School of Chemical and Biomedical Engineering

CH2010

Project- COVID19 Pandemic

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Part 1. First 1000 COVID-19 cases in Singapore

Part 1 of the Excel data file provides selected patient information of the first 1000 confirmed cases of COVID-19 in Singapore.

Answer all six questions below by analysing the data

For each question, state clearly the sample size used, the assumptions with justifications and the potential flaws of the approach chosen (no approach is perfect).

If you find the question ambiguous, follow your own interpretation, then provide a justification of your interpretation.

1. Plot a histogram showing the distribution of COVID-19 patients by age group, *e.g.* 0 – 10 years, 11 – 20 years, 21 – 30 years, *etc*. What is the average age to contract the virus?

(4 marks)

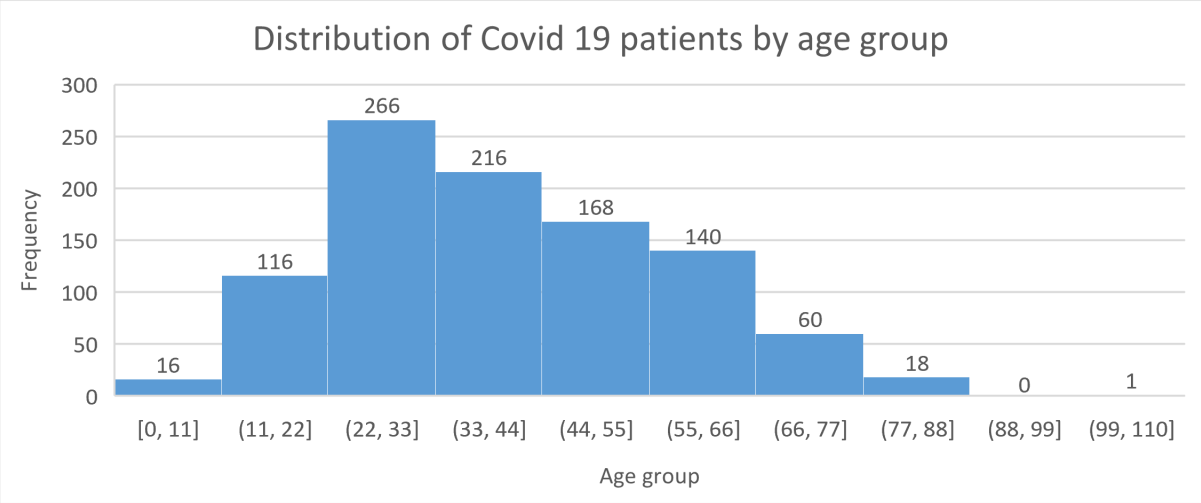


Figure 1. Histogram of covid-19 patients

Average Age to contract the virus:

$\bar{X}$ =41.064

2. According to the data provided, is it true that males generally take longer to recover than females? How conclusive is your answer?

(4 marks)

Assumptions:

1) Data is Normally Distributed
2) Sample size(n)>30
3) Central Limit Theorem
4) Data does not change over time

Flaw:

1) If data is not normally distributed and is skewed to either side.

Male

No. of males recovered:394
Total no. of days for males to recover: 6406
Average no. of days for male to recover:$\frac{6406}{394} = 16.259\ days$

Female

No. of females recovered:276
Total no. of days for females to recover: 4377
Average no. of days for females to recover:$\frac{4377}{276} = 15.859\ days$

Thus, is true that males took longer to recover than females.

To test for conclusiveness of answer, use hypothesis test
Assumption:

1) $\sigma_1 and\ \sigma_2$ are unknown and unequal
2) 95% confidence interval;5% level of significance (α)

Hypothesis Test between 2 means:

Let $\bar{X}_1 = Sample\ mean\ of\ male, \bar{X}_2 = Sample\ mean\ of\ female$;
$\mu_1 = Population\ mean\ of\ male\ , \mu_2 = Population\ mean\ of\ female$;
${S_1}^2 = Sample\ variance\ of\ male$,
${S_2}^2 = Sample\ variance\ of\ female$;
$n_1 = sample\ size\ of\ male\ recovered, n_2 = sample\ size\ of\ female\ recovered$

Hypothesis statement:
$H_0 = \mu_1 - \mu_2 = 0$
$H_1 = \mu_1 - \mu_2 > 0$

Deriving Test statistics (t distribution):

$\bar{X}_1 = 16.259\ days, \bar{X}_2 = 15.859\ days$

${S_1}^2 = 64.100, {S_2}^2 = 50.158$

$n_1 = 394, n_2 = 276$

$d_0 = 0$

$T' = \frac{(\bar{X}_1 - \bar{X}_2) - d_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{(16.259 - 15.859) - 0}{\sqrt{\frac{64.100}{394} + \frac{50.158}{276}}} = 0.682$

One tail test

$$\upsilon=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{(\frac{s_1^2}{n_1})^2}{(n_1-1)}+\frac{(\frac{s_2^2}{n_2})^2}{(n_2-1)}}=\frac{\left(\frac{64.100}{394}+\frac{50.158}{276}\right)^2}{\frac{(\frac{64.100}{394})^2}{(394-1)}+\frac{(\frac{50.158}{276})^2}{(276-1)}}=633$$

$t_{0.05,633}$:1.647 taken from : https://math.wikia.org/wiki/T_table

Since T'< $t_{0.05,633}$, therefore we cannot reject H_0 as there is insufficient data to reject. We cannot conclude that males take longer to recover than females under 95% confidence interval.

3. According to the data provided, is it true that males are less likely to recover (i.e. die from COVID-19), than females? How conclusive is your answer?

(4 marks)

Assumptions:

1) People in hospital are considered as alive
2) Binomial distributed
3) 90% confidence interval;10% level of significance (α)
4) Simple Random Sample
5) There was an error, Case no. 476 was deceased and edited into the data.

Flaw:

1) Population is not normally distributed
2) People in the hospital are considered as another category, eg. Under treatment

$p_1 = proportion\ of\ dead\ male, p_2 = proportion\ of\ dead\ female;$

$\hat{p}_1 = estimated\ proportion\ of\ dead\ male,$

$\hat{p}_2 = estimated\ proportion\ of\ dead\ females;$

$x_1 = no.of\ deceased\ male\ , x_2 = no.of\ deceased\ female;$

$n_1 = total\ no.of\ male\ , n_2 = total\ no.of\ female$

$$\hat{p}_1=\frac{No.of\ male\ deceased}{Total\ number\ of\ male}=\frac{5}{577}=0.00867$$

$$\hat{p}_2=\frac{No.of\ female\ deceased}{Total\ number\ of\ female}=\frac{3}{423}=0.00709$$

$\hat{p}_1 > \hat{p}_2$, is true that males are less likely to recover than females. Hypothesis test is needed, to test for its conclusiveness.

Hypothesis statement:
H_0=$p_1 - p_2 = 0$
H_1=$p_1 - p_2 > 0$
We are testing if p_1= p_2=p

Test statistics:

$$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{5 + 3}{577 + 423} = 0.008$$

$$Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})(\frac{1}{n_1} + \frac{1}{n_2})}} = \frac{0.00867 - 0.00709}{\sqrt{0.008(1-0.008)(\frac{1}{577} + \frac{1}{423})}} = 0.277$$

P(z>0.277) =1-P(z<0.277) →rejecting region

=1-0.609

=0.391

0.391>α, we cannot reject H_0. There is insufficient evidence to refute that the probability of male less likely to recover is the same as the probability of female less likely to recover. Thus, the conclusion above is not conclusive under 90% confidence interval.

4. Estimate the mean number of days to recover with 95% confidence intervals.

(4 marks)

Assumptions:

1) Sample size of 670 which is the number of recovered patients is considered to be large
2) Population distribution is symmetrical.
3) Sample Standard deviation is close to Population standard deviation

Flaw:

1) Sample used is not normally distributed
2) Sample standard deviation is not close to population standard deviation

Since population variance is unknown, t-distribution will be used for analysis

2 sided bounded:

95% confidence interval;5% level of significance (α)
n (sample size) =670
Degree of freedom: 669
$t_{0.025,669}$=1.964

$\bar{X} = 16.094\ days$
$s = 7.636 days$

Hence the 95% confidence interval for μ is:

$$\bar{X} - t_{0.025}\frac{s}{\sqrt{n}} < \mu < \bar{X} + t_{0.025}\frac{s}{\sqrt{n}}$$

$$16.094 - 1.964 \times \frac{7.636}{\sqrt{670}} < \mu < 16.094 + 1.964 \times \frac{7.636}{\sqrt{670}}$$

$$15.515 < \mu < 16.673$$

Therefore, given the sample, we are 95% certain that the mean of days to recover falls between 15.515 and 16.673

5. According to the data provided, is it true that a Singaporean (nationality-wise) male is more likely to contract COVID-19 than a Singaporean female? How conclusive is your answer? (4 marks)

Assumptions:

1) Binomial distributed
2) 90% confidence interval;10% level of significance (α)
3) Simple Random Sample

Flaw:

1) Sample is not normally distributed

$p_1 = \ proportion\ of\ singaporean\ male\ contract\ covid - 19,$

$p_2 = proportion\ of\ \ singaporean\ female\ contract\ covid - 19;$

$\hat{p}_1 = estimated\ proportion\ of\ singaporean\ male\ contract\ covid - 19,$

$\hat{p}_2 = estimated\ proportion\ of\ singaporean\ female\ contract\ covid - 19;$

$x_1 = no.of\ singaporean\ male\ contract\ covid - 19\ ,$

$x_2 = no.of\ singaporean\ female\ contract\ covid - 19;$

$n_1 = total\ no.of\ singaporean\ male\ , n_2 = total\ no.of\ singaporean\ female$

$$\hat{p}_1 = \frac{No.of\ singaporean\ male\ that\ contract\ covid19}{Total\ number\ of\ male} = \frac{400}{577} = 0.693$$

$$\hat{p}_2 = \frac{No.of\ singaporean\ female\ that\ contract\ covid19}{Total\ number\ of\ female} = \frac{324}{423} = 0.766$$

$\hat{p}_1 < \hat{p}_2$, is not true that males are more likely to contract covid-19 than females but to further conclude the results, hypothesis test is needed.

Hypothesis statement:
H_0=$p_1 - p_2 = 0$
H_1=$p_1 - p_2 > 0$

We are testing if p_1= p_2=p

Test statistics:

$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{400 + 324}{577 + 423} = 0.724$

$Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})(\frac{1}{n_1}+\frac{1}{n_2})}} = \frac{0.693 - 0.766}{\sqrt{0.724(1-0.724)(\frac{1}{577}+\frac{1}{423})}} = -2.55$

P(z<-2.55) =1-P(z<2.55) →rejecting region
http://pages.stat.wisc.edu/~ifischer/Statistical_Tables/Z-distribution.pdf

=1-0.995

=0.005

0.005<α, we reject H_0. There is sufficient evidence to prove that the probability of Singaporean male to contract covid-19 is higher than the probability of Singaporean female to contract covid-19 using 95% confidence.

6. According to the data, is it true that a COVID-19 patient at or above the age of 50 takes longer to recover than a patient who is younger than 50? How conclusive is your answer? (4 marks)

Assumptions:

1) Data is Normally Distributed
2) Sample size(n)>30
3) Central Limit Theorem
4) Data does not change over time
5) Included case 282, and he is 76 years old

Patients recovered who are less than 50 years old

No. of patients recovered who are less than 50 years old: 433
Total no. of days for patients less than 50 years old to recover: 6821
Average no. of days for patients that are less than 50 years old to recover:
$\frac{6821}{433} = 15.753\ days$

Patients Recovered who are more than 50 years old

No. of patients recovered who are more than 50 years old: 237
Total no. of days for patients that are more than 50 years old to recover: 3878
Average no. of days for patients that are less than 50 years old to recover:
$\frac{3878}{237} = 16.363\ days$

Thus, is true that patients that are 50 years old and above took longer to recover than those patients that are 50 years old and below.

To test for conclusiveness of answer, use hypothesis test

Assumption:

1) $\sigma_1 and\ \sigma_2$ are unknown and unequal
2) 95% confidence interval;5% level of significance (α)

Hypothesis Test between 2 means:

Let
$\bar{X}_1 = Sample\ mean\ of\ no. of\ days\ for\ patients\ less\ than\ 50\ years\ old\ to\ recover$,
$\bar{X}_2 = Sample\ mean\ of\ no. of\ days\ for\ patients\ more\ than\ 50\ years\ old\ to\ recover$;
$\mu_1 = Population\ mean\ of no. of\ days\ for\ patients\ less\ than\ 50\ years\ old\ to\ recover,$
$\mu_2 = Population\ mean\ of\ no. of\ days\ for\ patients\ more\ than\ 50\ years\ old\ to\ recover$;
${S_1}^2 = Sample\ variance\ of\ male$,
${S_2}^2 = Sample\ variance\ of\ female$;
$n_1 = sample\ size\ of$ total no. of days for patients less than 50 years old to recover,
$n_2 = sample\ size\ of$ total no. of days for patients more than 50 years old to recover

Hypothesis statement:

$H_0 = \mu_1 - \mu_2 = 0$
$H_1 = \mu_1 - \mu_2 > 0$

Deriving Test statistics (t distribution):

$\bar{X}_1 = 15.753\ days, \bar{X}_2 = 16.363\ days$

${S_1}^2 = 46.136, {S_2}^2 = 80.246$

$n_1 = 433, n_2 = 237$

$d_0 = 0$

$T' = \frac{(\bar{X}_1 - \bar{X}_2) - d_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{(15.753 - 16.363) - 0}{\sqrt{\frac{46.136}{433} + \frac{80.246}{237}}} = -0.914$

One tail test

$$\upsilon=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{(\frac{s_1^2}{n_1})^2}{(n_1-1)}+\frac{(\frac{s_2^2}{n_2})^2}{(n_2-1)}}=\frac{\left(\frac{46.136}{433}+\frac{80.246}{237}\right)^2}{\frac{(\frac{46.136}{433})^2}{(433-1)}+\frac{(\frac{80.246}{237})^2}{(237-1)}}=386$$

(Single sided test)$t_{0.05,386}$:-1.649 taken from : https://math.wikia.org/wiki/T_table

Since T'> $t_{0.05,633}$, therefore we cannot reject H_0 as there is insufficient data to conclude that patients at 50 or above takes longer to recover than a patient who is younger than 50 under 95% confidence interval.

Part 2. COVID-19 in Singapore and overseas

Part 2 of the Excel data file provides the data of the number of new cases of COVID-19 every day, between 31 December 2019 and 2 August 2020, confirmed in Singapore, China, United Kingdom and United States.

Analyse the data and answer all three questions below.

If you find the question ambiguous, follow your own interpretation, then provide a justification of your interpretation.

7. How does the daily number of new cases in Singapore correlate to the daily number of new cases in China, United Kingdom and United States, respectively?

(4 marks)

Using Pearson product-moment correlation coefficient (r), it will be able to find the direction and degree of linear relations between 2 variables or in our case between 2 countries.

The correlation coefficient can be found using:

$$r=\frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$$

To test for linearity, we use 2 tail hypothesis test of significance level of 0.05.

$H_0 = \rho = 0$
$H_1 = \rho \neq 0$

Test Statistics:

$$t=\frac{b_1}{s\sqrt{S_{xx}}}=\frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Degree of freedom= 216-2=214

$t_{0.025}$=-1.971

Critical Region: t<-1.971 or t>1.971

Using Excel Functions (Appendix B):

Singapore and China relations

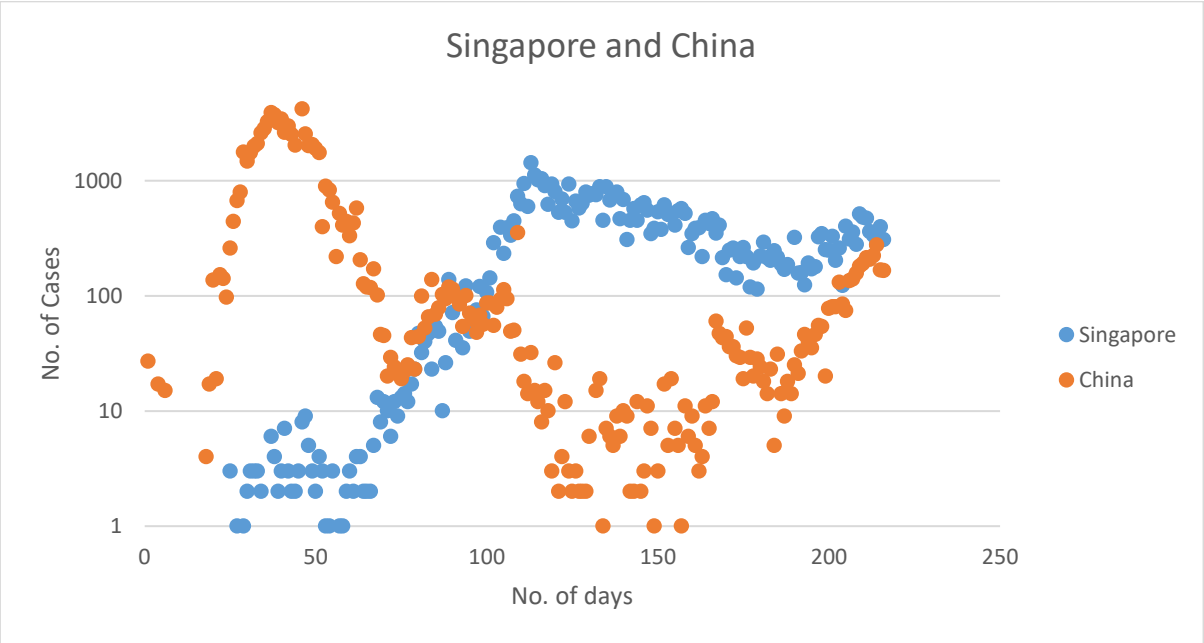


Figure 2. Scatter plot of Singapore and China new cases vs the no. of days

Singapore and China relations

Sxx=17411595.33

Syy=355982706.8

Sxy=-19104728.78

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{19104728.78}{\sqrt{(17411595.33)*(355982706.8)}} = -0.24267(5\text{ d.p})$$

Looking at the r value, both countries cases are negatively correlated as the r value is <0.

The correlation can be seen in figure 2 above. Figure 2 shows that the daily number of new cases of China increases while Singapore cases decreases. Since the correlation coefficient (r) is not close to -1, the correlation is weak between Singapore and China cases.

To affirm the above conclusion of linearly correlated, hypothesis test can be used,

Test Statistics:

$$t = \frac{b_1}{s\sqrt{S_{xx}}} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = -3.65925\ (5\text{ d.p})$$

Since t<-1.971, there is sufficient evidence to reject H_0, thus there are certain correlation between China and Singapore which fortify our claim above.

Singapore and UK relations

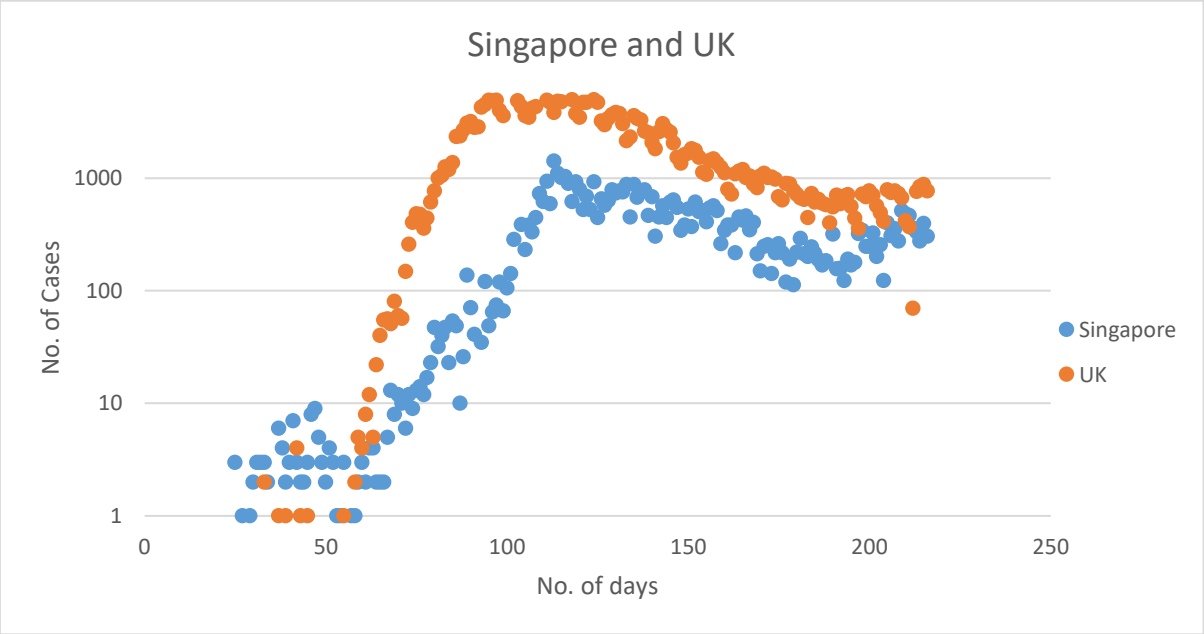


Figure 3. Scatter plot of Singapore and UK new cases vs the no. of days

Sxx= 17411595.33

Syy= 598239880.6

Sxy= 65490238.56

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{65490238.56}{\sqrt{(17411595.33)*(598239880.6)}} = 0.64168(5\ d.p)$$

Looking at the r value, both countries cases are positively correlated as the r value is >0.

The correlation can be seen in figure 3 above. Figure 3 shows that the daily number of new cases of UK increases while Singapore cases increases. Since the correlation coefficient (r) is not close to 1, the correlation is moderate between Singapore and UK cases.

To affirm the above conclusion of linearly correlated, hypothesis test can be used,

Test Statistics:

$$t = \frac{b_1}{s\sqrt{S_{xx}}} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = 12.23904\ (5\ d.p)$$

Since t>1.971, there is sufficient evidence to reject H_0, thus there is correlation between UK and Singapore which fortify our claim above.

Singapore and US relations

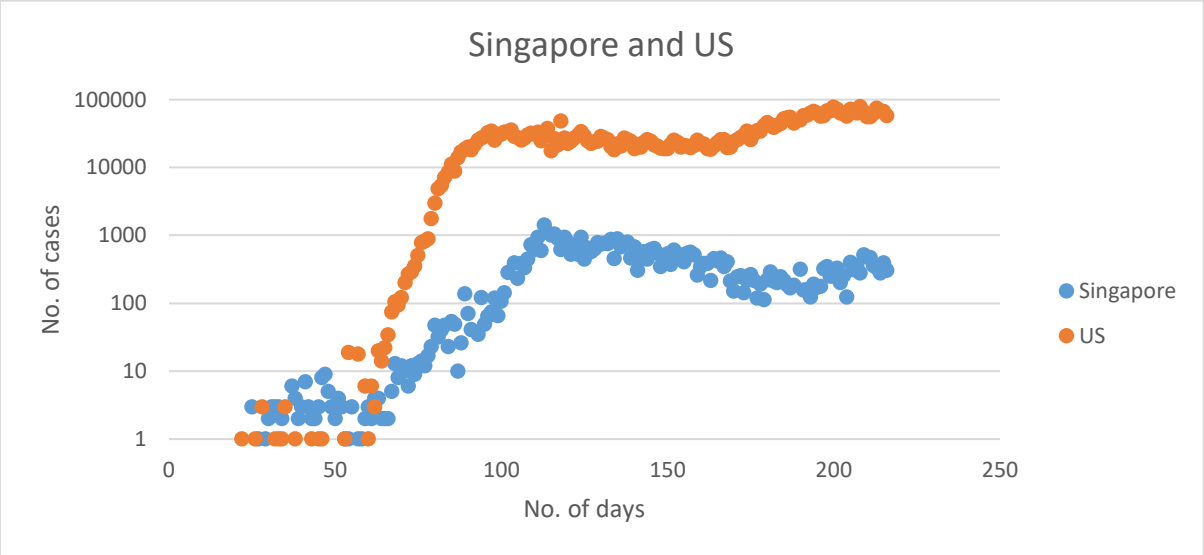


Figure 4. Scatter plot of Singapore and US new cases vs the no. of days

Sxx= 17411595.33

Syy= 99283933847

Sxy= 543202110.3

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{543202110.3}{\sqrt{(17411595.33)*(99283933847)}} = 0.41315(5\ d.p)$$

Looking at the r value, both countries cases are positively correlated as the r value is >0.

The correlation can be seen in figure 4 above. Figure 4 shows that the daily number of new cases of US increases while Singapore cases increases. Since the correlation coefficient (r) is not close to 1, the correlation is moderate between Singapore and US cases.

To affirm the above conclusion of linearly correlated, hypothesis test can be used,

Test Statistics:

$$t = \frac{b_1}{s\sqrt{S_{xx}}} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = 6.63668(5\ d.p)$$

Since t>1.971, there is sufficient evidence to reject H_0, thus there is correlation between US and Singapore which fortify our claim above.

8. When COVID-19 spreads from one country to another, we may see some similarity in the behaviour of the outbreaks. For example, the number of new cases in Singapore may not correlate well with the number of new cases in China on a same-day basis, but may correlate better with the number of new cases in China x days ago. Find out the values of x that maximise the correlation between the number of new cases in Singapore and the number of new cases in China, United Kingdom and United States, respectively. Explain the method used to determine x and the assumptions made with justifications. Solutions that use an automated algorithm to find out x will score more marks (of course, you need to clearly explain the algorithm used and how it is computationally implemented).

(8 marks)

Assumption:

Data for each country used to compare are not autocorrelated

Using the concept of cross-correlation:

Singapore's 1st day cases best correlates with China cases 79 days ago which is x1 in figure 5. That was found using the MATLAB script file in figure 6.

Singapore's 1st day cases best correlates with United Kingdom cases 15 days ago which is x2 in figure 5. That was found using the MATLAB script file in figure 6.

United States' 1st day cases best correlates with Singapore cases 63 days ago which is x3 in figure 5. That was found using the MATLAB script file in figure 6.

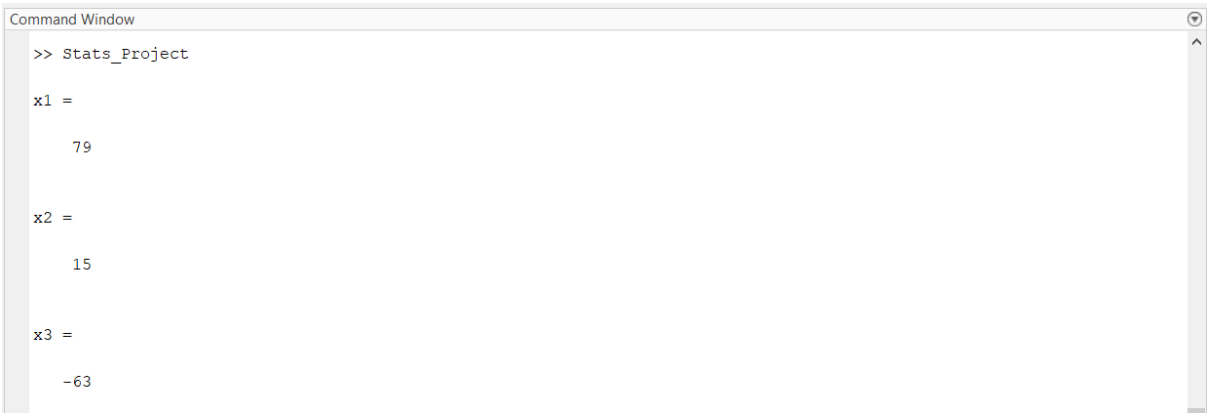


Figure 5. Values of 'x' days

Explanation of algorithm used:

C:\2nd Partition\Matlab\Stats_Project.m

EDITOR PUBLISH VIEW

```
1 -  Singapore=transpose(table2array(COVID19DataforProject1S2([1:end],2)));
2 -  China=transpose(table2array(COVID19DataforProject1S2([1:end],3)));
3 -  UK=transpose(table2array(COVID19DataforProject1S2([1:end],4)));
4 -  US=transpose(table2array(COVID19DataforProject1S2([1:end],5)));
5
6 -  cross_corr1=xcorr(Singapore,China);% all correlation factor number for singapore and china
7 -  [cross_corr1, lags1]=xcorr(Singapore,China);% all lags(the number of days shifted) tested
8 -  maxvalue1=max(cross_corr1);%maximum value of correlation factor number
9 -  a=find(cross_corr1== maxvalue1);%column number that has the maximum value of correlation factor number
10 -  x1=lags1(a)% x days that has the best correlation
11
12 -  cross_corr2=xcorr(Singapore,UK);% all correlation factor number for singapore and UK
13 -  [cross_corr2, lags2]=xcorr(Singapore,UK);
14 -  maxvalue2=max(cross_corr2);
15 -  b=find(cross_corr2== maxvalue2);
16 -  x2=lags2(b)
17
18 -  cross_corr3=xcorr(Singapore,US);% all correlation factor number for singapore and US
19 -  [cross_corr3, lags3]=xcorr(Singapore,US);
20 -  maxvalue3=max(cross_corr3);
21 -  c=find(cross_corr3== maxvalue3);
22 -  x3=lags3(c)
23
24 -  plot(lags1,cross_corr1)
25 -  title('Cross Correlation between Singapore and China')
26 -  xlabel('Time lag')
27 -  ylabel('Cross Correlation Factor')
28 -  figure(2)
29 -  plot(lags2,cross_corr2)
30 -  title('Cross Correlation between Singapore and UK')
31 -  xlabel('Time lag')
32 -  ylabel('Cross Correlation Factor')
33 -  figure(3)
34 -  plot(lags3,cross_corr3)
35 -  title('Cross Correlation between Singapore and US')
36 -  xlabel('Time lag')
37 -  ylabel('Cross Correlation Factor')
```

Figure 6. A script file of using cross correlation function to find x days.

With reference to figure 6:

Firstly, data from excel file are transposed to array which are indicated from line 1-4.

Thereafter, ‘xcorr’ function is used to find the cross-correlated coefficient by cross correlating 2 data. Taking an example of Singapore and China (line 6), the function works by making Singapore fixed while China shift horizontally along the x axis. This shift is called lags. All the values of the cross-correlated coefficient are found in line 6 by shifting China data 1 point at a time horizontally.

In addition, all lags that are tested in cross-correlation are stated in line7. Higher cross-correlated coefficient between Singapore and China gives us better correlation between them. Thus, ‘max’ command is used to find the maximum cross-correlation coefficient that can be seen in line 8.

After getting the maximum cross-correlation coefficient, the column number of it can be found using ‘find’ command, by relating the cross-correlation arrays and the maximum cross-correlation coefficient, this can be seen line 9. Lastly, once the column number is

found, it is subbed into the arrays of lags that was derived in line 7 which is indicated in line 10 to give us the lag value which is our 'x' days.

Positive x or lag values represents that China has shift horizontally to the right whereas negative x or lag values represents that China has shift horizontally to the left.

This concept was brought forward to the other countries which can be seen from line 12 to 22.

Graphs of all the correlation can be found in Appendix C

This video can be used to further fortify the understanding of this concept:

https://www.youtube.com/watch?v=RO8s1TrElEw&ab_channel=DavidDorran

9. Propose numerical models that describe the trends in the number of new cases in Singapore, China, United Kingdom and United States, respectively. How well do the models fit?

(4 marks)

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE
Singapore Trend	Singapore_no_of_cases vs. Days	sin8	1.6709e+06	0.9040	192	0.8925	93.2877
Singapore Trend 1	Singapore_no_of_cases vs. Days	poly8	3.7886e+06	0.7824	207	0.7740	135.2873
Singapore Trend 2	Singapore_no_of_cases vs. Days	fourier8	2.3083e+06	0.8674	198	0.8560	107.9716

Table 1. Shows the different trend and its different fit type for Singapore cases

Singapore Trend

I propose to use the sum of sine with 8 terms to describe the trends of new cases in Singapore that can be found in the curve fitting toolbox in MATLAB. Using this numerical model, the adjusted R-squared value is 0.8925 that can be seen in table 1. When compared to other models in table 1, Fourier and polynomial, the root-mean squared error (RMSE) is significantly higher than the sum of sine model and both R-squared value are lower than sum of sine.

Trend line and its function is shown in appendix D.

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE
China Trend	China_no_of_cases vs. Days	gauss8	2.4539e+06	0.9931	192	0.9923	113.0524
China Trend 1	China_no_of_cases vs. Days	sin8	1.5131e+08	0.5750	192	0.5240	887.7246
China Trend 2	China_no_of_cases vs. Days	fourier8	1.4670e+08	0.5879	198	0.5525	860.7630

Table 2. Shows the different trend and its different fit type for China cases

China Trend

I propose to use the gaussian with 8 terms to describe the trends of new cases in China that can be found in the curve fitting toolbox in MATLAB. Using this numerical model, the adjusted R-squared value is 0.9923 that can be seen in table 2, which is very close to the best fit criteria which has R-squared value of 1. When compared to other models in table 1, Fourier and sum of sine, the root-mean squared error (RMSE) is significantly higher than the sum of sine model and both R^2value are very much lower than gaussian.

