Algorithm 1 Metropolis-Hastings Algorithm
Generate samples from $p(x) \propto p^*(x)$ given proposal density $q(x^* \mid x)$ in I iterations

Require: $I > 0$, $p^*(x)$, and $q(x^* \mid x^{(i-1)})$
  $x^{(0)} \leftarrow x_0$; $\forall x_0 \in \mathbf{X}$
  for $i = 1$ to I **do**
    sample x^* from $q(x \mid x^{(i-1)})$
    $\alpha \leftarrow \min\left(\frac{p^*(x^*)}{p^*(x^{(i-1)})} \times \frac{q(x^{(i-1)} \mid x^*)}{q(x^* \mid x^{(i-1)})}, 1.0\right)$
    sample u from $\mathcal{U}[0, 1]$
    if $u < \alpha$ **then**
      $x^{(i)} \leftarrow x^*$
    else
      $x^{(i)} \leftarrow x^{(i-1)}$
    end if
  end for

Algorithm 2 Gelman-Rubin Diagnostic
TODO

Require: $M \geq 2$
  for chain $= 1$ to M **do**
    run MCMC algorithm for chain, for length $2n$ with different initial values
    discard the first n draws in chain
    $B \leftarrow \frac{n}{M-1} \sum_{i=1}^{M} \left(\overline{\theta_i} - \sum_{i=1}^{M} \overline{\theta_i}\right)$ // between-chain variance
    $W \leftarrow \frac{1}{M} \sum_{i=1}^{M} s_i^2$ // within-chain variance
    calculate potential scale reduction factor
  end for