# Optimisation Stages Discussion

For the same set of data:

| | | |
|---|---|---|
| 299 | 1 | 0 |
| 298 | 2 | 0 |
| 296 | 4 | 0 |
| 292 | 8 | 0 |
| 284 | 16 | 0 |
| 269 | 31 | 0 |
| 247 | 50 | 3 |
| 212 | 79 | 9 |
| 172 | 103 | 25 |
| 122 | 141 | 37 |
| 89 | 136 | 75 |
| 65 | 114 | 121 |
| 51 | 85 | 164 |
| 47 | 53 | 200 |
| 43 | 33 | 224 |
| 41 | 14 | 245 |
| 41 | 6 | 253 |
| 41 | 3 | 256 |
| 41 | 1 | 258 |
| 41 | 0 | 259 |

# handshakes = 10;
infectious period = 5;
initial # infected people = 1;
total # people = 300.

## Stage 1:

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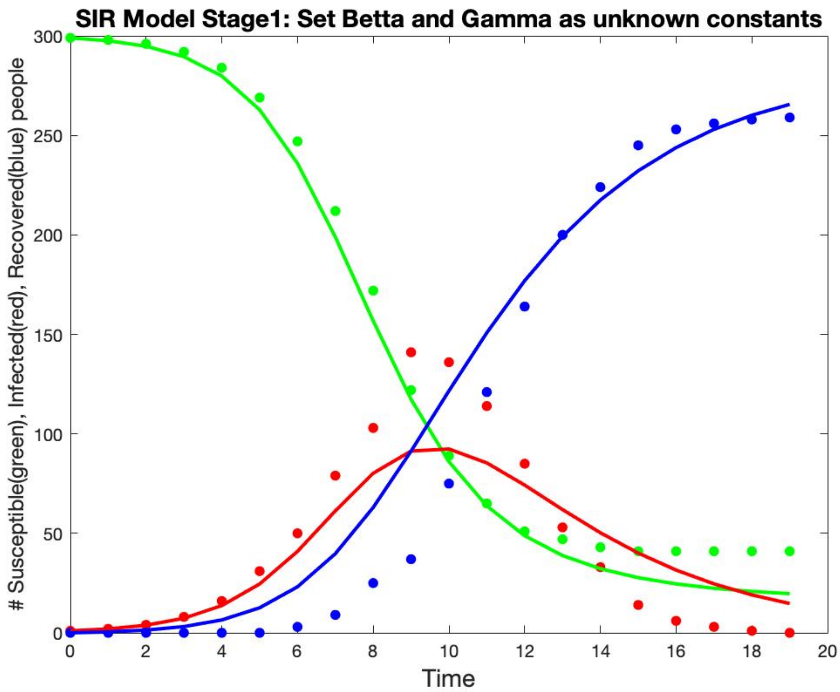
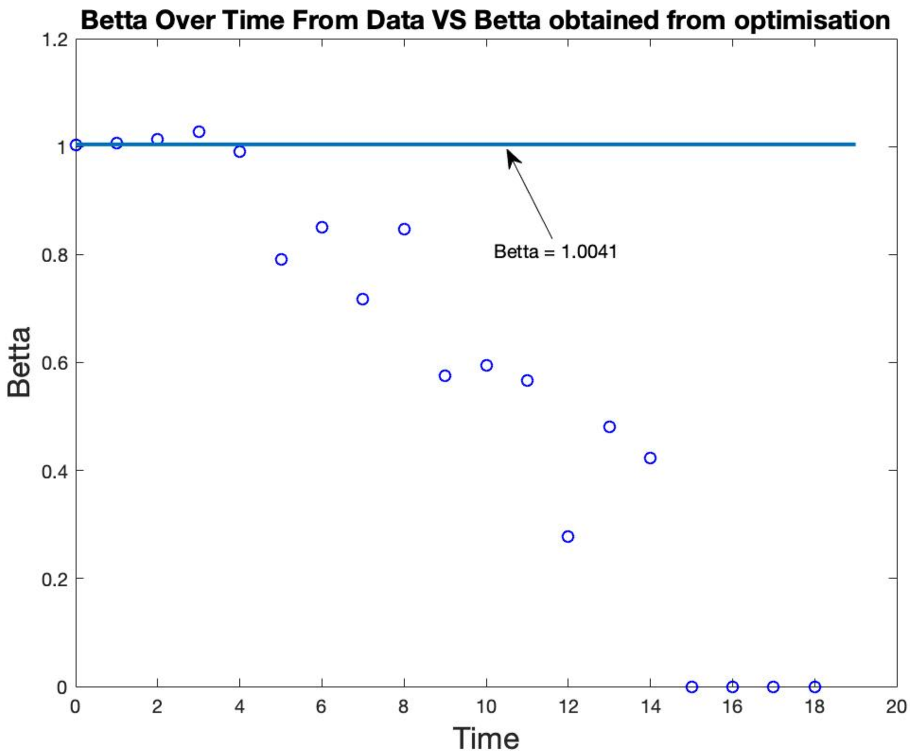
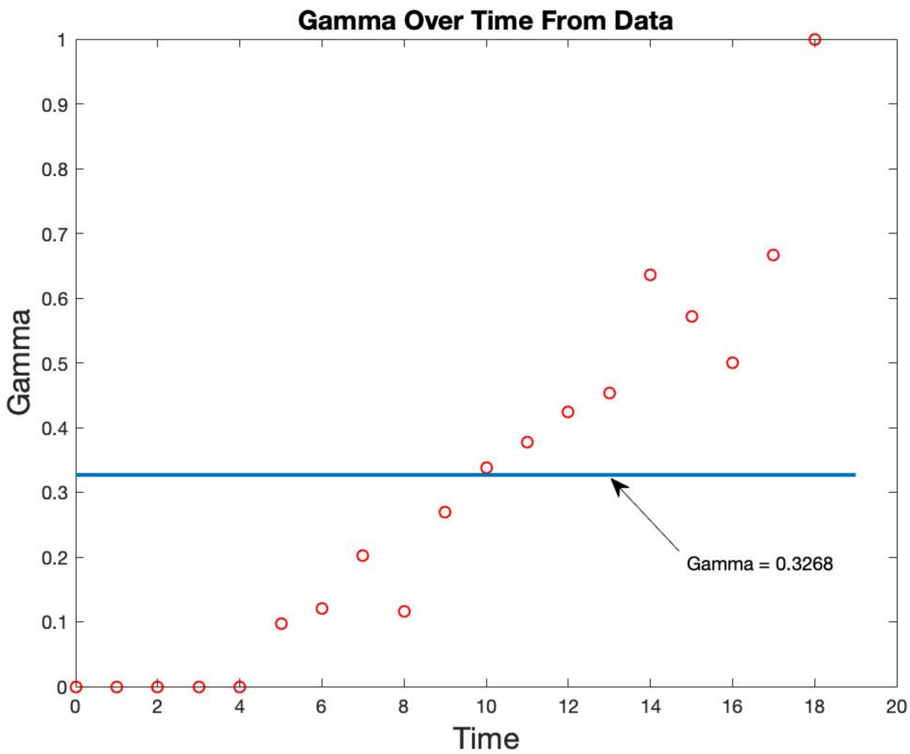
Treat $\beta$ and $\gamma$ as unknown parameters and solve for them to minimise the residuals.



