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**Project Report of Prime Number Analyzer Report**

**Prime Number Analyzer Report**

**1. Introduction** The Prime Number Analyzer is a Python-based tool designed to perform three key mathematical operations related to prime numbers:

* Checking if a given number is prime.
* Finding the prime factors of a given number.
* Generating all prime numbers up to a given limit.

This project serves as an educational and practical tool to enhance understanding of prime numbers and their properties.

**2. Features and Functionality**

* **Prime Check:** Determines if a number is prime by checking divisibility up to its square root.
* **Prime Factorization:** Computes the prime factors of a given number.
* **Prime Number Generation:** Lists all prime numbers up to a user-defined limit.

**3. Implementation** The program is implemented in Python using efficient mathematical algorithms:

* The **is\_prime(n)** function checks if a number is prime by testing divisibility up to its square root.
* The **prime\_factors(n)** function finds the prime factorization of a number by iterating through possible divisors.
* The **generate\_primes(end)** function uses list comprehension to generate all prime numbers up to a specified limit.

**4. User Interaction** The user interacts with the program via a simple command-line interface:

1. The user enters a number to check for primality.
2. The program outputs whether the number is prime.
3. The program then finds and displays its prime factors.
4. The user inputs a limit to generate all prime numbers up to that value.
5. The program displays the list of primes within the specified range.

**5. Conclusion** The Prime Number Analyzer is a simple yet effective tool to explore prime numbers and their characteristics. It is useful for students, educators, and anyone interested in number theory. The project can be extended by incorporating additional features such as optimized prime-checking algorithms or graphical representations of prime distributions.