Recall the joint density given in Example 4 of the MCMC notes,

\[ p(x, y) = \frac{n!}{(n-x)! x!} y^{x+\alpha-1} (1-y)^{n-x+\beta-1} \]

where we will take \( \alpha = 1, \beta = 2, \) and \( n = 10. \)

For this distribution, construct a Gibbs sample (Example 4 gives the marginal distributions). After burning in the sampler for 100 iterations, generate a vector of 5000 draws of \((x, y)\) pairs from this distribution. From this sampler estimate \( E(x), E(y), \sigma^2(x), \sigma^2(y) \) and \( \sigma(x, y). \)

You might want to look over the \texttt{R} notes on Metropolis-Hastings sampler.