MS Hands-on

S. I.(Symptomatic and Asymptomatic) R.

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Simple SIR Model:

$$\frac{\partial S}{\partial t} = -\beta SI$$

$$\frac{\partial I}{\partial t} = \beta SI - \gamma I$$

$$\frac{\partial R}{\partial t} = \gamma I$$

Susceptible declines, Recovered increases and Infected increases and then decreases having peak at some location.

With initial values; we gets following plot:

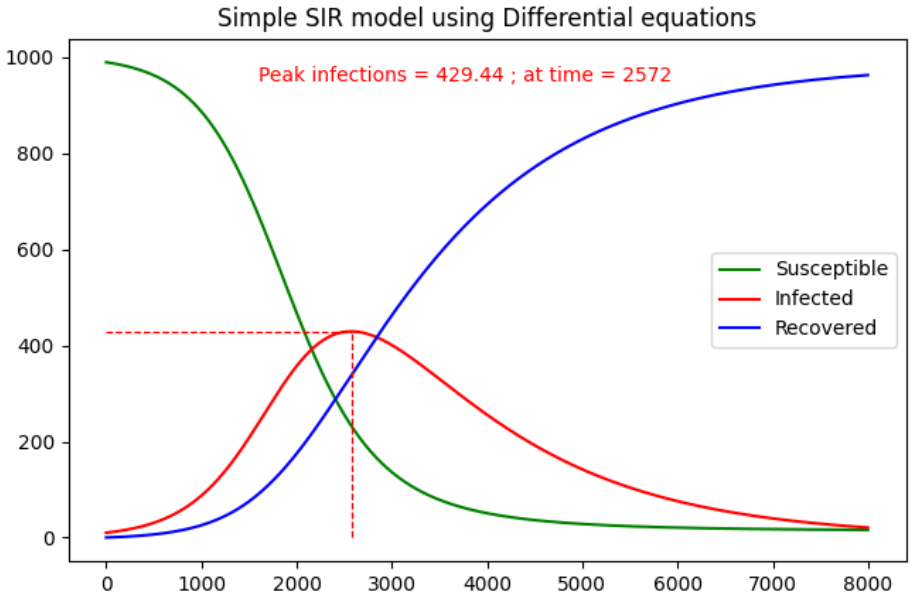
Susceptible = 990

Infected = 10

Recovered = 0

Beta = 0.0015

Gamma = 0.35



SIR Model with Births and Deaths:

$$\frac{\partial S}{\partial t} = -\beta SI + \Delta$$

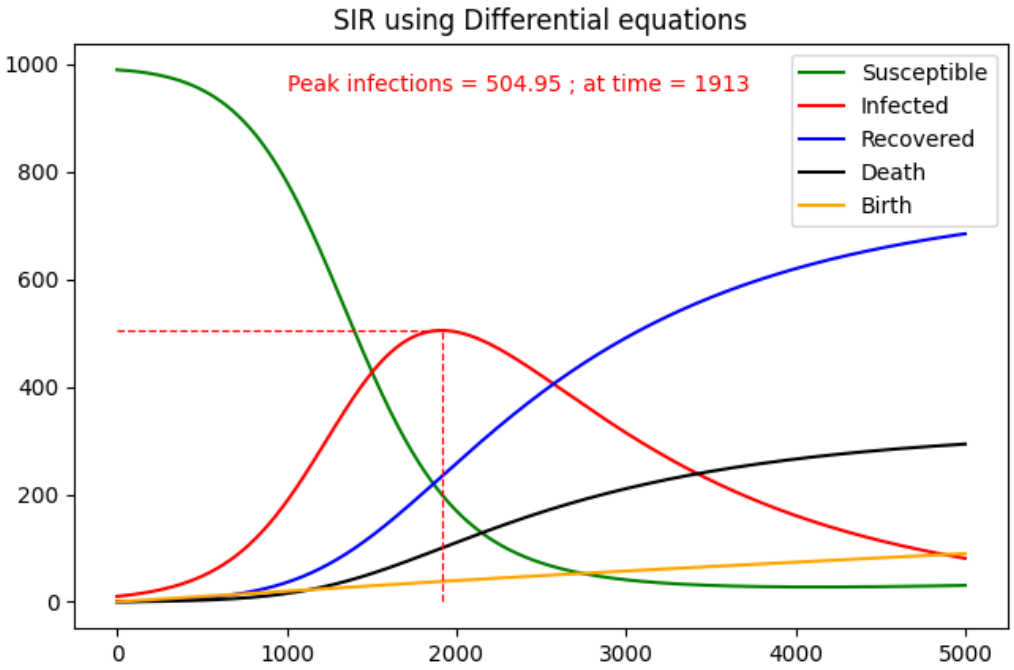
$$\frac{\partial I}{\partial t} = \beta SI - \delta\gamma I - (1 - \delta)\gamma I$$