Trend line and its function is shown in appendix D.

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE
UKTrend 1	UK_no_of_cases vs. Days	gauss8	1.7035e+07	0.9715	192	0.9681	297.8681
UK Trend 2	UK_no_of_cases vs. Days	fourier8	2.5249e+07	0.9578	198	0.9542	357.1015
UK Trend	UK_no_of_cases vs. Days	sin8	1.5130e+07	0.9747	192	0.9717	280.7179

Table 3. Shows the different trend and its different fit type for UK cases

UK Trend

I propose to use the sum of sin with 8 terms to describe the trends of new cases in UK that can be found in the curve fitting toolbox in MATLAB even though gaussian and Fourier also have good relation with the data that can be seen in table 3. Using this numerical model, the adjusted R-squared value is 0.9717 that can be seen in table 3, which is very close to the best fit criteria which has R-squared value of 1. When compared to other models in table 3, Fourier and gaussian, the root-mean squared error (RMSE) is higher than the sum of sine model, thus it shows that sum of sine model has a better fit and both R^2value are lower than sum of sine.

Trend line and its function is shown in appendix D.

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE
US Trend 2	US_no_of_cases vs. Days	fourier8	2.6128e+09	0.9737	198	0.9714	3.6326e+03
US Trend 1	US_no_of_cases vs. Days	gauss8	2.3254e+09	0.9766	193	0.9739	3.4711e+03
US Trend	US_no_of_cases vs. Days	sin8	1.8950e+09	0.9809	192	0.9786	3.1416e+03

Table 4. Shows the different trend and its different fit type for US cases

US Trend

I propose to use the sum of sin with 8 terms to describe the trends of new cases in US that can be found in the curve fitting toolbox in MATLAB even though gaussian and Fourier also have good relation with the data that can be seen in table 4. Using this numerical model, the adjusted R-squared value is 0.9786 that can be seen in table 3, which is very close to the best fit criteria which has R-squared value of 1. When compared to other models in table 4, Fourier and gaussian, the root-mean squared error (RMSE) is higher than the sum of sine model, thus it shows that sum of sine model has a better fit and both R^2value are lower than sum of sine.

Trend line and its function is shown in appendix D.

Table of Fits

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE
US Trend	US_no_of_cases vs. Da...	sin8	1.8950e+09	0.9809	192	0.9786	3.1416e+03
UK Trend	UK_no_of_cases vs. Da...	sin8	1.5130e+07	0.9747	192	0.9717	280.7179
Singapore Trend	Singapore_no_of_case...	sin8	1.6709e+06	0.9040	192	0.8925	93.2877
China Trend	China_no_of_cases vs. ...	gauss8	2.4539e+06	0.9931	192	0.9923	113.0524

Table 5. Shows the proposed model for all the 4 countries.

Appendix A

1003	Q1		Q2		Q3	
1004	Average Age	41.064	No.of males recovered	394	No.of males deceased	5
1005			Total no. of days for males to recover	6406	Total number of male	577
1006			variance(males) of recovered days	64.10074786		
1007			Standard deviation for recovered days	8.006294265	Probability of Male dead	0.008665511
1008			Average no of days recovered for male	16.25888325		
1009						
1010						
1011			No.of Females recovered	276		
1012			Total no. of days for females to recover	4377	No.of females deceased	3
1013			Average no of days recovered for female	15.85869565	Total number of female	423
1014			Total no. of patients recovered	670	Probability of female dead	0.007092199
1015			variance(female) of recovered days	50.15814229		
1016			Standard deviation for recovered days	7.082241333		
1017			Total no of days recovered	10783	Total Deceased	8

1003	Q4		Q5	
1004	Average recovery days	16.0940299	No. of Singaporeans males got covid	400
1005	SD of recovered days	7.63626351	Total no. of singaporeans	724
1006	Sample size	670	Probability of singaporean male getting covid	0.693240901
1007			Total number of male	577
1008				
1009				
1010				
1011			No. of females got covid	324
1012			Probability of singaporean female getting covid	0.765957447
1013			Total number of female	423

Q6	
Number of people recovered who are less than 50	433
Total number of days for patients less than 50	6821
Mean	15.7528868
Variance	46.135553
Number of people recovered who are more than 50	237
Total number of days for patients more than 50	3962
mean	16.7172996
Variance	80.246013

Appendix B

Singapore and China

	A	B	C	D	G	H	I	J	K	L	M	N	O
1		No. of cases	216		Singapore and China								
2					Sxx	17411595.3	Syy	355982707	Sxy	-19104729		r	t
3		Days	Singapore	China	x-(xbar)^2	xbar	y-(ybar)^2	ybar	(x-xbar)	(y-ybar)	(x-xbar)*(y-ybar)	-0.242665001	-3.6592576
4	Dec 31, 2019	1	0	27	59103.01235	243.111111	144076.478	406.574074	-243.11111	-379.57407	92278.6749		
5	Jan 1, 2020	2	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
6	Jan 2, 2020	3	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
7	Jan 3, 2020	4	0	17	59103.01235		151767.959		-243.11111	-389.57407	94709.78601		
8	Jan 4, 2020	5	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
9	Jan 5, 2020	6	0	15	59103.01235		153330.255		-243.11111	-391.57407	95196.00823		
10	Jan 6, 2020	7	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
11	Jan 7, 2020	8	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
12	Jan 8, 2020	9	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
13	Jan 9, 2020	10	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
14	Jan 10, 2020	11	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
15	Jan 11, 2020	12	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
16	Jan 12, 2020	13	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
17	Jan 13, 2020	14	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
18	Jan 14, 2020	15	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
19	Jan 15, 2020	16	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
20	Jan 16, 2020	17	0	0	59103.01235		165302.478		-243.11111	-406.57407	98842.6749		
21	Jan 17, 2020	18	0	4	59103.01235		162065.885		-243.11111	-402.57407	97870.23045		
22	Jan 18, 2020	19	0	17	59103.01235		151767.959		-243.11111	-389.57407	94709.78601		
23	Jan 19, 2020	20	0	136	59103.01235		73210.3296		-243.11111	-270.57407	65779.56379		
24	Jan 20, 2020	21	0	19	59103.01235		150213.663		-243.11111	-387.57407	94223.56379		
25	Jan 21, 2020	22	0	151	59103.01235		65318.1073		-243.11111	-255.57407	62132.89712		
26	Jan 22, 2020	23	0	140	59103.01235		71061.737		-243.11111	-266.57407	64807.11934		
27	Jan 23, 2020	24	0	97	59103.01235		95836.1073		-243.11111	-309.57407	75260.89712		
28	Jan 24, 2020	25	3	259	57653.34568		21778.1073		-240.11111	-147.57407	35434.1749		
29	Jan 25, 2020	26	0	441	59103.01235		1185.14438		-243.11111	34.4259259	-8369.325103		
30	Jan 26, 2020	27	1	665	58617.79012		66783.9592		-242.11111	258.425926	-62567.78807		
31	Jan 27, 2020	28	0	787	59103.01235		144723.885		-243.11111	380.425926	-92485.76955		
32	Jan 28, 2020	29	1	1753	58617.79012		1812862.77		-242.11111	1346.42593	-325984.677		
33	Jan 29, 2020	30	2	1466	58134.5679		1122383.29		-241.11111	1059.42593	-255439.3621		
34	Jan 30, 2020	31	3	1740	57653.34568		1778024.7		-240.11111	1333.42593	-320170.3807		
35	Jan 31, 2020	32	3	1980	57653.34568		2475669.14		-240.11111	1573.42593	-377797.0473		
36	Feb 1, 2020	33	3	2095	57653.34568		2850782.11		-240.11111	1688.42593	-405409.8251		
37	Feb 2, 2020	34	2	2590	58134.5679		4767348.77		-241.11111	2183.42593	-526448.251		
38	Feb 3, 2020	35	0	2812	59103.01235		5786073.89		-243.11111	2405.42593	-584785.7695		
39	Feb 4, 2020	36	0	3237	59103.01235		8011310.92		-243.11111	2830.42593	-688107.9918		
40	Feb 5, 2020	37	6	3872	56221.67901		12009176.8		-237.11111	3465.42593	-821690.9918		
41	Feb 6, 2020	38	4	3727	57174.12346		11025228.3		-239.11111	3320.42593	-793950.7325		
42	Feb 7, 2020	39	2	3160	58134.5679		7581354.33		-241.11111	2753.42593	-663881.5844		
43	Feb 8, 2020	40	3	3418	57653.34568		9068686.11		-240.11111	3011.42593	-723076.8251		
44	Feb 9, 2020	41	7	2607	55748.45679		4841874.26		-236.11111	2200.42593	-519545.0103		
45	Feb 10, 2020	42	3	2974	57653.34568		6591675.89		-240.11111	2567.42593	-616467.4918		
46	Feb 11, 2020	43	2	2490	58134.5679		4340663.59		-241.11111	2083.42593	-502337.1399		
47	Feb 12, 2020	44	2	2028	58134.5679		2629022.03		-241.11111	1621.42593	-390943.8066		
48	Feb 13, 2020	45	3	15141	57653.34568		217103307		-240.11111	14734.4259	-3537899.381		

	A	B	C	D	G	H	I	J	K	L	M	N	O
48	Feb 13, 2020	45	3	15141	57653.34568		217103307		-240.11111	14734.4259	-3537899.381		
49	Feb 14, 2020	46	8	4156	55277.23457		14058194.8		-235.11111	3749.42593	-881531.6955		
50	Feb 15, 2020	47	9	2538	54808.01235		4542976.48		-234.11111	2131.42593	-498990.4918		
51	Feb 16, 2020	48	5	2007	56696.90123		2561363.14		-238.11111	1600.42593	-381079.1955		
52	Feb 17, 2020	49	3	2052	57653.34568		2707426.48		-240.11111	1645.42593	-395085.0473		
53	Feb 18, 2020	50	2	1890	58134.5679		2200552.48		-241.11111	1483.42593	-357670.4733		
54	Feb 19, 2020	51	4	1750	57174.12346		1804793.22		-239.11111	1343.42593	-321228.0658		
55	Feb 20, 2020	52	3	394	57653.34568		158.107339		-240.11111	-12.574074	3019.174897		
56	Feb 21, 2020	53	1	891	58617.79012		234668.478		-242.11111	484.425926	-117284.8992		
57	Feb 22, 2020	54	1	826	58617.79012		175918.107		-242.11111	419.425926	-101547.677		
58	Feb 23, 2020	55	3	647	57653.34568		57804.6259		-240.11111	240.425926	-57728.93621		
59	Feb 24, 2020	56	0	218	59103.01235		35560.1814		-243.11111	-188.57407	45844.45267		
60	Feb 25, 2020	57	1	515	58617.79012		11756.1814		-242.11111	108.425926	-26251.1214		
61	Feb 26, 2020	58	1	410	58617.79012		11.7369684		-242.11111	3.42592593	-829.4547325		
62	Feb 27, 2020	59	2	439	58134.5679		1051.44067		-241.11111	32.4259259	-7818.251029		
63	Feb 28, 2020	60	3	329	57653.34568		6017.73697		-240.11111	-77.574074	18626.39712		
64	Feb 29, 2020	61	2	428	58134.5679		459.070302		-241.11111	21.4259259	-5166.028807		
65	Mar 1, 2020	62	4	574	57174.12346		28031.4407		-239.11111	167.425926	-40033.39918		
66	Mar 2, 2020	63	4	205	57174.12346		40632.1073		-239.11111	-201.57407	48198.60082		
67	Mar 3, 2020	64	2	127	58134.5679		78161.6629		-241.11111	-279.57407	67408.41564		
68	Mar 4, 2020	65	2	119	58134.5679		82698.8481		-241.11111	-287.57407	69337.30453		
69	Mar 5, 2020	66	2	117	58134.5679		83853.1444		-241.11111	-289.57407	69819.52675		
70	Mar 6, 2020	67	5	170	56696.90123		55967.2925		-238.11111	-236.57407	56330.91564		
71	Mar 7, 2020	68	13	101	52951.12346		93375.5147		-230.11111	-305.57407	70315.98971		
72	Mar 8, 2020	69	8	46	55277.23457		130013.663		-235.11111	-360.57407	84774.97119		
73	Mar 9, 2020	70	12	45	53412.34568		130735.811		-231.11111	-361.57407	83563.78601		
74	Mar 10, 2020	71	10	20	54340.79012		149439.515		-233.11111	-386.57407	90114.71193		
75	Mar 11, 2020	72	6	29	56221.67901		142562.181		-237.11111	-377.57407	89527.00823		
76	Mar 12, 2020	73	12	24	53412.34568		146362.922		-231.11111	-382.57407	88417.11934		
77	Mar 13, 2020	74	9	22	54808.01235		147897.218		-234.11111	-384.57407	90033.06379		
78	Mar 14, 2020	75	13	19	52951.12346		150213.663		-230.11111	-387.57407	89185.10082		
79	Mar 15, 2020	76	14	22	52491.90123		147897.218		-229.11111	-384.57407	88110.19342		
80	Mar 16, 2020	77	12	25	53412.34568		145598.774		-231.11111	-381.57407	88186.00823		
81	Mar 17, 2020	78	17	43	51126.23457		132186.107		-226.11111	-363.57407	82208.13786		
82	Mar 18, 2020	79	23	23	48448.90123		147129.07		-220.11111	-383.57407	84428.91564		
83	Mar 19, 2020	80	47	44	38459.5679		131459.959		-196.11111	-362.57407	71104.80453		
84	Mar 20, 2020	81	32	99	44567.90123		94601.811		-211.11111	-307.57407	64932.30453		
85	Mar 21, 2020	82	40	52	41254.12346		125722.774		-203.11111	-354.57407	72017.93416		
86	Mar 22, 2020	83	47	65	38459.5679		116672.848		-196.11111	-341.57407	66986.47119		
87	Mar 23, 2020	84	23	138	48448.90123		72132.0333		-220.11111	-268.57407	59116.13786		
88	Mar 24, 2020	85	54	69	35763.01235		113956.255		-189.11111	-337.57407	63839.00823		
89	Mar 25, 2020	86	49	78	37679.12346		107960.922		-194.11111	-328.57407	63779.8786		
90	Mar 26, 2020	87	10	102	54340.79012		92765.3666		-233.11111	-304.57407	70999.60082		
91	Mar 27, 2020	88	26	94	47137.23457		97702.5518		-217.11111	-312.57407	67863.30453		
92	Mar 28, 2020	89	138	119	11048.34568		82698.8481		-105.11111	-287.57407	30227.23045		
93	Mar 29, 2020	90	71	113	29622.23457		86185.737		-172.11111	-293.57407	50527.36008		
94	Mar 30, 2020	91	41	98	40848.90123		95217.9592		-202.11111	-308.57407	62366.24897		
95	Mar 31, 2020	92	0	84	59103.01235		104054.033		-243.11111	-322.57407	78421.34156		

