🧠 Bit Manipulation – Pattern-Wise Checklist (DSA Game Mode 🎮)

🔓 LEVEL 0: Rules of the Game

- [ ] Solve in **order (Easy → Medium → Hard)**
- [ ] No skipping problems
- [ ] After each level:
  - [ ] Write down **new bit tricks**
  - [ ] Re-solve 1 problem without help
- [ ] If stuck > 30 min → read hint → retry later

🟢 LEVEL 1: Basics of Bits (Binary & Operators)

Goal: Become comfortable with binary representation & basic operators

Easy

- [ ] LC 191 – Number of 1 Bits
- [ ] LC 338 – Counting Bits
- [ ] LC 231 – Power of Two
- [ ] LC 342 – Power of Four

Medium

- [ ] LC 405 – Convert a Number to Hexadecimal
- [ ] LC 476 – Number Complement

Level Clear Condition ✅

- [ ] Can explain AND, OR, XOR, SHIFT in own words
- [ ] Can manually convert decimal → binary

🟢 LEVEL 2: XOR Magic 🪄 (Most Important)

Goal: Master XOR cancellation logic

Easy

- [ ] LC 136 – Single Number
- [ ] LC 461 – Hamming Distance

Medium

- [ ] LC 260 – Single Number III
- [ ] LC 477 – Total Hamming Distance

Hard

- [ ] LC 421 – Maximum XOR of Two Numbers in an Array

Level Clear Condition ✅

- [ ] Instantly recognize XOR-based problems
- [ ] Know why a ^ a = 0

🟢 **LEVEL 3: Bit Masking (Flags & States)**

Goal: Use bits to represent sets and states

Easy

- [ ] LC 1356 – Sort Integers by Number of 1 Bits

Medium

- [ ] LC 78 – Subsets
- [ ] LC 784 – Letter Case Permutation

Hard

- [ ] LC 187 – Repeated DNA Sequences
- [ ] LC 318 – Maximum Product of Word Lengths

Level Clear Condition ✅

- [ ] Can set / unset / toggle bits confidently
- [ ] Understand bitmask as set representation

🟢 LEVEL 4: Bit Tricks & Optimizations ⚡

Goal: Reduce unnecessary loops using smart tricks

Easy

- [ ] LC 762 – Prime Number of Set Bits

Medium

- [ ] LC 201 – Bitwise AND of Numbers Range
- [ ] LC 1318 – Minimum Flips to Make a OR b Equal to c

Hard

- [ ] LC 1545 – Find Kth Bit in Nth Binary String

Level Clear Condition ✅

- [ ] Know n & (n - 1) removes lowest set bit
- [ ] Can count set bits efficiently

🟢 LEVEL 5: Subsets & Combinations via Bits

Goal: Generate power sets using bit logic

Medium

- [ ] LC 90 – Subsets II
- [ ] LC 1239 – Maximum Length of a Concatenated String with Unique Characters

Hard

- [ ] LC 1681 – Minimum Incompatibility

Level Clear Condition ✅

- [ ] Comfortable with for mask in range(1 << n)
- [ ] Understand submask enumeration

🟢 LEVEL 6: Trie + Bit Manipulation (Advanced)

Goal: Combine data structures with bit logic

Medium

- [ ] LC 1707 – Maximum XOR With an Element From Array

Hard

- [ ] LC 1938 – Maximum Genetic Difference Query

Level Clear Condition ✅

- [ ] Can build a binary trie
- [ ] Understand greedy XOR traversal

🔴 LEVEL 7: Hardcore Bitwise Thinking 🧠🔥

Goal: Reach interview + competitive coding level

Hard

- [ ] LC 1611 – Minimum One Bit Operations to Make Integers Zero
- [ ] Codeforces – Submask Enumeration Problems
- [ ] AtCoder – Bit DP Intro Problems

Final Boss Defeated 🏆

- [ ] Can combine math + bits
- [ ] Can derive solution without memorizing tricks

📌 BONUS TRACKS (Optional Power-Ups)

- [ ] Re-solve 5 random problems without seeing code
- [ ] Teach XOR logic to someone else
- [ ] Write your own bit manipulation cheat sheet