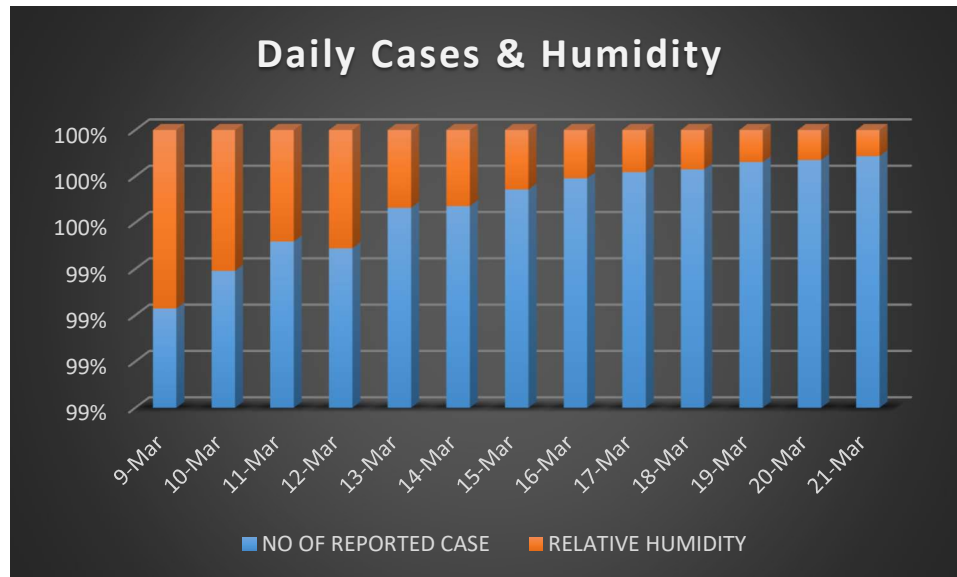




Covid-19 FACTORS ***Correlated research(2020)***

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1) Daily cases and relative Humidity in Italy :



Correlation using Excel

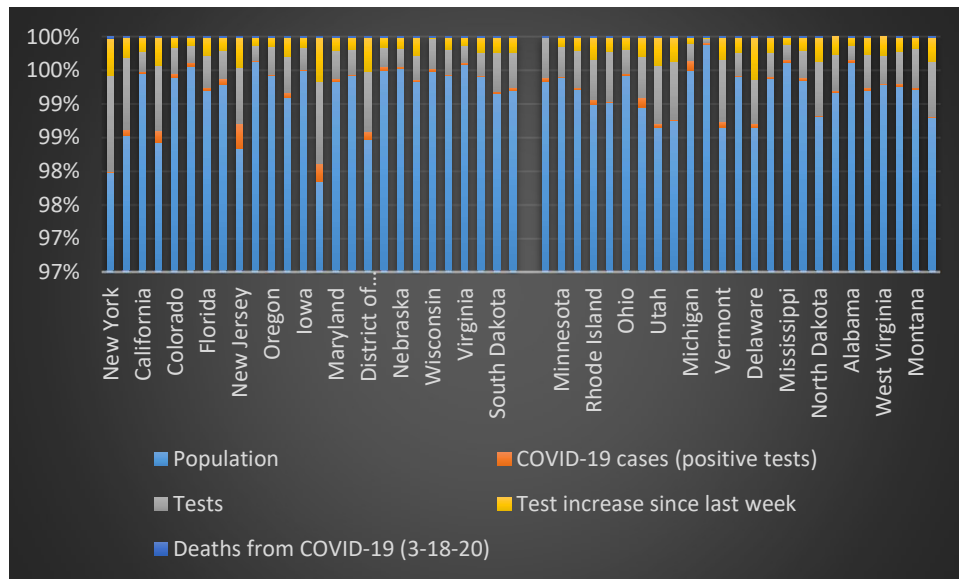
| | % CHANGE IN NO OF REPORTED CASES | % CHANGE IN RELATIVE HUMIDITY |
|----------------------------------|----------------------------------|-------------------------------|
| % CHANGE IN NO OF REPORTED CASES | 1 | |
| % CHANGE IN RELATIVE HUMIDITY | 0.615671123 | 1 |

$R(\text{Humidity}) = 0.6157$ [quite high correlation]

-So the daily cases affected by relative Humidity.

