Metropolis-Hastings Algorithm

1. Suppose that the number of children per household in the U.S. has the following distribution

x	0	1	2	3	4	5
$\mathrm{P}(X = x)$	0.15	0.18	0.35	0.20	0.08	0.04

a. Describe in detail how you could implement by hand a Metropolis-Hastings algorithm to simulate from this distribution, using a random walk to neighboring states as the proposal chain.
b. Write a few lines of code to implement and run your algorithm, and summarize the approximate distribution. Does your algorithm seem to work?
c. Specify the transition matrix for the M-H algorithm in the previous part.
d. Find the stationary distribution of the M-H chain. Is it the target distribution?

2. The standard double exponential distribution has a pdf which satisfies

$$f(x) \propto e^{-|x|}, \qquad -\infty < x < \infty$$

a. Describe in detail a Metropolis-Hastings algorithm for simulating from this distribution.
b. Write a few lines of code to implement the algorithm and run it. Does the algorithm seem to produce values from the target distribution?