

Part-2.R

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```
library(ggplot2)

Education1<- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Final/Education/Education - Use Case 1.csv', header = TRUE)
Education2<- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Final/Education/Education - Use Case 2.csv', header = TRUE)

Health1 <- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Financial/Health/Health - Use Case 1.csv', header = TRUE)
Health2 <- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Financial/Health/Health - Use Case 2.csv', header = TRUE)
Health3 <- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Financial/Health/Health - Use Case 3.csv', header = TRUE)
Financial_Sector1 <- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Final/Financial Sector/Financial Sector - Use Case 1.csv', header=TRUE)
Financial_Sector2 <- read.csv(file='E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Final/Financial Sector/Financial Sector - Use Case 2.csv', header=TRUE)

str(Education1)
```

```
## 'data.frame': 266 obs. of 23 variables:
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...
## $ Indicator.Name : chr "Literacy rate, adult total (% of people ages 15 and above)" "Literacy rate, adult total (% of people ages 15 and above)" "Literacy rate, adult total (% of people ages 15 and above)" "Literacy rate, adult total (% of people ages 15 and above)" ...
## $ X2001      : num NA NA NA NA 67.4 ...
## $ X2002      : num NA NA NA NA ...
## $ X2003      : num NA NA NA NA ...
## $ X2004      : num NA NA NA NA ...
## $ X2005      : num NA NA NA NA ...
## $ X2006      : num NA NA NA NA ...
## $ X2007      : num NA NA NA NA ...
## $ X2008      : num NA NA NA NA ...
## $ X2009      : num NA NA NA NA ...
## $ X2010      : num 96.8 NA NA NA NA ...
## $ X2011      : num NA NA 31.4 NA NA ...
## $ X2012      : num NA NA NA NA NA ...
## $ X2013      : num NA NA NA NA NA ...
## $ X2014      : num NA NA NA NA 66 ...
## $ X2015      : num NA NA NA NA NA ...
## $ X2016      : num NA NA NA NA NA ...
## $ X2017      : num NA NA NA NA NA ...
## $ X2018      : num 97.8 NA NA NA NA ...
## $ X2019      : num NA NA NA NA NA ...
## $ X2020      : num NA NA NA NA NA ...
```

```
summary(Education1)
```

```
## i..Country.Code    Country.Name      Indicator.Name      X2001
## Length:266        Length:266       Length:266        Min.   :14.38
## Class :character  Class :character  Class :character  1st Qu.:62.32
## Mode  :character  Mode  :character  Mode  :character  Median  :82.49
##                                         Mean   :77.63
##                                         3rd Qu.:91.51
##                                         Max.   :99.65
##                                         NA's   :196
## 
## X2002      X2003      X2004      X2005
## Min.   :34.66  Min.   :21.82  Min.   :28.38  Min.   :23.52
## 1st Qu.:60.75 1st Qu.:57.91 1st Qu.:61.20 1st Qu.:60.64
## Median  :78.39 Median  :78.93 Median  :81.84 Median  :80.31
## Mean    :76.11 Mean    :73.27 Mean    :77.24 Mean    :75.61
## 3rd Qu.:91.16 3rd Qu.:89.92 3rd Qu.:90.53 3rd Qu.:91.51
## Max.   :99.80 Max.   :98.58 Max.   :99.70 Max.   :98.63
## NA's   :207   NA's   :214   NA's   :202   NA's   :204
## 
## X2006      X2007      X2008      X2009
## Min.   :22.47  Min.   :28.29  Min.   :26.83  Min.   :48.04
## 1st Qu.:60.81 1st Qu.:61.19 1st Qu.:63.89 1st Qu.:65.44
## Median  :81.62 Median  :83.03 Median  :84.03 Median  :88.28
## Mean    :76.24 Mean    :77.61 Mean    :79.47 Mean    :81.12
## 3rd Qu.:92.30 3rd Qu.:92.69 3rd Qu.:93.86 3rd Qu.:93.98
## Max.   :99.02 Max.   :99.59 Max.   :100.00 Max.   :99.76
## NA's   :197   NA's   :190   NA's   :192   NA's   :192
## 
## X2010      X2011      X2012      X2013
## Min.   :25.31  Min.   :30.62  Min.   :30.56  Min.   :32.43
## 1st Qu.:69.87 1st Qu.:72.68 1st Qu.:69.43 1st Qu.:70.06
## Median  :89.54 Median  :92.01 Median  :84.71 Median  :86.82
## Mean    :81.28 Mean    :84.02 Mean    :80.60 Mean    :81.94
## 3rd Qu.:94.32 3rd Qu.:97.39 3rd Qu.:94.31 3rd Qu.:94.95
## Max.   :99.78 Max.   :99.90 Max.   :99.97 Max.   :99.99
## NA's   :175   NA's   :167   NA's   :181   NA's   :191
## 
## X2014      X2015      X2016      X2017
## Min.   :32.00  Min.   :26.00  Min.   :22.31  Min.   :48.30
## 1st Qu.:73.54 1st Qu.:73.50 1st Qu.:75.55 1st Qu.:67.03
## Median  :88.22 Median  :91.02 Median  :92.39 Median  :86.37
## Mean    :83.05 Mean    :83.20 Mean    :84.93 Mean    :82.12
## 3rd Qu.:95.39 3rd Qu.:95.41 3rd Qu.:95.54 3rd Qu.:95.44
## Max.   :99.98 Max.   :99.98 Max.   :99.99 Max.   :99.79
## NA's   :172   NA's   :185   NA's   :193   NA's   :196
## 
## X2018      X2019      X2020
## Min.   :34.52  Min.   :58.00  Min.   :30.76
## 1st Qu.:73.35 1st Qu.:73.51 1st Qu.:73.58
## Median  :88.71 Median  :89.25 Median  :86.89
## Mean    :82.65 Mean    :85.16 Mean    :83.72
## 3rd Qu.:96.01 3rd Qu.:96.01 3rd Qu.:96.03
## Max.   :99.99 Max.   :100.00 Max.   :99.79
## NA's   :152   NA's   :204   NA's   :214
```

