

CMSC714 – Fall 2006
Homework 1 (due September 19)

Identify correctness/performance problems in the MPI program given at <http://www.cs.umd.edu/~hollings/cs714/f06/hw1.c> , which is supposed to calculate the approximation of the number pi by a Monte Carlo simulation. For each defect found, describe briefly (1) why it is considered a defect, (2) which of the defect types presented in the lecture it belongs to (or it belongs to none), and (3) how it can be fixed.

```
#include <mpi.h>
#include <stdio.h>
#include <stdlib.h>
#include <time.h>

#define N 1000003L

int main()
{
    long n, k, i;
    int rank, size;
    double x, y;
    MPI_Init(NULL, NULL);
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
    MPI_Comm_size(MPI_COMM_WORLD, &size);
    srand(time(NULL));
    n = N;
    k = 0;
    for (i=0; i<n/size; i++) {
        char inside;
        x = rand()/((double)RAND_MAX);
        y = rand()/((double)RAND_MAX);
        if (x * x + y * y < 1.0) {
            inside = 1;
        }
        else {
            inside = 0;
        }
        if (rank == 0) {
            int j;
            if (inside == 1) k = k + 1;
            for (j=1; j<size; j++) {
                MPI_Status status;
                MPI_Recv(&inside, 1, MPI_CHAR, j, 0, MPI_COMM_WORLD, &status);
                if (inside == 1) k = k + 1;
            }
        }
        else {
            MPI_Send(&inside, 1, MPI_CHAR, 0, 0, MPI_COMM_WORLD);
        }
    }
    if (rank == 0) {
        printf("%f\n", 4.0 * k / ((double)n));
    }
    return 0;
}
```