, 120
 sentinel value, **196**, 220, 671
 sequence structure, **138**, 180
 sequential access files, **663**, 698
 reading from, 671–673
 rereading, 677
 searching, 677–680
 writing data to, 668–671
 sequential search, **238**, 261
 [Serializable] attribute, 684
 SerializableDemonstration program,
 685–687
 serialization, **684**–687, 698
 Serialize() method, 685
 set accessors, **364**–369, 371, 373, 413,
 429, 435, 440, 446–447, 527, 623
 set_AccountNum set accessor, 528
 set_Balance set accessor, 528
 SetIDNumber() method, 363–364
 set keyword, 15
 SetPriceAndTax() method, 379
 SetSelected() method, 576
 setter, **365**, 413
 Shift property, 640
 short-circuit evaluation, **156**–157,
 180, 289
 short-circuit operators, 213–214
 shortcut arithmetic operators, 64–66
 add and assign shortcut operator
 (+=), **65**
 divide and assign shortcut operator
 (/=), 65

- multiply and assign shortcut operator (`*=`), 65
- postfix arithmetic operator (`++`), 65–66
- postfix decrement operator (`--`), 66
- prefix decrement operator (`--`), 66
- prefix increment operator (`++`), 65–66
- subtract and assign shortcut operator (`-=`), 65
- shortcut operators, 193
- short data type, 56–57, 59, 71, 90, 283
- ShowDialog() method, 591
- ShowDog class, 8–9
- ShowTodayCircle property, 577
- ShowToday property, 577
- ShowWelcomeMessage() method, 276–277
- side effects, 157–158, 180
- signature, 324, 345
- significant digits, 59, 91
- simple data types, 48, 90, 360
- SimpleMethod() method, 333–334
- single-argument methods, 281–284
- single-dimensional arrays, 252, 261
- single quotation mark escape sequence (`\'`), 74
- SizeMode property, 569
- Size property, 105–106, 109, 112, 125, 409, 546, 549, 572, 608, 611, 645
- snap lines, 581, 599
- SoapException class, 490
- software, 2, 38
- Solution Explorer, 103, 409, 564, 593
 - files part of current project, 104–105
 - form name, 105
 - nodes, 104
 - project name, 103
- someMoney variable, 52–54
- someNums array, 293
- SomeOtherClass class, 277
- someValue variable, 65
- someWorker object, 452
- SortArray program, 248
- Sorted property, 572
- sorting
 - arrays, 246–248
 - arrays of objects, 398–402
 - characters, 398
 - integers, 398
 - properties, 105–106
- Sort() method, 248, 250–252, 270, 294
- source code, 22, 40
 - colors, 720
 - syntax errors, 24
- Speak() method, 462–464
- specialButton button, 177–178
- specialButton_Click() method, 178
- Split() method, 672
- Spruce class, 427–428
- Spruce objects, 428
- StackOverflowException class, 491
- StackTrace property, 521–526, 528
- StandardDiscount() method, 617, 621
- standard numeric format strings, 60–61, 91