2) Population and cases:

a-Recent data for Covid-19 cases and tests alongside state population size in US states:



Correlation with Excel:

| | Population | COVID-19 cases (positive tests) | Tests | Test increase since last week | Deaths from COVID-19 (3-18-20) |
|---------------------------------|-------------|---------------------------------|-------------|-------------------------------|--------------------------------|
| Population | 1 | | | | |
| COVID-19 cases (positive tests) | 0.450141222 | 1 | | | |
| Tests | 0.668344438 | 0.395658314 | 1 | | |
| Test increase since last week | 0.814458897 | 0.473518055 | 0.938933035 | 1 | |
| Deaths from COVID-19 (3-18-20) | 0.353823657 | 0.256593412 | 0.879044104 | 0.74377908 | 1 |

R (population & cases) = 0.45 [average correlation]

R (Tests & cases) = 0.3956 [average correlation]

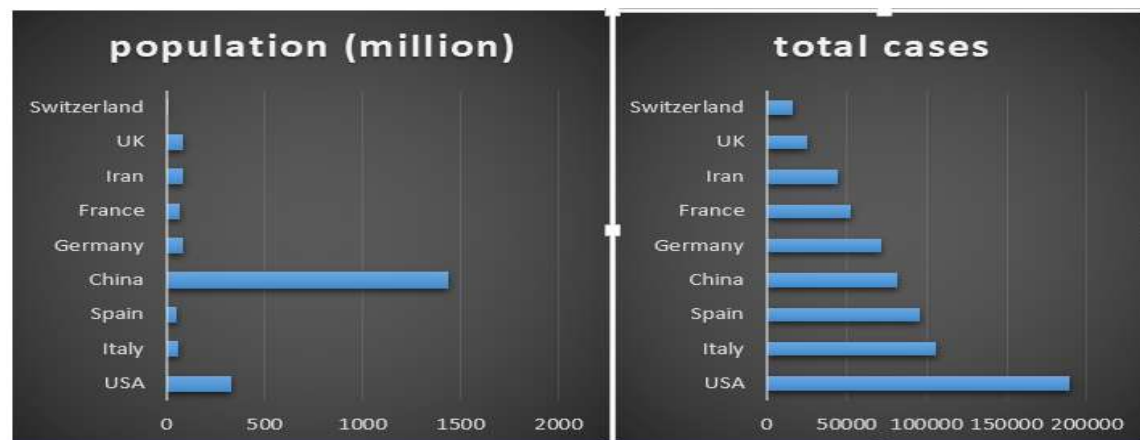
R (Tests & Deaths) = 0.879

R (population & Deaths) = 0.3538

b-Ratio of cases, population and affecting population in various countries as a ratio of USA sorted by cases affected ratio

| Comparing countries stats in relation to USA | | | | | |
|--|-------------|-------------|------------------|----------------|--|
| Country | Total Cases | Cases ratio | Population ratio | Affected ratio | |
| Spain | 95,923 | 0.51 | 0.14 | 3.60 | |
| Switzerland | 16,605 | 0.09 | 0.03 | 3.37 | |
| Italy | 105,792 | 0.56 | 0.18 | 3.07 | |
| Germany | 71,808 | 0.38 | 0.25 | 1.50 | |
| France | 52,128 | 0.28 | 0.20 | 1.40 | |
| USA | 188,578 | 1.00 | 1.00 | 1.00 | |
| Iran | 44,605 | 0.24 | 0.25 | 0.93 | |
| UK | 25,150 | 0.13 | 0.25 | 0.53 | |
| China | 81,518 | 0.43 | 4.35 | 0.10 | |

Even though the countries such as Spain, Switzerland, Italy, Germany and France have a smaller population ratio and a smaller number of cases, if you look at the affected population ratio, that number is a lot higher than the USA.



