Mini-Project Draft Chapter 1 Report

**MA7080 Mathematical Modelling**

**Team SRB60**

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# Mini-Project chapter 1 -Covid 19 Modelling

# Tasks 1-3

For this project, we have taken the Covid-19 global data from the below website

<https://covid19.who.int/info/>

We have selected the below 3 countries and their ‘cumulative cases, data for the Covid-19 data modelling and analysis:

* United States of America
* United Kingdom
* Italy

Task 4

By observing the data, the start of COVID for each country is taken as 100 Patients and by that we can identify that epidemic start dates for each country as

* United States of America: 23-02-2020
* United Kingdom: 03-03-2020
* Italy: 23-02-2020

We have considered 100 patients as start of Covid because the cases started to rise for all 3 countries nearly around same time frame (end of February to start of march) which is within 10 days. This could produce visible coherence when comparing the graphs.

Task 5

The graphs for the raw data are given in Figure xxxx below.

* By Plotting the graphs for the raw data of Cumulative cases for the selected 3 countries on Y-axis and start of pandemic days/dates on x-axis, we can observe certain curve patterns for all the countries.
* To establish if they are any waves indeed, we must look at the whole population for each country. Hence, we have represented the number of cases in millions for better visibility of all the data.

<<<<<<<<<<<<<<<<<<<Graphs>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

Task 6

Now we normalize the cumulative cases data by dividing with the respective country’s population and plot the graph as function of time. These graphs are presented in Figure xxxx.

The population of UK and Italy is close to each other but in comparison, the population of USA is 5 times larger.

By this we observe…..

Task 7

We can now split the series of each country to identify waves. To achieve this, we are converting our data into logarithmic data and plot the graphs. Then we can recognize the wave patterns by depicting straight line fragments approximation.

The logarithmic graphs for the 3 countries are given in below Figures XXX

The log graph for USA >>>>>>>>>>>>>>>

The log graph for UK>>>>>>>>>>>>>>>>>

The log graph for Italy>>>>>>>>>>>>>>>

Identify the waves

Task 8

Let us first consider USA wave 1.

(a)

Plot the graph using normalized cumulative fractions of raw data i.e., observed data

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

(b)

Take the log of these observed normalized values of the first wave and plot the log graph

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

(C)

* Identify linear fragments in the log graph and the corresponding days. Now calculate a, r by linear regression method using those log values
* Using linear regression formula log p= a+rt (where t = day number /time) calculate the expected values

Plot graph showing expected and observed values i.e., exponential model prediction graph

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

* Now calculate the error by taking the difference of expected and observed values for each data point.

Plot the error graph of expected and observed values

(d)

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

(f)

Calculate the values of K for each data point



K= observed vals(1+Expected vals)/ Expected vals

Plot graph using these K values

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

(e)

* Calculate ‘used value of K’ by taking the last value in the K values column where the graph becomes constant.
* Then calculate ln(P/(K-P)) p-observed value, k - used value of K. Plot the graph using these log values and time

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

* Calculate a, r using the above log values for the whole wave data, and calculate exp(a+rt)
* Using this we calculate the logistic model values with function

P(t) =  





Used k val - K(t)

Plot the final graph with observed and logistic model values on y axis and days on x axis.

<<<<<<<<<<<<<<<<<<<Graph>>>>>>>>>>>>>>>>

Repeat above steps for all waves of the 3 countries.

Task 9

References: