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% Take Home Exam 1 (Mezzetti Anita)
% Exercise 4c:
clear all
close all
clc

% given parameters
s = 1;          % initial price
r = 0.1;        % rf interest rate
T = 0.5;        % maturity
K = 0.9;        % strike price
sigma = 0.1;    % volatility
b = 1.3;        % barrier

% MC
% plot the constant MC price computed by MCpriceBarrierUODM
Ntime = 100;    % steps
Nsim = 1.0e6;    % # simulations
rng default     % default seed

mc_price = MCpriceBarrierUODM(r,sigma,Ntime,Nsim,T,s,K,b);
display(mc_price)

% Binomial prices
N = [2:2:200];    % steps

bin_prices = zeros(length(N),1);          % initialisation
for i = 1:length(N)
    u = 1+r*T/N(i)+sigma*sqrt(T/N(i));  % up
    d = 1+r*T/N(i)-sigma*sqrt(T/N(i));  % down
    bin_prices(i) = BinomialpriceBarrierUODM(r,d,u,N(i),T,s,K,b);
end


% plots
figure
plot(N,mc_price*ones(1,length(N)),'g')
hold on
plot(N,bin_prices,'b')
title('Exercise 4c')
xlabel('N')
ylabel('Option Price')
legend('Monte Carlo','Binomial Process')
```