```
str(Education2)
```

```
## 'data.frame': 266 obs. of 23 variables:  
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...  
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...  
## $ Indicator.Name : chr "Current education expenditure, total (% of total expenditure in public institutions)" "Current education expenditure, total (% of total expenditure in public institutions)" "Current education expenditure, total (% of total expenditure in public institutions)" "Current education expenditure, total (% of total expenditure in public institutions)" ...  
## $ X2001      : num 96.1 NA NA NA NA ...  
## $ X2002      : num 88.9 NA NA NA NA ...  
## $ X2003      : num NA NA NA NA NA ...  
## $ X2004      : num NA NA NA NA NA ...  
## $ X2005      : num 96.8 NA NA NA NA ...  
## $ X2006      : num NA NA NA NA 75.7 ...  
## $ X2007      : num 100 NA NA NA NA ...  
## $ X2008      : num 100 NA NA 88.8 NA ...  
## $ X2009      : num 92.8 NA NA 89.5 NA ...  
## $ X2010      : num NA NA 81.7 91.4 NA ...  
## $ X2011      : num 100 NA 82.6 92.2 NA ...  
## $ X2012      : num 100 NA 84.9 87 NA ...  
## $ X2013      : num 100 NA 81.1 89.4 NA ...  
## $ X2014      : num 100 NA 80.7 NA NA ...  
## $ X2015      : num 100 NA 80.4 NA NA ...  
## $ X2016      : num 100 NA NA NA NA ...  
## $ X2017      : num NA NA NA NA NA ...  
## $ X2018      : num NA NA NA NA NA ...  
## $ X2019      : num NA NA NA NA NA ...  
## $ X2020      : num NA NA NA NA NA NA NA NA NA ...
```

```
summary(Education2)
```

```

## i..Country.Code    Country.Name      Indicator.Name      X2001
## Length:266        Length:266       Length:266        Min.   : 52.77
## Class :character  Class :character  Class :character  1st Qu.: 88.82
## Mode  :character  Mode  :character  Mode  :character  Median  : 92.02
##                                         Mean   : 89.21
##                                         3rd Qu.: 94.63
##                                         Max.   :100.00
##                                         NA's   :205
## X2002              X2003            X2004            X2005
## Min.   :39.58     Min.   :65.81     Min.   :58.31     Min.   : 61.54
## 1st Qu.: 89.39    1st Qu.:90.09    1st Qu.:90.17    1st Qu.: 90.03
## Median  : 91.31   Median  :92.16   Median  :92.84   Median  : 92.89
## Mean    : 90.42   Mean    :91.27   Mean    :91.21   Mean    : 90.95
## 3rd Qu.: 94.48   3rd Qu.:94.05   3rd Qu.:95.24   3rd Qu.: 95.24
## Max.   :100.00   Max.   :99.19   Max.   :99.30   Max.   :100.00
## NA's   :189      NA's   :213     NA's   :197     NA's   :201
## X2006              X2007            X2008            X2009
## Min.   : 71.83   Min.   : 64.67   Min.   : 57.54   Min.   : 62.61
## 1st Qu.: 88.50   1st Qu.: 89.38   1st Qu.: 88.59   1st Qu.: 88.06
## Median  : 91.77   Median  : 92.93   Median  : 91.73   Median  : 91.71
## Mean    : 89.97   Mean    : 91.20   Mean    : 90.67   Mean    : 90.54
## 3rd Qu.: 93.91   3rd Qu.: 94.86   3rd Qu.: 95.00   3rd Qu.: 94.78
## Max.   :100.00   Max.   :100.00   Max.   :100.00   Max.   :100.00
## NA's   :196      NA's   :189     NA's   :179     NA's   :174
## X2010              X2011            X2012            X2013
## Min.   : 57.24   Min.   : 43.44   Min.   : 32.81   Min.   : 49.23
## 1st Qu.: 88.58   1st Qu.: 87.43   1st Qu.: 87.52   1st Qu.: 87.89
## Median  : 90.72   Median  : 91.28   Median  : 91.61   Median  : 92.01
## Mean    : 89.99   Mean    : 89.94   Mean    : 89.22   Mean    : 90.15
## 3rd Qu.: 93.50   3rd Qu.: 94.35   3rd Qu.: 94.95   3rd Qu.: 95.09
## Max.   :100.00   Max.   :100.00   Max.   :100.00   Max.   :100.00
## NA's   :154      NA's   :156     NA's   :157     NA's   :150
## X2014              X2015            X2016            X2017
## Min.   : 61.70   Min.   : 64.63   Min.   : 71.01   Min.   : 76.15
## 1st Qu.: 88.59   1st Qu.: 89.03   1st Qu.: 91.07   1st Qu.: 91.15
## Median  : 93.29   Median  : 93.11   Median  : 93.65   Median  : 93.50
## Mean    : 91.32   Mean    : 91.84   Mean    : 92.43   Mean    : 92.78
## 3rd Qu.: 95.28   3rd Qu.: 95.88   3rd Qu.: 95.89   3rd Qu.: 95.59
## Max.   :100.00   Max.   :100.00   Max.   :100.00   Max.   : 99.80
## NA's   :167      NA's   :173     NA's   :174     NA's   :180
## X2018              X2019            X2020
## Min.   : 74.66   Min.   : 71.04   Min.   : 86.56
## 1st Qu.: 89.67   1st Qu.: 85.97   1st Qu.: 91.60
## Median  : 93.36   Median  : 94.12   Median  : 96.02
## Mean    : 92.50   Mean    : 91.42   Mean    : 95.12
## 3rd Qu.: 95.69   3rd Qu.: 98.13   3rd Qu.: 98.57
## Max.   :100.00   Max.   :100.00   Max.   :100.00
## NA's   :191      NA's   :232     NA's   :253

```

```
str(Health1)
```

```
## 'data.frame': 266 obs. of 23 variables:  
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...  
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...  
## $ Indicator.Name : chr "Life expectancy at birth, total (years)" ...  
## $ X2001      : num 73.9 51.6 56.3 49.5 47.1 ...  
## $ X2002      : num 73.9 52 56.8 49.8 47.7 ...  
## $ X2003      : num 74 52.6 57.3 58.2 48.4 ...  
## $ X2004      : num 74.2 53.2 57.8 50.7 49.3 ...  
## $ X2005      : num 74.3 54 58.3 51.3 50.2 ...  
## $ X2006      : num 74.4 54.8 58.8 51.9 51.1 ...  
## $ X2007      : num 74.6 55.7 59.4 52.5 52.2 ...  
## $ X2008      : num 74.7 56.6 59.9 53 53.2 ...  
## $ X2009      : num 74.9 57.5 60.5 53.6 54.3 ...  
## $ X2010      : num 75 58.5 61 54.1 55.4 ...  
## $ X2011      : num 75.2 59.4 61.6 54.6 56.3 ...  
## $ X2012      : num 75.3 60.2 62.1 55.1 57.2 ...  
## $ X2013      : num 75.4 61 62.5 55.6 58.1 ...  
## $ X2014      : num 75.6 61.6 63 56.1 58.8 ...  
## $ X2015      : num 75.7 62.3 63.4 56.5 59.4 ...  
## $ X2016      : num 75.9 62.8 63.8 57 59.9 ...  
## $ X2017      : num 76 63.2 64.1 57.4 60.4 ...  
## $ X2018      : num 76.2 63.6 64.5 57.8 60.8 ...  
## $ X2019      : num 76.3 64 64.8 58.1 61.1 ...  
## $ X2020      : logi NA NA NA NA NA NA ...
```

