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% Computer Lab 6
% Exercise 1 (c.)
% NB the following code is very inefficient but hopefully clear at
  least
h = 0.01; %
M = 1000; % number of simulations/paths per value of h
mu = 1;
T = 1;
sigma = 1;
X_0 = 1;
N = T/h; % number of grid points per simulation

temp = zeros(M,1); % for MC estimator
for jj = 1:M
    X = zeros(N,1); % vector to store the path
    dB = sqrt(h).*randn(N,1); % Brownian increments
    X(1,1) = X_0;
    % simulate one path of X
    for n = 1:N-1
        X(n+1,1) = X(n,1) + h*mu*X(n,1) + sigma*X(n,1)*dB(n+1,1);
    end
    dB(1,1) = 0;
    B_T = sum(dB);
    X_T = X_0*exp((mu-(sigma^2)/2)*T + sigma*B_T); % true solution
    % calculate the error for this path
    temp(jj,1) = abs(X_T - X(N,1));
end
E_h = mean(temp); % MC estimates of E[|X_T - X_T^h|]
disp(E_h)

    0.159600793305891

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