

Index

& (ampersand) operator	134	\W character class	156
(\$) dollar sign, assertion made by	157	A	
.NET environment	18	Add method	240
application domain	19	for a dictionary object	166
as arrays and strings	5	in a BucketHash class	181
timing test for	18	of the arraylist	36
.NET Framework		storing data in a collection	12
array class	3	AddEdge method	288
ArrayLists	41	AddRange method	38, 39
collection classes in	1	AddVertex method	288
dictionary classes	8	Adelson-Velskii, G. M.	263
Stack class	69	adjacency matrix	286, 288, 290, 291
.NET Framework class library		adjustShortPath method	307, 308
System		advanced data structures	
data structures	1	for searching	263
.NET Framework library	11	algorithms	1
ArrayList	35	advanced sorting	42, 249
.NET version of c#	93	binary search	62, 64, 66
[] brackets, enclosing a character class	155	Bubble Sort	45
\b assertion	157	determining node position	222
\d character class	156	Dijkstra's algorithms	303, 305, 312
\D character class	156	greedy	152, 303, 314, 324
\S character class	156	HeapSort	254
\w character class	156		

algorithms (<i>cont.</i>)		contained in	
implementation	290	CollectionBase class	12
Insertion Sort	49	indexof method	38
iterative	65	remove method	37
knapsack problem	322	ArrayLists add method	81
minimum spanning tree	299	ArrayLists object	70
QuickSort	259	arrays	
recursive	65	as class objects	3
selection sort	48	as linear collection storage	3
ShellSort	249	compared to BitArray Class	94
shortest-path	302	compared to linked list	194, 195
sorting	42	concerning issues with	194
topological sorting	289	declaring	27
And operator	98, 245	heaps building	254
anonymous group	158	indexed data collections	26
append method	140	initializing	27
application domain	19	Jagged Arrays	32
arithmetic expression, storing		multidimensional arrays	30
as string	7, 74	new elements insertions to	3
Array Class	26	parameter arrays	32
built-in binary search		static/dynamic	3
method	65	arrBits	114
for retrieving metadata	28	ASC function	127
array class method	28	ASCII code	127
array elements	28	ASCII values	177, 240
array Metadata	28	assertions	156, 160
array object	26	Zero-Width Lookahead	160
array techniques	125	Zero-Width Lookbehind	160
ArrayList class	26, 35	associations	8
applications of	36	asterisk (*)	148
members of	35	as quantifier	151
ArrayList object	35	as the greedy operator	
ArrayLists	3, 11, 12	AVL trees	263
addrange/insertrange		fundamentals	263
method	38	implementing	264
and resizing	41	nodes in	264, 266
as buckets	181	rotation	263
capacity property	37	AVLTree class	
comparing to arrays	26	deletion method	268

Index**343**

B		binNumber array (binary)	113
benchmark tests	17	bins, queues representing	88
benchmarking. <i>See</i> timing tests		bit	
Big O analysis	1	index of bit to set	113
bin configuration	87	bit mask	107
binary number		bit pattern	
converting to decimal		for an integer value	104
equivalents	97	Bit sets	94
binary number system	96	bit shift	
binary numbers	94, 96	demonstration application	107
combining with bitwise operators	99	bit value	
comparing bit-by-bit	98	retrieving	111
manipulating	97	BitArray	
binary search	55, 62	binNumber	113
recursive	64	BitSet	113
binary search algorithm	64	compared with array for	
using iterative and		sieve of Eratosthenes	117
recursive code	66	retrieve a bit value	111
binary search method	64, 66	similar to arraylist	110
binary search trees	218, 220, 235	storing set of boolean values	117
building	221	BitArray class	94, 110
finding node and		data structure to store set members	244
minimum/maximum		finding prime numbers	94
values in	227	methods and properties	113
handling unbalanced	263	storing sets of bits	117
inserting series of numbers		writing the seive of	
into	225	Eratosthenes	94, 96
leaf node (with One Child)		bitBuffer variable	107
removal	230	Bits	
leaf node (with two children)		in VB.NET	96
removal	230	BitSet	113
leaf node removal	228	bitshift operators	94, 97, 103
transversing	224	bitwise operators	94, 97, 98
binary trees	9, 218, 220	and applicability	99
BinarySearchTree (BST) class	221, 222, 268	and ConvertBits method	99
binNumber	113	similar to boolean values	98
		truth tables	98