- StartsWith() method, 80
- state, 5, 39, 355
- statements, 18
 - commenting out, 17
 - ending with semicolon (`;`), 11
 - executing two or more
 - conditionally, 144
 - method body, 276
 - self-documenting, 81
- static classes, 475
- static field modifier, 357
- static keyword, 13, 20, 40, 111, 274–276, 280, 289, 300, 375
- static methods, 78, 111, 274–275, 282, 303, 358, 394, 471, 621
- static modifier, 358
- STEP keyword, 199
- step value, 199, 220
- Stopwatch class, 214–215
- StreamReader class, 665
- StreamReader objects, 671, 676, 682, 692
- streams, 664–668
 - exposing, 665, 698
 - input, 665
 - output, 665
- StreamWriter class, 665, 689
- StreamWriter constructor, 666
- StreamWriter object, 666, 669, 674–675
- Strikeout property, 553
- string argument, 552, 557, 613
- String class, 77, 398, 453, 474, 672
- String Collection Editor, 573
- string data type, 48, 76–80, 92, 286, 669, 671–672
- String.Format() method, 53, 116–117
- string interpolation, 53
- String objects, 453
- string objects, 676, 684, 692
- strings, 76–80, 324
 - accessing character with
 - subscripts, 232
 - arguments, 11
 - assigning array character to, 231
 - characters, 74
 - combining values, 53
 - comparing, 77–79, 453
 - concatenating, 53, 90, 392
 - console input, 84
 - converting, 84–88, 512–513
 - converting integer to, 325
 - converting numbers to, 61
 - converting to number, 86–87, 317–320
 - data types, 85–86
 - delimiters, 669
 - escape characters, 117
 - format string, 53–54
 - formatting, 53–54, 116–117
 - forms, 106
 - holding name of class, 452
 - immutable, 79
 - interpreting characters literally, 557
 - largest and smallest values, 48
 - length, 79, 234
 - lexically, 78
 - placeholders for values, 53
 - separating fields into array of, 672
 - starting characters, 80
 - substrings, 79
 - text boxes, 114
 - tokens, 669
 - user input, 88
- struct, 360
- StudentChanged() method, 624
- Student class, 370–373, 387, 439–441, 450–451, 622–627, 632, 663
- Student constructor, 403
- Student objects, 372–373, 403, 624
- stu object, 623
- subclasses, 427, 461, 465, 477
- subroutines, 5
- subscripts, 228, 230, 261, 675
 - accessing character in array, 232
 - constants, 233
 - integers, 230
 - range of, 233–234
 - two-dimensional arrays, 253
 - variables, 233
- Substring() method, 79
- substrings, 79
- subtract and assign shortcut operator (`-=`), 65, 615
- subtraction operator (`-`), 63, 615
- sub variable, 233
- SUDSParserException class, 490
- suggestion mode, 718, 720
- sumButton button, 118
- summing numbers, 114
- sum property, 114
- superclass, 427, 461, 477
- SuspendLayout() method, 549
- Swap() method, 322–323