	A	B	C	D	G	H	I	J	K	L	M	N	O
95	Mar 31, 2020	92	0	84	59103.01235		104054.03		-243.11111	-322.57407	78421.34156		
96	Apr 1, 2020	93	35	54	43310.23457		124308.48		-208.11111	-352.57407	73374.5823		
97	Apr 2, 2020	94	121	100	14911.12346		93987.663		-122.11111	-306.57407	37436.10082		
98	Apr 3, 2020	95	49	70	37679.12346		113282.11		-194.11111	-336.57407	65332.76749		
99	Apr 4, 2020	96	65	62	31723.5679		118731.29		-178.11111	-344.57407	61372.47119		
100	Apr 5, 2020	97	75	48	28261.34568		128575.37		-168.11111	-358.57407	60280.28601		
101	Apr 6, 2020	98	120	67	15156.34568		115310.55		-123.11111	-339.57407	41805.34156		
102	Apr 7, 2020	99	66	56	31368.34568		122902.18		-177.11111	-350.57407	62090.56379		
103	Apr 8, 2020	100	106	86	18799.45679		102767.74		-137.11111	-320.57407	43954.26749		
104	Apr 9, 2020	101	142	86	10223.45679		102767.74		-101.11111	-320.57407	32413.60082		
105	Apr 10, 2020	102	286	55	1839.45679		123604.33		42.888889	-351.57407	-15078.6214		
106	Apr 11, 2020	103	0	79	59103.01235		107304.77		-243.11111	-327.57407	79636.89712		
107	Apr 12, 2020	104	390	93	21576.34568		98328.7		146.88889	-313.57407	-46060.54733		
108	Apr 13, 2020	105	233	112	102.2345679		86773.885		-10.111111	-294.57407	2978.471193		
109	Apr 14, 2020	106	386	94	20417.23457		97702.552		142.88889	-312.57407	-44663.36214		
110	Apr 15, 2020	107	334	49	8260.790123		127859.22		90.888889	-357.57407	-32499.51029		
111	Apr 16, 2020	108	447	50	41570.67901		127145.07		203.88889	-356.57407	-72701.49177		
112	Apr 17, 2020	109	728	352	235117.2346		2978.3296		484.88889	-54.574074	-26462.36214		
113	Apr 18, 2020	110	623	31	144315.5679		141055.89		379.88889	-375.57407	-142676.4177		
114	Apr 19, 2020	111	942	18	488445.679		150989.81		698.88889	-388.57407	-271570.1029		
115	Apr 20, 2020	112	596	14	124530.5679		154114.4		352.88889	-392.57407	-138535.0288		
116	Apr 21, 2020	113	1426	32	1399226.123		140305.74		1182.8889	-374.57407	-443079.5103		
117	Apr 22, 2020	114	1111	15	753231.1235		153330.26		867.88889	-391.57407	-339842.7881		
118	Apr 23, 2020	115	1016	12	597357.2346		155688.7		772.88889	-394.57407	-304961.9177		
119	Apr 24, 2020	116	1037	8	630259.5679		158861.29		793.88889	-398.57407	-316423.5288		
120	Apr 25, 2020	117	897	15	427570.679		153330.26		653.88889	-391.57407	-256045.9362		
121	Apr 26, 2020	118	618	10	140541.679		157271		374.88889	-396.57407	-148671.214		
122	Apr 27, 2020	119	931	3	473191.1235		162872.03		687.88889	-403.57407	-277614.1214		
123	Apr 28, 2020	120	799	26	309012.4568		144836.63		555.88889	-380.57407	-211556.8992		
124	Apr 29, 2020	121	528	2	81161.67901		163680.18		284.88889	-404.57407	-115258.6584		
125	Apr 30, 2020	122	690	4	199709.679		162065.89		446.88889	-402.57407	-179905.8807		
126	May 1, 2020	123	528	12	81161.67901		155688.7		284.88889	-394.57407	-112409.7695		
127	May 2, 2020	124	932	3	474567.9012		162872.03		688.88889	-403.57407	-278017.6955		
128	May 3, 2020	125	447	2	41570.67901		163680.18		203.88889	-404.57407	-82488.15844		
129	May 4, 2020	126	657	3	171304.0123		162872.03		413.88889	-403.57407	-167034.8251		
130	May 5, 2020	127	573	2	108826.679		163680.18		329.88889	-404.57407	-133464.4918		
131	May 6, 2020	128	632	2	151234.5679		163680.18		388.88889	-404.57407	-157334.3621		
132	May 7, 2020	129	788	2	296903.9012		163680.18		544.88889	-404.57407	-220447.9177		
133	May 8, 2020	130	741	6	247893.3457		160459.59		497.88889	-400.57407	-199441.3807		

	A	B	C	D	G	H	I	J	K	L	M	N	O
134	May 9, 2020	131	768	0	275508.3457		165302.48		524.88889	-406.57407	-213406.214		
135	May 10, 2020	132	753	15	259986.679		153330.26		509.88889	-391.57407	-199659.2695		
136	May 11, 2020	133	876	19	400548.3457		150213.66		632.88889	-387.57407	-245291.3251		
137	May 12, 2020	134	451	1	43217.79012		164490.33		207.88889	-405.57407	-84314.34362		
138	May 13, 2020	135	884	7	410738.5679		159659.44		640.88889	-399.57407	-256082.5844		
139	May 14, 2020	136	675	6	186528.0123		160459.59		431.88889	-400.57407	-173003.4918		
140	May 15, 2020	137	752	5	258967.9012		161261.74		508.88889	-401.57407	-204356.5844		
141	May 16, 2020	138	793	9	302377.7901		158065.14		549.88889	-397.57407	-218621.5658		
142	May 17, 2020	139	465	6	49234.67901		160459.59		221.88889	-400.57407	-88882.93621		
143	May 18, 2020	140	682	10	192623.4568		157271		438.88889	-396.57407	-174051.9547		
144	May 19, 2020	141	305	9	3830.234568		158065.14		61.888889	-397.57407	-24605.4177		
145	May 20, 2020	142	451	2	43217.79012		163680.18		207.88889	-404.57407	-84106.45473		
146	May 21, 2020	143	570	2	106856.3457		163680.18		326.88889	-404.57407	-132250.7695		
147	May 22, 2020	144	448	12	41979.45679		155688.7		204.88889	-394.57407	-80843.84362		
148	May 23, 2020	145	614	2	137558.5679		163680.18		370.88889	-404.57407	-150052.0288		
149	May 24, 2020	146	642	3	159112.3457		162872.03		398.88889	-403.57407	-160981.214		
150	May 25, 2020	147	548	11	92957.23457		156478.85		304.88889	-395.57407	-120606.1399		
151	May 26, 2020	148	344	7	10178.5679		159659.44		100.88889	-399.57407	-40312.58436		
152	May 27, 2020	149	383	1	19568.90123		164490.33		139.88889	-405.57407	-56735.30658		
153	May 28, 2020	150	533	3	84035.5679		162872.03		289.88889	-403.57407	-116991.6399		
154	May 29, 2020	151	373	0	16871.12346		165302.48		129.88889	-406.57407	-52809.45473		
155	May 30, 2020	152	611	17	135342.2346		151767.96		367.88889	-389.57407	-143319.9733		
156	May 31, 2020	153	506	5	69110.5679		161261.74		262.88889	-401.57407	-105569.3621		
157	Jun 1, 2020	154	518	19	75563.90123		150213.66		274.88889	-387.57407	-106539.8066		
158	Jun 2, 2020	155	408	7	27188.34568		159659.44		164.88889	-399.57407	-65885.3251		
159	Jun 3, 2020	156	544	5	90534.12346		161261.74		300.88889	-401.57407	-120829.177		
160	Jun 4, 2020	157	569	1	106203.5679		164490.33		325.88889	-405.57407	-132172.0844		
161	Jun 5, 2020	158	517	11	75015.12346		156478.85		273.88889	-395.57407	-108343.3436		
162	Jun 6, 2020	159	261	6	320.0123457		160459.59		17.888889	-400.57407	-7165.825103		
163	Jun 7, 2020	160	344	9	10178.5679		158065.14		100.88889	-397.57407	-40110.80658		
164	Jun 8, 2020	161	383	5	19568.90123		161261.74		139.88889	-401.57407	-56175.75103		
165	Jun 9, 2020	162	386	3	20417.23457		162872.03		142.88889	-403.57407	-57666.25103		
166	Jun 10, 2020	163	218	4	630.5679012		162065.89		-25.111111	-402.57407	10109.0823		
167	Jun 11, 2020	164	451	11	43217.79012		156478.85		207.88889	-395.57407	-82235.45473		
168	Jun 12, 2020	165	422	7	32001.23457		159659.44		178.88889	-399.57407	-71479.36214		
169	Jun 13, 2020	166	463	12	48351.12346		155688.7		219.88889	-394.57407	-86762.45473		
170	Jun 14, 2020	167	347	60	10792.90123		120113.59		103.88889	-346.57407	-36005.19547		
171	Jun 15, 2020	168	407	47	26859.5679		129293.51		163.88889	-359.57407	-58930.19547		
172	Jun 16, 2020	169	214	43	847.4567901		132186.11		-29.111111	-363.57407	10584.04527		

	A	B	C	D	G	H	I	J	K	L	M	N	O
173	Jun 17, 2020	170	151	44	8484.45679		131459.96		-92.111111	-362.57407	33397.10082		
174	Jun 18, 2020	171	247	36	15.12345679		137325.14		3.8888889	-370.57407	-1441.121399		
175	Jun 19, 2020	172	257	36	192.9012346		137325.14		13.888889	-370.57407	-5146.86214		
176	Jun 20, 2020	173	142	30	10223.45679		141808.03		-101.11111	-376.57407	38075.82305		
177	Jun 21, 2020	174	218	29	630.5679012		142562.18		-25.111111	-377.57407	9481.304527		
178	Jun 22, 2020	175	262	19	356.7901235		150213.66		18.888889	-387.57407	-7320.843621		
179	Jun 23, 2020	176	218	52	630.5679012		125722.77		-25.111111	-354.57407	8903.748971		
180	Jun 24, 2020	177	119	29	15403.5679		142562.18		-124.11111	-377.57407	46861.13786		
181	Jun 25, 2020	178	191	20	2715.567901		149439.51		-52.111111	-386.57407	20144.80453		
182	Jun 26, 2020	179	113	28	16928.90123		143318.33		-130.11111	-378.57407	49256.69342		
183	Jun 27, 2020	180	219	24	581.345679		146362.92		-24.111111	-382.57407	9224.286008		
184	Jun 28, 2020	181	291	18	2293.345679		150989.81		47.888889	-388.57407	-18608.38066		
185	Jun 29, 2020	182	213	14	906.6790123		154114.4		-30.111111	-392.57407	11820.84156		
186	Jun 30, 2020	183	202	23	1690.123457		147129.07		-41.111111	-383.57407	15769.15638		
187	Jul 1, 2020	184	246	5	8.345679012		161261.74		2.8888889	-401.57407	-1160.102881		
188	Jul 2, 2020	185	215	31	790.2345679		141055.89		-28.111111	-375.57407	10557.80453		
189	Jul 3, 2020	186	188	14	3037.234568		154114.4		-55.111111	-392.57407	21635.19342		
190	Jul 4, 2020	187	169	9	5492.45679		158065.14		-74.111111	-397.57407	29464.65638		
191	Jul 5, 2020	188	185	18	3376.901235		150989.81		-58.111111	-388.57407	22580.47119		
192	Jul 6, 2020	189	0	14	59103.01235		154114.4		-243.11111	-392.57407	95439.11934		
193	Jul 7, 2020	190	319	25	5759.123457		145598.77		75.888889	-381.57407	-28957.23251		
194	Jul 8, 2020	191	157	21	7415.123457		148667.37		-86.111111	-385.57407	33202.21193		
195	Jul 9, 2020	192	158	33	7243.901235		139557.59		-85.111111	-373.57407	31795.30453		
196	Jul 10, 2020	193	124	46	14187.45679		130013.66		-119.11111	-360.57407	42948.3786		
197	Jul 11, 2020	194	191	40	2715.567901		134376.55		-52.111111	-366.57407	19102.5823		
198	Jul 12, 2020	195	170	35	5345.234568		138067.29		-73.111111	-371.57407	27166.19342		
199	Jul 13, 2020	196	178	46	4239.45679		130013.66		-65.111111	-360.57407	23477.3786		
200	Jul 14, 2020	197	322	55	6223.45679		123604.33		78.888889	-351.57407	-27735.28807		
201	Jul 15, 2020	198	346	54	10586.12346		124308.48		102.88889	-352.57407	-36275.95473		
202	Jul 16, 2020	199	249	20	34.67901235		149439.51		5.8888889	-386.57407	-2276.49177		
203	Jul 17, 2020	200	248	77	23.90123457		108619.07		4.8888889	-329.57407	-1611.251029		
204	Jul 18, 2020	201	327	80	7037.345679		106650.63		83.888889	-326.57407	-27395.93621		
205	Jul 19, 2020	202	202	80	1690.123457		106650.63		-41.111111	-326.57407	13425.82305		
206	Jul 20, 2020	203	257	130	192.9012346		76493.218		13.888889	-276.57407	-3841.306584		
207	Jul 21, 2020	204	123	84	14426.67901		104054.03		-120.11111	-322.57407	38744.73045		
208	Jul 22, 2020	205	399	74	24301.34568		110605.51		155.88889	-332.57407	-51844.60288		
209	Jul 23, 2020	206	310	135	4474.123457		73752.478		66.888889	-271.57407	-18165.28807		
210	Jul 24, 2020	207	354	139	12296.34568		71595.885		110.88889	-267.57407	-29670.99177		
211	Jul 25, 2020	208	277	157	1148.45679		62287.218		33.888889	-249.57407	-8457.788066		

	A	B	C	D	G	H	I	J	K	L	M	N	O
211	Jul 25, 2020	208	277	157	1148.45679		62287.218		33.888889	-249.57407	-8457.788066		
212	Jul 26, 2020	209	513	179	72840.01235		51789.959		269.88889	-227.57407	-61419.71399		
213	Jul 27, 2020	210	481	189	56591.12346		47338.478		237.88889	-217.57407	-51758.45473		
214	Jul 28, 2020	211	469	213	51025.79012		37470.922		225.88889	-193.57407	-43726.23251		
215	Jul 29, 2020	212	359	207	13430.23457		39829.811		115.88889	-199.57407	-23128.4177		
216	Jul 30, 2020	213	334	223	8260.790123		33699.441		90.888889	-183.57407	-16684.84362		
217	Jul 31, 2020	214	278	276	1217.234568		17049.589		34.888889	-130.57407	-4555.584362		
218	Aug 1, 2020	215	396	166	23375.01235		57875.885		152.88889	-240.57407	-36781.10288		
219	Aug 2, 2020	216	307	165	4081.790123		58358.033		63.888889	-241.57407	-15433.89918		

Singapore and UK

	A	B	C	E	P	Q	R	S	T	U	V	W	X
1		No. of cases	216		singapore and uk								
2					Sxx	17411595	Syy	598239881	Sxy	65490239		r	t
3		Days	Singapore	UK	x-(xbar)^2	xbar	y-(ybar)^2	ybar	(x-xbar)	(y-ybar)	(x-xbar)*(y-ybar)	0.6416816	12.239044
4	Dec 31, 2019	1	0	0	59103.012	243.11111	1980170.1	1407.1852	-243.11111	-1407.1852	342102.3539		
5	Jan 1, 2020	2	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
6	Jan 2, 2020	3	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
7	Jan 3, 2020	4	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
8	Jan 4, 2020	5	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
9	Jan 5, 2020	6	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
10	Jan 6, 2020	7	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
11	Jan 7, 2020	8	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
12	Jan 8, 2020	9	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
13	Jan 9, 2020	10	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
14	Jan 10, 2020	11	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
15	Jan 11, 2020	12	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
16	Jan 12, 2020	13	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
17	Jan 13, 2020	14	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
18	Jan 14, 2020	15	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
19	Jan 15, 2020	16	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
20	Jan 16, 2020	17	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
21	Jan 17, 2020	18	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
22	Jan 18, 2020	19	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
23	Jan 19, 2020	20	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
24	Jan 20, 2020	21	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
25	Jan 21, 2020	22	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
26	Jan 22, 2020	23	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
27	Jan 23, 2020	24	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
28	Jan 24, 2020	25	3	0	57653.346		1980170.1		-240.11111	-1407.1852	337880.7984		
29	Jan 25, 2020	26	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
30	Jan 26, 2020	27	1	0	58617.79		1980170.1		-242.11111	-1407.1852	340695.1687		
31	Jan 27, 2020	28	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
32	Jan 28, 2020	29	1	0	58617.79		1980170.1		-242.11111	-1407.1852	340695.1687		
33	Jan 29, 2020	30	2	0	58134.568		1980170.1		-241.11111	-1407.1852	339287.9835		
34	Jan 30, 2020	31	3	0	57653.346		1980170.1		-240.11111	-1407.1852	337880.7984		
35	Jan 31, 2020	32	3	0	57653.346		1980170.1		-240.11111	-1407.1852	337880.7984		
36	Feb 1, 2020	33	3	2	57653.346		1974545.4		-240.11111	-1405.1852	337400.5761		
37	Feb 2, 2020	34	2	0	58134.568		1980170.1		-241.11111	-1407.1852	339287.9835		
38	Feb 3, 2020	35	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
39	Feb 4, 2020	36	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		

