CS6233

Midterm – Part2

Programming Problem

1 hour, 25 minutes

10 points

Please submit your C-code for the following programming problem via the assignment page at NYU classes before the allotted time expires.

This problem is **open book, notes, class page, man pages, etc.**

You must **work alone** and may not consult or seek help from others; locally, remotely, via internet forums, etc.

You may perform your work on a Linux virtual machine or a Linux laptop.

You shall checkout with the teaching assistant before exiting the zoom meeting.

Programming problem:

Write a program that calculates the area of a circle with unit radius (i.e. $area = \pi r^2 = \pi$). This can be achieved by enclosing a circle inside a square of length 2 units.

Your program's main process shall create a child process in order to speedup the computations. Both processes (the parent and child) shall share only one variable (an integer, lets' call it `counter`) and the corresponding synchronization variable (e.g. a semaphore). **Do not use atomic integers**.

Each of the processes shall generate 1,000,000 random points, each with an *(x,y)* coordinate, with *x* and *y* ranging between -1 and 1. Each process shall then compute whether the point is inside the circle or not (it may do so by computing the radius $r = \sqrt{x^2 + y^2}$ and evaluating if it's <=1) and immediately increment the shared integer (`counter`) variable whenever the point is inside the circle, i.e. **updates shall take place immediately after evaluating a point and NOT wait for the entire 1,000,000 points to be computed**.

After the parent process is done with computing its 1,000,000 points, it shall wait for the child process to exit (at such point 2,000,000 points would have updated) and print the area of the circle as the $4 \times \frac{points\ inside}{total\ points}$, i.e. the area of the rectangle (2 units x 2 units) multiplied by the percentage of points that are inside the circle.