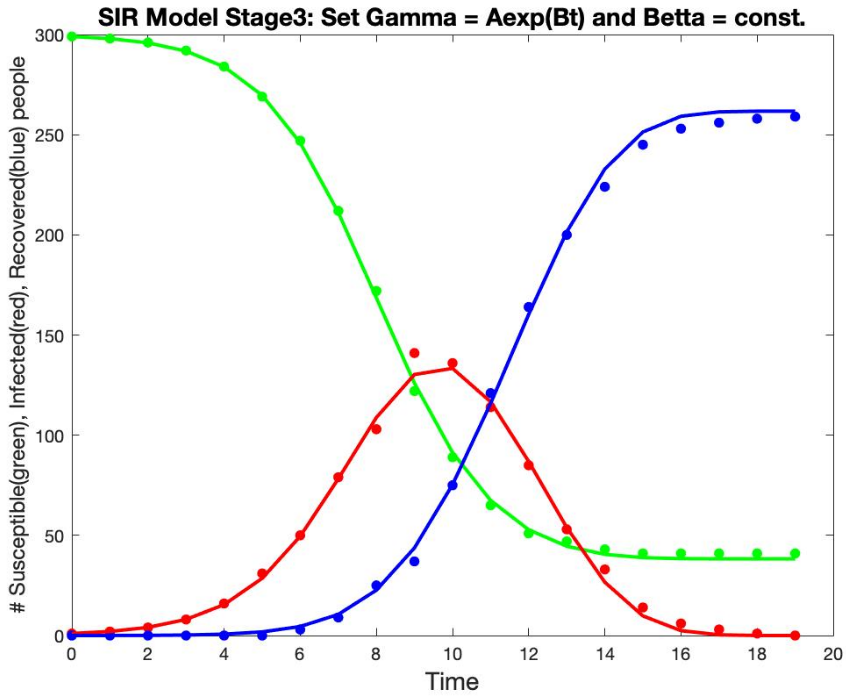

Residual = 11446 $\beta = 1.0041$ $\gamma = 0.3267$


Betta Over Time From Data VS Betta obtained from optimisation
Betta = 1.0041
Betta
Time
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
14
16
18
20

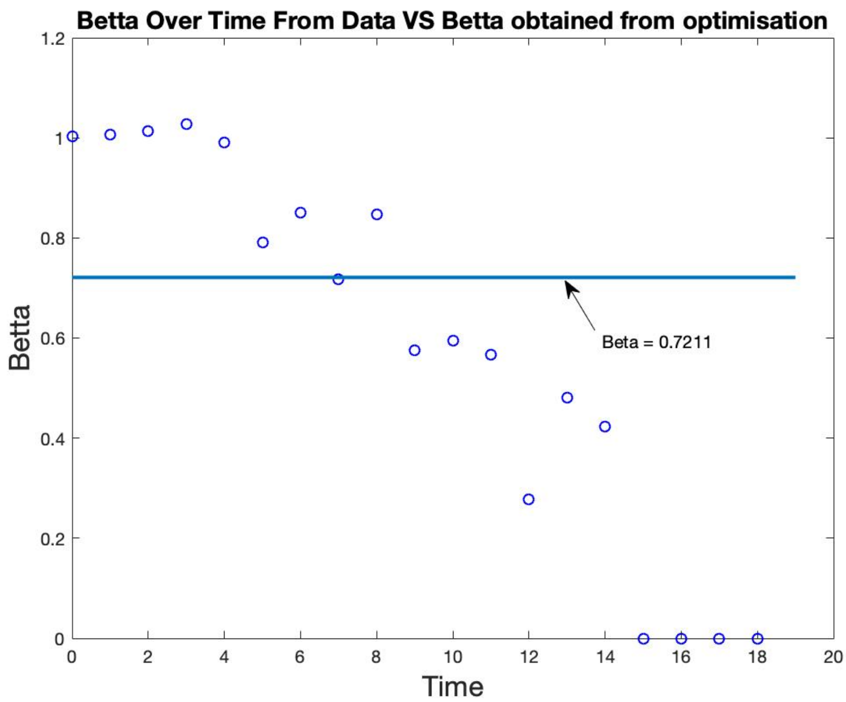

Gamma Over Time From Data
Gamma = 0.3268
Gamma
Time
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
12
14
16
18
20

