GA6: Ebola Outbreak II_LMa_130918

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%% ETSMP Ebola Outbreak II
% Udvalgte løsninger

%% Process 1:
% The number of infected is constant independent of the day
% y(n)=x

%% Creations of realisations
days=10;
patients=10;
propability_success=0.5;
yn=binornd(patients,propability_success,1) %binomial random variables

%% Ensemble mean, brugt side 48 i formelsamling
% For binomial: E[x]=n*p
Ensemble_mean=patients*propability_success;  %= 5, s 48 i formelsamling

%% Ensemble variance, brugt side 48 i formelsamling
% var(x) = p*n(1-p)
Ensemble_variance=patients*propability_success*(1-propability_success); %=2.5

%% Mean and variance of one realization
Realization_mean=mean(yn)
Realization_variance=var(yn)

%% Verifikation med matlab
yn=binornd(patients,propability_success,1,100000);
Ensenble_mean_sim=mean(yn) %Should be equal to the ensemble mean
Ensemble_var_sim=var(yn) % Should be equal to the ensemble variance

%% WSS or ergodic?
%% The process is WSS as the mean and variance is constant with time.
%% The process is not ergodic, as one realization has a variance of 0.

%% Process 2
% Stochastic proces: yn=x+wn
x=binornd(patients,propability_success,1) %number of infected day 0
wn=randi([-2 2],1,days) %creates discrete uniformly distributed data.
yn=x+wn %number of infected day n

%% The ensemble mean and varaince?
% da E[wn]= (a+b)/2=(2+-2)/2=0, E[x]= n*p = 5
% E[yn]=E[x+wn]=E[x]+E[wn]= 0+5= 5
%
% da var(wn)=((b-a+1)^2-1)/12= ((2--2+1)^2-1)/12=2
% var(yn)=E[yn^2]-E[yn]^2=var(x)+var(wn)=p*n(1-p)+2=4.5

%% Mean and variance of one realization
Mean_realization=mean(yn)
Var_realization=var(yn)

%% Verifikation med matlab funktion, vi bør gøre dette for alle 10 dage, men
da processen er WSS kan vi nøjes med dag 1
testDag1=binornd(patients,propability_success,1,10000)+randi([-2 2],1,10000);
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Mean_ensemble=mean(testDag1) %skal gerne give 5
Var_ensemble=var(testDag1) % skal gerne give 4.5

%% WSS or ergodic?
%% The process is WSS as the mean and variance is constant with time.
%% The process is not ergodic, as the timely mean is not always equal to the
ensemle mean.


%% Process 3:
%Giving the population symptoms and infection
Population=rand(1,1000); %Number of population

for n=1:length(Population)
if Population(n)<=0.2 %Infected and symptoms
    Infected(n)=1;
    Symptoms(n)=1;
elseif 0.2<Population(n) && Population(n)<=0.5 %Symptoms but not infected
    Infected(n)=0;
    Symptoms(n)=1;
elseif Population(n)>0.99 %Infected and no symptoms
    Infected(n)=1;
    Symptoms(n)=0;
else %No symptoms and not infected
    Infected(n)=0;
    Symptoms(n)=0;
end
end

%% Realizations of an outbreak in hospotal
N_tot_realizations=3;
for N_realization=1:N_tot_realizations
     N=randi(length(Population),1,10); %Ten random selected persons from the
population
     N_Infected(1:days)=0;
     for k=1:10
          N_Infected(1)=N_Infected(1)+Infected(N(k)); %The infected people of
the selection
     end

     for day=2:days
          N_Infected(day)=N_Infected(day-1);
          for n=1:N_Infected(day-1)
               Infected_new=randi(2)-1;  %Every infected patient infects 0 or
1 new person pr. day
              N_Infected(day)=N_Infected(day)+Infected_new;  %The total
number of infected on day "day"
          end
     end
     Realization=N_realization
     Number_infected_day=N_Infected
end
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ETSMP_EbolaII_solution_LMa_130918

Process 1:

yn = 3

Realization_mean = 3

Realization_variance = 0

Ensenble_mean_sim = 5.0017

Ensemble_var_sim = 2.4705

Process 2:

x = 7

wn = -2 0 2 0 -2 0 -2 -1 0 1

yn = 5 7 9 7 5 7 5 6 7 8

Mean_realization = 6.6000

Var_realization = 1.8222

Mean_ensemble = 4.9956

Var_ensemble = 4.4222

Process 3:

Realization = 1

Number_infected_day = 2 3 6 9 14 22 32 48 71 113

Realization = 2

Number_infected_day = 0 0 0 0 0 0 0 0 0 0

Realization = 3

Number_infected_day = 5 5 9 16 27 36 57 81 121 177