# Assignment 1 Design

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Program Description

This bash program utilizes the Monte Carlo method and gnuplot to create pdfs of two different plots. The plots display the data produced by monte_carlo.c.

1 plot.sh

Purpose: This bash script uses the provided Monte Carlo file to generate data and produce the plots similar to the given figures using gnuplot. The images below show the figures and an example output of running ./monte_carlo.

Monte Carlo Error Estimation
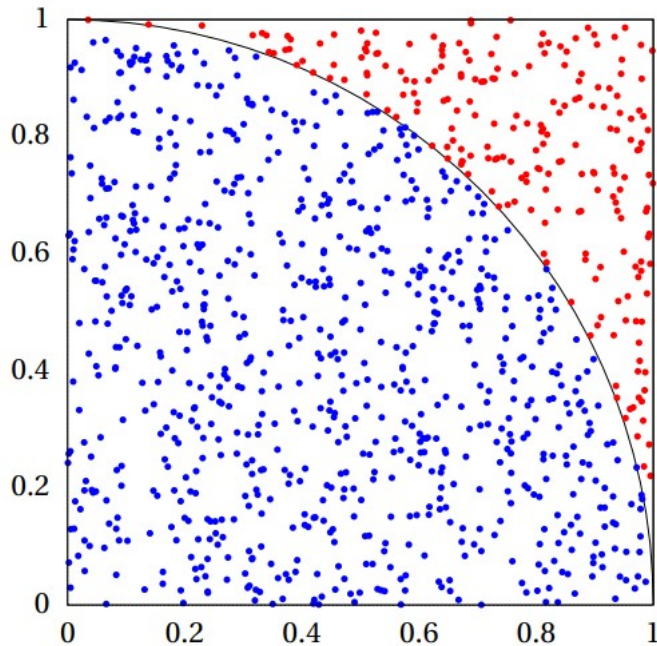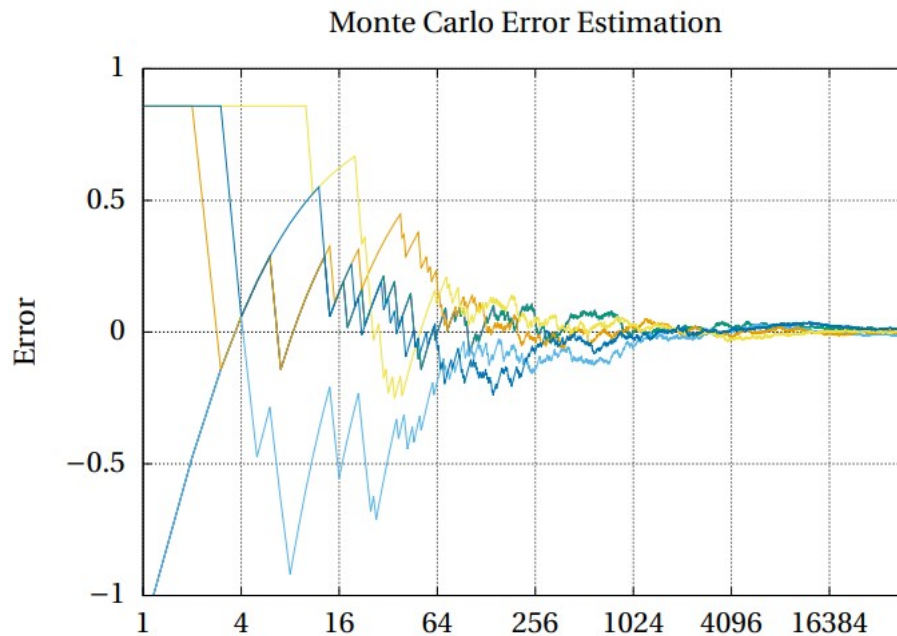
Output for the monte_carlo program

```
$ ./monte_carlo -n 10
 Iteration        Pi                    x                    y  circle
         0         4            0.445822            0.55245        1
         1         4            0.772659           0.506885        1
         2   2.66667            0.999439          0.0812311        0
         3         3            0.727855           0.515805        1
         4       3.2            0.199699           0.390919        1
         5   3.33333            0.579692           0.536917        1
         6   3.42857            0.358613           0.367796        1
         7       3.5            0.241639           0.905172        1
         8   3.55556            0.974999          0.0754683        1
         9       3.2            0.862372           0.706275        0
```

Pseudocode:

Remove .o files using make clean.
Compile using make monte_carlo.

In order to graph plot 1:
Run the monte_carlo program with 1000 iterations and print the columns for x, y and circle to a temporary dat file.
Using gnuplot,
    Set the first row to titles in order to skip it when plotting.
    Output the plot to a pdf.
    Label the plot, x and y axes.

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The x and y range are both 0 to 1.

The plot is a square.

Define the palette to make points with 0 in the circle column red and 1 blue. Points within the circle will be blue and outside will be red.

Remove the color box on the side.

Create the line with a radius of 1 from the origin using a circle object.

Plot the temporary dat file with dots using the defined palette. It has no title.

In order to graph plot 2:

Run the monte_carlo program five times with 65,536 iterations and five different seeds. For each data set, print the columns for iterations and the error (estimated pi minus pi) to different temporary dat files.

Using gnuplot,

Set the first row to titles in order to skip it when plotting.

Output the plot to a pdf.

Label the plot, x (iterations) and y (error) axes.

The x range is 1 to 65,536, and the y range is both -1 to 1.

The x axis has tics evenly spaced but with numbers 4 to the power of 0 through 7.

The y axis has tics at increments of 0.5.

Set the grid.

Plot the five temporary dat files on the same plot with lines and no title.

2   monte_carlo.c

Purpose: This is a given file containing the implementation of the Monte Carlo method.

3   Makefile

Purpose: This is a given file that is used to clean, format, and compile the program.