Table of Contents

In	troduc	tion	1
I	The	e Interview	6
1	Getti	ng Ready	7
2	Strategies For A Great Interview		
3	Conducting An Interview		
4	Probl	em Solving	23
II	Pro	blems	42
5	Primi	tive Types	43
	5.1	Computing the parity of a word	43
	5.2	Swap bits	45
	5.3	Reverse bits	46
	5.4	Find a closest integer with the same weight	47
	5.5	Compute $x \times y$ without arithmetical operators	48
	5.6	Compute x/y	50
	5.7	Compute x^y	51
	5.8	Reverse digits	52
	5.9	Check if a decimal integer is a palindrome	52
	5.10	Generate uniform random numbers	54
	5.11	Rectangle intersection	55
6	Array	rs	57
	6.1	The Dutch national flag problem	57
	6.2	Increment an arbitrary-precision integer	61

	6.3	Multiply two arbitrary-precision integers	62
	6.4	Advancing through an array	63
	6.5	Delete a key from an array	64
	6.6	Delete duplicates from a sorted array	65
	6.7	Buy and sell a stock once	66
	6.8	Buy and sell a stock twice	67
	6.9	Enumerate all primes to <i>n</i>	68
	6.10	Permute the elements of an array	70
	6.11	Compute the next permutation	73
	6.12	Sample offline data	75
	6.13	Sample online data	76
	6.14	Compute a random permutation	77
	6.15	Compute a random subset	79
	6.16	Generate nonuniform random numbers	80
	6.17	The Sudoku checker problem	82
	6.18	Compute the spiral ordering of a 2D array	84
	6.19	Rotate a 2D array	87
	6.20	Compute rows in Pascal's Triangle	89
7	String	75	91
•	7.1	Interconvert strings and integers	91
	7.2	Base conversion	93
	7.3	Compute the spreadsheet column encoding	94
	7.4	Replace and remove	95
	7.5	Test palindromicity	96
	7.6	Reverse all the words in a sentence	97
	7.7	Compute all mnemonics for a phone number	98
	7.8	The look-and-say problem	100
	7.9	Convert from Roman to decimal	101
	7.10	Compute all valid IP addresses	102
	7.11	Write a string sinusoidally	103
	7.12	Implement run-length encoding	104
	7.13	Implement the UNIX tail command	105
	7.14	Find the first occurrence of a substring	106
8	Linka	ed Lists	109
O		Merge two sorted lists	110
	8.2	Reverse a singly linked list	111
	8.3	Reverse a single sublist	111
	8.4	~	113
	8.5	Test for cyclicity	115
		** °	
	8.6	Test for overlapping lists—lists may have cycles	116
	8.7	Delete a node from a singly linked list	118
	8.8	Remove the <i>k</i> th last element from a list	118
	8.9	Remove duplicates from a sorted list	119

	8.10	Implement cyclic right shift for singly linked lists	120
	8.11	Implement even-odd merge	121
	8.12	Test whether a singly linked list is palindromic	123
	8.13	Implement list pivoting	124
	8.14	Add list-based integers	125
9	Stack	s and Queues	127
	9.1	Implement a stack with max API	127
	9.2	Evaluate RPN expressions	130
	9.3	Test a string over "{,},(,),[,]" for well-formedness	131
	9.4	Normalize pathnames	132
	9.5	BST keys in sort order	134
	9.6	Search a postings list	135
	9.7	Compute buildings with a sunset view	136
	9.8	Sort a stack	138
	9.9	Compute binary tree nodes in order of increasing depth	139
	9.10	Implement a circular queue	141
	9.11	Implement a queue using stacks	142
	9.12	Implement a queue with max API	143
10	Binar	y Trees	146
	10.1	Test if a binary tree is balanced	148
	10.2	Test if a binary tree is symmetric	149
	10.3	Compute the lowest common ancestor in a binary tree	150
	10.4	Compute the LCA when nodes have parent pointers	152
	10.5	Sum the root-to-leaf paths in a binary tree	153
	10.6	Find a root to leaf path with specified sum	154
	10.7	Compute the <i>k</i> th node in an inorder traversal	155
	10.8	Compute the successor	156
	10.9	Implement an inorder traversal with $O(1)$ space	157
	10.10	Reconstruct a binary tree from traversal data	159
	10.11	Reconstruct a binary tree from a preorder traversal with markers .	161
	10.12	Form a linked list from the leaves of a binary tree	162
	10.13	Compute the exterior of a binary tree	163
	10.14	Compute the right sibling tree	165
	10.15	Implement locking in a binary tree	166
11	Heaps	S	169
	11.1	Merge sorted files	170
	11.2	Sort an increasing-decreasing array	172
	11.3	Sort an almost-sorted array	173
	11.4	Compute the <i>k</i> closest stars	174
	11.5	Compute the median of online data	176
	11.6	Compute the k largest elements in a max-heap	177
	11.7	Implement a stack API using a heap	179