	A	B	C	E	P	Q	R	S	T	U	V	W	X
39	Feb 4, 2020	36	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
40	Feb 5, 2020	37	6	1	56221.679		1977356.8		-237.11111	-1406.1852	333422.1317		
41	Feb 6, 2020	38	4	0	57174.123		1980170.1		-239.11111	-1407.1852	336473.6132		
42	Feb 7, 2020	39	2	1	58134.568		1977356.8		-241.11111	-1406.1852	339046.8724		
43	Feb 8, 2020	40	3	0	57653.346		1980170.1		-240.11111	-1407.1852	337880.7984		
44	Feb 9, 2020	41	7	0	55748.457		1980170.1		-236.11111	-1407.1852	332252.0576		
45	Feb 10, 2020	42	3	4	57653.346		1968928.7		-240.11111	-1403.1852	336920.3539		
46	Feb 11, 2020	43	2	1	58134.568		1977356.8		-241.11111	-1406.1852	339046.8724		
47	Feb 12, 2020	44	2	0	58134.568		1980170.1		-241.11111	-1407.1852	339287.9835		
48	Feb 13, 2020	45	3	1	57653.346		1977356.8		-240.11111	-1406.1852	337640.6872		
49	Feb 14, 2020	46	8	0	55277.235		1980170.1		-235.11111	-1407.1852	330844.8724		
50	Feb 15, 2020	47	9	0	54808.012		1980170.1		-234.11111	-1407.1852	329437.6872		
51	Feb 16, 2020	48	5	0	56696.901		1980170.1		-238.11111	-1407.1852	335066.428		
52	Feb 17, 2020	49	3	0	57653.346		1980170.1		-240.11111	-1407.1852	337880.7984		
53	Feb 18, 2020	50	2	0	58134.568		1980170.1		-241.11111	-1407.1852	339287.9835		
54	Feb 19, 2020	51	4	0	57174.123		1980170.1		-239.11111	-1407.1852	336473.6132		
55	Feb 20, 2020	52	3	0	57653.346		1980170.1		-240.11111	-1407.1852	337880.7984		
56	Feb 21, 2020	53	1	0	58617.79		1980170.1		-242.11111	-1407.1852	340695.1687		
57	Feb 22, 2020	54	1	0	58617.79		1980170.1		-242.11111	-1407.1852	340695.1687		
58	Feb 23, 2020	55	3	1	57653.346		1977356.8		-240.11111	-1406.1852	337640.6872		
59	Feb 24, 2020	56	0	0	59103.012		1980170.1		-243.11111	-1407.1852	342102.3539		
60	Feb 25, 2020	57	1	0	58617.79		1980170.1		-242.11111	-1407.1852	340695.1687		
61	Feb 26, 2020	58	1	2	58617.79		1974545.4		-242.11111	-1405.1852	340210.9465		
62	Feb 27, 2020	59	2	5	58134.568		1966123.3		-241.11111	-1402.1852	338082.428		
63	Feb 28, 2020	60	3	4	57653.346		1968928.7		-240.11111	-1403.1852	336920.3539		
64	Feb 29, 2020	61	2	8	58134.568		1957719.2		-241.11111	-1399.1852	337359.0947		
65	Mar 1, 2020	62	4	12	57174.123		1946541.7		-239.11111	-1395.1852	333604.2798		
66	Mar 2, 2020	63	4	5	57174.123		1966123.3		-239.11111	-1402.1852	335278.0576		
67	Mar 3, 2020	64	2	22	58134.568		1918738		-241.11111	-1385.1852	333983.5391		
68	Mar 4, 2020	65	2	40	58134.568		1869195.3		-241.11111	-1367.1852	329643.5391		
69	Mar 5, 2020	66	2	55	58134.568		1828404.8		-241.11111	-1352.1852	326026.8724		
70	Mar 6, 2020	67	5	56	56696.901		1825701.4		-238.11111	-1351.1852	321732.2058		
71	Mar 7, 2020	68	13	51	52951.123		1839238.3		-230.11111	-1356.1852	312073.2798		
72	Mar 8, 2020	69	8	81	55277.235		1758767.1		-235.11111	-1326.1852	311800.8724		
73	Mar 9, 2020	70	12	60	53412.346		1814907.9		-231.11111	-1347.1852	311349.465		
74	Mar 10, 2020	71	10	57	54340.79		1823000		-233.11111	-1350.1852	314743.1687		
75	Mar 11, 2020	72	6	148	56221.679		1585547.3		-237.11111	-1259.1852	298566.7984		
76	Mar 12, 2020	73	12	259	53412.346		1318329.2		-231.11111	-1148.1852	265358.3539		
77	Mar 13, 2020	74	9	406	54808.012		1002371.8		-234.11111	-1001.1852	234388.5761		

	A	B	C	E	P	Q	R	S	T	U	V	W	X
77	Mar 13, 2020	74	9	406	54808.012		1002371.8		-234.11111	-1001.1852	234388.5761		
78	Mar 14, 2020	75	13	484	52951.123		852270.89		-230.11111	-923.18519	212435.1687		
79	Mar 15, 2020	76	14	478	52491.901		863385.11		-229.11111	-929.18519	212886.6502		
80	Mar 16, 2020	77	12	361	53412.346		1094503.4		-231.11111	-1046.1852	241785.0206		
81	Mar 17, 2020	78	17	442	51126.235		931582.44		-226.11111	-965.18519	218239.0947		
82	Mar 18, 2020	79	23	611	48448.901		633910.85		-220.11111	-796.18519	175249.2058		
83	Mar 19, 2020	80	47	769	38459.568		407280.33		-196.11111	-638.18519	125155.2058		
84	Mar 20, 2020	81	32	999	44567.901		166615.15		-211.11111	-408.18519	86172.42798		
85	Mar 21, 2020	82	40	1055	41254.123		124034.4		-203.11111	-352.18519	71532.72428		
86	Mar 22, 2020	83	47	1255	38459.568		23160.331		-196.11111	-152.18519	29845.20576		
87	Mar 23, 2020	84	23	1198	48448.901		43758.442		-220.11111	-209.18519	46043.98354		
88	Mar 24, 2020	85	54	1378	35763.012		851.77503		-189.11111	-29.185185	5519.242798		
89	Mar 25, 2020	86	49	2338	37679.123		866416.22		-194.11111	930.81481	-180681.4979		
90	Mar 26, 2020	87	10	2375	54340.79		936665.52		-233.11111	967.81481	-225608.3868		
91	Mar 27, 2020	88	26	2692	47137.235		1650749.1		-217.11111	1284.8148	-278947.572		
92	Mar 28, 2020	89	138	3087	11048.346		2821777.8		-105.11111	1679.8148	-176567.2016		
93	Mar 29, 2020	90	71	3197	29622.235		3203437.1		-172.11111	1789.8148	-308047.0165		
94	Mar 30, 2020	91	41	2822	40848.901		2001701		-202.11111	1414.8148	-285949.7942		
95	Mar 31, 2020	92	0	2858	59103.012		2104863.6		-243.11111	1450.8148	-352709.2016		
96	Apr 1, 2020	93	35	4273	43310.235		8212894.6		-208.11111	2865.8148	-596407.9053		
97	Apr 2, 2020	94	121	4514	14911.123		9652298.3		-122.11111	3106.8148	-379376.6091		
98	Apr 3, 2020	95	49	4913	37679.123		12290738		-194.11111	3505.8148	-680517.6091		
99	Apr 4, 2020	96	65	4868	31723.568		11977239		-178.11111	3460.8148	-616409.572		
100	Apr 5, 2020	97	75	4911	28261.346		12276718		-168.11111	3503.8148	-589030.2016		
101	Apr 6, 2020	98	120	4020	15156.346		6826801.3		-123.11111	2612.8148	-321666.535		
102	Apr 7, 2020	99	66	3592	31368.346		4773415.8		-177.11111	2184.8148	-386954.9794		
103	Apr 8, 2020	100	106	5282	18799.457		15014190		-137.11111	3874.8148	-531280.1646		
104	Apr 9, 2020	101	142	5450	10223.457		16344352		-101.11111	4042.8148	-408773.4979		
105	Apr 10, 2020	102	286	5131	1839.4568		13866797		42.8888889	3723.8148	159710.2798		
106	Apr 11, 2020	103	0	4858	59103.012		11908123		-243.11111	3450.8148	-838931.4239		
107	Apr 12, 2020	104	390	4313	21576.346		8443759.7		146.888889	2905.8148	426831.9095		
108	Apr 13, 2020	105	233	3579	102.23457		4716779.6		-10.111111	2171.8148	-21959.46091		
109	Apr 14, 2020	106	386	3489	20417.235		4333952.9		142.888889	2081.8148	297468.2058		
110	Apr 15, 2020	107	334	4178	8260.7901		7677414.7		90.8888889	2770.8148	251836.2798		
111	Apr 16, 2020	108	447	4326	41570.679		8519479.9		203.888889	2918.8148	595113.9095		
112	Apr 17, 2020	109	728	5065	235117.23		13379609		484.888889	3657.8148	1773633.761		
113	Apr 18, 2020	110	623	5292	144315.57		15091786		379.888889	3884.8148	1475797.984		
114	Apr 19, 2020	111	942	4956	488445.68		12594087		698.888889	3548.8148	2480227.243		
115	Apr 20, 2020	112	596	4721	124530.57		10981369		352.888889	3313.8148	1169408.428		

	A	B	C	E	P	Q	R	S	T	U	V	W	X
115	Apr 20, 2020	112	596	4721	124530.57		10981369		352.888889	3313.8148	1169408.428		
116	Apr 21, 2020	113	1426	3853	1399226.1		5982010.1		1182.88889	2445.8148	2893127.169		
117	Apr 22, 2020	114	1111	4854	753231.12		11880532		867.888889	3446.8148	2991452.28		
118	Apr 23, 2020	115	1016	4760	597357.23		11241367		772.888889	3352.8148	2591353.317		
119	Apr 24, 2020	116	1037	5487	630259.57		16644889		793.888889	4079.8148	3238919.65		
120	Apr 25, 2020	117	897	5158	427570.68		14068612		653.888889	3750.8148	2452616.132		
121	Apr 26, 2020	118	618	4970	140541.68		12693649		374.888889	3562.8148	1335659.687		
122	Apr 27, 2020	119	931	3748	473191.12		5479414		687.888889	2340.8148	1610220.502		
123	Apr 28, 2020	120	799	3473	309012.46		4267590.8		555.888889	2065.8148	1148363.502		
124	Apr 29, 2020	121	528	4706	81161.679		10882179		284.888889	3298.8148	939795.6872		
125	Apr 30, 2020	122	690	4729	199709.68		11034454		446.888889	3321.8148	1484482.132		
126	May 1, 2020	123	528	5442	81161.679		16279731		284.888889	4034.8148	1149473.909		
127	May 2, 2020	124	932	4966	474567.9		12665163		688.888889	3558.8148	2451627.984		
128	May 3, 2020	125	447	4737	41570.679		11087667		203.888889	3329.8148	678912.2428		
129	May 4, 2020	126	657	3229	171304.01		3319009.2		413.888889	1821.8148	754028.9095		
130	May 5, 2020	127	573	2982	108826.68		2480041.7		329.888889	1574.8148	519513.9095		
131	May 6, 2020	128	632	3389	151234.57		3927590		388.888889	1981.8148	770705.7613		
132	May 7, 2020	129	788	3682	296903.9		5174782.4		544.888889	2274.8148	1239521.317		
133	May 8, 2020	130	741	3827	247893.35		5855503.7		497.888889	2419.8148	1204798.909		
134	May 9, 2020	131	768	3767	275508.35		5568726		524.888889	2359.8148	1238640.576		
135	May 10, 2020	132	753	3063	259986.68		2741722.7		509.888889	1655.8148	844281.5761		
136	May 11, 2020	133	876	2157	400548.35		562222.26		632.888889	749.81481	474549.465		
137	May 12, 2020	134	451	2329	43217.79		849742.55		207.888889	921.81481	191635.0576		
138	May 13, 2020	135	884	3586	410738.57		4747234		640.888889	2178.8148	1396378.206		
139	May 14, 2020	136	675	3402	186528.01		3979286.1		431.888889	1994.8148	861538.3539		
140	May 15, 2020	137	752	3307	258967.9		3609296.3		508.888889	1899.8148	966794.6502		
141	May 16, 2020	138	793	2628	302377.79		1490388.8		549.888889	1220.8148	671312.5021		
142	May 17, 2020	139	465	2526	49234.679		1251746.6		221.888889	1118.8148	248252.5761		
143	May 18, 2020	140	682	2079	192623.46		451335.15		438.888889	671.81481	294852.0576		
144	May 19, 2020	141	305	1838	3830.2346		185601.4		61.8888889	430.81481	26662.65021		
145	May 20, 2020	142	451	2589	43217.79		1396686.3		207.888889	1181.8148	245686.1687		
146	May 21, 2020	143	570	3052	106856.35		2705415.8		326.888889	1644.8148	537671.6872		
147	May 22, 2020	144	448	2718	41979.457		1718235.5		204.888889	1310.8148	268571.3909		
148	May 23, 2020	145	614	2574	137558.57		1361456.8		370.888889	1166.8148	432758.6502		
149	May 24, 2020	146	642	2062	159112.35		428782.44		398.888889	654.81481	261198.3539		
150	May 25, 2020	147	548	1527	92957.235		14355.59		304.888889	119.81481	36530.20576		
151	May 26, 2020	148	344	1364	10178.568		1864.9602		100.888889	-43.185185	-4356.90535		
152	May 27, 2020	149	383	1624	19568.901		47008.664		139.888889	216.81481	30329.98354		
153	May 28, 2020	150	533	1672	84035.568		70126.886		289.888889	264.81481	76766.87243		

	A	B	C	E	P	Q	R	S	T	U	V	W	X
154	May 29, 2020	151	373	1835	16871.123		183025.52		129.888889	427.81481	55568.39095		
155	May 30, 2020	152	611	1760	135342.23		124478.29		367.888889	352.81481	129796.6502		
156	May 31, 2020	153	506	1527	69110.568		14355.59		262.888889	119.81481	31497.98354		
157	Jun 1, 2020	154	518	1125	75563.901		79628.479		274.888889	-282.18519	-77569.57202		
158	Jun 2, 2020	155	408	1079	27188.346		107705.52		164.888889	-328.18519	-54114.09053		
159	Jun 3, 2020	156	544	1441	90534.123		1143.4417		300.888889	33.814815	10174.50206		
160	Jun 4, 2020	157	569	1484	106203.57		5900.5158		325.888889	76.814815	25033.09465		
161	Jun 5, 2020	158	517	1356	75015.123		2619.9232		273.888889	-51.185185	-14019.0535		
162	Jun 6, 2020	159	261	1243	320.01235		26956.775		17.8888889	-164.18519	-2937.090535		
163	Jun 7, 2020	160	344	1120	10178.568		82475.331		100.888889	-287.18519	-28973.79424		
164	Jun 8, 2020	161	383	801	19568.901		367460.48		139.888889	-606.18519	-84798.57202		
165	Jun 9, 2020	162	386	721	20417.235		470850.11		142.888889	-686.18519	-98048.23868		
166	Jun 10, 2020	163	218	1099	630.5679		94978.108		-25.111111	-308.18519	7738.872428		
167	Jun 11, 2020	164	451	1158	43217.79		62093.257		207.888889	-249.18519	-51802.83128		
168	Jun 12, 2020	165	422	1199	32001.235		43341.071		178.888889	-208.18519	-37242.01646		
169	Jun 13, 2020	166	463	1017	48351.123		152244.48		219.888889	-390.18519	-85797.38683		
170	Jun 14, 2020	167	347	1052	10792.901		126156.52		103.888889	-355.18519	-36899.79424		
171	Jun 15, 2020	168	407	890	26859.568		267480.52		163.888889	-517.18519	-84760.90535		
172	Jun 16, 2020	169	214	822	847.45679		342441.7		-29.111111	-585.18519	17035.39095		
173	Jun 17, 2020	170	151	1043	8484.4568		132630.85		-92.111111	-364.18519	33545.50206		
174	Jun 18, 2020	171	247	1102	15.123457		93137.997		3.88888889	-305.18519	-1186.831276		
175	Jun 19, 2020	172	257	1013	192.90123		155381.96		13.8888889	-394.18519	-5474.794239		
176	Jun 20, 2020	173	142	1027	10223.457		144540.78		-101.11111	-380.18519	38440.9465		
177	Jun 21, 2020	174	218	986	630.5679		177396.96		-25.111111	-421.18519	10576.42798		
178	Jun 22, 2020	175	262	687	356.79012		518666.7		18.8888889	-720.18519	-13603.49794		
179	Jun 23, 2020	176	218	639	630.5679		590108.48		-25.111111	-768.18519	19289.98354		
180	Jun 24, 2020	177	119	896	15403.568		261310.29		-124.11111	-511.18519	63443.76132		
181	Jun 25, 2020	178	191	886	2715.5679		271634		-52.111111	-521.18519	27159.53909		
182	Jun 26, 2020	179	113	778	16928.901		395874		-130.11111	-629.18519	81863.98354		
183	Jun 27, 2020	180	219	721	581.34568		470850.11		-24.111111	-686.18519	16544.68724		
184	Jun 28, 2020	181	291	671	2293.3457		541968.63		47.8888889	-736.18519	-35255.09053		
185	Jun 29, 2020	182	213	649	906.67901		574844.78		-30.111111	-758.18519	22829.79835		
186	Jun 30, 2020	183	202	446	1690.1235		923876.96		-41.111111	-961.18519	39515.39095		
187	Jul 1, 2020	184	246	730	8.345679		458579.78		2.88888889	-677.18519	-1956.312757		
188	Jul 2, 2020	185	215	617	790.23457		624392.63		-28.111111	-790.18519	22212.98354		
189	Jul 3, 2020	186	188	651	3037.2346		571816.03		-55.111111	-756.18519	41674.20576		
190	Jul 4, 2020	187	169	602	5492.4568		648323.18		-74.111111	-805.18519	59673.16872		
191	Jul 5, 2020	188	185	579	3376.9012		685890.7		-58.111111	-828.18519	48126.76132		
192	Jul 6, 2020	189	0	401	59103.012		1012408.6		-243.11111	-1006.1852	244614.7984		

