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'''
This program implements the model discussed in George Markowsky's talk:
"Modeling and Battling COVID-19" which is available at
www.DrGM.us.

This program is purposely simple to display the modeling. The user is
welcome to add improved input capabilities.
'''

import matplotlib.pyplot as plt # matplotlib is a standard Python graphplotting package

# i, s, r, and t are lists of values so we can plot them
i = [1e-7] # initial value for infectious people 1 in 10,000,000
s = [1.0 - i[0]] # Initial fraction of susceptible people
r = [0.0]  # Initially, no person is recovered
t = [0]    # Collection of days or times. Starts at time 0.

a = 1.0/14 # An initial value for the a constant. See the report for details.
b = .025   # An initial value for the b constant. See the report for details.
c = 7      # An initial value for the c constant. See the report for details.

# To help understand the following code note that i[-1],s[-1], r[-1]
# are the most recent values of i, s, and r.
for j in range(1,301): # Run for days 1 to 300
    inew = i[-1] + b*c*s[-1]*i[-1] - a*i[-1]
    rnew = r[-1] + a*i[-1]
    snew = s[-1] - b*c*s[-1]*i[-1]
    i.append(inew) # Add the new value of i to the end of the list.
    r.append(rnew) # Add the new value of r to the end of the list.
    s.append(snew) # Add the new value of s to the end of the list.
    t.append(j)    # Add the new value of t to the end of the list.

# plotting points as a scatter plot
plt.plot(t, s, label= "Susceptible", color= "green")#, marker= "*", s=30)
plt.plot(t, i, label= "Infected", color= "blue")#, marker= "+", s=30)
plt.plot(t, r, label= "Recovered", color= "black")#, marker= ".", s=30)

plt.xlabel('Days')    # Label x-axis
plt.ylabel('Percent') # Label y-axiz
# The following sets the title.
plt.title('i(0) = %8.7f, b = %4.3f, c = %4.3f, and a = %4.3f'% (i[0],b,c,a))
plt.legend() # Display the legend

plt.show() # Display the graph.
```