Parallel Computing Assignment (due Nov. 14th)

1. Write a python code using mpi4pi, which can send a message in a ring:
   a. process 0 -> 1 -> 2 -> ... -> np-1 -> 0;
   b. repeat the above circle for 50 times;
   c. in the end, print out the elapsed time.

2. Write a parallel program, say python script, to calculate π using the following integral:
$$\pi = \int_0^1 \frac{4}{1+x^2} \, dx.$$

3. Write a parallel python program to use Pool and random numbers to calculate the value of π.

4. Write a parallel program to numerically solve the temperature distribution for a 2D system, i.e. a square plate with one side at a fixed temperature T=20°C and the other three sides fixed at T=40°C.
   a. *hint*: heat equation: $\frac{\partial T}{\partial t} = \kappa \nabla^2 T = \kappa(\partial_x^2 T + \partial_y^2 T)$.
   b. *hint*: domain decomposition.
   c. *hint*: use finite difference.

Change the number of processes involved in the calculation and evaluate:
   d. speedup,
   e. efficiency.