$$\frac{\partial R}{\partial t} = \delta\gamma I$$

Susceptible declines, Recovered/Deaths increases and Infected increases and then decreases having peak at some location, there are constant births.

With initial values; we gets following plot:

Susceptible = 990
Infected = 10
Recovered = 0
Beta = 0.0015
Gamma = 0.35
Birth Rate = 0.01 * Current Population
Delta = 0.7



SIR Model with Births, Deaths and Lockdown:

$$\frac{\partial S}{\partial t} = -\beta\lambda SI + \Delta$$

$$\frac{\partial I}{\partial t} = \beta\lambda SI - \delta\gamma I - (1 - \delta)\gamma I$$

$$\frac{\partial R}{\partial t} = \delta\gamma I$$

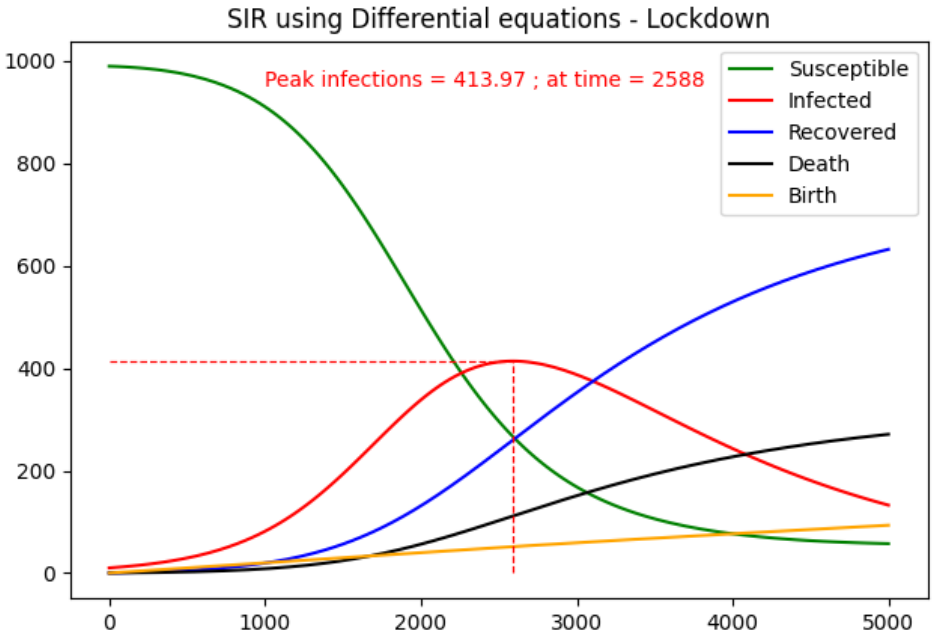
With lockdown imposed; infected peoples are affected. Decreasing rate of infection.

Susceptible declines, Recovered/Deaths increases and Infected increases and then decreases having peak at some location, there are constant births.

Peak moves 30% late in time period than the system without lockdown.