	A	B	C	E	P	Q	R	S	T	U	V	W	X
192	Jul 6, 2020	189	0	401	59103.012		1012408.6		-243.11111	-1006.1852	244614.7984		
193	Jul 7, 2020	190	319	555	5759.1235		726219.59		75.8888889	-852.18519	-64671.38683		
194	Jul 8, 2020	191	157	704	7415.1235		494469.4		-86.111111	-703.18519	60552.05761		
195	Jul 9, 2020	192	158	597	7243.9012		656400.03		-85.111111	-810.18519	68955.76132		
196	Jul 10, 2020	193	124	693	14187.457		510060.48		-119.11111	-714.18519	85067.39095		
197	Jul 11, 2020	194	191	715	2715.5679		479120.33		-52.111111	-692.18519	36070.53909		
198	Jul 12, 2020	195	170	565	5345.2346		709275.89		-73.111111	-842.18519	61573.09465		
199	Jul 13, 2020	196	178	442	4239.4568		931582.44		-65.111111	-965.18519	62844.27984		
200	Jul 14, 2020	197	322	361	6223.4568		1094503.4		78.8888889	-1046.1852	-82532.38683		
201	Jul 15, 2020	198	346	726	10586.123		464013.26		102.888889	-681.18519	-70086.38683		
202	Jul 16, 2020	199	249	685	34.679012		521551.44		5.88888889	-722.18519	-4252.868313		
203	Jul 17, 2020	200	248	772	23.901235		403460.22		4.88888889	-635.18519	-3105.349794		
204	Jul 18, 2020	201	327	704	7037.3457		494469.4		83.8888889	-703.18519	-58989.42387		
205	Jul 19, 2020	202	202	569	1690.1235		702554.4		-41.111111	-838.18519	34458.72428		
206	Jul 20, 2020	203	257	493	192.90123		835734.55		13.8888889	-914.18519	-12697.01646		
207	Jul 21, 2020	204	123	413	14426.679		988404.18		-120.11111	-994.18519	119412.6872		
208	Jul 22, 2020	205	399	793	24301.346		377223.44		155.888889	-614.18519	-95744.64609		
209	Jul 23, 2020	206	310	751	4474.1235		430579		66.8888889	-656.18519	-43891.49794		
210	Jul 24, 2020	207	354	773	12296.346		402190.85		110.888889	-634.18519	-70324.09053		
211	Jul 25, 2020	208	277	731	1148.4568		457226.4		33.8888889	-676.18519	-22915.16461		
212	Jul 26, 2020	209	513	667	72840.012		547874.11		269.888889	-740.18519	-199767.7572		
213	Jul 27, 2020	210	481	421	56591.123		972561.22		237.888889	-986.18519	-234602.4979		
214	Jul 28, 2020	211	469	371	51025.79		1073679.7		225.888889	-1036.1852	-234062.7202		
215	Jul 29, 2020	212	359	70	13430.235		1788064.2		115.888889	-1337.1852	-154964.9053		
216	Jul 30, 2020	213	334	763	8260.7901		414974.55		90.8888889	-644.18519	-58549.27572		
217	Jul 31, 2020	214	278	846	1217.2346		314928.81		34.8888889	-561.18519	-19579.12757		
218	Aug 1, 2020	215	396	880	23375.012		277924.22		152.888889	-527.18519	-80600.7572		
219	Aug 2, 2020	216	307	771	4081.7901		404731.59		63.8888889	-636.18519	-40645.16461		

Singapore and US

	A	B	C	F	Y	Z	AA	AB	AC	AD	AE	AF	AG
1		No. of cases	216		Singapore and US								
2					Sxx	17411595	Syy	99283933847	Sxy	543202110		r	t
3		Days	Singapore	US	x-(xbar)^2	xbar	y-(ybar)^2	ybar	(x-xbar)	(y-ybar)	(x-xbar)*(y-ybar)	0.4131452	6.6366793
4	Dec 31, 2019	1	0	0	59103.012	243.11111	457572504.2	21390.94444	-243.11111	-21390.944	5200376.272		
5	Jan 1, 2020	2	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
6	Jan 2, 2020	3	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
7	Jan 3, 2020	4	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
8	Jan 4, 2020	5	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
9	Jan 5, 2020	6	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
10	Jan 6, 2020	7	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
11	Jan 7, 2020	8	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
12	Jan 8, 2020	9	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
13	Jan 9, 2020	10	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
14	Jan 10, 2020	11	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
15	Jan 11, 2020	12	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
16	Jan 12, 2020	13	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
17	Jan 13, 2020	14	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
18	Jan 14, 2020	15	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
19	Jan 15, 2020	16	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
20	Jan 16, 2020	17	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
21	Jan 17, 2020	18	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
22	Jan 18, 2020	19	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
23	Jan 19, 2020	20	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
24	Jan 20, 2020	21	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
25	Jan 21, 2020	22	0	1	59103.012		457529723.3		-243.11111	-21389.944	5200133.16		
26	Jan 22, 2020	23	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
27	Jan 23, 2020	24	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
28	Jan 24, 2020	25	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
29	Jan 25, 2020	26	0	1	59103.012		457529723.3		-243.11111	-21389.944	5200133.16		
30	Jan 26, 2020	27	1	0	58617.79		457572504.2		-242.11111	-21390.944	5178985.327		
31	Jan 27, 2020	28	0	3	59103.012		457444167.6		-243.11111	-21387.944	5199646.938		
32	Jan 28, 2020	29	1	0	58617.79		457572504.2		-242.11111	-21390.944	5178985.327		
33	Jan 29, 2020	30	2	0	58134.568		457572504.2		-241.11111	-21390.944	5157594.383		
34	Jan 30, 2020	31	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
35	Jan 31, 2020	32	3	1	57653.346		457529723.3		-240.11111	-21389.944	5135963.327		
36	Feb 1, 2020	33	3	1	57653.346		457529723.3		-240.11111	-21389.944	5135963.327		
37	Feb 2, 2020	34	2	1	58134.568		457529723.3		-241.11111	-21389.944	5157353.272		
38	Feb 3, 2020	35	0	3	59103.012		457444167.6		-243.11111	-21387.944	5199646.938		
39	Feb 4, 2020	36	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		

	A	B	C	F	Y	Z	AA	AB	AC	AD	AE	AF	AG
40	Feb 5, 2020	37	6	0	56221.679		457572504.2		-237.11111	-21390.944	5072030.605		
41	Feb 6, 2020	38	4	1	57174.123		457529723.3		-239.11111	-21389.944	5114573.383		
42	Feb 7, 2020	39	2	0	58134.568		457572504.2		-241.11111	-21390.944	5157594.383		
43	Feb 8, 2020	40	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
44	Feb 9, 2020	41	7	0	55748.457		457572504.2		-236.11111	-21390.944	5050639.66		
45	Feb 10, 2020	42	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
46	Feb 11, 2020	43	2	1	58134.568		457529723.3		-241.11111	-21389.944	5157353.272		
47	Feb 12, 2020	44	2	0	58134.568		457572504.2		-241.11111	-21390.944	5157594.383		
48	Feb 13, 2020	45	3	1	57653.346		457529723.3		-240.11111	-21389.944	5135963.327		
49	Feb 14, 2020	46	8	1	55277.235		457529723.3		-235.11111	-21389.944	5029013.605		
50	Feb 15, 2020	47	9	0	54808.012		457572504.2		-234.11111	-21390.944	5007857.772		
51	Feb 16, 2020	48	5	0	56696.901		457572504.2		-238.11111	-21390.944	5093421.549		
52	Feb 17, 2020	49	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
53	Feb 18, 2020	50	2	0	58134.568		457572504.2		-241.11111	-21390.944	5157594.383		
54	Feb 19, 2020	51	4	0	57174.123		457572504.2		-239.11111	-21390.944	5114812.494		
55	Feb 20, 2020	52	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
56	Feb 21, 2020	53	1	1	58617.79		457529723.3		-242.11111	-21389.944	5178743.216		
57	Feb 22, 2020	54	1	19	58617.79		456760009.3		-242.11111	-21371.944	5174385.216		
58	Feb 23, 2020	55	3	0	57653.346		457572504.2		-240.11111	-21390.944	5136203.438		
59	Feb 24, 2020	56	0	0	59103.012		457572504.2		-243.11111	-21390.944	5200376.272		
60	Feb 25, 2020	57	1	18	58617.79		456802754.2		-242.11111	-21372.944	5174627.327		
61	Feb 26, 2020	58	1	0	58617.79		457572504.2		-242.11111	-21390.944	5178985.327		
62	Feb 27, 2020	59	2	6	58134.568		457315848.9		-241.11111	-21384.944	5156147.716		
63	Feb 28, 2020	60	3	1	57653.346		457529723.3		-240.11111	-21389.944	5135963.327		
64	Feb 29, 2020	61	2	6	58134.568		457315848.9		-241.11111	-21384.944	5156147.716		
65	Mar 1, 2020	62	4	3	57174.123		457444167.6		-239.11111	-21387.944	5114095.16		
66	Mar 2, 2020	63	4	20	57174.123		456717266.4		-239.11111	-21370.944	5110030.272		
67	Mar 3, 2020	64	2	14	58134.568		456973753.8		-241.11111	-21376.944	5154218.827		
68	Mar 4, 2020	65	2	22	58134.568		456631786.7		-241.11111	-21368.944	5152289.938		
69	Mar 5, 2020	66	2	34	58134.568		456119076		-241.11111	-21356.944	5149396.605		
70	Mar 6, 2020	67	5	74	56696.901		454412120.4		-238.11111	-21316.944	5075801.327		
71	Mar 7, 2020	68	13	105	52951.123		453091430.9		-230.11111	-21285.944	4898132.327		
72	Mar 8, 2020	69	8	95	55277.235		453517249.8		-235.11111	-21295.944	5006913.16		
73	Mar 9, 2020	70	12	121	53412.346		452410536.7		-231.11111	-21269.944	4915720.494		
74	Mar 10, 2020	71	10	200	54340.79		449056126.4		-233.11111	-21190.944	4939844.605		
75	Mar 11, 2020	72	6	271	56221.679		446052053.3		-237.11111	-21119.944	5007773.494		
76	Mar 12, 2020	73	12	287	53412.346		445376471.1		-231.11111	-21103.944	4877356.049		
77	Mar 13, 2020	74	9	351	54808.012		442679262.2		-234.11111	-21039.944	4925684.772		
78	Mar 14, 2020	75	13	511	52951.123		435972080		-230.11111	-20879.944	4804707.216		

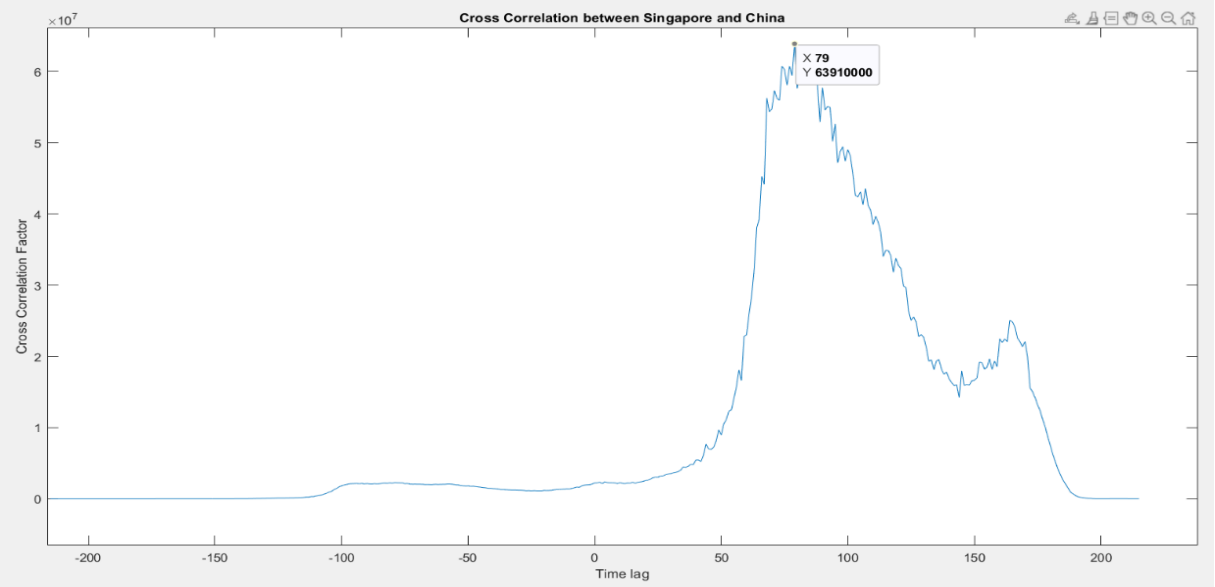
	A	B	C	F	Y	Z	AA	AB	AC	AD	AE	AF	AG
79	Mar 15, 2020	76	14	777	52491.901		424934705.6		-229.11111	-20613.944	4722883.716		
80	Mar 16, 2020	77	12	823	53412.346		423040338.7		-231.11111	-20567.944	4753480.494		
81	Mar 17, 2020	78	17	887	51126.235		420411737.8		-226.11111	-20503.944	4636169.66		
82	Mar 18, 2020	79	23	1766	48448.901		385138444.4		-220.11111	-19624.944	4319668.327		
83	Mar 19, 2020	80	47	2988	38459.568		338668364.2		-196.11111	-18402.944	3609021.883		
84	Mar 20, 2020	81	32	4835	44567.901		274099296.4		-211.11111	-16555.944	3495143.827		
85	Mar 21, 2020	82	40	5374	41254.123		256542509.3		-203.11111	-16016.944	3253219.383		
86	Mar 22, 2020	83	47	7123	38459.568		203574238.7		-196.11111	-14267.944	2798102.438		
87	Mar 23, 2020	84	23	8459	48448.901		167235187.1		-220.11111	-12931.944	2846464.66		
88	Mar 24, 2020	85	54	11236	35763.012		103122896.7		-189.11111	-10154.944	1920412.827		
89	Mar 25, 2020	86	49	8789	37679.123		158809003.8		-194.11111	-12601.944	2446177.438		
90	Mar 26, 2020	87	10	13963	54340.79		55174358.67		-233.11111	-7427.9444	1731536.383		
91	Mar 27, 2020	88	26	16797	47137.235		21104325.56		-217.11111	-4593.9444	997396.3827		
92	Mar 28, 2020	89	138	18695	11048.346		7268116.448		-105.11111	-2695.9444	283373.716		
93	Mar 29, 2020	90	71	19979	29622.235		1993587.114		-172.11111	-1411.9444	243011.3272		
94	Mar 30, 2020	91	41	18360	40848.901		9186624.225		-202.11111	-3030.9444	612587.5494		
95	Mar 31, 2020	92	0	21595	59103.012		41638.66975		-243.11111	204.05556	-49608.17284		
96	Apr 1, 2020	93	35	24998	43310.235		13010849.78		-208.11111	3607.0556	-750668.3395		
97	Apr 2, 2020	94	121	27103	14911.123		32627578.67		-122.11111	5712.0556	-697505.4506		
98	Apr 3, 2020	95	49	28819	37679.123		55176009.34		-194.11111	7428.0556	-1441868.117		
99	Apr 4, 2020	96	65	32425	31723.568		121750382		-178.11111	11034.056	-1965287.895		
100	Apr 5, 2020	97	75	34272	28261.346		165921592.2		-168.11111	12881.056	-2165448.562		
101	Apr 6, 2020	98	120	25398	15156.346		16056494.23		-123.11111	4007.0556	-493313.0617		
102	Apr 7, 2020	99	66	30561	31368.346		84089918.89		-177.11111	9170.0556	-1624118.728		
103	Apr 8, 2020	100	106	30613	18799.457		85046308.67		-137.11111	9222.0556	-1264446.284		
104	Apr 9, 2020	101	142	33323	10223.457		142373949.8		-101.11111	11932.056	-1206463.395		
105	Apr 10, 2020	102	286	33901	1839.4568		156501490		42.888889	12510.056	536542.3827		
106	Apr 11, 2020	103	0	35527	59103.012		199828066.7		-243.11111	14136.056	-3436632.173		
107	Apr 12, 2020	104	390	28391	21576.346		49000777.78		146.88889	7000.0556	1028230.383		
108	Apr 13, 2020	105	233	27620	102.23457		38801133.11		-10.111111	6229.0556	-62982.67284		
109	Apr 14, 2020	106	386	25023	20417.235		13191827.56		142.88889	3632.0556	518980.3827		
110	Apr 15, 2020	107	334	26922	8260.7901		30592575.56		90.888889	5531.0556	502711.4938		
111	Apr 16, 2020	108	447	30148	41570.679		76686022		203.88889	8757.0556	1785466.327		
112	Apr 17, 2020	109	728	31667	235117.23		105597317.8		484.88889	10276.056	4982745.16		
113	Apr 18, 2020	110	623	30833	144315.57		89152413.11		379.88889	9442.0556	3586931.994		
114	Apr 19, 2020	111	942	32922	488445.68		132965242.2		698.88889	11531.056	8058926.605		
115	Apr 20, 2020	112	596	24601	124530.57		10304456.67		352.88889	3210.0556	1132792.938		
116	Apr 21, 2020	113	1426	28065	1399226.1		44543017.56		1182.8889	6674.0556	7894666.16		
117	Apr 22, 2020	114	1111	37289	753231.12		252748170.4		867.88889	15898.056	13797745.77		

