Assignment 1 Design

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1 Introduction

In this assignment, we will be using a provided Monte Carlo estimation C program to create interesting graphs with the data outputted by the program. We will be using gnu-plot to plot data and create these graphs.

2 Psuedocode

2.1 Monte Carlo Visualization

This section shows the process for the first plot, which displays how many points in a Monte Carlo simulations fall within a circle of radius 1 centered around the origin. Dividing the number of inner points by the number of outer points estimates π.

```
make required files
run monte carlo with a high n # of points, direct output into output.dat
use awk on output.dat to print only 3rd and 4th columns with x, y coords
direct output of above into temp.dat
remove the column headers ("x", "y") using tail, put in coordinates.dat
use awk to separate coordinates.dat into points that either:
    exceed 1 in distance from origin -> greaterthan.dat
    are lesser then 1 in distance from origin -> lessthan.dat
use gnuplot to plot lessthan.dat and greaterthan.dat in the same graph :
    also plot the line sqrt(1-x^2) to divide outer and inner dots
```

2.2 Error Visualization

The next plot shows the difference between the estimation of PI as determined by the Monte Carlo method and the actual value of π. This graph uses a Logarithmic scale in the X-axis, with the errors being represented (linearly) in the y axis. This will follow a similar process to plot #1 (up to a certain point).

```
loop n times (about 5):
    run monte carlo with random seed using a random number generator
    place output of monte carlo in a file (output.dat)
    seperate out column 2 containing π estimation using awk
    remove header using tail
    determine difference between estimation and actual value of π:
        differences should be put into a text file (differences.dat)
    use gnuplot to plot the difference in estimation and actual value:
        change gnuplot to show a logarithmic x-scale
```

2.3 Variations in converging to π

The final plot will the distribution of final results of monte_carlo. This will include running Monte Carlo with a set number of iterations but with different seeds to show how accurately the Monte Carlo estimation converges to π.

```
loop n times where n is at least 100:
    run monte carlo with random seed with 1000 iterations
    seperate out column 2 containing π estimation using awk
    Use tail to obtain last element (final estimation), append to file.dat
use awk to seperate data from file.dat into different ranges:
    use wc to count how many elements are in each range
    use awk again to print the result of wc in a printable format
use gnuplot to plot the result of each iteration of the loop
```