```
summary(Health1)
```

```

## i..Country.Code   Country.Name      Indicator.Name      X2001
## Length:266       Length:266       Length:266       Min.   :40.37
## Class :character Class :character Class :character  1st Qu.:59.74
## Mode  :character Mode  :character Mode  :character  Median  :69.72
##                                         Mean   :66.92
##                                         3rd Qu.:74.19
##                                         Max.   :81.42
##                                         NA's   :19
## X2002          X2003          X2004          X2005
## Min.   :41.38   Min.   :42.42   Min.   :42.73   Min.   :42.52
## 1st Qu.:60.38   1st Qu.:60.75   1st Qu.:61.12   1st Qu.:61.54
## Median :70.26   Median :70.35   Median :70.53   Median :70.81
## Mean    :67.27   Mean    :67.46   Mean    :67.84   Mean    :68.15
## 3rd Qu.:74.56   3rd Qu.:74.61   3rd Qu.:74.83   3rd Qu.:75.00
## Max.   :81.56   Max.   :81.76   Max.   :82.03   Max.   :81.93
## NA's   :16     NA's   :19     NA's   :19     NA's   :18
## X2006          X2007          X2008          X2009
## Min.   :42.59   Min.   :42.85   Min.   :43.38   Min.   :44.15
## 1st Qu.:61.87   1st Qu.:62.29   1st Qu.:62.88   1st Qu.:63.61
## Median :71.07   Median :71.34   Median :71.64   Median :71.81
## Mean    :68.54   Mean    :68.92   Mean    :69.31   Mean    :69.70
## 3rd Qu.:75.16   3rd Qu.:75.25   3rd Qu.:75.31   3rd Qu.:75.68
## Max.   :82.38   Max.   :82.51   Max.   :82.68   Max.   :82.93
## NA's   :18     NA's   :17     NA's   :17     NA's   :17
## X2010          X2011          X2012          X2013
## Min.   :45.10   Min.   :46.21   Min.   :47.42   Min.   :48.66
## 1st Qu.:64.30   1st Qu.:64.87   1st Qu.:65.52   1st Qu.:66.00
## Median :72.05   Median :72.21   Median :72.41   Median :72.60
## Mean    :70.08   Mean    :70.45   Mean    :70.86   Mean    :71.13
## 3rd Qu.:75.97   3rd Qu.:76.25   3rd Qu.:76.57   3rd Qu.:76.92
## Max.   :82.98   Max.   :83.42   Max.   :85.42   Max.   :83.83
## NA's   :18     NA's   :18     NA's   :16     NA's   :18
## X2014          X2015          X2016          X2017
## Min.   :49.89   Min.   :50.88   Min.   :51.59   Min.   :52.24
## 1st Qu.:66.36   1st Qu.:66.75   1st Qu.:67.08   1st Qu.:67.27
## Median :72.85   Median :73.09   Median :73.33   Median :73.51
## Mean    :71.48   Mean    :71.72   Mean    :72.00   Mean    :72.22
## 3rd Qu.:77.07   3rd Qu.:77.24   3rd Qu.:77.47   3rd Qu.:77.56
## Max.   :83.98   Max.   :84.28   Max.   :84.23   Max.   :84.68
## NA's   :17     NA's   :17     NA's   :17     NA's   :18
## X2018          X2019          X2020
## Min.   :52.80   Min.   :53.28   Mode:logical
## 1st Qu.:67.41   1st Qu.:67.55   NA's:266
## Median :73.62   Median :73.85
## Mean    :72.42   Mean    :72.62
## 3rd Qu.:77.57   3rd Qu.:77.81
## Max.   :84.93   Max.   :85.08
## NA's   :20     NA's   :20

```

```
str(Health2)
```

```
## 'data.frame': 266 obs. of 23 variables:  
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...  
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...  
## $ Indicator.Name : chr "People using at least basic sanitation services (% of population)" "People using at least basic  
sanitation services (% of population)" "People using at least basic sanitation services (% of population)" "People using at  
least basic sanitation services (% of population)" ...  
## $ X2001      : num 98.3 23.2 21.9 22.6 29 ...  
## $ X2002      : num 98.2 23.6 23.3 23.1 30.4 ...  
## $ X2003      : num 98.1 24 24.7 23.7 31.9 ...  
## $ X2004      : num 98.1 24.4 26.1 24.3 33.3 ...  
## $ X2005      : num 98 24.8 27.5 24.9 34.7 ...  
## $ X2006      : num 97.9 25.3 28.9 25.5 36 ...  
## $ X2007      : num 97.9 25.7 30.4 26.1 37.3 ...  
## $ X2008      : num 97.8 26.2 31.9 26.8 38.5 ...  
## $ X2009      : num 97.7 26.6 33.4 27.5 39.8 ...  
## $ X2010      : num 97.7 27.1 34.9 28.2 41.1 ...  
## $ X2011      : num 97.6 27.2 36.4 28.8 42.3 ...  
## $ X2012      : num 97.5 27.7 38 29.6 43.6 ...  
## $ X2013      : num 97.5 28.2 39.5 30.3 44.9 ...  
## $ X2014      : num 97.5 28.6 41.1 31 46.1 ...  
## $ X2015      : num 97.5 29.1 42.6 31.8 47.4 ...  
## $ X2016      : num 97.5 29.6 44.2 32.5 48.6 ...  
## $ X2017      : num NA 30.1 45.8 33.3 49.9 ...  
## $ X2018      : num NA 30.4 47.4 33.9 51.1 ...  
## $ X2019      : num NA 30.7 49 34.7 51.4 ...  
## $ X2020      : num NA 30.9 50.5 35.4 51.7 ...
```