Correlation using Excel:

| | <i>total cases</i> | <i>population</i> | <i>cases ratio</i> | <i>population ratio</i> | <i>affected ratio</i> |
|-------------------------|--------------------|-------------------|--------------------|-------------------------|-----------------------|
| total cases | 1 | | | | |
| population | 0.205077 | 1 | | | |
| cases ratio | 0.999962 | 0.2015786 | 1 | | |
| population ratio | 0.204921 | 0.999998 | 0.201431 | 1 | |
| affected ratio | -0.0305 | -0.54808 | -0.02761 | -0.547471161 | 1 |

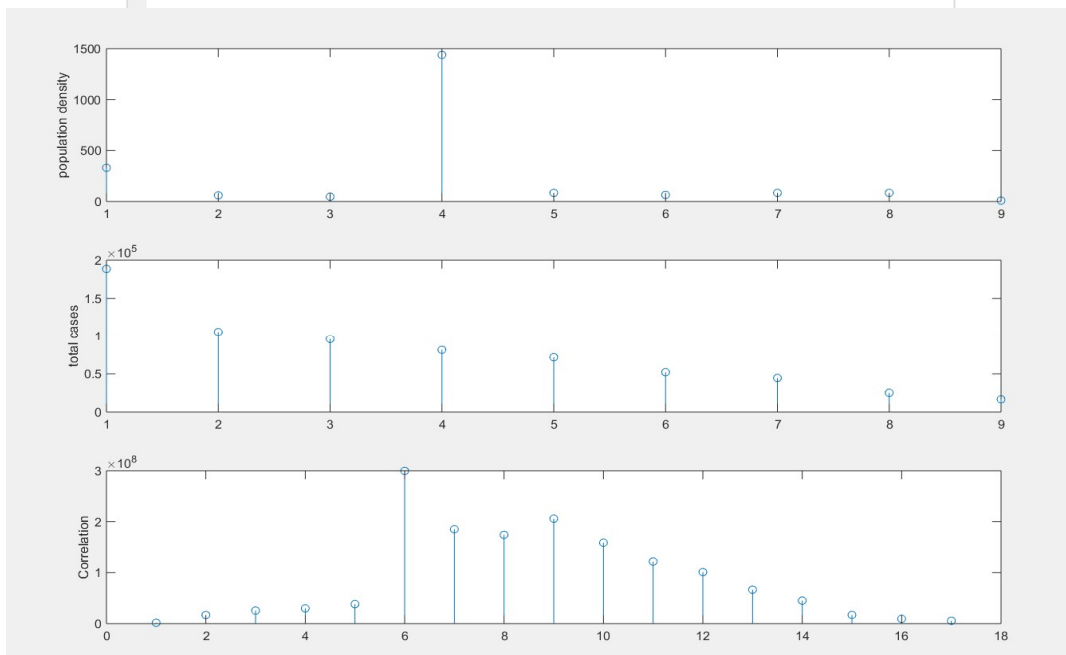
R (population & total cases) = 0.205

MATLAB code and the plots:

```

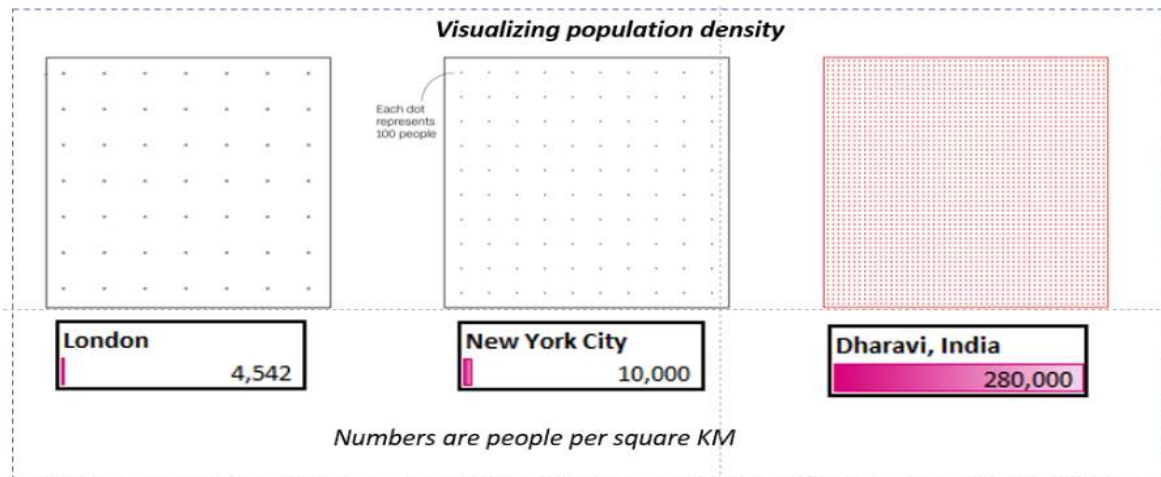
Editor - D:\2nd Assignment\Assignment2_correlation.m
Assignment2_correlation.m
1  clc
2  clear all
3  x=input('Enter the first series:');
4  h=input('Enter the second series:');
5  y=xcorr(x,h);
6  figure; subplot(3,1,1);
7  stem(x); ylabel('population density');
8  subplot(3,1,2);
9  stem(h); ylabel('total cases');
10 subplot(3,1,3);
11 stem(fliplr(y)); ylabel('Correlation');
12 disp('the resultant signal is'); fliplr(y);
13
14
15
16
Command Window
Enter the first series:[331 60 47 1439 84 65 84 84 9]
Enter the second series:[188578 105792 95923 81518 71808 52128 44605 25150 16605]
the resultant signal is
fx >>

```



Impact of Population density

Even though it appears Italy is affected the most, one important factor this does not take into consideration is the population density.



The more important factor here would be population density in an area where there are a significant number of coronavirus cases. For example, in NYC the population density is like 10,000 people per square kilometer while in London its 4,542 people per square kilometer. As of March 31, we have 43,139 cases in New York City versus 25,150 cases in London.

| | Population Density | Number of Cases |
|---------------|--------------------|-----------------|
| New York City | 10,000 | 43,139 |
| London | 4,542 | 25,150 |

On the other hand, in places in India like Dharavi in Mumbai the population density is something like 280,000 people per square kilometer. **Population density & the effectiveness of quarantining will play a significantly larger role in how the virus spreads than the total population of the country.**

3) Temperature and cases in china cities:

