# Tutorial 8: Monte Carlo methods

## Computing $\pi$ using Monte Carlo sampling

1. Write a function `compute_pi(N)` which uses Monte Carlo sampling and the fact that

$$U \sim \text{Uniform}[0,1]^2 \quad \implies \quad P\big(\|U\|_2 \leq 1\big) = \tfrac{\pi}{4}$$

   to compute an approximation to $\pi$ using only `rand()` and elementary algebra.

2. Write a function `convergence()` which verifies that the return value of `compute_pi(N)` involves an $O(N^{-1/2})$ error as predicted by the central limit theorem.