```
summary(Health2)
```

```

## i..Country.Code    Country.Name      Indicator.Name      X2001
## Length:266        Length:266       Length:266        Min.   : 3.087
## Class :character  Class :character  Class :character  1st Qu.: 37.775
## Mode  :character  Mode  :character  Mode  :character  Median  : 78.152
##                                         Mean   : 66.932
##                                         3rd Qu.: 95.692
##                                         Max.   :100.000
##                                         NA's   :12
## X2002              X2003          X2004          X2005
## Min.   : 3.418  Min.   : 3.75  Min.   : 4.072  Min.   : 4.387
## 1st Qu.: 37.601 1st Qu.: 38.24 1st Qu.: 41.291 1st Qu.: 43.379
## Median : 78.672 Median : 79.43 Median : 80.344 Median : 81.240
## Mean   : 67.509 Mean   : 68.06 Mean   : 68.609 Mean   : 69.309
## 3rd Qu.: 95.939 3rd Qu.: 96.10 3rd Qu.: 96.231 3rd Qu.: 96.260
## Max.   :100.000  Max.   :100.00  Max.   :100.000  Max.   :100.000
## NA's   : 9       NA's   : 9     NA's   : 9     NA's   : 8
## X2006              X2007          X2008          X2009
## Min.   : 4.697  Min.   : 5.004  Min.   : 5.331  Min.   : 5.653
## 1st Qu.: 44.713 1st Qu.: 45.915 1st Qu.: 46.114 1st Qu.: 48.025
## Median : 82.160 Median : 83.234 Median : 83.658 Median : 84.157
## Mean   : 69.993 Mean   : 70.778 Mean   : 71.385 Mean   : 72.086
## 3rd Qu.: 96.420 3rd Qu.: 96.676 3rd Qu.: 96.662 3rd Qu.: 96.792
## Max.   :100.000  Max.   :100.000  Max.   :100.000  Max.   :100.000
## NA's   : 7       NA's   : 5     NA's   : 5     NA's   : 4
## X2010              X2011          X2012          X2013
## Min.   : 5.97   Min.   : 6.283  Min.   : 6.593  Min.   : 6.895
## 1st Qu.: 49.69  1st Qu.: 49.970 1st Qu.: 51.012 1st Qu.: 52.490
## Median : 84.74  Median : 85.318 Median : 86.199 Median : 86.575
## Mean   : 72.68  Mean   : 73.010 Mean   : 73.595 Mean   : 74.172
## 3rd Qu.: 97.04  3rd Qu.: 97.161 3rd Qu.: 97.467 3rd Qu.: 97.572
## Max.   :100.00  Max.   :100.000  Max.   :100.000  Max.   :100.000
## NA's   : 4       NA's   : 3     NA's   : 3     NA's   : 3
## X2014              X2015          X2016          X2017
## Min.   : 7.194  Min.   : 7.488  Min.   : 7.779  Min.   : 8.067
## 1st Qu.: 54.378 1st Qu.: 56.692 1st Qu.: 58.873 1st Qu.: 60.870
## Median : 86.870 Median : 87.213 Median : 87.535 Median : 87.859
## Mean   : 74.731 Mean   : 75.284 Mean   : 75.666 Mean   : 76.085
## 3rd Qu.: 97.585 3rd Qu.: 97.633 3rd Qu.: 97.796 3rd Qu.: 98.023
## Max.   :100.000  Max.   :100.000  Max.   :100.000  Max.   :100.000
## NA's   : 3       NA's   : 3     NA's   : 5     NA's   :11
## X2018              X2019          X2020
## Min.   : 8.351  Min.   : 8.632  Min.   : 8.91
## 1st Qu.: 54.904 1st Qu.: 55.382 1st Qu.: 56.22
## Median : 88.309 Median : 89.140 Median : 89.80
## Mean   : 76.105 Mean   : 76.287 Mean   : 76.67
## 3rd Qu.: 98.125 3rd Qu.: 98.426 3rd Qu.: 98.73
## Max.   :100.000  Max.   :100.000  Max.   :100.00
## NA's   :21      NA's   :26     NA's   :30

```

```
str(Health3)
```

```
## 'data.frame': 266 obs. of 23 variables:  
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...  
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...  
## $ Indicator.Name : chr "Physicians (per 1,000 people)" "Physicians (per 1,000 people)" "Physicians (per 1,000 people)"  
"Physicians (per 1,000 people)" ...  
## $ X2001      : num NA NA 0.19 NA NA ...  
## $ X2002      : num NA NA NA NA NA ...  
## $ X2003      : num NA NA NA NA NA ...  
## $ X2004      : num NA NA NA NA 0.0621 ...  
## $ X2005      : num NA NA NA NA NA ...  
## $ X2006      : num NA NA 0.16 NA NA ...  
## $ X2007      : num NA NA 0.174 NA NA ...  
## $ X2008      : num NA NA 0.174 NA NA ...  
## $ X2009      : num NA NA 0.213 NA 0.131 ...  
## $ X2010      : num NA 0.169 0.236 0.218 NA ...  
## $ X2011      : num NA NA 0.252 NA NA ...  
## $ X2012      : num NA NA 0.241 NA NA ...  
## $ X2013      : num NA NA 0.285 NA NA ...  
## $ X2014      : num NA NA 0.298 NA NA ...  
## $ X2015      : num NA NA 0.285 NA NA ...  
## $ X2016      : num NA NA 0.278 NA NA ...  
## $ X2017      : num NA 0.191 NA 0.237 0.215 ...  
## $ X2018      : num NA NA NA NA NA ...  
## $ X2019      : num NA NA NA NA NA ...  
## $ X2020      : logi NA NA NA NA NA NA ...
```

```
summary(Health3)
```

```

## i..Country.Code   Country.Name      Indicator.Name      X2001
## Length:266       Length:266       Length:266       Min.   :0.028
## Class :character Class :character Class :character  1st Qu.:1.072
## Mode  :character Mode  :character Mode  :character  Median  :2.174
##                                         Mean   :2.217
##                                         3rd Qu.:3.069
##                                         Max.   :7.310
##                                         NA's   :168
## X2002          X2003          X2004          X2005
## Min.   :0.019   Min.   :0.011   Min.   :0.0216  Min.   :0.024
## 1st Qu.:1.113  1st Qu.:1.010  1st Qu.:0.1974  1st Qu.:0.637
## Median :2.234  Median :2.267  Median :1.3050  Median :1.952
## Mean   :2.345  Mean   :2.285  Mean   :1.6806  Mean   :2.129
## 3rd Qu.:3.213  3rd Qu.:3.205  3rd Qu.:2.7194  3rd Qu.:3.186
## Max.   :7.341  Max.   :7.435  Max.   :7.3718  Max.   :7.403
## NA's   :173    NA's   :174    NA's   :128     NA's   :163
## X2006          X2007          X2008          X2009
## Min.   :0.026   Min.   :0.0224  Min.   :0.0141  Min.   :0.0188
## 1st Qu.:1.050  1st Qu.:0.6240  1st Qu.:0.3744  1st Qu.:0.3723
## Median :2.236  Median :1.8642  Median :1.7258  Median :1.5991
## Mean   :2.294  Mean   :2.1265  Mean   :1.9229  Mean   :1.9127
## 3rd Qu.:3.329  3rd Qu.:3.1319 3rd Qu.:3.0941  3rd Qu.:3.0514
## Max.   :7.397  Max.   :7.5503  Max.   :7.5612  Max.   :7.5796
## NA's   :168    NA's   :156    NA's   :132     NA's   :134
## X2010          X2011          X2012          X2013
## Min.   :0.0212  Min.   :0.0129  Min.   :0.0315  Min.   :0.0126
## 1st Qu.:0.5224 1st Qu.:0.7376 1st Qu.:0.7369 1st Qu.:0.6247
## Median :1.5214  Median :2.2484  Median :2.2681  Median :2.4044
## Mean   :1.9090  Mean   :2.3094  Mean   :2.3043  Mean   :2.3944
## 3rd Qu.:2.8665 3rd Qu.:3.2999 3rd Qu.:3.4792 3rd Qu.:3.5331
## Max.   :7.6320  Max.   :7.7692  Max.   :7.7028  Max.   :7.8089
## NA's   :93     NA's   :153    NA's   :152     NA's   :155
## X2014          X2015          X2016          X2017
## Min.   :0.0230  Min.   :0.0376  Min.   :0.0313  Min.   :0.0434
## 1st Qu.:0.8946 1st Qu.:0.7571 1st Qu.:0.5478 1st Qu.:0.7406
## Median :2.2247  Median :2.2494  Median :2.0368  Median :1.6820
## Mean   :2.4439  Mean   :2.3291  Mean   :2.3030  Mean   :2.1583
## 3rd Qu.:3.4314 3rd Qu.:3.4662 3rd Qu.:3.5800 3rd Qu.:3.3371
## Max.   :7.8097  Max.   :7.7690  Max.   :7.9541  Max.   :8.2950
## NA's   :153    NA's   :159    NA's   :163     NA's   :111
## X2018          X2019          X2020
## Min.   :0.0358  Min.   :0.0542  Mode:logical
## 1st Qu.:0.7024 1st Qu.:0.1623  NA's:266
## Median :2.1311  Median :0.9281
## Mean   :2.4462  Mean   :2.0214
## 3rd Qu.:3.8460 3rd Qu.:3.3520
## Max.   :8.4199  Max.   :8.0130
## NA's   :170    NA's   :225

```