| Country | Province | Properties | | | | | February, 2020 | | | | | COVID-19 | |
|---------|--------------|-------------|-------------------------------------|--------------|-------------|--------------|----------------|----------|------------------------|------------|-----------|-----------------|--------|
| | | Population | Density, Population/km ² | Gender Ratio | Average Age | Elevation, m | Max T °C | Min T °C | Average Temperature °C | Humidity % | Wind km/h | Confirmed Cases | Deaths |
| China | Hubei | 59,170,000 | 318 | 1.06 | 38.4 | 37 | 15.4 | 1.4 | 8.3 | 77.9 | 5.4 | 64786 | 2563 |
| | Guangdong | 113,460,000 | 630 | 1.06 | 38.4 | 21 | 21.0 | 10.3 | 15.1 | 76.8 | 8.2 | 1347 | 7 |
| | Henan | 96,050,000 | 575 | 1.06 | 38.4 | 104 | 13.7 | -0.1 | 6.3 | 61.9 | 6.8 | 1271 | 19 |
| | Zhejiang | 57,370,000 | 562 | 1.06 | 38.4 | 19 | 15.1 | 4.5 | 9.3 | 70.1 | 7.6 | 1205 | 1 |
| | Hunan | 68,990,000 | 329 | 1.06 | 38.4 | 63 | 16.2 | 4.4 | 9.6 | 75.2 | 8.4 | 1016 | 4 |
| | Anhui | 63,240,000 | 454 | 1.06 | 38.4 | 37 | 14.4 | 0.1 | 7.1 | 76.9 | 9.6 | 989 | 6 |
| | Jiangxi | 46,480,000 | 278 | 1.06 | 38.4 | 37 | 16.6 | 5.9 | 10.5 | 73.4 | 5.3 | 934 | 1 |
| | Shandong | 100,470,000 | 653 | 1.06 | 38.4 | 23 | 11.6 | 0.2 | 5.4 | 56.0 | 8.3 | 755 | 6 |
| | Jiangsu | 80,510,000 | 785 | 1.06 | 38.4 | 15 | 14.2 | 2.4 | 7.8 | 73.0 | 9.0 | 631 | 0 |
| | Chongqing | 31,020,000 | 377 | 1.06 | 38.4 | 244 | 14.3 | 8.0 | 10.7 | 78.3 | 3.4 | 576 | 6 |
| | Sichuan | 83,410,000 | 172 | 1.06 | 38.4 | 500 | 14.9 | 5.4 | 9.75 | 65.50 | 6.10 | 529 | 3 |
| | Heilongjiang | 37,730,000 | 83 | 1.06 | 38.4 | 126 | -5.8 | -20.6 | -12.7 | 69.9 | 9.9 | 480 | 12 |
| | Beijing | 21,540,000 | 1313 | 1.06 | 38.4 | 43.5 | 7.8 | -4.8 | 1.0 | 55.7 | 7.2 | 400 | 4 |
| | Shanghai | 24,240,000 | 3823 | 1.06 | 38.4 | 4 | 14.1 | 2.4 | 8.1 | 72.8 | 9.1 | 335 | 3 |
| | Hebei | 75,560,000 | 403 | 1.06 | 38.4 | 83 | 10.6 | -1.5 | 4.1 | 54.6 | 8.5 | 311 | 6 |
| | Fujian | 39,410,000 | 324 | 1.06 | 38.4 | 14 | 18.4 | 8.3 | 12.7 | 70.6 | 7.4 | 294 | 1 |
| | Guangxi | 49,260,000 | 209 | 1.06 | 38.4 | 499 | 20.4 | 11.5 | 15.5 | 74.4 | 9.6 | 252 | 2 |
| | Shaanxi | 38,640,000 | 247 | 1.06 | 38.4 | 405 | 14.5 | 2.3 | 7.8 | 62.4 | 3.9 | 245 | 1 |
| | Yunnan | 48,300,000 | 123 | 1.06 | 38.4 | 1892 | 18.0 | 3.4 | 10.6 | 64.1 | 9.0 | 174 | 2 |
| | Hainan | 9,340,000 | 275 | 1.06 | 38.4 | 222 | 24.5 | 16.8 | 19.9 | 81.1 | 11.3 | 168 | 5 |
| | Guizhou | 36,000,000 | 205 | 1.06 | 38.4 | 1275 | 12.5 | 3.9 | 7.6 | 82.0 | 8.5 | 146 | 2 |
| | Tianjin | 15,600,000 | 1380 | 1.06 | 38.4 | 1078 | 8.6 | -4.0 | 1.8 | 61.8 | 9.3 | 135 | 3 |
| | Shanxi | 37,180,000 | 181 | 1.06 | 38.4 | 800 | 10.0 | -7.1 | 0.6 | 52.6 | 7.0 | 133 | 0 |
| | Liaoning | 43,590,000 | 299 | 1.06 | 38.4 | 55 | 2.0 | -12.6 | -5.36 | 64.22 | 8.26 | 121 | 1 |
| | Jilin | 27,040,000 | 2704 | 1.06 | 38.4 | 202 | -2.4 | -15.7 | -8.96 | 66.52 | 9.60 | 93 | 1 |

