```
% Copyright 2021 Bjorn Birnir
% This program cannot prevent infection, but it
% can help minimize it. It application is completely
% the responsibility of the user.
clear all
figure(1), clf
figure(2), clf
figure(3), clf
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%
% What it the volume of the room?
V=3574.9; % parameters for Room 1310 in the UCSB Library
% What is the air exchange rate, ACH ?
ACH=6.41;
% What is the number of infectious persons in the room?
b=1;
% Do everyone wear a mask, a=1, NO, a=9, YES?
a=5;
% How many people are in the room?
I=800; % > b, p<10%
% Are the people at rest E=1.584 or exercising E=5.89?
E=1.584; %E is exhalation rate
% These rates are typical for rooms of dimensions
% 7 top 14 meters
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%
%Values of dissipation constants depending
%on lifetime of virus with different relative
%humidity RH
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```
k0=0.0031;   %21 RH
k5=0.0078;   %35 RH
ka=0.016;    %51 RH
kb=0.024;    %65 RH
kc=0.028;     %81 RH
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Values of dissipation constants depending
%on air exchange per minute ACH
k6=0.01; %0.6 ACH
k1=0.016; %1 ACH
k2=0.025; %1.5 ACH
k3=0.1; %6ACH
kj=ACH/60; %kj=ACH/60
%k=0.1  %this is with the standard 6ACH
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Exhalation rate per minute E=1.584 m^3/min. At rest.
% Exhalation rate per minute E=5.89 m^3/min. Heavy exercise.
% C(t) is concentration of virions (viruses
% in aerosols)
C(1)=b*E/(3*a*V);
% The factor 1/3 corresponds to a silent person, 1 is a talkative person
p(1)=0.6*(1-exp(-C(1)));
% 0.6 = 0.3 (30% vaccination effectiveness VE) x 2 virulence factor of delta
% Want p<1% after 2 hours
m=2; %number of infected persons
%pb(1)=(factorial(l-b)/(factorial(l-(b+m))*factorial(m)))*p(1)^(m)*(1-p(1))^(l-(b+m)) %l
people in room, one infectious
%one person infected, m=1
%pb(1)=(l-1)*p(1)*(1-p(1))^(l-2);
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```
%two people infected, m=2
pb(1)=0.5*(l-1)*(l-2)*p(1)^2*(1-p(1))^(l-3);
%three people infected, m=3
%pb(1)=(l-1)*(l-2)*(l-3)*p(1)^3*(1-p(1))^(l-4)/6;
k=kj+k5; %kj and viral decay at 35% RH
for j=2:1:480
C(j)=(C(1)/k)*(1-exp(-k*j));%concentration of virions
p(j)=0.6*(1-exp(-C(1)*j+C(j)));% probability of infection
%m number of people infected
%pb(j)=(factorial(l-b)/(factorial(l-(b+m))*factorial(m)))*p(j)^(m)*(1-p(j))^(l-(b+m)); %l people
in room, one infectious, m infected
%one person infected, m=1
%pb(j)=(l-1)*p(j)*(1-p(j))^(l-2);
%two people infected, m=2
pb(j)=0.5*(l-1)*(l-2)*p(j)^2*(1-p(j))^(l-3);
%three people infected, m=3
%pb(j)=(l-1)*(l-2)*(l-3)*p(j)^3*(1-p(j))^(l-4)/6;
end
% Want pb < 10% after 2 hours
figure(1), clf
plot(C,'LineWidth',2);hold on
ylabel('Average droplet concentration','FontSize',15), xlabel('time (minutes)','FontSize',15)
figure(2), clf
plot(p,'LineWidth',2);hold on
ylabel('Probability of Infection','FontSize',15), xlabel('time (minutes)','FontSize',15)
figure(3), clf
plot(pb,'LineWidth',2);hold on
ylabel('Binomial probability of infection','FontSize',15), xlabel('time (minutes)','FontSize',15)
```