12	Search	ning	181
	12.1	Search a sorted array for first occurrence of k	183
	12.2	Search a sorted array for the first element greater than $k \dots \dots$	184
	12.3	Search a sorted array for entry equal to its index	186
	12.4	Search a cyclically sorted array	186
	12.5	Compute the integer square root	188
	12.6	Compute the real square root	189
	12.7	Search in a 2D sorted array	191
	12.8	Find the min and max simultaneously	192
	12.9	Find the <i>k</i> th largest element	194
	12.10	Compute the optimum mailbox placement	196
	12.11	Find the missing IP address	197
	12.12	Find the duplicate and missing elements	199
12	Hash '	Tables	202
13	13.1	Partition into anagrams	202
	13.2	Test for palindromic permutations	203
	13.3	Is an anonymous letter constructible?	205
	13.4	Implement an ISBN cache	207
	13.5	Compute the LCA, optimizing for close ancestors	209
	13.6	Compute the <i>k</i> most frequent queries	210
	13.7	Find the nearest repeated entries in an array	210
	13.8	Find the smallest subarray covering all values	211
	13.9	Find smallest subarray sequentially covering all values	215
	13.10	Find the longest subarray with distinct entries	217
	13.11	Find the length of a longest contained range	218
	13.11	Compute the average of the top three scores	220
	13.12	Compute all string decompositions	221
	13.14	Find a highest affinity pair	223
	13.15	Test the Collatz conjecture	224
	13.16	Implement a hash function for chess	226
	15.10	impenient a masir function for chess	220
14	Sortin		228
	14.1	Compute the intersection of two sorted arrays	229
	14.2	Implement mergesort in-place	231
	14.3	Count the frequencies of characters in a sentence	232
	14.4	Find unique elements	233
	14.5	Render a calendar	233
	14.6	Sets of disjoint intervals	235
	14.7	Compute the union of intervals	237
	14.8	Partitioning and sorting an array with many repeated entries	239
	14.9	Team photo day—1	241
	14.10	Implement a fast sorting algorithm for lists	243
	14.11	Compute a salary threshold	244

15	Binar	y Search Trees	247
	15.1	Test if a binary tree satisfies the BST property	247
	15.2	Find the first occurrence of a key in a BST	250
	15.3	Find the first key larger than a given value in a BST	252
	15.4	Find the k largest elements in a BST	253
	15.5	Compute the LCA in a BST	254
	15.6	Reconstruct a BST from traversal data	255
	15.7	Find the closest entries in three sorted arrays	258
	15.8	Enumerate numbers of the form $a + b\sqrt{2}$	260
	15.9	The most visited pages problem	262
	15.10	Build a minimum height BST from a sorted array	264
	15.11	Insertion and deletion in a BST	265
	15.12	Test if three BST nodes are totally ordered	267
	15.13	The range lookup problem	269
	15.14		271
	15.15	Count the number of entries in an interval	273
16	Recur	sion	275
	16.1	The Tower of Hanoi problem	275
	16.2	Generate all nonattacking placements of <i>n</i> -Queens	278
	16.3	Generate permutations	280
	16.4	Generate the power set	282
	16.5	Generate all subsets of size k	284
	16.6	Generate strings of matched parens	285
	16.7	Generate palindromic decompositions	286
	16.8	Generate binary trees	288
	16.9	Implement a Sudoku solver	289
	16.10	Compute a Gray code	291
	16.11	Compute the diameter of a tree	293
17	Dyna	mic Programming	296
	17.1	Count the number of score combinations	298
	17.2	Compute the Levenshtein distance	300
	17.3	Count the number of ways to traverse a 2D array	302
	17.4	Plan a fishing trip	305
	17.5	Search for a sequence in a 2D array	305
	17.6	The knapsack problem	307
	17.7	Divide the spoils fairly	309
	17.8	The bedbathandbeyond.com problem	310
	17.9	Find the minimum weight path in a triangle	312
	17.10	Pick up coins for maximum gain	313
	17.11	Count the number of moves to climb stairs	315
	17.12	Compute the probability of a Republican majority	316
	17.13	The pretty printing problem	318
	17.14	Find the longest nondecreasing subsequence	319