- SwapProgram program, 322–323
 - switch-case structure. *See* switch structure
 - switch keyword, 164
 - switch structure, **163**
 - alternative courses of action, 166
 - break keyword, 164–165
 - case keyword, 164
 - case labels, **164**
 - default case, 165
 - default keyword, 164
 - enumerations, 166–167
 - governing type, **164**
 - GUI applications, 175, 177–178
 - return statement, 164
 - switch keyword, 164
 - throw statement, 164
 - syntax, **3**, 38
 - syntax errors, **3**, 24, 38, 120
 - IDE (Integrated Development Environment), 27
 - System.Array class, 230, 234, 245, 398
 - System.Console class, 279
 - System.Diagnostics.Process.Start() method, 557
 - System.Exception class, 492–494, 494
 - System.Exception objects, 495–497
 - System.IO namespace, 658, 692
 - System namespace, 12, 18–20, 450, 471, 515
 - aliases, **48**
 - fully qualified data type names, 50
 - System.Object class, 450
 - System.Runtime.Serialization.
 - Formatters.Binary namespace, 684
 - System.Runtime.Serialization namespace, 684
 - system software, **2**, 38
 - System.Windows.Forms.AxHost class, 543
 - System.Windows.Forms.ButtonBase class, 543
 - System.Windows.Forms.Button class, 610
 - System.Windows.Forms.Control class, 543–544
 - System.Windows.Forms.DataGrid class, 543
 - System.Windows.Forms.DataGridView class, 543
 - System.Windows.Forms.
 - DateTimePicker class, 543
 - System.Windows.Forms.GroupBox class, 543
 - System.Windows.Forms.Integration.
 - ElementHost class, 543
 - System.Windows.Forms.Integration.
 - Label class, 543
 - System.Windows.Forms.Integration.
 - ListControl class, 543
 - System.Windows.Forms.Integration.
 - ListView class, 543
 - System.Windows.Forms.Integration.
 - MdiClient class, 543
 - System.Windows.Forms.Integration.
 - MonthCalendar class, 543
 - System.Windows.Forms.Integration.
 - PictureBox class, 543
 - System.Windows.Forms.
 - PrintPreviewControl class, 544
 - System.Windows.Forms.ProgressBar class, 544
 - System.Windows.Forms.
 - ScrollableControl class, 544
 - System.Windows.Forms.ScrollBar class, 544
 - System.Windows.Forms.Splitter class, 544
 - System.Windows.Forms.StatusBar class, 544
 - System.Windows.Forms.TabControl class, 544
 - System.Windows.Forms.TextBoxBase class, 544
 - System.Windows.Forms.ToolBar class, 544
 - System.Windows.Forms.TrackBar class, 544
 - System.Windows.Forms.TreeView class, 544
 - System.Windows.Forms.
 - WebBrowserBase class, 544
 - terminating programs, 515
 - ternary operators, 168, 180
 - TestCarpet class, 375–376
 - testing for equivalency, 147–148
 - testScore variable, 169
 - TextBox class, 113, 216
 - TextBox control, **112**–117
 - text boxes, **113**–115, 122, 130, 176, 330
 - TextBox objects, 544, 688–691
 - TextChanged event, 633
 - Text control, 474
 - Text Editor, 121
 - text editors, 21
 - filename extensions, 22
 - find and replace feature, 234
 - versus* IDE (Integrated Development Environment) and, 28–29
 - identifiers, 28
 - textExpression variable, 168
 - text files, **656**, 697
 - GUI application creation, 688–691
 - reading data, 683–687
 - reading data into form, 691–696
 - reading objects from, 684
 - writing to, 683–687
 - text in labels, 112–113
 - Text property, 105–106, 109, 112–114, 125–127, 216, 219, 546–547, 549, 555, 561–562, 565, 567, 569–570, 572, 575, 587, 589, 592, 594–595, 608, 610, 632–633, 635, 642–643, 645, 688, 691, 694–695
 - TextReader class, 665
 - TextWriter class, 665
 - theTreeInMyBackYard object, 428
 - thirdDel delegate, 619
 - this keyword, 471, 548
 - this reference, **378**–380, 385, 400, 413
 - three-dimensional arrays, 256
 - ThreeLinesOutput class, 28
 - ThreeLinesOutput.cs file, 23–25
 - ThreeLinesOutput.exe file, 25
 - ThreeLinesOutput project, 27
 - throwing exceptions, 498–503, 505–506, 519, 528–529
 - throw keyword, 529, 531
 - switch structure, 164
 - tickets array, 257
 - ticketsUnderMinimum variable, 170
 - time, 577–580, 658
 - TIMES constant, 214
 - TippingTable program, 207–209
- ## T
- TabIndex property, 116, 546, 549, 645–646
 - TabIndex value, 642, 645–646
 - tables, 253
 - tab order, **116**, 131
 - TabStop property, 116, 642
 - TakeBloodPressure() method, 431
 - Tax class, 521–522, 524
 - Tax.DetermineTaxRate() method, 524
 - taxRate array, 522
 - TAX_RATE constant, 81
 - taxRate variable, 285
 - temporary variables, 323
 - tempTotal variable, 213
 - temp variable, 401
 - terabytes, 715

