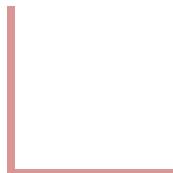


Mathematical Foundations for Computer Applications

Prime numbers

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Prime Numbers

- Prime numbers are natural numbers that are divisible by only 1 and the number itself.
- Prime numbers are positive integers greater than 1 with exactly two factors, 1 and the number itself.
- Example-2, 3, 5, 7, 11, 13, etc.
- Note: 1 is neither prime nor composite.

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Prime Numbers

Properties of Prime Numbers

- A prime number is a whole number greater than 1.
- It has exactly two factors, that is, 1 and the number itself.
- There is only one even prime number, that is, 2.
- Any two prime numbers are always co-prime to each other.
- Every number can be expressed as the product of prime numbers.

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Prime Numbers

- **Finding Prime Numbers Using Factorization**
- **Step 1:** First find the factors of the given number
- **Step 2:** Check the number of factors of that number
- **Step 3:** If the number of factors is more than two, it is not a prime number.
- **Examples:**
 - a) $36=2 \times 3 \times 2 \times 3$. So, the factors of 36 here are 1, 2, 3, 4, 6, 9, 12, 18, and 36. Since the number of factors of 36 is more than 2, it is **not a prime number**
 - b) $19 = 1 \times 19$. there are two factors of 19. Hence, it is a **prime number**.

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Prime Numbers

- To check whether a **large number** is a prime number or not,
- Step 1: Check the units place of that number. If it ends with 0, 2, 4, 6 and 8, it is not a prime number.
- Step 2: Take the sum of the digits of that number. If the sum is divisible by 3, the number is not a prime number.
- Step 3: After confirming the falsity of steps 1 and 2, find the square root of the given number.

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Prime Numbers

- Step 4: Divide the given number by all the prime numbers below its square root value.
- Step 5: If the number is divisible by any of the prime numbers less than its square root, it is not a prime number; otherwise, it is prime.
- **Exception:** If a large number is ending with 5, then it is always divisible by 5. Hence, it is not a prime number

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Prime Numbers-Example

- a) 234256 --Since the unit digit of 234256 is 6, it is not a prime number.
 - b) 26577 --The unit digit of this number is not 0, 2, 4, 6 or 8
 - Sum of digits = $2 + 6 + 5 + 7 + 7 = 27$, divisible by 3, 26577 is not a prime number.
 - c) 2345 -- Number ends with 5, divisible by 5. 2345 is not a prime number
 - d) 797 – It is prime number
 - e) Check 21577 , 176543 , 23451, 98760
- <https://www.wolframalpha.com/input/?i=is+176543+prime%3F>

Applications of Number Theory

- Number theory has important applications in **computer organization and security, coding and cryptography, random number generation, hash functions, and graphics**. Conversely, number theorists use computers in factoring large integers, determining primes, testing conjectures, and solving other problems.



THANK YOU

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