With initial values; we gets following plot:

Susceptible = 990
Infected = 10
Recovered = 0
Beta = 0.0015
Gamma = 0.35
Birth Rate = 0.01 * Current Population
Delta = 0.7
Lambda = 1 or 0.5 interchanging every time period



SIR Model with Births, Deaths, Lockdown, Symptomatic and Asymptomatic:

$$\frac{\partial B}{\partial t} = \Delta$$

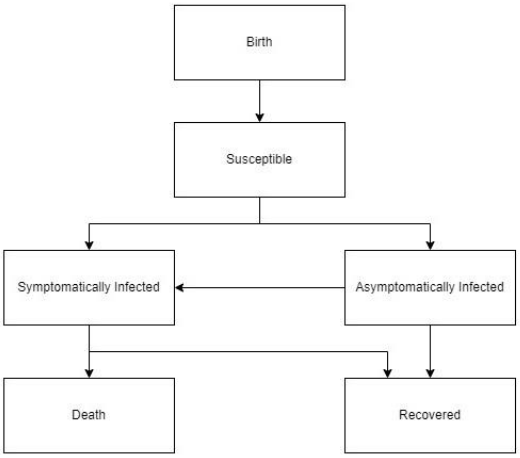
$$\frac{\partial S}{\partial t} = -\beta S\lambda I_s - \zeta S\lambda I_A + \Delta$$

$$\frac{\partial I_A}{\partial t} = \zeta S\lambda I_A - \omega\tau I_A - (1-\tau)\omega I_A$$

$$\frac{\partial I_s}{\partial t} = \beta S\lambda I_s + (1-\tau)\omega I_A - \delta\gamma I_s - (1-\delta)\gamma I_s$$

$$\frac{\partial D}{\partial t} = (1-\delta)\gamma I_s$$

$$\frac{\partial R}{\partial t} = \delta\gamma I_s + \omega\tau I_A$$

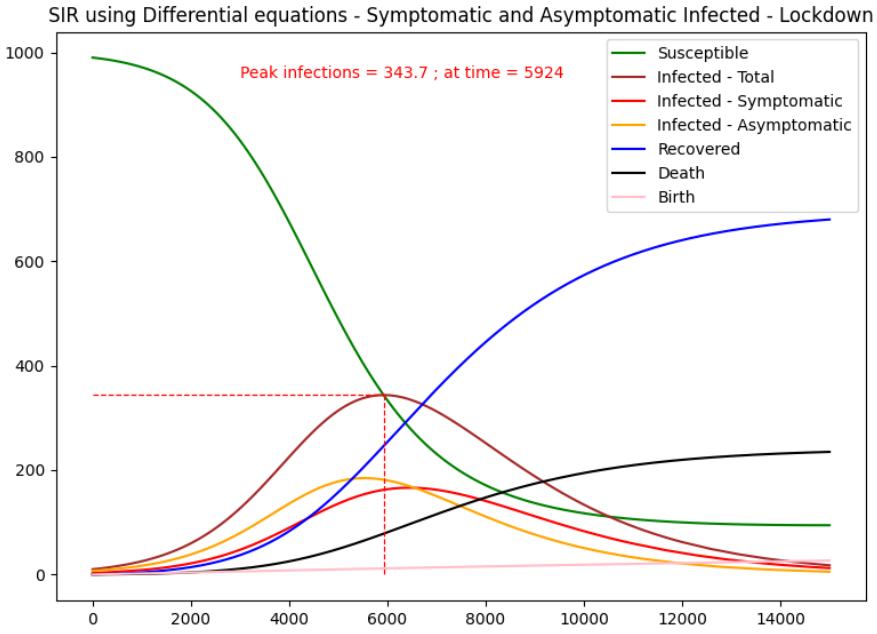


With lockdown imposed; infected peoples are affected. Decreasing rate of infection.