```
str(Financial_Sector1)
```

```
## 'data.frame': 266 obs. of 24 variables:  
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...  
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...  
## $ Indicator.Name : chr "Bank capital to assets ratio (%)" ...  
## $ Indicator.Code : chr "FB.BNK.CAPA.ZS" "FB.BNK.CAPA.ZS" "FB.BNK.CAPA.ZS" "FB.BNK.CAPA.ZS" ...  
## $ X2001 : num NA NA NA NA NA NA NA NA NA ...  
## $ X2002 : num NA NA NA NA NA NA NA NA NA ...  
## $ X2003 : num NA NA NA NA NA NA NA NA NA ...  
## $ X2004 : num NA NA NA NA NA NA NA NA NA ...  
## $ X2005 : num NA NA NA NA NA ...  
## $ X2006 : num NA NA NA NA NA ...  
## $ X2007 : num NA NA NA NA NA ...  
## $ X2008 : num NA NA NA NA NA ...  
## $ X2009 : num NA NA NA NA NA ...  
## $ X2010 : num NA NA NA NA 8.28 ...  
## $ X2011 : num NA NA 8.25 NA 8.53 ...  
## $ X2012 : num NA NA 7.63 NA 8.68 ...  
## $ X2013 : num NA NA 11.64 NA 9.33 ...  
## $ X2014 : num NA NA 11.87 NA 7.96 ...  
## $ X2015 : num NA NA 9.23 NA 8.42 ...  
## $ X2016 : num NA NA 11.4 NA 10.2 ...  
## $ X2017 : num NA NA 11.7 NA 11.6 ...  
## $ X2018 : num NA NA 11.1 NA 13.3 ...  
## $ X2019 : num NA NA NA NA NA ...  
## $ X2020 : num NA NA NA NA NA ...
```

```
summary(Financial_Sector1)
```

```

## i..Country.Code    Country.Name      Indicator.Name    Indicator.Code
## Length:266        Length:266       Length:266       Length:266
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##
##
##          X2001        X2002        X2003        X2004
##  Min.   : 6.889   Min.   : 5.158   Min.   : 5.346   Min.   : 5.619
##  1st Qu.: 7.467   1st Qu.: 6.950   1st Qu.: 7.225   1st Qu.: 6.971
##  Median :11.094   Median :10.281   Median :10.561   Median :10.651
##  Mean   :14.946   Mean   :12.952   Mean   :12.400   Mean   :11.482
##  3rd Qu.:18.573   3rd Qu.:16.523   3rd Qu.:14.997   3rd Qu.:14.119
##  Max.   :30.708   Max.   :28.278   Max.   :26.450   Max.   :21.923
##  NA's   :262      NA's   :259     NA's   :259     NA's   :259
##          X2005        X2006        X2007        X2008
##  Min.   : 0.000   Min.   : 0.000   Min.   : 0.000   Min.   : 0.000
##  1st Qu.: 6.012   1st Qu.: 6.402   1st Qu.: 6.380   1st Qu.: 6.143
##  Median : 9.099   Median : 9.374   Median : 9.289   Median : 8.780
##  Mean   : 9.198   Mean   : 9.267   Mean   : 9.387   Mean   : 9.169
##  3rd Qu.:11.956   3rd Qu.:11.786   3rd Qu.:11.785   3rd Qu.:11.585
##  Max.   :21.546   Max.   :22.925   Max.   :22.477   Max.   :24.422
##  NA's   :234      NA's   :224     NA's   :220     NA's   :192
##          X2009        X2010        X2011        X2012
##  Min.   : 0.000   Min.   : 1.490   Min.   : 4.000   Min.   : 3.965
##  1st Qu.: 6.523   1st Qu.: 7.326   1st Qu.: 7.268   1st Qu.: 7.538
##  Median : 9.268   Median : 9.505   Median : 9.623   Median : 9.936
##  Mean   : 9.371   Mean   :10.032   Mean   :10.035   Mean   :10.296
##  3rd Qu.:11.473   3rd Qu.:12.147   3rd Qu.:12.194   3rd Qu.:12.481
##  Max.   :21.956   Max.   :22.500   Max.   :22.330   Max.   :22.936
##  NA's   :180      NA's   :156     NA's   :152     NA's   :148
##          X2013        X2014        X2015        X2016
##  Min.   : 3.685   Min.   : 3.645   Min.   : 3.530   Min.   : 3.393
##  1st Qu.: 7.792   1st Qu.: 7.663   1st Qu.: 7.506   1st Qu.: 7.471
##  Median : 9.725   Median : 9.963   Median : 9.852   Median :10.233
##  Mean   :10.391   Mean   :10.424   Mean   :10.327   Mean   :10.445
##  3rd Qu.:12.442   3rd Qu.:12.634   3rd Qu.:12.844   3rd Qu.:12.716
##  Max.   :23.685   Max.   :24.849   Max.   :24.119   Max.   :23.712
##  NA's   :144      NA's   :142     NA's   :134     NA's   :133
##          X2017        X2018        X2019        X2020
##  Min.   : 4.806   Min.   : 4.472   Min.   : 3.555   Min.   : 4.028
##  1st Qu.: 7.845   1st Qu.: 8.073   1st Qu.: 7.929   1st Qu.: 7.894
##  Median :10.350   Median :10.688   Median :10.611   Median :10.043
##  Mean   :10.695   Mean   :10.772   Mean   :10.845   Mean   :10.152
##  3rd Qu.:12.657   3rd Qu.:12.718   3rd Qu.:12.831   3rd Qu.:11.875
##  Max.   :24.146   Max.   :23.857   Max.   :25.071   Max.   :22.211
##  NA's   :130      NA's   :131     NA's   :137     NA's   :164

```

