Assignment 3

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# Implementing the SEIRV model summary:

* If SEIRV is simulated from time t=0 days to t=d days, an array is maintained to keep track of S, E, I and R at each time.
* From CSV, confirmed cases and tests are read from 9th March 2021 to 20th September 2021 and vaccinations are read from 14th March 2021 to 26th April 2021
* The simulation process is exactly as mentioned in the assignment. The usage of appropriate variables makes the program understandable.
* Functions dV, dW and CIR calculate vaccinations, Immunity waining and cases to infection ratio at a particular day.
* The loss function records the 7-day average of confirmed cases from csv and the 7-day average from simulation between 16th March and 26th April and obtained mean squared error of their logs.
* The gradient function is defined as mentioned in the assignment. It returns a vector indicating the steepest ascent direction at a particular state in simulation.
* The minimization function is the partial constrained gradient descent algorithm.
* After every 100 iterations, the step-size is reset to 1 and the parameters are constrained such that R ∈(0.156\*N,0.36\*N), CIR0 ∈(12,30), S + E + I + R = N and S,E,I,R are integers.
* We obtain:
  + beta = 0.44905
  + S0 = 47600008
  + E0 = 699996
  + I0 = 699996
  + R0 = 21000000
  + CIR0 = 23.010

Chart, scatter chart

Description automatically generated

Figure 1 Between 16th March 2021 and 26th April 2021

# Open Loop Controls

1. Beta = 2\*beta/3

Cases till 20th September 2021 : 82737

Chart, line chart

Description automatically generated

Figure 2 Susceptible each day (S)

Chart, line chart

Description automatically generated

Figure 3 cases per day (di)

1. Beta = beta/2

Cases till 20th September 2021 : 4568

Chart, line chart

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Figure 4 Susceptible each day (S)

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Figure 5 Infected per day (di)

1. Beta = beta/3

Cases till 20th September 2021 : 0

Chart, line chart

Description automatically generated

Figure 6 Susceptible each day (S)

Chart, line chart

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Figure 7 Infected per day (di)

# Closed Loop Control

Cases till 20th September 2021 : 316556

Chart

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Figure 8 Susceptible each day (S)

Chart, line chart

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Figure 9 Infected per day (di)