black nodes	268	CArray class object	44
Boolean truth table	98	case-insensitive matching	163
Boolean value	113	character array, instantiating a	
breadth-first search	293, 296	string from	120
BubbleSort algorithm	45, 46	character classes	153, 155
BubbleSort method	47	[aeiou]	155
Bucket Hashing	181	period (.)	153
buckets	181	characters	
BuildArray subroutine	90	Unicode values of	127
BuildGlossary subroutine	189	Chars method	83
Byte values	96, 111	Chars property	139
C		child	
C#		deleting a node with one	230
and arrays in	26	Circular linked list	203
and regular expression	156	Class Data Members	239
binary tree in	220	class method	29
built-in Hashtable class	183	Clear method	13, 76
CStack	70	of the ArrayList Class	70
dimensions of arrays	30	Coin-Changing Problem	324
in bitwise operators	99	Collection Classes	11, 12
peek operation	69	built-in enumerator	11
role of sets	237	implementing using arrays	11
strings as class object	3	in .NET Framework	1
C# code		storing class object	11
for constructing Huffman		Collection operations	2
code	327	CollectionBase class	11
C# strings	3	inner list	12
C# struct	4	collections	1, 2
C#, arrays	3	linear and nonlinear	2
Capacity property		collections count	2
of the ArrayList object	35	Collision	177
CapturesCollection Class	161	collNumber	183
caret (^)	155	comma-delimited string	125
Carpet class	336	comma-separated value	
carpet thief program	337	strings (CSVs)	125
CArray class	44	compareTo method	127
in prime number sorting	95	Compression of data	326
storing numbers	44	computer programming	
		role of stacks	93

Index**345**

Concat method	134	for timing classes	21
connected unidirected graph	284	data structures	1, 68
connections		data structures and algorithms	1
between network	299	data types	
constructor method	239	numeric	5
for CSet class	239	default capacity	
for CStack	70	hash table with	185
for String class	120	of queue	82
constructors		default constructor	21, 73
for Stack class	73	for base class	167
Contains method	37, 77	Delete method	233
ContainsKey method	188	delVertex. <i>See also</i> graphs	291
ContainsValue method	188	DeMorgan's Laws	239
continuous items	333	depth of a tree	220
ConvertBits function	107	depth-first search	293, 294
ConvertBits method	99	Dequeue method	91, 92
copy constructors	184	Dequeue operation	7, 80, 90
CopyTo method	77, 169	dictionary	8, 42, 165
cost. <i>See also</i> weight of the		key-value pairs	8
vertex	283	dictionary, associative arrays	8
Count method	12, 167	DictionaryBase	166
Count property	70	DictionaryBase class, 165. <i>See</i>	
and stack operation	69	<i>also</i> SortedList Class	172
CSet class	243	DictionaryBase Methods	169
BitArray implementation of	244	dictionary-based data	
CSVs (comma-separated		structure	
value strings)	125	SortedList	165
CType function	169	DictionaryEntry array	169
custom-built data structure or		DictionaryEntry objects	166, 167,
algorithm	66		170, 174
cycle	284	Difference method	242
D		digraph	284
Data compression		Dijkstra, Edsger	303
Huffman code	326	Dijkstra's algorithm	308
data fields	206	direct access collections	2
data items, memory reserved		and struct	3
for	18	string	3
data members		directed graph. <i>See</i> digraph	
		displaying method	47