```
str(Financial_Sector2)
```

```
## 'data.frame': 266 obs. of 24 variables:  
## $ i..Country.Code: chr "ABW" "AFE" "AFG" "AFW" ...  
## $ Country.Name : chr "Aruba" "Africa Eastern and Southern" "Afghanistan" "Africa Western and Central" ...  
## $ Indicator.Name : chr "Inflation, consumer prices (annual %)" ...  
## $ Indicator.Code : chr "FP.CPI.TOTL.ZG" "FP.CPI.TOTL.ZG" "FP.CPI.TOTL.ZG" "FP.CPI.TOTL.ZG" ...  
## $ X2001 : num 2.88 5.84 NA 4.36 152.56 ...  
## $ X2002 : num 3.32 8.76 NA 3.19 108.9 ...  
## $ X2003 : num 3.66 7.45 NA 1.76 98.22 ...  
## $ X2004 : num 2.529 5.023 NA 0.694 43.542 ...  
## $ X2005 : num 3.4 8.56 12.69 5.63 22.95 ...  
## $ X2006 : num 3.61 8.9 6.78 4.42 13.31 ...  
## $ X2007 : num 5.39 8.45 8.68 3.61 12.25 ...  
## $ X2008 : num 8.96 12.57 26.42 8.45 12.48 ...  
## $ X2009 : num -2.14 8.95 -6.81 3.28 13.73 ...  
## $ X2010 : num 2.08 5.54 2.18 1.78 14.47 ...  
## $ X2011 : num 4.32 8.97 11.8 4.02 13.48 ...  
## $ X2012 : num 0.627 9.159 6.441 4.578 10.278 ...  
## $ X2013 : num -2.37 5.75 7.39 2.44 8.78 ...  
## $ X2014 : num 0.421 5.37 4.674 1.758 7.28 ...  
## $ X2015 : num 0.475 5.25 -0.662 2.13 9.15 ...  
## $ X2016 : num -0.931 6.595 4.384 1.495 30.695 ...  
## $ X2017 : num -1.03 6.4 4.98 1.76 29.84 ...  
## $ X2018 : num 3.626 4.721 0.626 1.784 19.629 ...  
## $ X2019 : num 4.26 3.92 2.3 1.76 17.08 ...  
## $ X2020 : num NA 4.98 NA 2.43 NA ...
```

```
summary(Financial_Sector2)
```

```

## i..Country.Code    Country.Name      Indicator.Name    Indicator.Code
## Length:266        Length:266       Length:266       Length:266
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##
##
##          X2001           X2002           X2003           X2004
##  Min.   :-9.616   Min.   :-9.798   Min.   :-3.583   Min.   :-18.109
##  1st Qu.: 2.438   1st Qu.: 1.903   1st Qu.: 1.766   1st Qu.: 2.142
##  Median : 4.066   Median : 3.066   Median : 3.300   Median : 3.721
##  Mean   : 8.533   Mean   : 5.641   Mean   : 5.584   Mean   : 4.866
##  3rd Qu.: 6.010   3rd Qu.: 5.699   3rd Qu.: 6.007   3rd Qu.: 6.147
##  Max.   :359.937  Max.   :108.897  Max.   :98.224   Max.   :51.461
##  NA's   :51       NA's   :49       NA's   :46       NA's   :45
##
##          X2005           X2006           X2007           X2008
##  Min.   :-1.385  Min.   :-1.409  Min.   :-10.067  Min.   :-0.4179
##  1st Qu.: 2.542  1st Qu.: 2.666  1st Qu.: 2.787  1st Qu.: 5.7054
##  Median : 4.252  Median : 4.430  Median : 4.966  Median : 9.3235
##  Mean   : 5.770  Mean   : 5.666  Mean   : 5.660  Mean   :10.1774
##  3rd Qu.: 7.331  3rd Qu.: 6.959  3rd Qu.: 7.666  3rd Qu.:12.0485
##  Max.   :36.959  Max.   :53.231  Max.   :35.025  Max.   :44.3913
##  NA's   :42       NA's   :39       NA's   :37       NA's   :36
##
##          X2009           X2010           X2011           X2012
##  Min.   :-6.811  Min.   :-3.900  Min.   :-0.400  Min.   :-3.046
##  1st Qu.: 1.190  1st Qu.: 1.807  1st Qu.: 3.348  1st Qu.: 2.577
##  Median : 3.131  Median : 3.523  Median : 4.980  Median : 3.852
##  Mean   : 4.057  Mean   : 4.191  Mean   : 6.317  Mean   : 5.499
##  3rd Qu.: 5.460  3rd Qu.: 5.695  3rd Qu.: 7.322  3rd Qu.: 6.315
##  Max.   :31.754  Max.   :28.187  Max.   :53.229  Max.   :59.220
##  NA's   :33       NA's   :31       NA's   :28       NA's   :29
##
##          X2013           X2014           X2015           X2016
##  Min.   :-4.295  Min.   :-7.2245  Min.   :-3.7492  Min.   :-3.0930
##  1st Qu.: 1.462  1st Qu.: 0.8838  1st Qu.: 0.3052  1st Qu.: 0.3888
##  Median : 2.785  Median : 2.5598  Median : 1.5285  Median : 1.6521
##  Mean   : 4.042  Mean   : 3.5705  Mean   : 3.5559  Mean   : 5.8881
##  3rd Qu.: 5.316  3rd Qu.: 4.6255  3rd Qu.: 4.0312  3rd Qu.: 4.1714
##  Max.   :40.639  Max.   :62.1686  Max.   :121.7381  Max.   :379.9996
##  NA's   :31       NA's   :33       NA's   :34       NA's   :34
##
##          X2017           X2018           X2019           X2020
##  Min.   :-1.537  Min.   :-2.815  Min.   :-3.233  Min.   :-2.5952
##  1st Qu.: 1.429  1st Qu.: 1.628  1st Qu.: 1.108  1st Qu.: 0.6385
##  Median : 2.380  Median : 2.517  Median : 2.289  Median : 2.3037
##  Mean   : 4.591  Mean   : 3.970  Mean   : 3.506  Mean   : 4.1524
##  3rd Qu.: 4.436  3rd Qu.: 3.945  3rd Qu.: 3.211  3rd Qu.: 3.5424
##  Max.   :187.852  Max.   :83.502  Max.   :87.241  Max.   :150.3227
##  NA's   :39       NA's   :44       NA's   :50       NA's   :77

```