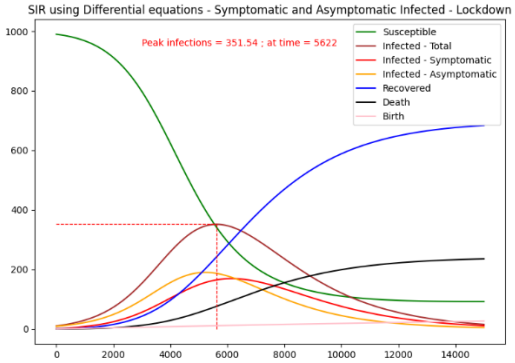
Susceptible declines, Recovered/Deaths increases and Infected(symptomatic, asymptomatic) increases and then decreases having peak at some location, there are constant births.

With initial values; we gets following plot:

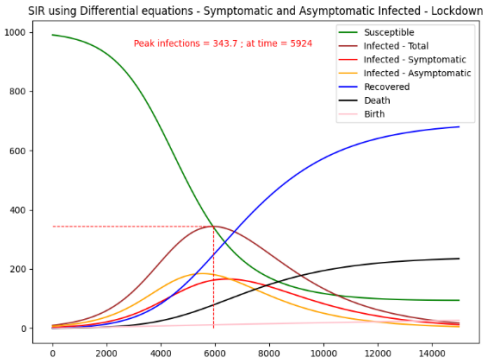
Susceptible	= 990	Birth Rate	= 0.01 * Current Population
Infected - Symptomatic	= 3	Delta	= 0.7
Infected - Asymptomatic	= 7	Lambda	= 1 or 0.5 per period
Recovered	= 0	Zeta	= 0.001
Beta	= 0.0005	Omega	= 0.3
Gamma	= 0.35	Tau	= 0.2



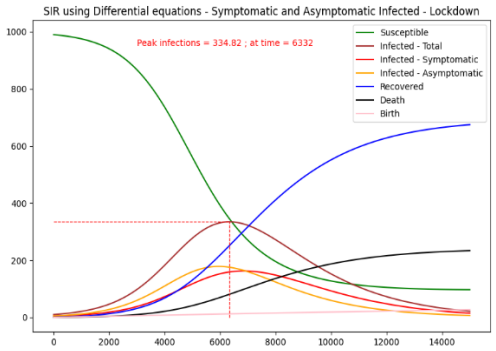
Symptomatic : 1, Asymptomatic : 9



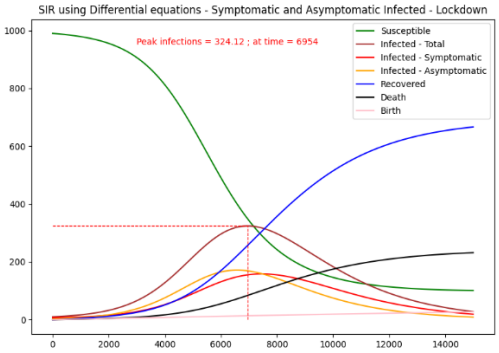
Symptomatic : 3, Asymptomatic : 7



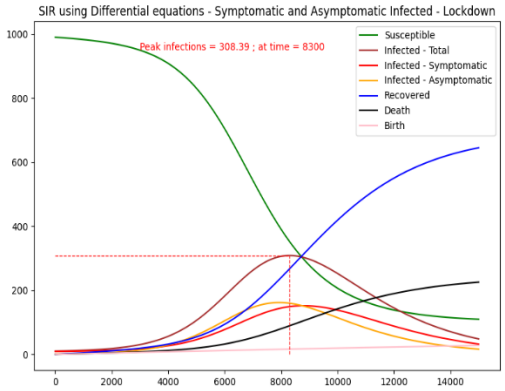
Symptomatic : 5, Asymptomatic : 5



Symptomatic : 7, Asymptomatic : 3



Symptomatic : 9, Asymptomatic : 1



More initial symptomatic cases causes peak to be earlier than later.