DESIGN

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1 Program Description

The purpose of the program is to estimate π. This program generates random points in a square with side l and the area of the square will be l^2. The area of a quadrant of a circle with radius l is $\frac{\pi l^2}{4}$. The ratio of these areas is $\frac{\pi}{4}$. We will use the number of points to represent the area. The monte-carlo.c is provided by Dr. Long and we will write a bash script using gnuplot the create two figures to estimate pi and find a decent number of iterations for the estimation.

2 Files to be included in directory asgn1:

1. **plot.sh**: This bash script produces the Monte Carlo method plots using gnuplot. This script will produce plots similar to Figures 2, 3.

2. **Makefile**: This file is provided and directs the compilation process of the Monte Carlo program.

3. **monte-carlo.c**: This file is provided and contains the implementation of the Monte Carlo program.

4. **README.md**: Describe how to use the script and Makefile.

5. **DESIGN.pdf**: Describes design for the program with pseudocode.

6. **WRITE_UP.pdf**: Describes how the program works in detail, codes included.

3 Pseudocode / Structure

1. π **estimation:**

```
monte-carlo -> 800 data points
AWK data points -> data.0 if point outside the circle
AWK data points -> data.1 if point inside the circle
Generate circle data -> circle.data
```

```
GNUplot plots circle.data
GNUplot plots data.0
GNUplot plots data.1
```

2. **Monte Carlo Error Estimation:**

```
calculates the actual PI
monte-carlo -> 65536 data points
for seed in seeds:
    monte-carlo -> estimated pi
    error = PI-pi
    AWK error >> error.dat
GNUplot plot error.dat
```

4   Credit

I attended Omar's section on 1/18/23, which helped review some bash commands and gave me general guidance on the assignment.