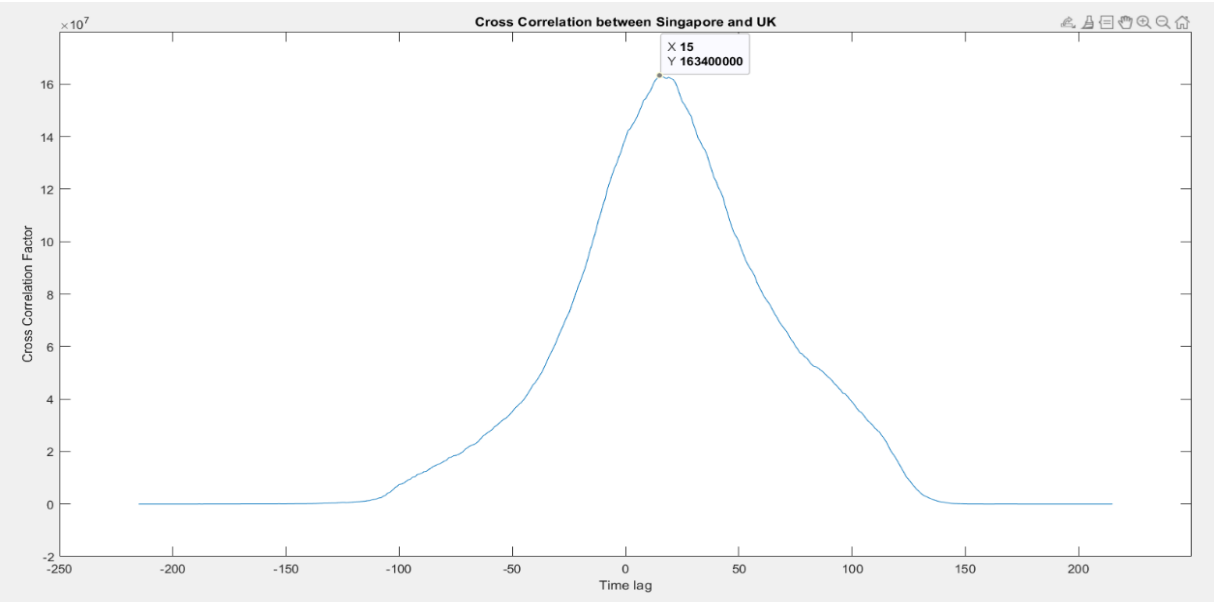
	A	B	C	F	Y	Z	AA	AB	AC	AD	AE	AF	AG
118	Apr 23, 2020	115	1016	17588	597357.23		14462386.45		772.88889	-3802.9444	-2939253.506		
119	Apr 24, 2020	116	1037	26543	630259.57		26543676.45		793.88889	5152.0556	4090159.66		
120	Apr 25, 2020	117	897	21352	427570.68		1516.669753		653.88889	-38.944444	-25465.33951		
121	Apr 26, 2020	118	618	48529	140541.68		736474059.3		374.88889	27138.056	10173755.49		
122	Apr 27, 2020	119	931	26857	473191.12		29877763.34		687.88889	5466.0556	3760038.883		
123	Apr 28, 2020	120	799	22541	309012.46		1322627.781		555.88889	1150.0556	639303.1049		
124	Apr 29, 2020	121	528	24132	81161.679		7513385.559		284.88889	2741.0556	780896.2716		
125	Apr 30, 2020	122	690	27326	199709.68		35224884.45		446.88889	5935.0556	2652310.383		
126	May 1, 2020	123	528	29917	81161.679		72693623.34		284.88889	8526.0556	2428978.494		
127	May 2, 2020	124	932	33955	474567.9		157855492		688.88889	12564.056	8655238.272		
128	May 3, 2020	125	447	29288	41570.679		62363486.45		203.88889	7897.0556	1610121.883		
129	May 4, 2020	126	657	24972	171304.01		12823958.89		413.88889	3581.0556	1482159.105		
130	May 5, 2020	127	573	22593	108826.68		1444937.559		329.88889	1202.0556	396544.7716		
131	May 6, 2020	128	632	23841	151234.57		6002772.225		388.88889	2450.0556	952799.3827		
132	May 7, 2020	129	788	24128	296903.9		7491473.114		544.88889	2737.0556	1491391.16		
133	May 8, 2020	130	741	28369	247893.35		48693259.34		497.88889	6978.0556	3474296.327		
134	May 9, 2020	131	768	26957	275508.35		30980974.45		524.88889	5566.0556	2921560.716		
135	May 10, 2020	132	753	25612	259986.68		17817310		509.88889	4221.0556	2152269.327		
136	May 11, 2020	133	876	20258	400548.35		1283563.114		632.88889	-1132.9444	-717027.9506		
137	May 12, 2020	134	451	18117	43217.79		10718712.23		207.88889	-3273.9444	-680616.6728		
138	May 13, 2020	135	884	22048	410738.57		431722.0031		640.88889	657.05556	421099.6049		
139	May 14, 2020	136	675	20782	186528.01		370813.3364		431.88889	-608.94444	-262996.3395		
140	May 15, 2020	137	752	27143	258967.9		33086143.11		508.88889	5752.0556	2927157.16		
141	May 16, 2020	138	793	25508	302377.79		16950146.45		549.88889	4117.0556	2263923.105		
142	May 17, 2020	139	465	24487	49234.679		9585560.003		221.88889	3096.0556	686980.3272		
143	May 18, 2020	140	682	18873	192623.46		6340044.225		438.88889	-2517.9444	-1105097.84		
144	May 19, 2020	141	305	21841	3830.2346		202550.0031		61.888889	450.05556	27853.43827		
145	May 20, 2020	142	451	19970	43217.79		2019083.114		207.88889	-1420.9444	-295398.5617		
146	May 21, 2020	143	570	23285	106856.35		3587446.448		326.88889	1894.0556	619145.716		
147	May 22, 2020	144	448	25434	41979.457		16346298.23		204.88889	4043.0556	828377.1605		
148	May 23, 2020	145	614	24147	137558.57		7595842.225		370.88889	2756.0556	1022190.383		
149	May 24, 2020	146	642	21236	159112.35		24007.78086		398.88889	-154.94444	-61805.61728		
150	May 25, 2020	147	548	20568	92957.235		677237.5586		304.88889	-822.94444	-250906.6173		
151	May 26, 2020	148	344	19064	10178.568		5414670.448		100.88889	-2326.9444	-234762.8395		
152	May 27, 2020	149	383	18910	19568.901		6155085.336		139.88889	-2480.9444	-347056.5617		
153	May 28, 2020	150	533	18721	84035.568		7128603.336		289.88889	-2669.9444	-773987.2284		
154	May 29, 2020	151	373	21817	16871.123		181523.3364		129.88889	426.05556	55339.88272		
155	May 30, 2020	152	611	25337	135342.23		15571354.45		367.88889	3946.0556	1451709.994		
156	May 31, 2020	153	506	23297	69110.568		3633047.781		262.88889	1906.0556	501080.8272		

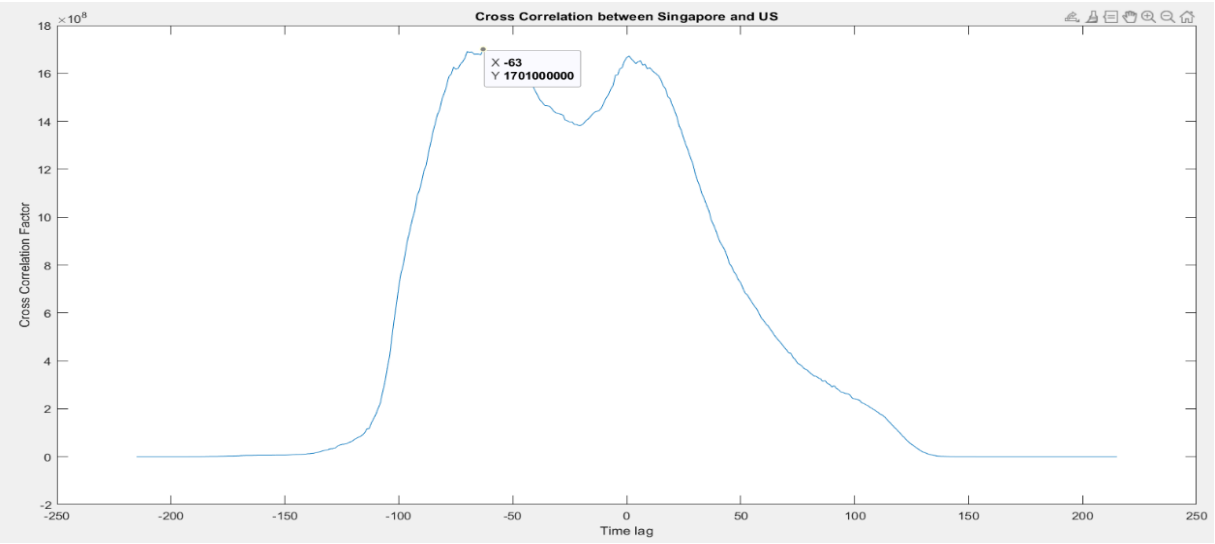
	A	B	C	F	Y	Z	AA	AB	AC	AD	AE	AF	AG
157	Jun 1, 2020	154	518	19807	75563.901		2508880.003		274.88889	-1583.9444	-435408.7284		
158	Jun 2, 2020	155	408	21086	27188.346		92991.1142		164.88889	-304.94444	-50281.95062		
159	Jun 3, 2020	156	544	20544	90534.123		717314.892		300.88889	-846.94444	-254836.1728		
160	Jun 4, 2020	157	569	19699	106203.57		2862676.003		325.88889	-1691.9444	-551385.8951		
161	Jun 5, 2020	158	517	21140	75015.123		62973.1142		273.88889	-250.94444	-68730.89506		
162	Jun 6, 2020	159	261	25178	320.01235		14341789.78		17.888889	3787.0556	67746.21605		
163	Jun 7, 2020	160	344	22223	10178.568		692316.4475		100.88889	832.05556	83945.16049		
164	Jun 8, 2020	161	383	22302	19568.901		830022.2253		139.88889	911.05556	127446.5494		
165	Jun 9, 2020	162	386	18822	20417.235		6599475.559		142.88889	-2568.9444	-367073.6173		
166	Jun 10, 2020	163	218	18665	630.5679		7430773.114		-25.111111	-2725.9444	68451.49383		
167	Jun 11, 2020	164	451	20614	43217.79		603642.6698		207.88889	-776.94444	-161518.1173		
168	Jun 12, 2020	165	422	22883	32001.235		2226229.781		178.88889	1492.0556	266912.1605		
169	Jun 13, 2020	166	463	25639	48351.123		18045976		219.88889	4248.0556	934100.216		
170	Jun 14, 2020	167	347	25540	10792.901		17214662		103.88889	4149.0556	431040.7716		
171	Jun 15, 2020	168	407	19543	26859.568		3414898.67		163.88889	-1847.9444	-302857.5617		
172	Jun 16, 2020	169	214	19957	847.45679		2056196.67		-29.111111	-1433.9444	41743.71605		
173	Jun 17, 2020	170	151	23705	8484.4568		5354853.114		-92.111111	2314.0556	-213150.2284		
174	Jun 18, 2020	171	247	25559	15.123457		17372687.11		3.8888889	4168.0556	16209.10494		
175	Jun 19, 2020	172	257	27762	192.90123		40590348.89		13.888889	6371.0556	88486.88272		
176	Jun 20, 2020	173	142	29909	10223.457		72557270.45		-101.11111	8518.0556	-861270.0617		
177	Jun 21, 2020	174	218	34158	630.5679		162997707.6		-25.111111	12767.056	-320594.9506		
178	Jun 22, 2020	175	262	25793	356.79012		19378093.11		18.888889	4402.0556	83149.93827		
179	Jun 23, 2020	176	218	31390	630.5679		99981112		-25.111111	9999.0556	-251087.3951		
180	Jun 24, 2020	177	119	34720	15403.568		177663722		-124.11111	13329.056	-1654283.895		
181	Jun 25, 2020	178	191	34339	2715.5679		167652142.7		-52.111111	12948.056	-674737.5617		
182	Jun 26, 2020	179	113	40949	16928.901		382517537.1		-130.11111	19558.056	-2544720.34		
183	Jun 27, 2020	180	219	45527	581.34568		582549177.8		-24.111111	24136.056	-581947.1173		
184	Jun 28, 2020	181	291	42486	2293.3457		445001368.9		47.888889	21095.056	1010218.772		
185	Jun 29, 2020	182	213	38673	906.67901		298669444.2		-30.111111	17282.056	-520381.8951		
186	Jun 30, 2020	183	202	41556	1690.1235		406629465.6		-41.111111	20165.056	-829007.8395		
187	Jul 1, 2020	184	246	43880	8.345679		505757619.8		2.8888889	22489.056	64968.38272		
188	Jul 2, 2020	185	215	52048	790.23457		939855055.3		-28.111111	30657.056	-861803.8951		
189	Jul 3, 2020	186	188	53399	3037.2346		1024515620		-55.111111	32008.056	-1763999.506		
190	Jul 4, 2020	187	169	54442	5492.4568		1092372273		-74.111111	33051.056	-2449450.451		
191	Jul 5, 2020	188	185	45221	3376.9012		567871547.8		-58.111111	23830.056	-1384791.006		
192	Jul 6, 2020	189	0	49093	59103.012		767403882		-243.11111	27702.056	-6734677.506		
193	Jul 7, 2020	190	319	49990	5759.1235		817905978.7		75.888889	28599.056	2170350.549		
194	Jul 8, 2020	191	157	57473	7415.1235		1301914733		-86.111111	36082.056	-3107065.895		
195	Jul 9, 2020	192	158	58906	7243.9012		1407379393		-85.111111	37515.056	-3192948.062		

	A	B	C	F	Y	Z	AA	AB	AC	AD	AE	AF	AG
195	Jul 9, 2020	192	158	58906	7243.9012		1407379393		-85.111111	37515.056	-3192948.062		
196	Jul 10, 2020	193	124	63004	14187.457		1731646393		-119.11111	41613.056	-4956577.284		
197	Jul 11, 2020	194	191	66625	2715.5679		2046119782		-52.111111	45234.056	-2357196.895		
198	Jul 12, 2020	195	170	63051	5345.2346		1735560229		-73.111111	41660.056	-3045812.951		
199	Jul 13, 2020	196	178	57258	4239.4568		1286445674		-65.111111	35867.056	-2335343.84		
200	Jul 14, 2020	197	322	58114	6223.4568		1348582809		78.888889	36723.056	2897041.049		
201	Jul 15, 2020	198	346	68518	10586.123		2220959365		102.88889	47127.056	4848850.383		
202	Jul 16, 2020	199	249	67717	34.679012		2146103423		5.8888889	46326.056	272808.9938		
203	Jul 17, 2020	200	248	76930	23.901235		3084586692		4.8888889	55539.056	271524.2716		
204	Jul 18, 2020	201	327	71494	7037.3457		2510316176		83.888889	50103.056	4203089.66		
205	Jul 19, 2020	202	202	63749	1690.1235		1794204870		-41.111111	42358.056	-1741386.728		
206	Jul 20, 2020	203	257	61796	192.90123		1632568514		13.888889	40405.056	561181.3272		
207	Jul 21, 2020	204	123	56750	14426.679		1250262810		-120.11111	35359.056	-4247015.451		
208	Jul 22, 2020	205	399	72048	24301.346		2566137278		155.88889	50657.056	7896872.105		
209	Jul 23, 2020	206	310	68848	4474.1235		2252172122		66.888889	47457.056	3174349.716		
210	Jul 24, 2020	207	354	63196	12296.346		1747662670		110.88889	41805.056	4635716.16		
211	Jul 25, 2020	208	277	78427	1148.4568		3253111633		33.888889	57036.056	1932888.549		
212	Jul 26, 2020	209	513	65498	72840.012		1945432350		269.88889	44107.056	11904004.22		
213	Jul 27, 2020	210	481	55993	56591.123		1197302249		237.88889	34602.056	8231444.549		
214	Jul 28, 2020	211	469	56243	51025.79		1214665776		225.88889	34852.056	7872692.105		
215	Jul 29, 2020	212	359	61734	13430.235		1627562132		115.88889	40343.056	4675311.883		
216	Jul 30, 2020	213	334	74985	8260.7901		2872322791		90.888889	53594.056	4871104.16		
217	Jul 31, 2020	214	278	68032	1217.2346		2175388063		34.888889	46641.056	1627254.605		
218	Aug 1, 2020	215	396	67023	23375.012		2082284494		152.88889	45632.056	6976634.272		
219	Aug 2, 2020	216	307	58407	4081.7901		1370188369		63.888889	37016.056	2364914.66		