displayNode method	221, 226	equivalent table	
displayPaths method	308	for bit values	98
dispMask variable	107	Eratosthenes	94
DistOriginal class	306	ExplicitCapture	
distributive set property	238	for regular expression	163
Double Hashing	181, 183	expression evaluator	74, 77
double quotation marks		extra connections	
enclosing string literals	120	in a network	299
double rotation		F	
in an AVL tree	264	False bit	98
doubly-linked list	200	Fibonacci numbers	315
node deletion	201	computation using recursive	
Remove method	201	and iterative version	317
duration members		FIFO (First-In, First-Out)	
of Timing class	21	structures	79, 80
dynamic programming	314	FillSack method	336
arrays for storing data	318	finalizer method	19
E		FindLast method	202
ECMAScript option		FindMax method	282
for regular expression	163	FindMin function	59
edges		FindMin() method	227
nodes connected by	218	First-In, First-Out structures	
representing as graph	286	(FIFO)	79, 80
elements		fixed-length code	327
accessing a arrays	28	For Each loop	36
accessing multidimensional		For loop	28, 107, 258,
arrays	29, 31		280
adding to an array	3	formatted string	140
empty set	238	found item, swapping with	
empty string	120	preceding	61
EnQueue operation	7, 80	frequency of occurrence	
EnsureCapacity method	139	for a character in a string	327
Enumerator object		frequently searched-for items,	
for a hash table	185	placing at beginning	59
equal set	238	G	
equalities for set	239	garbage collection	18
equality, testing for	26	garbage collector, calling	18
Equals method	127		

Index**347**

- | | | | |
|--------------------------------|----------|----------------------------|------------------|
| generalized indexed | | represented in VB.NET | 283 |
| collections | 7 | searching | 293 |
| generic class | 16 | topological sorting | 289 |
| Generic Linked List | 214 | vertex removal | 291 |
| Generic Linked List Class | 214 | weighted | 302 |
| Generic Node Class | 214 | Greedy algorithms | 303, 314, 324 |
| generic program | | group | |
| data type placeholder | 14 | nonlinear collection, | |
| generic programming | 1, 14 | unordered | 9 |
| generic Queue | 82 | group collections | 9 |
| generic Swap function | 14 | Grouping Constructs | 157 |
| generics | 1 | | |
| genRandomLevel method | 280 | H | |
| Get method | | HandleReorient method | 275 |
| BitSet BitArray | 111 | hash function | 8, 176, 177, 181 |
| to retrieve bits stored | 111 | in a BucketHash class | 181 |
| GetAdjUnvisitedVertex | | Hash table | |
| method | 294 | addition/removal of | |
| getCurrent method | 207 | elements | 182 |
| GetEnumerator method | 169 | building glossary or | |
| GetLength method | 29 | dictionary | 189 |
| getMin method | 307, 308 | hash function | 8 |
| GetRange method | 39, 40 | key/value pairs stored in | 166 |
| GetSuccessor method | 233 | load factor | 182 |
| GetType method | 29 | remove method | 167 |
| for data type of array | 29 | retrieving data | 8 |
| GetUpperBound method | 29 | retrieving keys and values | |
| GetValue method | 28 | from | 185 |
| global optimum | 314 | Hashtable class | 176, 184 |
| glossary, building with a hash | | .NET Framework library | 176 |
| table | 189 | methods of | 74 |
| Graph Class | 285, 306 | Hashtable objects | |
| graph search algorithm | | instantiating and adding | |
| minimum spanning tree | 299 | data to | 184 |
| graphs | 10 | load factor | 184 |
| building | 287 | heap | 18 |
| minimum spanning trees | 299 | building | 254 |
| real world systems modeled | | heap sort | 9 |
| by | 284 | HeapSort Algorithm | 254 |

