C# Programming Tricks Cheat Sheet

1. Fast Exponentiation (Binary Powering): a^n in O(log n).
   - If n is even: a^n = (a^(n/2))^2; If odd: a * a^(n-1).

2. Bit Tricks:
   - Remove last set bit: n & (n-1).
   - Check power of 2: n > 0 && (n & (n-1)) == 0.
   - Count set bits: keep applying n & (n-1).
   - Get lowest set bit: n & -n.

3. Modular Arithmetic:
   - (a * b) % m = ((a % m) * (b % m)) % m.
   - (a + b) % m = ((a % m) + (b % m)) % m.
   - (a - b) % m = ((a % m) - (b % m) + m) % m.

4. GCD/LCM:
   - Euclidean Algorithm O(log(min(a, b))).
   - lcm(a, b) = a / gcd(a, b) * b (avoid overflow).

5. Factorial & nCr:
   - Precompute factorials mod M.
   - Use modular inverse for division under modulo.

6. Swap without temp:
   - a = a ^ b; b = a ^ b; a = a ^ b;

7. Count digits: digits(n) = floor(log10(n)) + 1.

8. Fast Fibonacci:
   - Matrix exponentiation O(log n).
   - Doubling formulas:
     F(2k) = F(k)*(2F(k+1) - F(k)).
     F(2k+1) = F(k+1)^2 + F(k)^2.

9. Prefix/Suffix Tricks:
   - Prefix sums, GCD/LCM arrays, bitmask DP.

10. Overflow-safe multiplication:
    - Use BigInteger or repeated addition method.