Appendix C

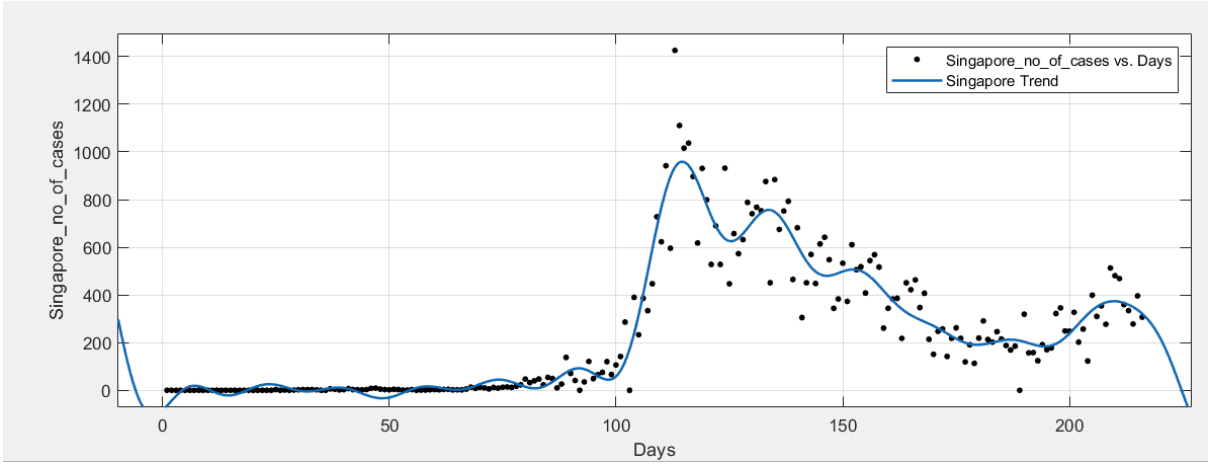

Cross Correlation between Singapore and China
×10^7
X 79
Y 63910000
Cross Correlation Factor
Time lag


Cross Correlation between Singapore and UK
×10^7
X 15
Y 163400000
Cross Correlation Factor
Time lag


Cross Correlation between Singapore and US
×10^8
X -63
Y 1701000000
Cross Correlation Factor
Time lag

Appendix D

Singapore Trend



General model Sin8:

f(x) =

a1*sin(b1*x+c1) + a2*sin(b2*x+c2) + a3*sin(b3*x+c3) +
a4*sin(b4*x+c4) + a5*sin(b5*x+c5) + a6*sin(b6*x+c6) +
a7*sin(b7*x+c7) + a8*sin(b8*x+c8)

Coefficients (with 95% confidence bounds):

a1 = 922.3 (-1.853e+05, 1.872e+05)
b1 = 0.001444 (-0.3298, 0.3327)
c1 = 0.1473 (-27.85, 28.14)
a2 = 315.3 (-205.2, 835.7)
b2 = 0.03838 (-0.00275, 0.07951)
c2 = 2.807 (-2.161, 7.774)
a3 = 102.1 (78.39, 125.9)
b3 = 0.1369 (0.131, 0.1427)
c3 = -1.842 (-2.545, -1.138)
a4 = 67.18 (47.09, 87.28)
b4 = 0.2463 (0.2374, 0.2552)
c4 = -7.239 (-8.289, -6.189)
a5 = 167.7 (50.21, 285.2)
b5 = 0.08083 (0.0649, 0.09676)
c5 = 4.027 (2.113, 5.942)
a6 = 41.77 (22.46, 61.07)
b6 = 0.3383 (0.3278, 0.3489)

c6 = -5.451 (-6.717, -4.184)

a7 = 66.18 (46.01, 86.36)

b7 = 0.1909 (0.183, 0.1987)

c7 = -7.636 (-8.601, -6.67)

a8 = 60.24 (40.93, 79.55)

b8 = 0.2928 (0.282, 0.3035)

c8 = -6.391 (-7.575, -5.207)

Goodness of fit:

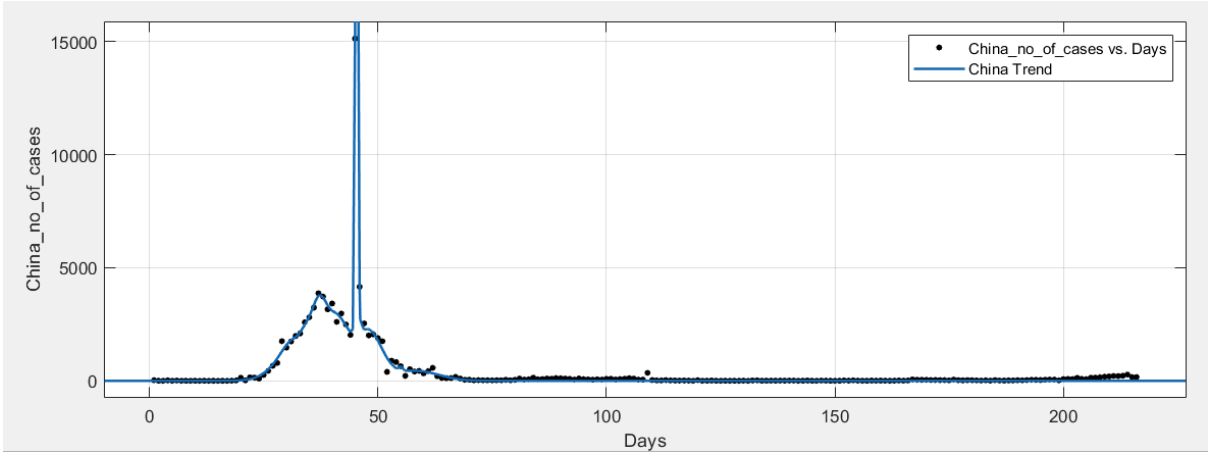
SSE: 1.671e+06

R-square: 0.904

Adjusted R-square: 0.8925

RMSE: 93.29

China Trend



General model Gauss8:

f(x) =

a1*exp(-((x-b1)/c1)^2) + a2*exp(-((x-b2)/c2)^2) +

a3*exp(-((x-b3)/c3)^2) + a4*exp(-((x-b4)/c4)^2) +

a5*exp(-((x-b5)/c5)^2) + a6*exp(-((x-b6)/c6)^2) +

a7*exp(-((x-b7)/c7)^2) + a8*exp(-((x-b8)/c8)^2)

Coefficients (with 95% confidence bounds):

a1 = 3.441e+04 (-3.491e+07, 3.498e+07)

b1 = 45.37 (-34.93, 125.7)

c1 = 0.3751 (-114.7, 115.5)

a2 = 1305 (-2280, 4891)

b2 = 37.3 (36.25, 38.34)

c2 = 1.978 (-0.5052, 4.461)

a3 = 1869 (-612.4, 4351)

b3 = 41.24 (40.05, 42.44)

c3 = 3.229 (0.09064, 6.367)

a4 = 2526 (129.3, 4922)

b4 = 34.36 (28.98, 39.75)

c4 = 6.591 (4.019, 9.164)

a5 = 2173 (1649, 2696)

b5 = 47.82 (46.52, 49.12)

c5 = 4.22 (2.549, 5.892)

a6 = -313.3 (-1543, 916.3)

b6 = 32.46 (29.66, 35.27)

c6 = 1.679 (-2.563, 5.921)

a7 = 438.3 (317.8, 558.8)

b7 = 58.29 (53.76, 62.83)

c7 = 7.031 (2.278, 11.78)

a8 = 177 (-3151, 3505)

b8 = 55.07 (31.43, 78.72)

c8 = 0.4403 (-13.68, 14.56)

Goodness of fit:

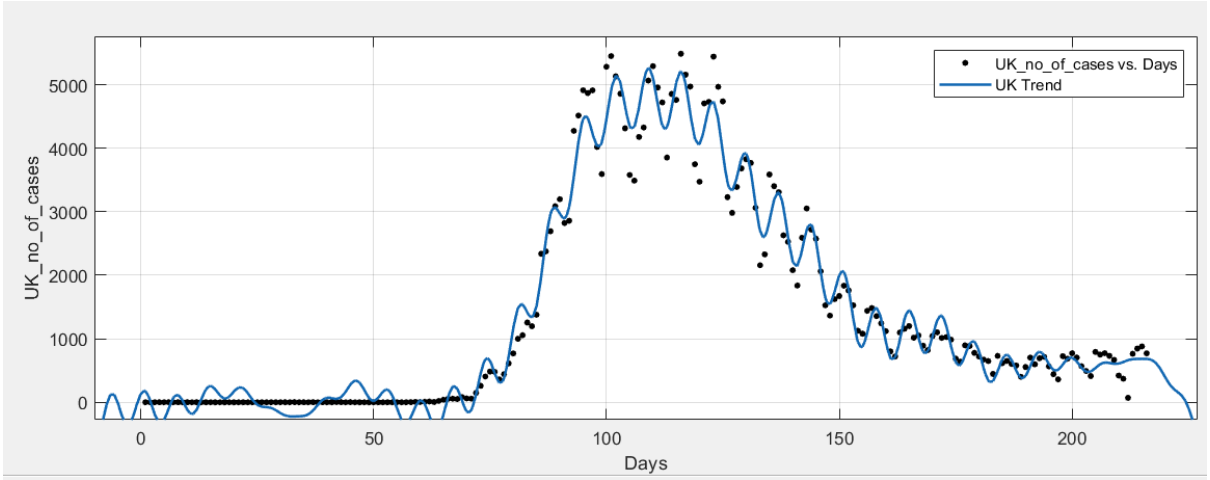
SSE: 2.454e+06

R-square: 0.9931

Adjusted R-square: 0.9923

RMSE: 113.1

UK Trend



General model Sin8:

f(x) =

a1*sin(b1*x+c1) + a2*sin(b2*x+c2) + a3*sin(b3*x+c3) +
a4*sin(b4*x+c4) + a5*sin(b5*x+c5) + a6*sin(b6*x+c6) +
a7*sin(b7*x+c7) + a8*sin(b8*x+c8)

Coefficients (with 95% confidence bounds):

a1 = 1874 (-9.58e+05, 9.617e+05)
b1 = 0.001317 (-1.917, 1.919)
c1 = 0.7659 (-467.4, 468.9)
a2 = 1136 (-2073, 4345)
b2 = 0.06959 (0.009093, 0.1301)
c2 = 0.1231 (-5.93, 6.176)
a3 = 2162 (-1.697e+04, 2.13e+04)
b3 = 0.03215 (-0.135, 0.1993)
c3 = -2.23 (-20.72, 16.26)
a4 = 363.9 (-118.9, 846.7)
b4 = 0.1115 (0.08256, 0.1404)
c4 = -3.787 (-6.237, -1.337)
a5 = 167.6 (87.71, 247.5)
b5 = 0.1532 (0.1387, 0.1677)
c5 = -0.5323 (-1.827, 0.7624)
a6 = 241 (182.9, 299.1)
b6 = 0.9165 (0.9111, 0.922)
c6 = 1.908 (1.239, 2.577)

a7 = 248.9 (191, 306.8)

b7 = 0.8818 (0.8765, 0.8871)

c7 = -0.1113 (-0.7617, 0.5391)

a8 = 136.7 (79.95, 193.5)

b8 = 0.2531 (0.2456, 0.2605)

c8 = 2.623 (1.71, 3.536)

Goodness of fit:

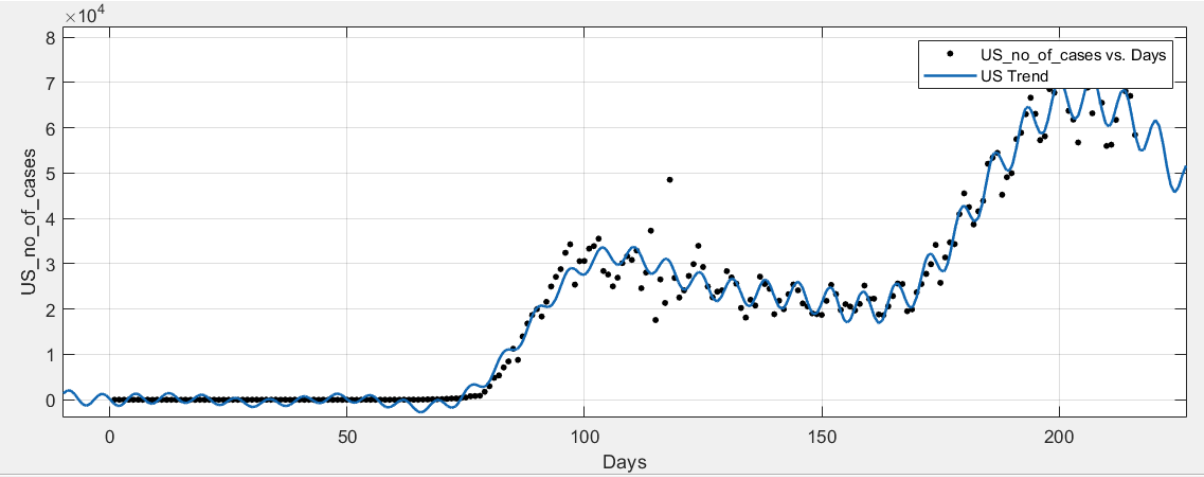
SSE: 1.513e+07

R-square: 0.9747

Adjusted R-square: 0.9717

RMSE: 280.7

US Trend:



General model Sin8:

f(x) =

a1*sin(b1*x+c1) + a2*sin(b2*x+c2) + a3*sin(b3*x+c3) +

a4*sin(b4*x+c4) + a5*sin(b5*x+c5) + a6*sin(b6*x+c6) +

a7*sin(b7*x+c7) + a8*sin(b8*x+c8)

Coefficients (with 95% confidence bounds):

a1 = 4.659e+04 (-1.981e+09, 1.981e+09)

b1 = 0.01354 (-301.3, 301.3)

c1 = -0.5232 (-1.44e+04, 1.439e+04)

a2 = 2.087e+04 (-2.161e+09, 2.161e+09)

b2 = 0.0231 (-484.9, 484.9)

c2 = 2.074 (-3.198e+04, 3.198e+04)

a3 = 1.319e+04 (-1.671e+07, 1.673e+07)

b3 = 0.06123 (-31.13, 31.25)

c3 = 1.649 (-4041, 4045)

a4 = 2334 (-7.963e+04, 8.43e+04)

b4 = 0.1411 (-0.1577, 0.44)

c4 = -0.1303 (-37.06, 36.8)

a5 = 3.764e+04 (-2.023e+07, 2.031e+07)

b5 = 0.9151 (0.7065, 1.124)

c5 = 2.103 (-5.41, 9.617)

a6 = 3584 (-5.363e+06, 5.37e+06)

b6 = 0.1037 (-12.41, 12.62)

c6 = 4.228 (-1404, 1413)

a7 = 6897 (-5.13e+05, 5.268e+05)

b7 = 0.08101 (-24.53, 24.7)

c7 = -2.38 (-4008, 4003)

a8 = 3.675e+04 (-2.023e+07, 2.031e+07)

b8 = 0.9159 (0.702, 1.13)

c8 = -1.066 (-8.798, 6.667)

Goodness of fit:

SSE: 1.895e+09

R-square: 0.9809

Adjusted R-square: 0.9786

RMSE: 3142