```
##   i..Country.Code Country.Name
## 36          CAN      Canada
##                                Indicator.Name    X2001    X2002
## 36 Literacy rate, adult total (% of people ages 15 and above) 77.62678 76.10504
##          X2003    X2004    X2005    X2006    X2007    X2008    X2009    X2010
## 36 73.26608 77.24002 75.61378 76.24419 77.61028 79.47413 81.1226 81.28109
##          X2011    X2012    X2013    X2014    X2015    X2016    X2017    X2018
## 36 84.02133 80.60362 81.94207 83.04999 83.20229 84.93415 82.1207 82.64855
##          X2019
## 36 85.16369
```

```

#Canada
x_Canada_Education1 <- c(2001:2019)
y_Canada_Education1 <- c(Education1[36, 4], Education1[36, 5], Education1[36, 6], Education1[36, 7],
                           Education1[36, 8], Education1[36, 9], Education1[36, 10], Education1[36, 11],
                           Education1[36, 12], Education1[36, 13], Education1[36, 14], Education1[36, 15],
                           Education1[36, 16], Education1[36, 17], Education1[36, 18], Education1[36, 19],
                           Education1[36, 20], Education1[36, 21], Education1[36, 22])

data <- data.frame(x_Canada_Education1, y_Canada_Education1)

x_Canada_Education2 <- c(2001:2019)
y_Canada_Education2 <- c(Education2[36, 4], Education2[36, 5], Education2[36, 6], Education2[36, 7],
                           Education2[36, 8], Education2[36, 9], Education2[36, 10], Education2[36, 11],
                           Education2[36, 12], Education2[36, 13], Education2[36, 14], Education2[36, 15],
                           Education2[36, 16], Education2[36, 17], Education2[36, 18], Education2[36, 19],
                           Education2[36, 20], Education2[36, 21], Education2[36, 22])

data <- data.frame(x_Canada_Education2, y_Canada_Education2)

x_Canada_Health1 <- c(2001:2019)
y_Canada_Health1 <- c(Health1[36, 4], Health1[36, 5], Health1[36, 6], Health1[36, 7],
                      Health1[36, 8], Health1[36, 9], Health1[36, 10], Health1[36, 11],
                      Health1[36, 12], Health1[36, 13], Health1[36, 14], Health1[36, 15],
                      Health1[36, 16], Health1[36, 17], Health1[36, 18], Health1[36, 19],
                      Health1[36, 20], Health1[36, 21], Health1[36, 22])

data <- data.frame(x_Canada_Health1,y_Canada_Health1)

x_Canada_Health2 <- c(2001:2019)
y_Canada_Health2 <- c(Health2[36, 4], Health2[36, 5], Health2[36, 6], Health2[36, 7],
                      Health2[36, 8], Health2[36, 9], Health2[36, 10], Health2[36, 11],
                      Health2[36, 12], Health2[36, 13], Health2[36, 14], Health2[36, 15],
                      Health2[36, 16], Health2[36, 17], Health2[36, 18], Health2[36, 19],
                      Health2[36, 20], Health2[36, 21], Health2[36, 22])

data <- data.frame(x_Canada_Health2,y_Canada_Health2)

x_Canada_Health3 <- c(2001:2019)
y_Canada_Health3 <- c(Health3[36, 4], Health3[36, 5], Health3[36, 6], Health3[36, 7],
                      Health3[36, 8], Health3[36, 9], Health3[36, 10], Health3[36, 11],
                      Health3[36, 12], Health3[36, 13], Health3[36, 14], Health3[36, 15],
                      Health3[36, 16], Health3[36, 17], Health3[36, 18], Health3[36, 19],
                      Health3[36, 20], Health3[36, 21], Health3[36, 22])

data <- data.frame(x_Canada_Health3,y_Canada_Health3)

x_Canada_Financial_Sector1 <- c(2001:2019)
y_Canada_Financial_Sector1 <- c(Financial_Sector1[36, 4], Financial_Sector1[36, 5], Financial_Sector1[36, 6], Financial_Sector1[36, 7],
                                    Financial_Sector1[36, 8], Financial_Sector1[36, 9], Financial_Sector1[36, 10], Financial_Sector1[36, 11],
                                    Financial_Sector1[36, 12], Financial_Sector1[36, 13], Financial_Sector1[36, 14], Financial_Sector1[36, 15],
                                    Financial_Sector1[36, 16], Financial_Sector1[36, 17], Financial_Sector1[36, 18], Financial_Sector1[36, 19])

```

```

ector1[36, 19],
                           Financial_Sector1[36, 20], Financial_Sector1[36, 21], Financial_Sector1[36, 22])

data <- data.frame(x_Canada_Financial_Sector1,y_Canada_Financial_Sector1)

x_Canada_Financial_Sector2 <- c(2001:2019)
y_Canada_Financial_Sector2 <- c(Financial_Sector2[36, 4], Financial_Sector2[36, 5], Financial_Sector2[36, 6], Financial_Sector2[36, 7],
                                  Financial_Sector2[36, 8], Financial_Sector2[36, 9], Financial_Sector2[36, 10], Financial_Sector2[36, 11],
                                  Financial_Sector2[36, 12], Financial_Sector2[36, 13], Financial_Sector2[36, 14], Financial_Sector2[36, 15],
                                  Financial_Sector2[36, 16], Financial_Sector2[36, 17], Financial_Sector2[36, 18], Financial_Sector2[36, 19],
                                  Financial_Sector2[36, 20], Financial_Sector2[36, 21], Financial_Sector2[36, 22])

data <- data.frame(x_Canada_Financial_Sector2,y_Canada_Financial_Sector2)

#Bhutan

x_Bhutan_Education1 <- c(2001:2019)
y_Bhutan_Education1 <- c(Education1[33, 4], Education1[33, 5], Education1[33, 6], Education1[33, 7],
                          Education1[33, 8], Education1[33, 9], Education1[33, 10], Education1[33, 11],
                          Education1[33, 12], Education1[33, 13], Education1[33, 14], Education1[33, 15],
                          Education1[33, 16], Education1[33, 17], Education1[33, 18], Education1[33, 19],
                          Education1[33, 20], Education1[33, 21], Education1[33, 22])

data2 <- data.frame(x_Bhutan_Education1,y_Bhutan_Education1)

x_Bhutan_Education2 <- c(2001:2019)
y_Bhutan_Education2 <- c(Education2[33, 4], Education2[33, 5], Education2[33, 6], Education2[33, 7],
                          Education2[33, 8], Education2[33, 9], Education2[33, 10], Education2[33, 11],
                          Education2[33, 12], Education2[33, 13], Education2[33, 14], Education2[33, 15],
                          Education2[33, 16], Education2[33, 17], Education2[33, 18], Education2[33, 19],
                          Education2[33, 20], Education2[33, 21], Education2[33, 22])