hierarchical collections	2, 8	initialization list	27
and tree	8	inner loop	
hierarchical manner, storing		in an insertion sort	50
data	218	in an selectionSort	48
Horner's rule	179	InnerHashTable	166
HTML anchor tag	164	InnerHashTable object	167
HTML formatting	136	InnerList	12
Huffman code	327	inOrder method	225, 226
Huffman code algorithm	327	inorder successor	230
Huffman coding	326	inorder traversal method	224, 225
data compression using	326	Insert method	141
Huffman, David	326	InsertAfter method	207
HuffmanTree class	331	InsertBefore method	207
I		InsertBeforeHeader Exception	
Icollection		class	207
and arraylists	38	Insertion method	201
ICollection interface	72	Insertion Sort	viii, 49
IComparable interface	264, 336	loops in	50
IDictionary interface	166	speed of	52
IEnumerable interface	11	Int32 structure	5
If-Then statement,		Integer array	33
short-circuiting	37, 61	Integer data type	5
IgnoreCase option		integer index, 2, 8. <i>See also</i>	
for regular expression	163	direct access collections	
IgnorePatternWhiteSpace		integer set members	244, 248
option for regular		Integer variable	70
expression	163	integers	
immutable String objects	119	bit pattern determination	104
immutable strings	3	converting into binary	
increment sequence	249	numbers	104
index-based access		Integer-to-Binary converter	
into a SortedList	174	application	104
IndexOf method	38, 122	intersection	9, 238
infix arithmetic	74	Intersection method	241
initial capacity		invalid index	38
for a hash table	184	IP addresses	166, 172
initial load factor		IPAddresses class	168
for a hash table	184	isArray class method	29
		IsMatch method	149

Index**349**

isSubset Method	241	LCSubstring function	321
Item method		left shift operator (<<)	103
calling	70	left-aligning a string	132
key-value pair	185	Length method	
of HashTable class	167	for multi-dimensional array	29
retrieving value	166, 167	Length property	139
Iterator class	200, 206	of StringBuilder class	138
insertion methods	207	levels	
iterFib function	318	breaking tree into	220
		determining for skip lists	
		of links	277
J		LIFO (Last-In, First-Out	
Jagged arrays	32	structures)	7
Join method	124	Like operator	
from an array to a string	124,	linear collections	7
	126	and array	2
		direct/sequential access	2
		list of elements	2
K		linear list	6
Key		direct access to elements	6
retrieving value based on	186	ordered or unordered	6
Key property		priority queue	7
for a dictionaryEntry object	170	sequential access	
key value, 220. <i>See also</i> key		collections	6
value pairs		stacks	
key-value pairs. <i>See also</i> key		last in, first-Out structures	7
value	165	stacks and queues	7
KeyValuePair Class	171	linear probing	183
KeyValuePair object		link member	
instantiating	171	of node	197
knapsack class	336	linked list	
knapsack problem	322	design modifications in	200
greedy solution to	333	doubly/circular linked list	200
Knuth, Don	11	insertion of items	196
		object-oriented design	196
L		removal of items	196
Landis, E. M.	263	LinkedList class	197, 206, 207,
Last-In, First-Out (LIFO)			208, 214, 217
structures	7	LinkedListNode	214
lazy deletion	268		
lazy quantifier	153		

- | | | | |
|--------------------------------|----------|------------------------------|----------|
| load factor | 184 | performing calculations on | |
| local optima | 314 | all elements | 31 |
| logical operators | 98 | Multiline option | |
| Lookbehind assertions | 160, 161 | for regular expression | 163 |
| loop | 284 | MustInherit class | 166 |
| | | mutable String objects | 137 |
| | | myfile.exe | 148 |
| M | | N | |
| machine code, translating | | named groups | 158 |
| recursive code to | 314 | native data type | 120 |
| MakeChange subroutine | 326 | negative integers, binary | |
| mask. <i>See also</i> bit mask | 107 | representation of | 105 |
| converting integer into a | | negative lookahead assertion | 160 |
| binary number | 104 | network graph | 10 |
| Match class | 148, 149 | Node class | 196, 200 |
| MatchCollection object | 150 | nodes | |
| matches | | connected by edges | 10 |
| at the beginning of a string | | in linked list | 195 |
| or a line | 156 | of a tree collection | 8 |
| at the end of the line | 157 | nonlinear collections | |
| specifying a definite | | hierarchical and group | |
| number of | 152 | collections | 8 |
| specifying a minimum and | | trees, heaps, graphs and | |
| a maximum number of | 152 | sets | 2 |
| specifying at word | | unordered group | 9 |
| boundaries | 157 | NP-complete problems | 10 |
| MaxCapacity property | 138 | NUM_VERTICES constant of | |
| merge method, called by | | the graph class | 288 |
| RecMergeSort | 252 | numElements | 250 |
| MergeSort algorithm | 251 | numeric codes for characters | 127 |
| metacharacter | 147 | | |
| asterisk (*) | 148 | O | |
| minimum spanning tree | | object-oriented programming | |
| algorithm | 299 | (OOP) | 11, 70 |
| modern operating systems | | code bloat | 14 |
| tree collection | 9 | octal, converting numbers | |
| moveRow method | 291 | from decimal to | 78 |
| multi-dimensional array | 29, 30 | | |
| accessing elements of | 31 | | |

Index**351**

OOOP (object-oriented programming)	11	Pop method	70, 73
open addressing	181, 183	Pop operation. <i>See</i> stack operations	
operations, performed on sets	238	postfix expression evaluator	93
optimal solution		postorder traversals	224, 226
for greedy algorithm	324	PQueue class	91
Or operator	245	code for	91
ordered graph	284	preorder traversal method	224
ordered list	6	primary stack operations	74
organizational chart	2	PrintList method	199
ORing	101	Priority Queues	90
		deriving from Queue class	90
P		Private constructor	279
PadLeft method	132	for the SkipList class	278
PadRight method	132	probability distribution	277
palindrome	71, 93	Probability distributions	60
ParamArray keyword	32	Process class	19
parameter arrays	32	process handling	90
parameterized constructor	197	Property method	264
parentheses (), surrounding		Public constructor	279
regular expression	157	Pugh, william	277
Pareto distributions	60	punch cards	86
Pareto, Vilfredo	60	Push method	74
Parse method			
Int32	5	Q	
Path. <i>See also</i> vertices		Quadratic probing	183
sequence in graph	284	quantifiers	151
finding the shortest in graph	302	asterisk (*)	151
Path() method	306	question mark (?)	
Pattern matching	147	quantifier	151
Peek method. <i>See</i> Queue operations		Queue class	68, 80, 90
period (.) character class	153	implementation using an ArrayList	81
period matches	154	sample application	82
pig Latin	146	Queue object	82
pivot value	262	Queue operations	80
plus sign (+) quantifier	151	Peek method	70, 76, 80

queues	68, 80	for text processing and pattern matching	164
and applications	93	in C#	148
changing the growth factor	82	metacharacters	147
First-In, First-Out structure	7	modifying using assertions	156
for breadth-first search	296	myfile.exe	148
used in sorting data	86	options	163
QuickSort algorithm	259	searches and substitution in strings	147
improvement to	262	surrounding parentheses	157
R		working with	148
radix sort	87	Remove method	12
random number generator	44	RemoveAt method	38
range operators		Replace method	150
in like comparisons		right shift operator (>>)	103
Rank property	29	root node	9, 219
readonly Property	264	RSort subroutine	90
rebalancing operations. <i>See</i> AVL trees		S	
recMergeSort method	252	searching	42
recMergeSort subroutines	253	Searching Algorithms	55
recursion		Selection Sort	48
base case of	252	compared with other sorting algorithms	53
reverse of	314	SelectionSort algorithm	48
recursive call	226, 315	code to implementation	48
recursive code, transting to machine code	314	SeqSearch method	60
recursive program	315	compared with Bubble sort	61
RedBlack class	270, 275	self-organisation	60
red-black tree	263, 268	sequential access collections	6
implementation code	270	Sequential search	55
insertion of items	269	implementation of	55
rules for	269	minimum and maximum values search by	58
Redim Preserve statements	3	speeding up	59
reference types	18	Sequential search function	57
RegEx class	147, 148	Set class	237
regular array	95	implementation using Hash table	239
regular expressions	147		
compiling options	163		

Index**353**

Set method	113	Sorting process	46
set of edges	10	sorting techniques	43
set of nodes	10	sPath array	308
set operations	9	splay tree	263
SetAll method	113	Split method	124
Sets	237	string into parts	124
operations performed on	238	Stack class	68, 70, 72, 73, 78
properties defined for	238	Stack Constructor Methods	73
remove/size methods	240	stack object	73
unordered data values	9	stack operations	7, 74
SetValue method	28	Pop operation	69
comparing with		pushing, popping, and	
multidimensional array	31	peeking	17
Shell, Donald, 249. <i>See also</i>		stacks	7, 18, 68
ShellSort algorithm		contains method	77
ShellSort Algorithm	249	in programming language	
shortest-path algorithm	302	implementations	68
showVertex method	300	Last-in, First-out (LIFO)	
sieve of Eratosthenes	94, 117	data structure	69
using a BitArray to write	114	Stacks applications	7
using integers in the array	96	stacks, data structure	79
skip lists	263, 275	string array	113, 125
fundamentals	275	String class	119
implementation	277	compared to StringBuilder	143
SkipList class	281	Like operator	
public/private constructor	278	methods involved	124
Sort method		methods of	121
in several. NET Framework		PadRight/PadLeft method	132
library classes	262	String class methods	83
SortedList	165	string literals	119, 120, 141
SortedList class	165, 172	String objects	119
Sorting	42, 44, 45, 87	comparing in VB.NET	126
data with Queue	86	concatenating	134
Sorting algorithms	42	instantiating	120
Bubble Sort	45	string processing	119, 130, 145,
time comparisons for all			147
sorting algorithms	51	StringBuffer class	146
Sorting data		StringBuilder class	viii, 3, 119,
algorithms for	53		137, 138, 142, 143, 145

StringBuilder objects		Timing class	1
and Append method	140	and data members	21
constructing	138	measurement of data	
modifying	139	structure and algorithms	1
obtaining and setting		timing code	18, 19,
information about	138		21
strings	119	moving into a class	23
aligning data	132	Timing Test class	21
breaking into individual		Timing tests	17
pieces of data	124	for .NET environment	18
building from arrays	126	oversimplified example	17
collection of characters	3	ToArray method	39, 78
comparing to patterns		transfer of contents	40
converting from lowercase		topological sorting	289
to uppercase	135	methods of	290
defining range of characters		TopSort method	292
in	154	ToString method	143, 170
finding longest common		Traveling Salesman problem	10
substring	319	traversal methods	224
in VB.NET	121	tree	
length of	121, 122	leaf	220
matching any character in		set of nodes	218
methods for comparing	126	tree collection	8
methods for manipulating	130	applications of	9
operation performed	121	elements of	8
palindrome	71	tree transversal	220
replacing one with another	142	TreeList class	329
StartsWith and EndsWith		Trim method	135
comparison methods	129	TrimEnd methods	135
struct	3	True bit	98
subroutine DispArray	321	two-dimensional array	33
Substring method	122	building LcSubstring	
Swap function	14	function	321
System.Array class	26	declaration	30
		result storage	319
T			
text file	191	U	
Text Processing	147	Unicode character set. <i>See</i>	
TimeSpan data type	21	strings	

Index**355**

Unicode table	127	VB.NET	
Union	9, 238	manipulation of Bits	96
Union method	241	skip list	277
Union operation	241	VB.NET applications	97
universe	238	vertex	283
unordered array, searching	58	Vertex class	
unordered graph	284	building	285
unordered list	6	for Dijkstra's algorithms	305
upper bound		Vertices	
of array	62, 110,	in graph	283, 284, 312
	262	representing	285
utility methods		Vertices sequence in graph	284
of Hashtable class	187	Visual Studio.NET	46
V		W	
<i>value. See also</i> Boolean value	113	weight of the vertex	283
Value property		wildcards	
for DictionaryEntry object	170	Windows application	
Value types	18	bit shifting operators	107
variable-length code	327	X	
Variables		Xor operator	99
assigning the starting time		Z	
to	23	zero-based array	170
stored on heap	18		
stored on stack	18		