**Project: Multithreaded Programming with Pthreads**

This project demonstrates the use of the pthreads API to write multithreaded programs in C. It consists of three parts:

1. Computing PI with threads using data parallelism techniques
2. Computing Fibonacci numbers with threads using functional parallelism
3. Printing words using **sched\_yield()** for thread synchronization

**Part A: Computing PI With Threads**

This part of the project explores the use of threads to compute the value of PI using the Monte Carlo method. The program **proj2a.c** computes PI by dividing the total number of sample points that fall within a circle of radius 0.5 inscribed in a square of side 1 by the total number of sample points generated. This ratio, multiplied by 4, gives an approximation of PI.

To build and run the project:

shCopy code

$ gcc proj2a.c -lpthread -o proj2a $ ./proj2a <sample\_points> <num\_threads>

**<sample\_points>** represents the total number of sample points generated, and **<num\_threads>** represents the number of threads used for the computation.

**Part B: Computing Fibonacci Numbers With Threads**

This part of the project generates the Fibonacci series using the pthreads library. The program **proj2b.c** creates a child thread that generates the Fibonacci numbers and stores them in a shared data structure. When the child thread finishes execution, the parent thread outputs the generated Fibonacci sequence.

To build and run the project:

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$ gcc proj2b.c -lpthread -o proj2b $ ./proj2b <num\_fibonacci\_numbers>

**<num\_fibonacci\_numbers>** represents the number of Fibonacci numbers that the program will generate.

## Part C: Printing Words With sched\_yield()

This part of the project prints words from a given phrase using two threads, one for words starting with a vowel and another for words starting with a consonant. The **proj2c.c** program takes a phrase of unspecified length as input and creates two threads that take turns printing the words of the phrase.

To build and run the project:

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$ gcc proj2c.c -lpthread -o proj2c $ ./proj2c <phrase>

**<phrase>** represents the input phrase to be processed by the program.

## Notes

* Make sure to run the programs on a compatible environment, as specified in the original instructions.
* To measure the execution time of the programs, you can use the **time** command on Unix-based systems:

shCopy code

$ time ./proj2a <sample\_points> <num\_threads>

* For timing results and plotting the data, use an Excel-like application or any other suitable software.

**Conclusion**

This project demonstrates the use of the pthreads library in C to implement multithreaded programs for various tasks:

1. Computing PI using the Monte Carlo method (Part A)
2. Generating Fibonacci numbers (Part B)
3. Printing words from a given phrase (Part C)

Each part of the project uses threads in different ways, such as data parallelism, functional parallelism, and thread synchronization. The programs provided in this README can be compiled and executed using the provided instructions. Additionally, you can explore the performance of these programs by measuring their execution time and analyzing the results.