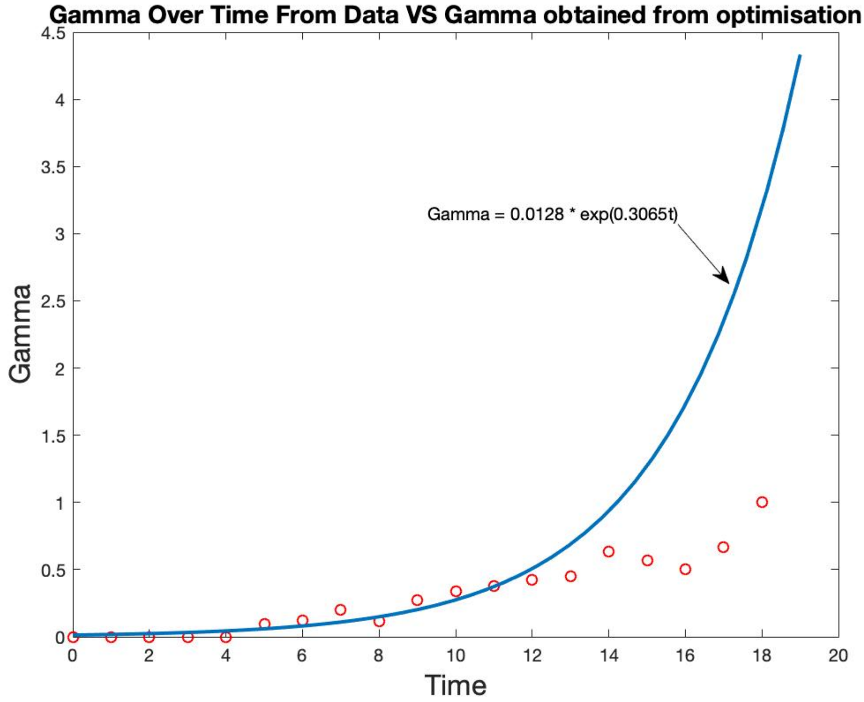
## Stage 2:

Set $\gamma = Ae^{Bt}$, where A and B are unknowns, and $\beta = const$. Solve for $\beta$, A and B to minimise the residuals.




Residual = 344.6369 $\beta = 0.7211$ $\gamma = 0.0128e^{0.3065t}$




Gamma Over Time From Data VS Gamma obtained from optimisation
Gamma = 0.0128 * exp(0.3065t)
Gamma
Time
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0
2
4
6
8
10
12
14
16
18
20

