**Engineering 7 – Unprecedented?**

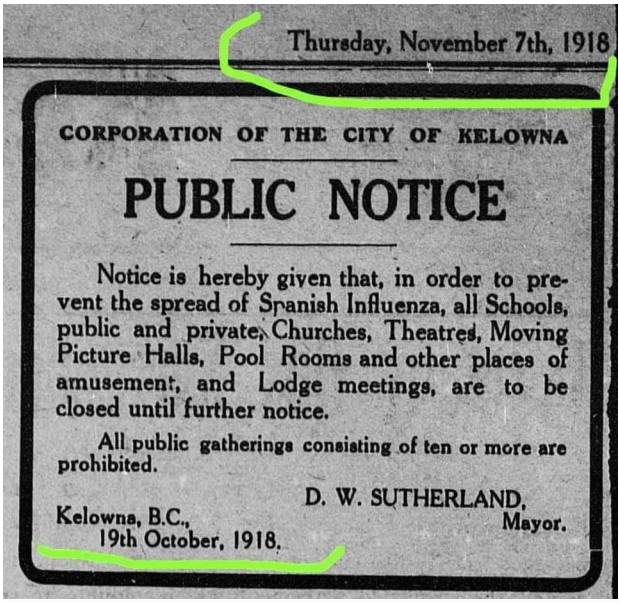
You will create a mathematical model to determine when the local outbreaks of the covid-19 pandemic will peak and reach a conclusion. Your model should be able to determine the population of infected, susceptible, recovered and dead. In order to develop an appropriate solution you will need collect data on:

- Deaths, virus tests, patient recovery, virus incubation, and contact tracing
- Government policies and population density factors that affect population 'mixing'
- The uncertainty associated with public health data

You will use your model to predict the future trends of covid-19 infection and transmission in several defined populations that you will be assigned. You will be accessing online data sets. Some resources provide data. Others offer mathematically modeled predictions. Some resources are more prone to error than others are. Please clarify with the instructor how you plan to use these resources in development of your own numerical model (i.e. to collect data, clarify physical models, or validate predictions.) The following are noted examples:

- https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html
- https://coronavirus.jhu.edu/map.html
- https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/
- https://covidtracking.com/api

Include the names of those whom you received specific assistance from and properly credit their contribution, as you would cite a reference in a research paper. This project is to be completed by individual students.



Thursday, November 7th, 1918

CORPORATION OF THE CITY OF KELOWNA

PUBLIC NOTICE

Notice is hereby given that, in order to prevent the spread of Spanish Influenza, all Schools, public and private, Churches, Theatres, Moving Picture Halls, Pool Rooms and other places of amusement, and Lodge meetings, are to be closed until further notice.

All public gatherings consisting of ten or more are prohibited.

D. W. SUTHERLAND,
Mayor.

Kelowna, B.C.,
19th October, 1918.

History repeats itself. Came across this poem written in 1869, reprinted during 1919 Pandemic.

This is Timeless....

And people stayed at home
And read books
And listened
And they rested
And did exercises
And made art and played
And learned new ways of being
And stopped and listened
More deeply
Someone meditated, someone prayed
Someone met their shadow
And people began to think differently
And people healed.
And in the absence of people who
Lived in ignorant ways
Dangerous, meaningless and heartless,
The earth also began to heal
And when the danger ended and
People found themselves
They grieved for the dead
And made new choices
And dreamed of new visions
And created new ways of living
And completely healed the earth
Just as they were healed.

Final Deliverables for each of the populations assigned:

- A table with predicted dates for peak viral infection and an "end" to the pandemic.
- Data plots of deaths, confirmed infections, recoveries, test conducted, and total population size.
- A discussion of mathematical models of the total infected, recovered, susceptible and dead that incorporate differential equations, address assumptions about the spread of the virus, and quantify residuals between model trends and reported data.
- 2-D plots of mathematical models of the total infected, recovered, susceptible, and dead.
- Tables of parameters, constraints, expressions, and assumptions used in mathematical models.
- Nonlinear time-independent plots of infection trends that correlate to parameters, constraints, expressions and assumptions used in mathematical models
- Monte Carlo Simulations that account for the uncertainty of your models.
- A discussion of the role of government policy on population mixing (i.e. quarantine, 'Stay-At-Home' orders), the impact of a future vaccine on population susceptibility, and the size of the inoculation needed for herd immunity,
- A 5 - 9 page report that addresses and analyzes the data collection, measurements, models, graphs and calculations described above .

Images, Other Recorded Data, and Animations may be submitted as advanced deliverables.