CSCI596 Assignment 2—Message Passing Interface—Answer

Program: `global_avg.c`

```
#include "mpi.h"
#include <stdio.h>
int nprocs;  /* Number of processes */
int myid;    /* My rank */

double global_sum(double partial) {
  MPI_Status status;
  int bitvalue, partner;
  double mydone, hisdone;

  mydone = partial;
  for (bitvalue=1; bitvalue<nprocs; bitvalue *= 2) {
    partner = myid ^ bitvalue;  /* XOR flips the l-th bit */
    MPI_Send(&mydone, 1, MPI_DOUBLE, partner, bitvalue, MPI_COMM_WORLD);
    MPI_Recv(&hisdone, 1, MPI_DOUBLE, partner, bitvalue, MPI_COMM_WORLD, &status);
    mydone += hisdone;
  }
  return mydone;
}

int main(int argc, char *argv[]) {
  double partial, sum, avg;
  double cpu1,cpu2;

  MPI_Init(&argc, &argv);
  MPI_Comm_rank(MPI_COMM_WORLD, &myid);
  MPI_Comm_size(MPI_COMM_WORLD, &nprocs);
  partial = (double) myid;
  printf("Node %d has %le\n", myid, partial);
  cpu1 = MPI_Wtime();
  sum = global_sum(partial);
  cpu2 = MPI_Wtime();
  if (myid == 0) {
    avg = sum/nprocs;
    printf("Global average = %le\n", avg);
    printf("Execution time (s) = %le\n", cpu2-cpu1);
  }
  MPI_Finalize();
  return 0;
}
```

Output

```
Node 0 has 0.000000e+00
Node 1 has 1.000000e+00
Node 2 has 2.000000e+00
Node 3 has 3.000000e+00
Node 5 has 5.000000e+00
Node 6 has 6.000000e+00
Node 4 has 4.000000e+00
Node 7 has 7.000000e+00
Global average = 3.500000e+00
Execution time (s) = 6.477118e-03
```

```
Node 0 has 0.000000e+00
Node 1 has 1.000000e+00
Node 2 has 2.000000e+00
Node 3 has 3.000000e+00
Global average = 1.500000e+00
Execution time (s) = 6.828308e-04
```