Correlation using Excel:

| | confirmed cases | population Density | gender ratio | Average age | Elevation | T average | Humidity | wind | deaths |
|--------------------|-----------------|--------------------|--------------|--------------|-----------|-----------|----------|-------|--------|
| confirmed cases | 1 | | | | | | | | |
| population Density | -0.089170192 | 1 | | | | | | | |
| gender ratio | -6.0638E-17 | 2.15683E-17 | 1 | | | | | | |
| Average age | -6.0638E-17 | 2.15683E-17 | 1 | 1 | | | | | |
| Elevation | -0.134877571 | -0.181719991 | -6.33907E-17 | -6.33907E-17 | 1 | | | | |
| T average | 0.904409933 | -0.176095432 | 7.6817E-17 | 7.6817E-17 | -0.08466 | 1 | | | |
| Humidity | 0.230046333 | -0.060878495 | 2.30505E-15 | 2.30505E-15 | -0.10323 | 0.3987 | 1 | | |
| wind | -0.275841759 | 0.240258271 | -7.43929E-16 | -7.43929E-16 | 0.10743 | -0.292 | 0.1029 | 1 | |
| deaths | 0.999612646 | -0.085516937 | 2.04034E-17 | 2.04034E-17 | -0.12219 | 0.9008 | 0.2234 | -0.27 | 1 |

R(T(average)) = 0.904 [high correlation]

R(humidity) = 0.23

R(wind)= -0.275

4) Other Factors affect on Coronavirus Cases:

- Air pollution
- Median Temperature
- Percent_High_Blood_pressure
- Diabetes_prevalence
- Total Trade
- Nursing personnel Total
- State Emergency Provisions
- Population 65+
- Percent smoker
- Total Hospital Beds
- Total Doctors

Correlation using Excel:

| Column1 | total cases | Air_Pollu | Median_Temp_Jan | Percent_High_Blood_P | Diabetes_Preva | Total Trade (Exp + Imp) | Nursing personnel | State of Emergency Pro | 65+(normalized) | Percent sm | Hospital beds per 10k | Total Doctors |
|-------------------------------|--------------|-----------|-----------------|----------------------|----------------|-------------------------|-------------------|------------------------|-----------------|------------|-----------------------|---------------|
| total cases | 1 | | | | | | | | | | | |
| Air_Pollution | -0.316909928 | 1 | | | | | | | | | | |
| Median_Temp_Jan_2020 | -0.243330468 | -0.4905 | 1 | | | | | | | | | |
| Percent_High_Blood_Pressure | -0.561051901 | 0.2673 | 0.338660416 | 1 | | | | | | | | |
| Diabetes_Prevalence | 0.460315036 | 0.349 | -0.593691325 | -0.235815694 | 1 | | | | | | | |
| Total Trade (Exp + Imp) | 0.546731185 | 0.2654 | -0.842689996 | -0.375562504 | 0.60894722 | 1 | | | | | | |
| Nursing personnel total | 0.518438783 | 0.4103 | -0.875606061 | -0.398474861 | 0.57803157 | 0.966848121 | 1 | | | | | |
| State of Emergency Provisions | 0.61184155 | -0.3676 | -0.243074114 | -0.470642804 | 0.08772629 | 0.19197683 | 0.188612602 | 1 | | | | |
| 65+(normalized) | 0.160943073 | -0.799 | 0.267687443 | -0.04424324 | -0.4738374 | 0.00199267 | -0.15655245 | 0.264683608 | 1 | | | |
| percent smoker | -0.020935669 | -0.4177 | 0.043129647 | 0.303860891 | -0.2558851 | 0.194464383 | 0.059871954 | -0.147186826 | 0.776455 | 1 | | |
| Hospital beds per 10k | -0.160067643 | -0.2384 | -0.156222374 | 0.397412593 | 0.05622446 | 0.247662425 | 0.056167136 | -0.203498243 | 0.493817 | 0.77034 | 1 | |
| Total Doctors | 0.137650098 | 0.6951 | -0.815895809 | -0.10299895 | 0.40941639 | 0.80717252 | 0.888766677 | -0.072303202 | -0.28789 | 0.05795 | 0.01208528 | 1 |

R(air pollution)=-0.317

R(median temp)=-0.243

R(percent high blood pressure)=-0.561

R(diabetes prevalence)=0.4603

R(total trade)=0.5467

R(nursing personal total)=0.5184

R(state of emergency provisions)=0.6118

R(65+ population)=0.161

R(percent smoker)=-0.021

R(Hospital beds per 10k)=0.16

R(total doctor)=0.1377