- TippingTable2 program, 210
 - tipRate variable, 208–209
 - TIPSTEP constant, 208
 - title field, 377
 - ToBoolean() method, 86
 - ToByte() method, 86
 - ToChar() method, 86
 - TodayDate property, 579
 - ToDecimal() method, 86
 - ToDouble() method, 84, 86
 - ToInt16() method, 86
 - ToInt32() method, 86, 513
 - ToInt64() method, 86
 - tokens, **669**, 698
 - ToLongDateString() method, 578
 - Toolbox, 126, 562
 - adding button to form, 107–112
 - listing controls, 107
 - Menus & Toolbars group, 585
 - pinning to screen, 107
 - TopLevelControl property, 546
 - TOPPING_PRICE constant, 567
 - Top property, 546
 - ToSbyte() method, 86
 - ToShortDateString() method, 578
 - ToSingle() method, 86
 - ToString() method, 86, 299, 372, 451, 502–503, 573, 610
 - format specifiers, 61
 - overriding, 452
 - total array, 258
 - totals
 - accumulated, **210**–211
 - add and assign shortcut operator (+=), 211
 - total variable, 211–212
 - ToUInt16() method, 86
 - ToUInt32() method, 86
 - ToUInt64() method, 86
 - traditional exception-handling
 - methods *versus* object-oriented
 - exception-handling methods, 497–498
 - TRANSACTIONS constant, 631
 - transitive, **428**, 477
 - Tree class, 427–428
 - triggering events, **608**, 648
 - Triple() method, 331–332
 - true-or-false comparisons, 68–69, 140, 142, 180
 - Truncate file mode, 666
 - truth tables, **154**, 180
 - TryBankAccount program, 527–528
 - try block, **498**–502, 505–511, 514–516, 519, 533, 668
 - try...catch block, 695
 - try keyword, 498
 - TryParse() method, 318–320, 367, 512–513
 - tuition field, 439–441
 - Tuition property, 440
 - two-dimensional arrays, **252**–254
 - TwoErrors class, 507–508
 - TwoErrors program, 507–508
 - TwoErrors2 program, 508–509
 - TwoErrors3 program, 509–510
 - .txt file extension, 557
 - type precedence, **71**, 92
 - type-safe data types, **83**, 92
- ## U
- uint data type, **56**, 71–72, 90
 - automatic conversions, 283
 - ulong data type, **56**, 71, 90, 283
 - UML. *See* Unified Modeling Language (UML) diagrams
 - unary form, 392
 - unary operators, **66**, 91, 168
 - overloaded, 392, 396
 - right-associative, **705**
 - Underline property, 553
 - UnhandledException window, 694
 - Unicode, **48**, 74–75, 90, 662, **709**, 716
 - characters represented as
 - numbers, 56
 - foreign alphabets, 75
 - letter values, 106
 - Unified Modeling Language (UML) diagrams, **426**, 477
 - unifying type, **71**, 92
 - uninitialized variables, 51
 - unnamed arguments, 337–338
 - overload resolution, 342–343
 - unnamed constants, 48
 - unreachable, **510**, 533
 - unsafe mode, 10
 - upper camel casing, **5**, 38
 - user-created namespaces, 28
 - user-defined application exception classes, 492
 - UseTaxMethod program, 283
 - ushort data type, **56**–57, 59, 71, 90
 - automatic conversions, 283
 - using clause, **19**, 40
 - using directive, **19**, 40
 - using statements, 21, 28–29, 33, 616, 719
 - using static System.Console statement, 20, 26, 28
- ## V
- ValidID project, 197–198
 - validValues array, 237–238, 240–241
 - ValueChanged property, 580
 - value keyword, 15, 366
 - value parameters, 282, **312**–313, 335, 344
 - Value property, 580
 - value-returning methods, 275, 286–289
 - values
 - comparing to valid values in array, 237
 - garbage, **211**
 - value types, **360**, 412
 - value variable, 70
 - Vampire class, 469
 - variable declaration, **50**, 90
 - variables, **4**, 8, 38, **48**, 90
 - aliases, 314–315
 - arrays, 228
 - assigning values, 50–51
 - camel casing, 3
 - checking value, 497
 - combining values, 53
 - comparing to valid values, 237
 - data types, 50, 57
 - declaring, 48–51, 57–59
 - displaying values, 52–56
 - enumerations, 82
 - fixed number of integral values
 - for, 82
 - identifiers, **4**, 50
 - increasing value in, 64–66, 193
 - initializing, **50**
 - initial value, 50
 - instance variables, **355**
 - local, **278**
 - methods, 278, 300
 - naming, 49–50
 - nonstatic, 358
 - out of scope, **200**
 - postfix arithmetic operator (++), 65
 - prefix arithmetic operator (++), 65
 - read-only, **235**
 - reducing value in, 66
 - scope, **278**
 - subscripts, 233
 - uninitialized, 51
 - usage, 58–59
 - variable substitution, 53
 - verbatim identifiers, **14**, 40
 - vertical tab escape sequence (\v), 74
 - viewButton button, 691
 - viewButton_Click() method, 692, 695
 - ViewInvoices program, 691–696

