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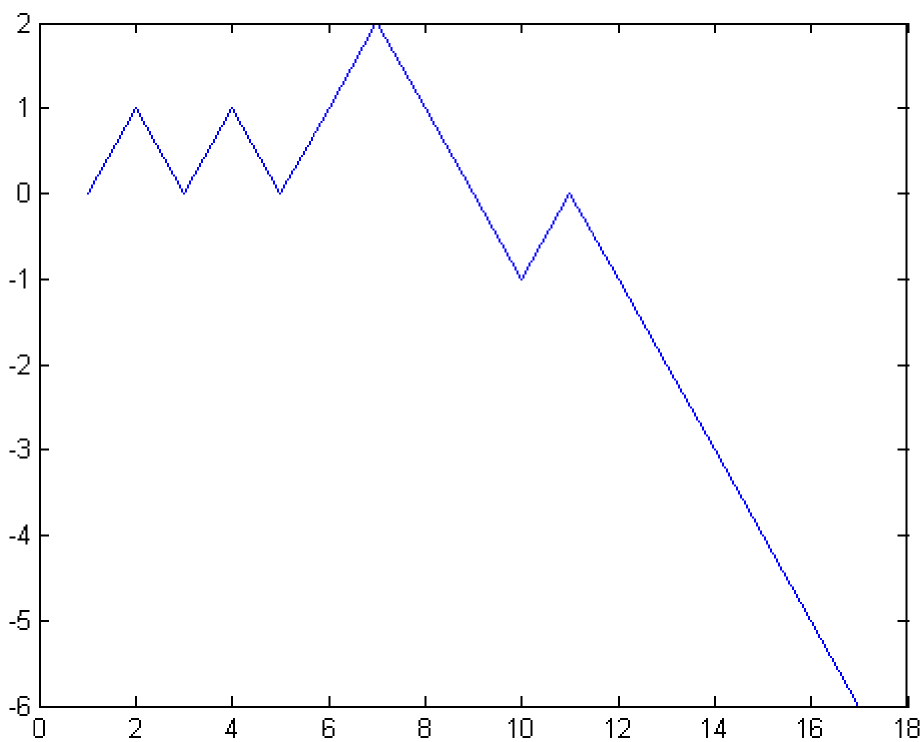
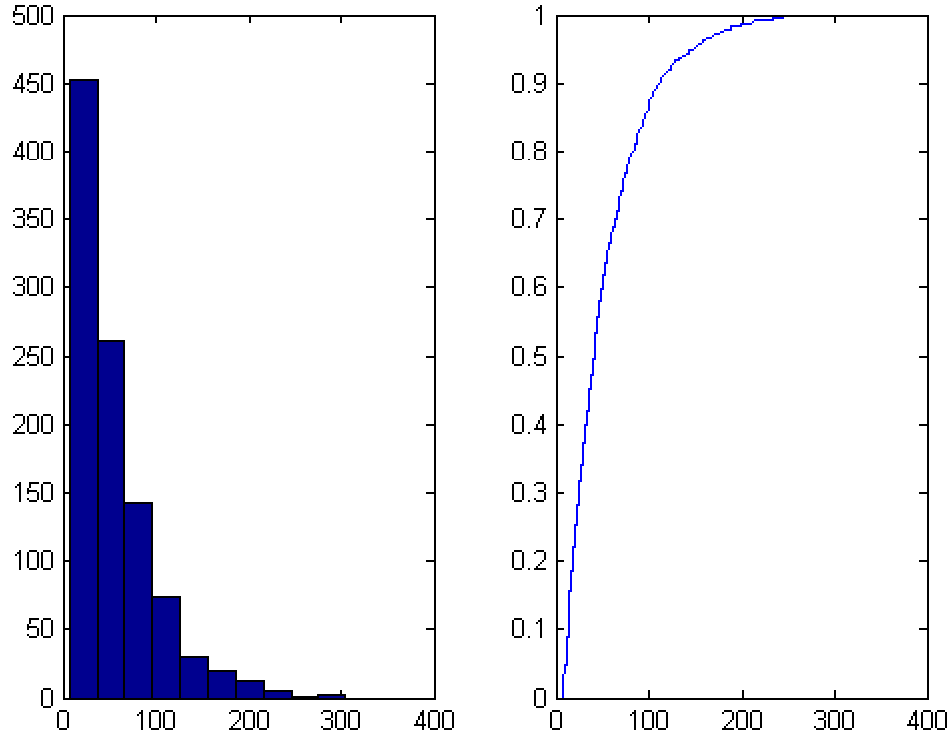
```
%%%%%%%%% Math 430 - Homework 7 %%%%%%%%%%%
%
% MONTES Virginie
% Due November 6
%
%%Problem 1:
```

