1. Which algorithm is used to find all prime numbers up to a given limit efficiently?
   1. **Sieve of Eratosthenes**
   2. Sieve of Sundaram
   3. Fermat's little theorem
   4. Euclid's algorithm
2. What is the time complexity of the Sieve of Eratosthenes for finding prime numbers up to 'n'?
   1. O(n)
   2. **O(n logn log n)**
   3. O(n^2)
   4. O(sqrt(n))
3. In the Sieve of Eratosthenes, which number is marked as prime first?
   1. 1
   2. **2**
   3. 3
   4. 0
4. What is the primary purpose of the segmented sieve algorithm?
   1. **Finding prime numbers in a given range**
   2. Finding prime factors of a number
   3. Generating random prime numbers
   4. Finding prime numbers up to 'n'
5. Which of the following statements is true about the Sieve of Sundaram?
   1. It finds all prime numbers up to 'n'.
   2. It works efficiently for large prime numbers.
   3. **It produces primes smaller than (2\*x + 2) for a given number 'x'.**
   4. It uses Fermat's little theorem for prime testing.
6. What is the primary purpose of the extended Euclidean algorithm?
   1. Finding prime numbers
   2. **Solving Diophantine equations**
   3. Calculating modular exponentiation
   4. Computing Euler's totient function
7. Which algorithm is used to find the greatest common divisor (GCD) of two numbers?
   1. Sieve of Eratosthenes
   2. Sieve of Sundaram
   3. Fermat's little theorem
   4. **Euclid's algorithm**
8. What is the GCD of 48 and 60?
   1. 8
   2. **12**
   3. 24
   4. 6
9. Which theorem is used to calculate modular inverses when 'p' is a prime number?
   1. Euler's Totient Theorem
   2. **Fermat's Little Theorem**
   3. Chinese Remainder Theorem
   4. Extended Euclidean Theorem
10. What is Euler's Totient Function, denoted as φ(n), used for?
    1. Finding prime numbers
    2. **Counting the number of positive integers less than 'n' that are coprime to 'n'**
    3. Calculating modular inverses
    4. Solving Diophantine equations
11. If φ(10) is the Euler's Totient Function of 10, what is its value?
    1. 1
    2. 2
    3. **4**
    4. 5
12. What is the value of φ(1) according to Euler's Totient Function?
    1. **0**
    2. 1
    3. 2
    4. Undefined
13. Which theorem states that if 'p' is a prime number, then for any integer 'a' not divisible by 'p', a^(p-1) ≡ 1 (mod p)?
    1. Euler's Totient Theorem
    2. **Fermat's Little Theorem**
    3. Chinese Remainder Theorem
    4. Wilson's Theorem
14. What is the modular inverse of 6 modulo 11 using Fermat's Little Theorem?
    1. 2
    2. 4
    3. **7**
    4. 9
15. Which function is used to calculate the largest power of a prime 'p' that divides 'n!'?
    1. **largestPower(n, p)**
    2. power(x, y, p)
    3. modFact(n, p)
    4. modInverse(n, p)
16. What is the time complexity of modular exponentiation using the binary exponentiation method?
    1. O(n)
    2. **O(log n)**
    3. O(n log n)
    4. O(2^n)
17. In the context of the Diophantine equation ax + by = c, what are 'a', 'b', and 'c'?
    1. Prime numbers
    2. **Coefficients**
    3. Modular inverses
    4. GCD values
18. Which algorithm is primarily used to find integral solutions to Diophantine equations?
    1. **Extended Euclidean algorithm**
    2. Sieve of Eratosthenes
    3. Fermat's little theorem
    4. Modular exponentiation
19. In the equation ax + by = c, when is it possible to find integral solutions?
    1. When a and b are coprime
    2. When a and b are prime
    3. When c is even
    4. **When c is a multiple of GCD(a, b)**
20. What is the primary use of Fermat's little theorem?
    1. Finding prime numbers
    2. Solving Diophantine equations
    3. **Calculating modular inverses**
    4. Calculating Euler's totient function
21. In Fermat's little theorem, if 'p' is a prime number and 'a' is not divisible by 'p', what does a^(p-1) ≡ 1 (mod p) imply?
    1. a is prime
    2. a is a multiple of p
    3. a is a primitive root modulo p
    4. **a has an inverse modulo p**
22. What is the modular inverse of 5 modulo 7 using Fermat's little theorem?
    1. 1
    2. 2
    3. 3
    4. **6**
23. What is the primary advantage of using Fermat's little theorem for modular inverses?
    1. It works for any value of 'p'.
    2. It works efficiently for large values of 'n'.
    3. **It works efficiently for large prime values of 'p'.**
    4. It does not require the extended Euclidean algorithm.
24. What is the primary use of the Euler's totient function (φ(n))?
    1. Calculating modular inverses
    2. Generating prime numbers
    3. Counting the number of primes up to 'n'
    4. **Counting the positive integers coprime to 'n'**
25. In the context of Euler's totient function, what does φ(1) represent?
    1. **0**
    2. 1
    3. 2
    4. Undefined
26. What is the value of φ(12) according to Euler's totient function?
    1. 1
    2. 4
    3. **6**
    4. 12
27. In the context of number theory, what is a totient?
    1. A prime number
    2. A power of 2
    3. **A positive integer coprime to another integer**
    4. An even number
28. Which of the following statements is true about the Chinese Remainder Theorem?
    1. It is used to find modular inverses.
    2. **It can be applied when 'p' is not prime.**
    3. It is used to solve Diophantine equations.
    4. It is used to find all prime numbers up to 'n'.
29. What is the primary use of the Chinese Remainder Theorem (CRT)?
    1. Solving Diophantine equations
    2. Finding prime numbers
    3. Calculating modular inverses
    4. **Solving systems of congruences**
30. What is the primary purpose of the modular inverse in number theory?
    1. Finding prime numbers
    2. **Solving Diophantine equations**
    3. Calculating Euler's totient function
    4. Calculating modular exponentiation
31. In the context of number theory, what does a remainder represent?
    1. The quotient of two numbers
    2. The product of two numbers
    3. **The result of a division operation**
    4. The difference between two numbers