data2 <- data.frame(x_Bhutan_Education2,y_Bhutan_Education2)

x_Bhutan_Health1 <- c(2001:2019)
y_Bhutan_Health1 <- c(Health1[33, 4], Health1[33, 5], Health1[33, 6], Health1[33, 7],
                      Health1[33, 8], Health1[33, 9], Health1[33, 10], Health1[33, 11],
                      Health1[33, 12], Health1[33, 13], Health1[33, 14], Health1[33, 15],
                      Health1[33, 16], Health1[33, 17], Health1[33, 18], Health1[33, 19],
                      Health1[33, 20], Health1[33, 21], Health1[33, 22])

data <- data.frame(x_Bhutan_Health1,y_Bhutan_Health1)

x_Bhutan_Health2 <- c(2001:2019)
y_Bhutan_Health2 <- c(Health2[33, 4], Health2[33, 5], Health2[33, 6], Health2[33, 7],
                      Health2[33, 8], Health2[33, 9], Health2[33, 10], Health2[33, 11],
                      Health2[33, 12], Health2[33, 13], Health2[33, 14], Health2[33, 15],
                      Health2[33, 16], Health2[33, 17], Health2[33, 18], Health2[33, 19],
                      Health2[33, 20], Health2[33, 21], Health2[33, 22])

data <- data.frame(x_Bhutan_Health2,y_Bhutan_Health2)

```

```

x_Bhutan_Health3 <- c(2001:2019)
y_Bhutan_Health3 <- c(Health3[33, 4], Health3[33, 5], Health3[33, 6], Health3[33, 7],
                      Health3[33, 8], Health3[33, 9], Health3[33, 10], Health3[33, 11],
                      Health3[33, 12], Health3[33, 13], Health3[33, 14], Health3[33, 15],
                      Health3[33, 16], Health3[33, 17], Health3[33, 18], Health3[33, 19],
                      Health3[33, 20], Health3[33, 21], Health3[33, 22])

data <- data.frame(x_Bhutan_Health3,y_Bhutan_Health3)

x_Bhutan_Financial_Sector1 <- c(2001:2019)
y_Bhutan_Financial_Sector1 <- c(Financial_Sector1[33, 4], Financial_Sector1[33, 5], Financial_Sector1[33, 6], Financial_Sector1[33, 7],
                                    Financial_Sector1[33, 8], Financial_Sector1[33, 9], Financial_Sector1[33, 10], Financial_Sector1[33, 11],
                                    Financial_Sector1[33, 12], Financial_Sector1[33, 13], Financial_Sector1[33, 14], Financial_Sector1[33, 15],
                                    Financial_Sector1[33, 16], Financial_Sector1[33, 17], Financial_Sector1[33, 18], Financial_Sector1[33, 19],
                                    Financial_Sector1[33, 20], Financial_Sector1[33, 21], Financial_Sector1[33, 22])

data <- data.frame(x_Bhutan_Financial_Sector1,y_Bhutan_Financial_Sector1)

x_Bhutan_Financial_Sector2 <- c(2001:2019)
y_Bhutan_Financial_Sector2 <- c(Financial_Sector2[33, 4], Financial_Sector2[33, 5], Financial_Sector2[33, 6], Financial_Sector2[33, 7],
                                    Financial_Sector2[33, 8], Financial_Sector2[33, 9], Financial_Sector2[33, 10], Financial_Sector2[33, 11],
                                    Financial_Sector2[33, 12], Financial_Sector2[33, 13], Financial_Sector2[33, 14], Financial_Sector2[33, 15],
                                    Financial_Sector2[33, 16], Financial_Sector2[33, 17], Financial_Sector2[33, 18], Financial_Sector2[33, 19],
                                    Financial_Sector2[33, 20], Financial_Sector2[33, 21], Financial_Sector2[33, 22])

data <- data.frame(x_Bhutan_Financial_Sector2,y_Bhutan_Financial_Sector2)

#China
x_China_Education1 <- c(2001:2019)
y_China_Education1 <- c(Education1[41, 4], Education1[41, 5], Education1[41, 6], Education1[41, 7],
                        Education1[41, 8], Education1[41, 9], Education1[41, 10], Education1[41, 11],
                        Education1[41, 12], Education1[41, 13], Education1[41, 14], Education1[41, 15],
                        Education1[41, 16], Education1[41, 17], Education1[41, 18], Education1[41, 19],
                        Education1[41, 20], Education1[41, 21], Education1[41, 22])

data3 <- data.frame(x_China_Education1,y_China_Education1)

x_China_Education2 <- c(2001:2019)
y_China_Education2 <- c(Education2[41, 4], Education2[41, 5], Education2[41, 6], Education2[41, 7],
                        Education2[41, 8], Education2[41, 9], Education2[41, 10], Education2[41, 11],
                        Education2[41, 12], Education2[41, 13], Education2[41, 14], Education2[41, 15],
                        Education2[41, 16], Education2[41, 17], Education2[41, 18], Education2[41, 19],
                        Education2[41, 20], Education2[41, 21], Education2[41, 22])

data3 <- data.frame(x_China_Education2,y_China_Education2)

```

```

x_China_Health1 <- c(2001:2019)
y_China_Health1 <- c(Health1[41, 4], Health1[41, 5], Health1[41, 6], Health1[41, 7],
                     Health1[41, 8], Health1[41, 9], Health1[41, 10], Health1[41, 11],
                     Health1[41, 12], Health1[41, 13], Health1[41, 14], Health1[41, 15],
                     Health1[41, 16], Health1[41, 17], Health1[41, 18], Health1[41, 19],
                     Health1[41, 20], Health1[41, 21], Health1[41, 22])

data <- data.frame(x_China_Health1,y_China_Health1)

x_China_Health2 <- c(2001:2019)
y_China_Health2 <- c(Health2[41, 4], Health2[41, 5], Health2[41, 6], Health2[41, 7],
                     Health2[41, 8], Health2[41, 9], Health2[41, 10], Health2[41, 11],
                     Health2[41, 12], Health2[41, 13], Health2[41, 14], Health2[41, 15],
                     Health2[41, 16], Health2[41, 17], Health2[41, 18], Health2[41, 19],
                     Health2[41, 20], Health2[41, 21], Health2[41, 22])

data <- data.frame(x_China_Health2,y_China_Health2)

x_China_Health3 <- c(2001:2019)
y_China_Health3 <- c(Health3[41, 4], Health3[41, 5], Health3[41, 6], Health3[41, 7],
                     Health3[41, 8], Health3[41, 9], Health3[41, 10], Health3[41, 11],
                     Health3[41, 12], Health3[41, 13], Health3[41, 14], