CSC 321 H1S Metropolis Algorithm Tutorial (Last update: April 8, 2016) **Winter 2016**

```
def p_star(w, x, y, sigma, sigma_w):
    loglik = sum(-.5*log(2*pi*sigma**2)-(dot(w, x)-y)**2/(2*sigma**2))
    log_pw = sum(-.5*log(2*pi*sigma_w**2)-w**2/(2*sigma_w**2))
    return exp(loglik+log_pw)


random.seed(0)
w = array([-3, 1.5])


sigma_w = 6

N = 20
sigma = 2.2
x_raw = 10*(random.random((N))-.5)
x = vstack((      ones_like(x_raw),
                       x_raw,
                  ))

y = dot(w, x) + scipy.stats.norm.rvs(scale= sigma,size=N)
scatter(x_raw,y)


sigma_jump = 1.0


n_iter = 500000
n_iter_burn_in = n_iter-10000
ws = zeros((n_iter - n_iter_burn_in, w.shape[0]))
w = random.random(w.shape)
for i in range(n_iter):
    w_prime = w + scipy.stats.norm.rvs(scale= sigma_jump,size=w.shape[0])
    p_accept = p_star(w_prime, x, y, sigma, sigma_w)/p_star(w, x, y, sigma, sigma_w)
    if p_accept > 1:
        w = w_prime
    else:
        if random.random() < p_accept:
            w = w_prime

    if i >= n_iter_burn_in:
        ws[i-n_iter_burn_in,:] = w


pred_y = mean(dot(ws, x), 0)
scatter(x_raw, pred_y)
```