BITWISE MANIPULATION ROADMAP (SORTED + INDEXED + PATTERNS)

EASY LEVEL (1–20)

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1. Set a bit
2. Clear a bit
3. Toggle a bit
4. Check ith bit
5. Count set bits (Kernighan)
6. Check power of 2
7. Swap using XOR
8. Even or odd check
9. Uppercase ↔ lowercase via bits
10. Turn off rightmost set bit
11. Rightmost set bit position
12. log2 via shifts
13. Check one-bit difference
14. Count total set bits 1 to N
15. Binary representation
16. Add without +
17. Find MSB position
18. Find LSB position
19. Bitwise NOT explanation
20. Left vs right shift

MEDIUM LEVEL (21–50)

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21. Single number (others twice)
22. Two unique numbers
23. Number once others thrice
24. Missing number XOR
25. Duplicate number XOR
26. Two-sum XOR variant

27. Subset mask generation
28. Generate all subsets
29. Generate string combinations
30. Decimal-binary-mask tricks
31. Nth magic number
32. Fast exponentiation
33. Fast multiplication
34. Reverse bits
35. Alternating bits check
36. Hamming distance
37. Total Hamming distance
38. Count bits DP
39. Max XOR pair (Trie)
40. Max XOR subarray
41. Min XOR pair
42. Duplicate letters using mask
43. First repeated char mask
44. Toggle char case using bits
45. Frequency via bits
46. Bit rotate
47. Binary GCD
48. LCM using bit-GCD
49. Divide without /
50. Multiply using bits

HARD LEVEL (51–85)

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51. TSP Bitmask DP
52. Assignment problem bit DP
53. Subset sum bit DP
54. Partition array bit DP
55. Min XOR pairings

56. Shortest Hamiltonian path
57. Gray code generate
58. Gray to binary
59. Gray sequence recursion
60. K-th Gray code
61. Range AND
62. Range OR
63. Range XOR
64. Max XOR via Trie
65. Max XOR with limit
66. XOR subset sum
67. XOR of all subsets
68. AND of all subsets
69. Graph adjacency mask
70. Binary trie insert
71. Trie max XOR query
72. Trie min XOR query
73. Trie delete
74. Highest power of $2 \leq N$
75. Next power of 2
76. Previous power of 2
77. Bitwise division
78. Bit compression subsets
79. Graph bipartite using bitset
80. Bitset sieve optimization
81. Smallest XOR subset
82. Maximum XOR subset (linear basis)
83. Unique binary string length N
84. Min flips to reach OR target
85. Hard mask graph DP

BONUS (86–90)

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86. Java BitSet usage
87. BitSet vs boolean array
88. Custom mask uppercase/lowercase
89. Bit ops with chars
90. Permission system via bitmask