## Stage 3:

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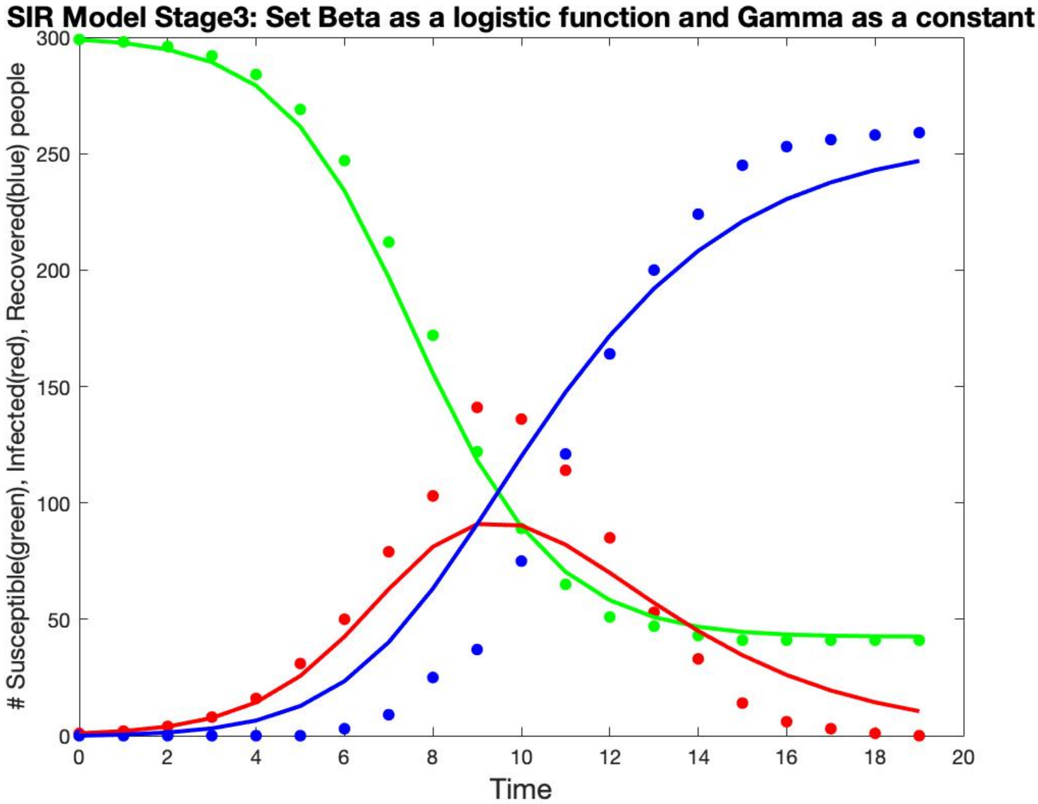
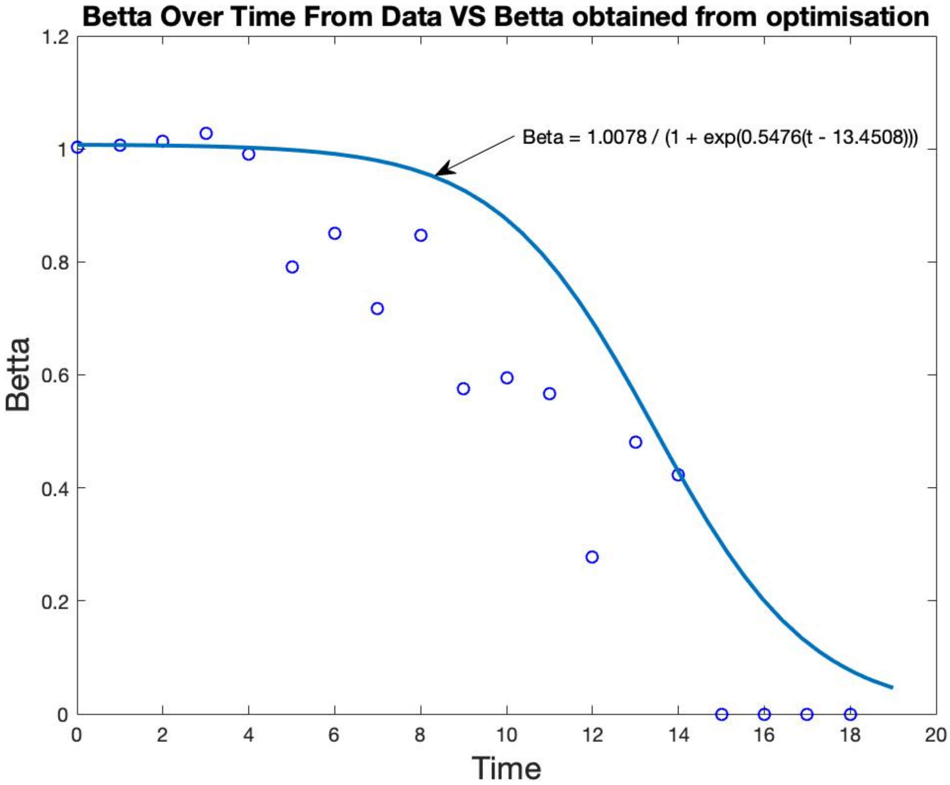
