DRS: Project Submission

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CS689-01

Distributed Software Systems

Introduction

Prime Factorization

Prime numbers are a set of all numbers that can only be equally divided by one and themselves. Examples of prime numbers include 2, 3,5 and 7. What very little people know is the importance of prime numbers and how the mathematical logic behind them has resulted in vital applications in our modern history today. Mathematician have been able to show that any whole number can be expressed as a product of primes. Only primes and nothing else. This rule is called the prime factorization rule.

The task of prime factorization may seem like a cool mathematical oddity at first but as the number to be factorized gets bigger, it gets more challenging. The best mathematicians and scientist have been able to determine that it is totally impossible to find a completely efficient algorithm for factorizing large numbers into primes. There is some limit to the size of number we can factorize into prime numbers. This fact is absolutely key to modern computer security. Modern encryption algorithms exploit the fact we can easily take two large primes and multiply them together to get a much larger number but that no computer has yet been created that can take the much larger number and very quickly figure out which of the two primes went into making it.

Pollards Rho Algorithm of Factorization

The Pollard’s Rho prime factorization is very fast for large composite numbers with small factors. This paper will describe our distributed system which performs prime factorization on large numbers using Pollard’s Rho algorithm. Let us look at some of the key concepts employed.

* Two numbers are said to congruent modulo n (x = y modulo n) if
  + Each leave the same reminder when divided by n
  + The absolute of their difference is a multiple of n
* Birthday Paradox: When assessing a set of people, the probability of two persons having the same birthday is high.
* Floyd’s Cycling Algorithm. If the tortoise and hare start at the same point and move in a cycle, as such as the hare goes twice the speed of the tortoise, they are bound/sure to meet at some point.

Our Algorithm is shown below

Start with random x and c. Take y equal to x and f(x) = x2 + c.

While a divisor isn’t obtained

Update x to f(x) (modulo n) [Tortoise Move]

Update y to f(f(y)) (modulo n) [Hare Move]

Calculate GCD of |x-y| and n

If GCD is not 1

If GCD is n, repeat from step 2 with another set of x, y and c

Else GCD is our answer

Once we are given a number N, our system generates two sets of random numbers using a random number generator. The two random Numbers are set to variables x and c. Variable x is copied into a variable named y. While a divisor is not yet found, the tortoise move is performed on x and the hare moves is performed on y. The greatest common denominator of the difference of x-y and n is computed.

how your system solves the  
problem, and testing you performed to confirm its effectiveness

Concepts (Background)

a brief discussion of the distributed systems concepts pertinent to your  
system and how they apply

Layered Architectural Style

Wrappers?

Threads in distributed System.

Iterative Server or Concurrent Server

Communication? Simple transient messaging with sockets? TCP sockets

Multicasting?

Naming?

Synchronization and co-ordination

Design and Methodology

describe the architecture of your system, design considerations,  
design of your testing methodology and justification for all

Results

data produced by your testing and analysis – how did changing parameters affect  
performance?

Creating a large

Conclusion

 final analysis, “future work” (i.e. ways your system would be expanded) and wrap  
things up

Appendix A

software dependencies (libraries, OS, compiler, etc) and compile/install instructions

Appendix B

Any raw data or more-detailed data

References

https://www.extremetech.com/extreme/219570-what-are-prime-numbers-and-why-are-they-so-vital-to-modern-life

https://www.geeksforgeeks.org/pollards-rho-algorithm-prime-factorization/