18	Greed	ly Algorithms and Invariants	322
	18.1	Implement Huffman coding	323
	18.2	Compute an optimum assignment of tasks	326
	18.3	Implement a schedule which minimizes waiting time	327
	18.4	The interval covering problem	328
	18.5	The 3-sum problem	331
	18.6	Find the majority element	332
	18.7	The gasup problem	334
	18.8	Compute the maximum water trapped by a pair of vertical lines	335
	18.9	Compute the largest rectangle under the skyline	337
19	Graph	ns	340
	19.1	Identify the celebrity	342
	19.2	Search a maze	343
	19.3	Paint a Boolean matrix	345
	19.4	Compute enclosed regions	347
	19.5	Degrees of connectedness—1	349
	19.6	Clone a graph	351
	19.7	Making wired connections	352
	19.8	Transform one string to another	354
	19.9	The shortest straight-line program for x^n	355
	19.10	Team photo day—2	357
	19.11	Compute a shortest path with fewest edges	358
20	Parall	el Computing	361
	20.1	Implement caching for a multithreaded dictionary	362
	20.2	Analyze two unsynchronized interleaved threads	364
	20.3	Implement synchronization for two interleaving threads	365
	20.4	Implement a thread pool	367
	20.5	Implement asynchronous callbacks	368
	20.6	Implement a Timer class	369
	20.7	The readers-writers problem	370
	20.8	The readers-writers problem with write preference	372
	20.9	Test the Collatz conjecture in parallel	372
	20.10	Design TeraSort and PetaSort	374
	20.11	Implement distributed throttling	375
21	Desig	n Problems	376
	21.1	Design a spell checker	377
	21.2	Design a solution to the stemming problem	378
	21.3	Plagiarism detector	379
	21.4	Pair users by attributes	380
	21.5	Design a system for detecting copyright infringement	381
	21.6	Design T _E X	382
	21.7	Design a search engine	382
		0	

	21.8	Implement PageRank	384
	21.9	Design a scalable priority system	385
	21.10	Create photomosaics	385
	21.11	Implement Mileage Run	386
	21.12	Implement Connexus	387
	21.13	Design an online advertising system	388
	21.14	Design a recommendation system	389
	21.15	Design an optimized way of distributing large files	390
	21.16	Design the World Wide Web	391
	21.17	Estimate the hardware cost of a photo sharing app	392
22	Hono	rs Class	393
	22.1	Compute the greatest common divisor	393
	22.2	Find the first missing positive entry ••	395
	22.3	Buy and sell a stock k times	396
	22.4	Compute the maximum product of all entries but one	397
	22.5	Compute the longest contiguous increasing subarray	399
	22.6	Rotate an array	401
	22.7	Identify positions attacked by rooks	402
	22.8	Justify text 🔮	404
	22.9	Reverse sublists k at a time \odot	406
	22.10	Implement list zipping	407
	22.11	Copy a postings list	408
		Compute the median of a sorted circular linked list	409
		Compute the longest substring with matching parens	410
	22.14	Compute the maximum of a sliding window	412
	22.15	Implement preorder and postorder traversals without recursion	413
	22.16	Compute fair bonuses	416
	22.17	Find k elements closest to the median	419
	22.18	Search a sorted array of unknown length 💿	420
	22.19	•	422
		Find the k th largest element—large n , small k	423
	22.21	Find an element that appears only once •	424
	22.22	Find the line through the most points	426
		Find the shortest unique prefix	428
		Compute the smallest nonconstructible change	430
		Find the most visited pages in a window	432
	22.26	Convert a sorted doubly linked list into a BST	433
	22.27	Convert a BST to a sorted doubly linked list	434
	22.28	Merge two BSTs	436
	22.29	Test if a binary tree is an almost BST	437
	22.30	The view from above	439
	22.31	Searching a min-first BST Searching a min-first BST	442
	22.32	Implement regular expression matching	443

22.33	Synthesize an expression	446
22.34	Count inversions	449
22.35	Draw the skyline 🍲	451
22.36	Find the two closest points	454
22.37	Measure with defective jugs	457
22.38	Compute the maximum subarray sum in a circular array 🔮	459
22.39	Determine the critical height	460
22.40	Voltage selection in a logic circuit	462
22.41	Find the maximum 2D subarray 💿	463
22.42	Trapping water 💿	466
22.43	Load balancing 🍑	467
22.44	Search for a pair-sum in an abs-sorted array	469
22.45	The heavy hitter problem 💿	472
22.46	Find the longest subarray whose sum $\leq k$ \odot	473
22.47	Degrees of connectedness—2 •	475
22.48	Compute a minimum delay schedule, unlimited resources $\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	477
22.49	Road network 💇	477
22.50	Test if arbitrage is possible	479
22.51	The readers-writers problem with fairness	481
22.52	Implement a producer-consumer queue	481
III Not	ation, Language, and Index	483
Notation		484
C++ best	practices, C++11, and C++ for Java developers	486
Index of	Terms	488