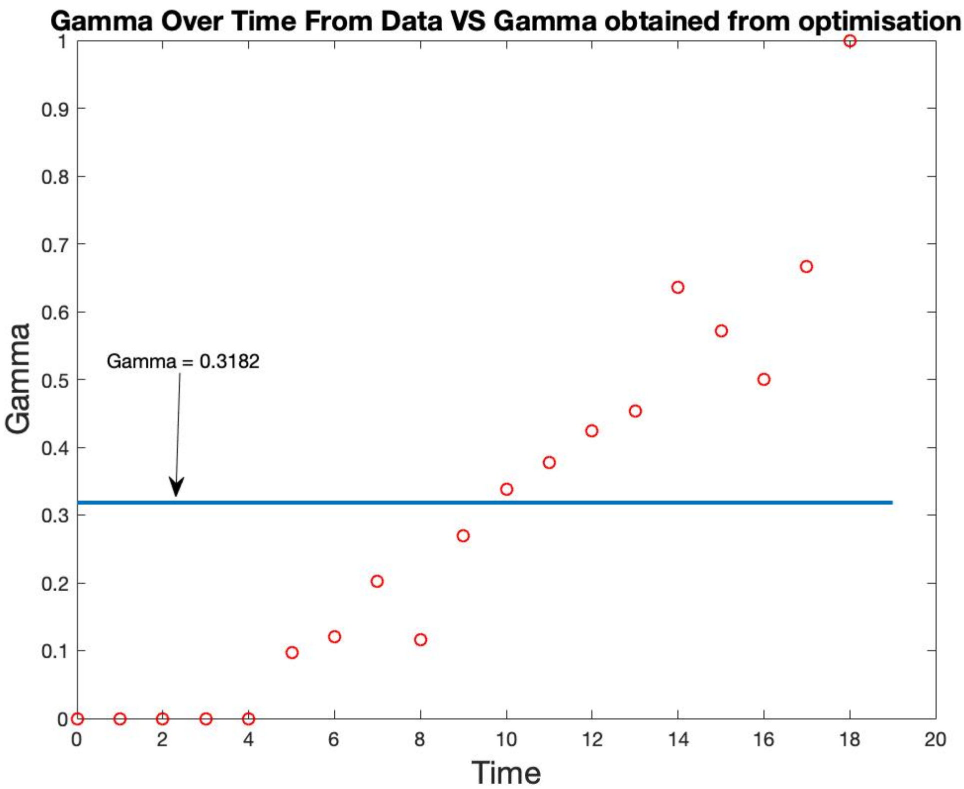
Set $\beta = \dfrac{L}{1 + e^{k(t - t_0)}}$ and $\gamma = const$. Solve for $L, k, t_0$, and $\gamma$ to minimise the residuals.