stochastic simulation for the Gambler's Ruin problem

```
clear all
close all

M = 1000;  % the size of MC run

% setting up the simulation results vectors
win = zeros(M,1);
duration = zeros(M,1);

durmax = 500;
X = zeros(durmax,1);

upper = 9;
lower = -6;


for m = 1:M,
    t = 1;
    X(1) = 0;
    while ( (X(t) < upper) & ( X(t) > lower) & (t < durmax)),
       t = t+1;
       X(t) = X(t-1) + (round(rand)*2 -1);
                                % round(rand)*2 - 1   would generate random
                                % +1 or -1 with equal probability
    end %   while loop
    if (X(t) == upper),  win(m) = 1;   end
    duration(m) = t;

end   % Monte Carlo loop

figure(1)
 plot(1:t, X(1:t))

% output the estimates

figure(2)
subplot(1,2,1)
```

```
  hist(duration)

[px,x] = ecdf(duration);   % this command does empirical CDF
  subplot(1,2,2)
  stairs(x,px);

phat = sum(win)/M;
meandur = mean(duration);

disp([' Est. Probability of win= ', num2str(phat), ', average duration= ', num2str

 mofe = 2*sqrt(phat*(1-phat)/M);
  disp(['95% CI for the probability to win  ',...
        num2str(phat - mofe), ' to ', ...
        num2str(phat + mofe)]);

p=-lower/(upper-lower);
disp(['Teoretical probability= ', num2str(p)]);


 Est. Probability of win= 0.422, average duration= 55.872
95% CI for the probability to win  0.39076 to 0.45324
Teoretical probability= 0.4
```