virtual methods, **441**, 461, 477
 visible, **442**, 477
 VisibleChanged event, 633
 Visible control, 474
 Visible property, 106, 109, 128, 546
 VisitedLinkColor property, 555
 Visual Basic, 5
 Visual Studio, 9
 automatic completion, 29
 closing, 35
 compiling code with IDE (Integrated Development Environment), 25–28
 editor, 21
 enumerations, 82
 Help documentation, 122
 namespaces, 12, 28
 program comments, 36
 Properties window, 546
 using statements, 28
 Void class, 16
 void keyword, **13**, 40, 276
 void methods, 275, 294
 void return type, 297, 613
 volatile, 697
 volatile field modifier, 357
 volatile memory, **656**

W

wasSuccessful variable, 513
 WEDNESDAY constant, 83
 weeklyBudget variable, 72
 welcomeLabel label, 562
 WelcomeMessage() method, 358, 361, 365
 where keyword, 15
 while keyword, 190

while loops, **190**–198, 216, 220, 519, 670, 672, 682
 comparing value to valid values in array, 237
 curly braces ({}), 193
 definite loops, 199
 displaying integers 1 through 10, 199
 empty body, **194**
 indefinite loops, 199
 loop body, 190–191
 loop control variable, **191**, 199
 navigating arrays, 234–235
 nested, 204
 performing arithmetic, 233
 searching arrays, 241–242
 whiteButton button, 645
 whitespace, **12**–13, 40
 whole numbers, 56–57
 widgets, **542**, 599
 width field, 375
 Width property, 106, 376, 390, 544, 546
 Width value, 583
 Window objects, 585
 windows, 107
 WindowsFormsApplication1 form, 102–103
 worker1 object, 401
 worker2 object, 401
 Work() method, 466–468
 WriteLine() method, 11–12, 26, 33, 58, 61–62, 66–68, 76, 84, 122, 149, 208, 270–272, 274, 281, 284, 288–289, 324, 434, 460, 500, 524, 665–666, 669, 671–672
 displaying variable values, 52–56
 Write member, 666

Write() method, 12, 84, 665–666
 displaying variable values, 52–56
 writer objects, 666, 669, 690
 WriteSequentialFile class, 670–671
 WriteSomeText program, 667
 writing to files, **657**, 698

X

XML-documentation format contents (< >), **18**, 40
 XML (eXtensible Markup Language), **18**, **668**
 XML files, 668
 XmlTextReader class, 668
 XmlTextWriter class, 668
 X property, 638
 x variable, 313, 315–316
 XxxException placeholder, 499

Y

Year property, 446
 yearsOfService variable, 157–158
 year variable, 163, 165
 yesButton_Click() method, 219
 yield keyword, 15
 yottabytes, 715
 yourAge variable, 51
 yourAnniversaryParty identifier, 355
 yourBook.AdvertisingMessage() method, 378
 Y property, 638

Z

zeroth element, 230
 zero variable, 495
 zettabytes, 715
 ZONE1 constant, 161
 ZONE2 constant, 161