Residual = 9115 $\beta = \dfrac{1.0078}{1 + e^{0.5476(t - 13.4508)}}$ $\gamma = 0.3182$


Betta Over Time From Data VS Betta obtained from optimisation
Beta = 1.0078 / (1 + exp(0.5476(t - 13.4508)))
Betta
Time


Gamma Over Time From Data VS Gamma obtained from optimisation
Gamma = 0.3182
Gamma
Time

## Stage 4:

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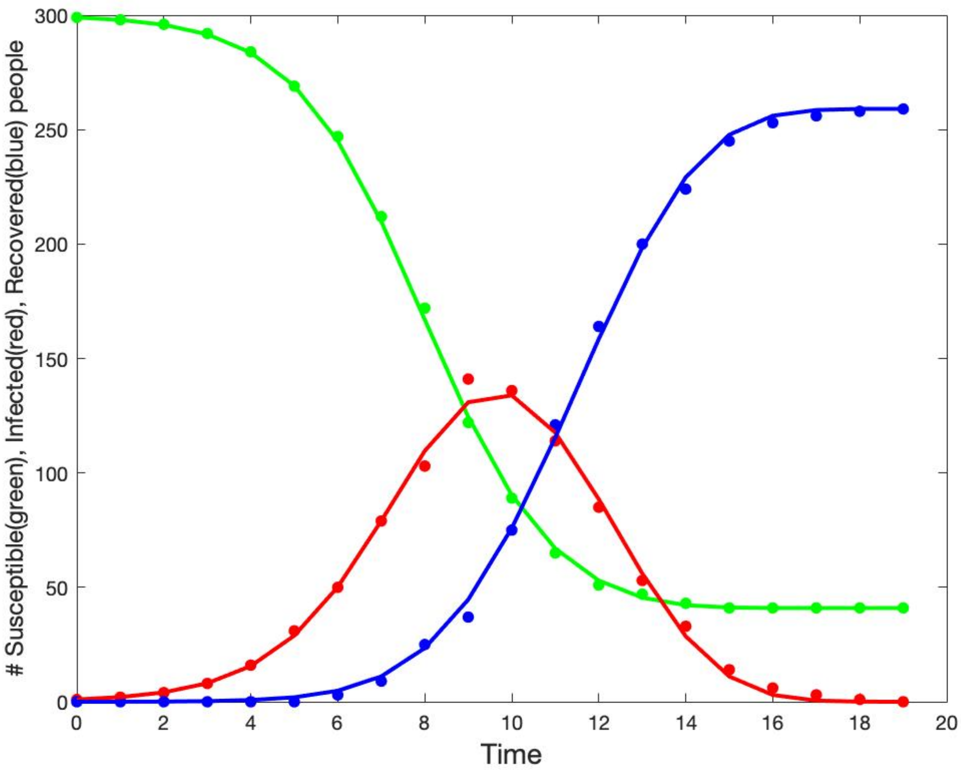
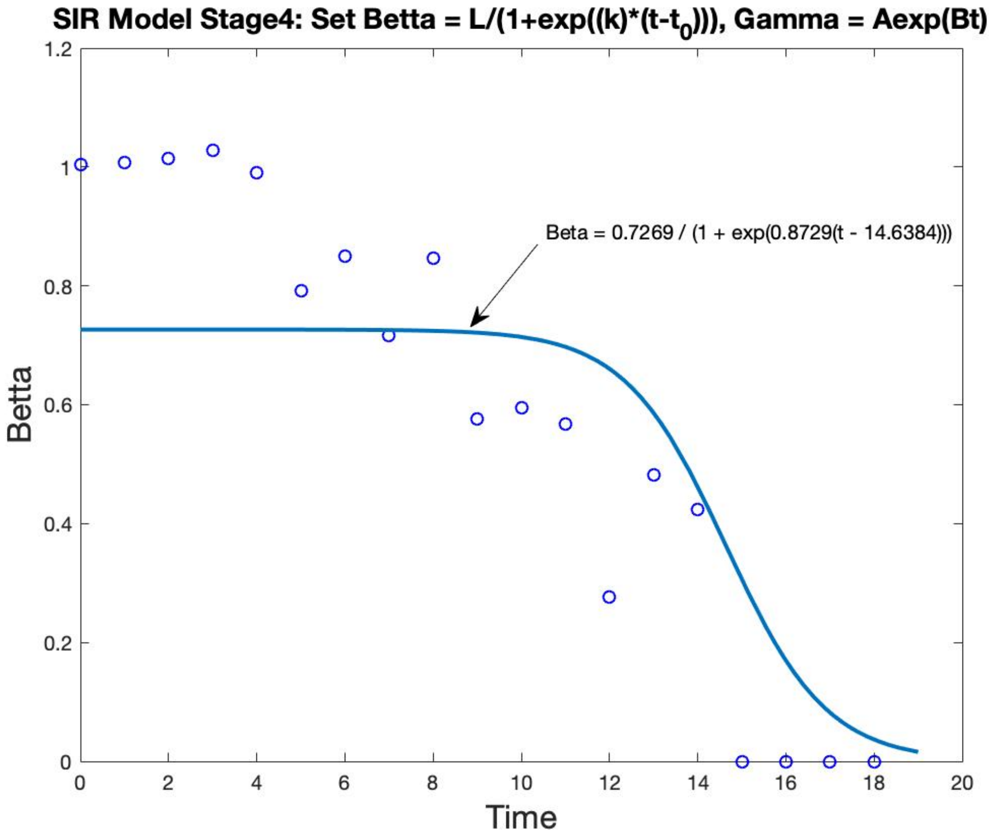
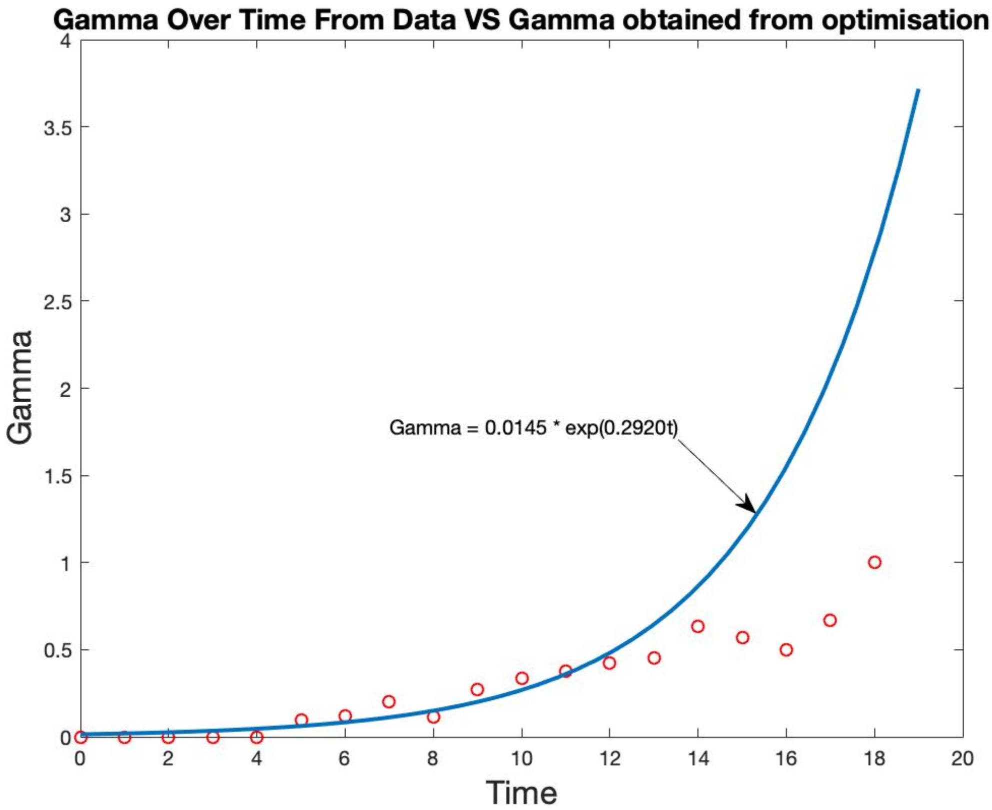
Set $\beta = \dfrac{L}{1 + e^{k(t-t_0)}}$ and $\gamma = Ae^{Bt}$. Solve for $L, k, t_0, A,$ and $B$ to minimise the residuals.




Residual = 287.8341 $\beta = \dfrac{0.7265}{1 + e^{0.8729(t-14.6384)}}$ $\gamma = 0.0145e^{0.2920t}$


SIR Model Stage4: Set Betta = L/(1+exp((k)*(t-t0))), Gamma = Aexp(Bt)
Beta = 0.7269 / (1 + exp(0.8729(t - 14.6384)))
Betta
Time
0
0.2
0.4
0.6
0.8
1
1.2
0
2
4
6
8
10
12
14
16
18
20


Gamma Over Time From Data VS Gamma obtained from optimisation
Gamma = 0.0145 * exp(0.2920t)
Gamma
Time
0
0.5
1
1.5
2
2.5
3
3.5
4
0
2
4
6
8
10
12
14
16
18
20