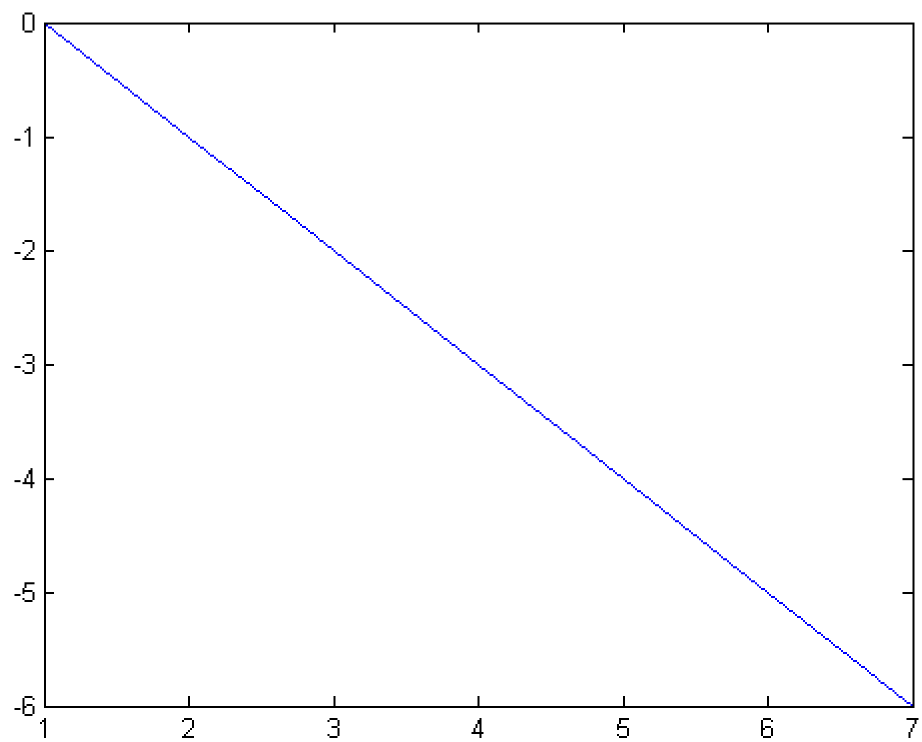


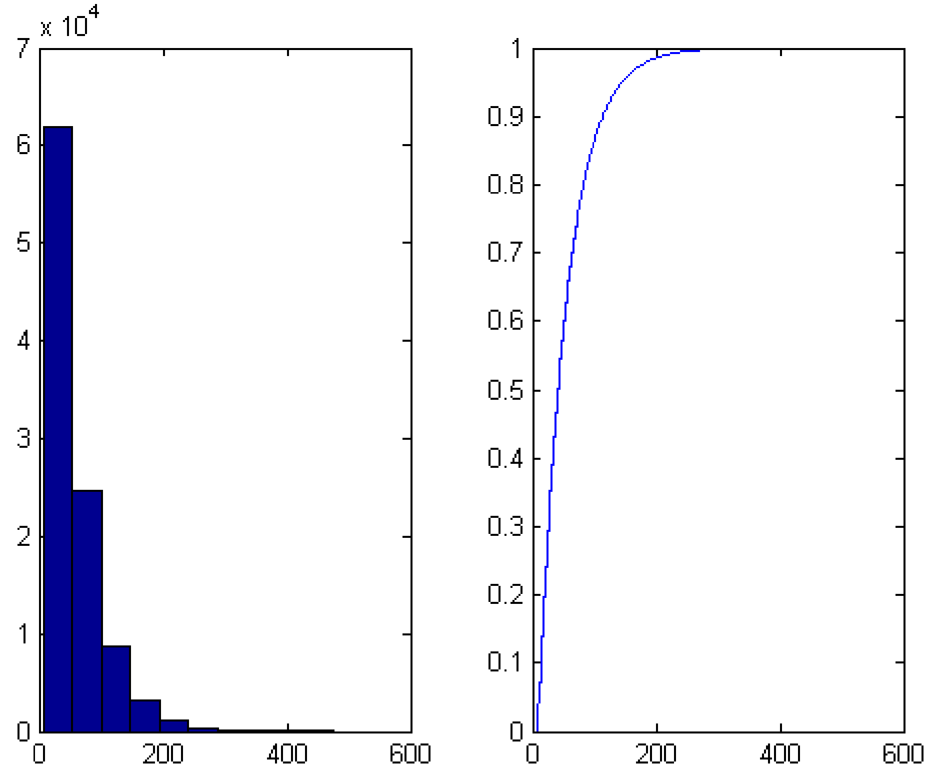


Simulation for M = 100000

```
% stochastic simulation for the Gambler's Ruin problem


M = 100000;  % the size of MC run

% setting up the simulation results vectors
win = zeros(M,1);
duration = zeros(M,1);

durmax = 500;
X = zeros(durmax,1);

upper = 9;
lower = -6;

for m = 1:M,
    t = 1;
    X(1) = 0;
    while ( (X(t) < upper) & ( X(t) > lower) & (t < durmax)),
       t = t+1;
       X(t) = X(t-1) + (round(rand)*2 -1);
                                 % round(rand)*2 - 1   would generate random
                                 % +1 or -1 with equal probability
    end %   while loop
    if (X(t) == upper),  win(m) = 1;   end
    duration(m) = t;

end   % Monte Carlo loop
```

```
figure(3)
 plot(1:t, X(1:t))

% output the estimates

figure(4)
subplot(1,2,1)
  hist(duration)

[px,x] = ecdf(duration);   % this command does empirical CDF
  subplot(1,2,2)
  stairs(x,px);

phat = sum(win)/M;
meandur = mean(duration);

disp([' Est. Probability of win= ', num2str(phat), ', average duration= ', num2str


p=-lower/(upper-lower);
disp(['Teoretical probability= ', num2str(p)]);

 mofe = 2*sqrt(phat*(1-phat)/M);
  disp(['95% CI for the probability to win ',...
       num2str(phat - mofe), ' to ', ...
       num2str(phat + mofe)]);


 Est. Probability of win= 0.40263, average duration= 54.9
Teoretical probability= 0.4
95% CI for the probability to win 0.39953 to 0.40573
```





the average durations

```
% We have A*B=54 and we obtained values of the average duration like
% D=[55.101; 55.096; 56.510; 54.895]
% So we can say tha for each case we have D = const * AB
% with in the first case const1 = 1.020, second case const2 = 1.020, third
% case const3 = 1.047, fourth case const4 = 1.017.
```

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