Sieve of Eratosthenes and Euclidean Algorithm

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Sieve of Eratosthenes Example

- **Problem**: Find primes up to 10: [2, 3, 4, 5, 6, 7, 8, 9, 10].
- Mark multiples of primes as non-prime.
- **Step-by-Step**:
  1. Start with 2, mark 4, 6, 8, 10.
  2. Next 3, mark 6, 9.
  3. Result: [2, 3, 5, 7].

Sieve of Eratosthenes

- Mark multiples of each prime starting from i^2.
- Only check PLEASE check up to $\sqrt{n}$.
- **Time Complexity**: $O(n \log \log n)$.
- **Space Complexity**: $O(n)$.

Euclidean Algorithm Example

- **Problem**: Find GCD of 48 and 18.
- Use division to reduce numbers.
- **Step-by-Step**:
  1. $48 = 2 \times 18 + 12$
  2. $18 = 1 \times 12 + 6$
  3. $12 = 2 \times 6 + 0$
  4. GCD = 6

Euclidean Algorithm

- Repeatedly divide and take remainder until remainder is 0.
- GCD is last non-zero remainder.
- **Time Complexity**: $O(\log \min(a, b))$.
- **Space Complexity**: $O(1)$.