

Part 3 Discussion/Answers (Part 3 Q3):

The image shows the MATLAB R2024a interface with the following components:

- Editor:** Contains a script for an SIR model. The code defines initial conditions, a time vector, and a non-linear SIR model to estimate parameters using 30 days of data. It also includes a linear least squares fit for 10 days of data.
- Command Window:** Displays the results of the model fitting, showing estimated parameters for 30 days and 10 days of data.
- Workspace:** Lists the variables created during the execution, including initial conditions, time vector, and fitted parameters.

```
1 %Initial Conditions
2 beta = 0.3;
3 gamma = 0.1;
4 N = 1000;
5 S0 = 990;
6 I0 = 10;
7
8 % Time vector for 30 days
9 t = 1:30;
10
11 % non-linear SIR model to get true data I(t)
12 I_true = zeros(1, length(t));
13 I_true(1) = I0;
14
15 for i = 2:length(t)
16     I_true(i) = I_true(i-1) * exp((beta*S0/N - gamma));
17 end
18
19 %ln
20 ln_I_true = log(I_true);
21
22 % Linear least squares for 30 days
23 X = [ones(length(t), 1), t'];
24 Y = ln_I_true;
25 coefficients = (X' * X) \ (X' * Y);
26
```

Command Window Output:

```
>> MAE384_Project_Part3
Estimated parameters using 30 days of data:
ln(I(0)): 2.1056
k: 0.1970
Estimated beta: 0.3000

Estimated parameters using 10 days of data:
ln(I(0)): 2.1056
k: 0.1970
Estimated beta: 0.3000
```

Workspace Variables:

Name	Value
beta	0.3000
beta_est	0.3000
beta_est_10	0.3000
coefficients	[2.1056, 0.1970]
gamma	0.1000
i	30
I0	10
I_true	1x30 double
k_10	0.1970
k_30	0.1970
ln_I0_10	2.1056
ln_I0_30	2.1056
ln_I_true	1x30 double
ln_I_true_10	[2.3026, 2.4079]
N	1000
S0	990
t	1x30 double
t_10	[1, 2, 3, 4, 5, 6, ...]
X	30x2 double
X_10	10x2 double
Y	30x1 double

Generally speaking, more data collected over time would have more accurate numbers to a true scenario, and this holds true in this project. However, It could be useful to take shorter periods of time at the start or end of an epidemic because of the flatter curves and not so drastic changes.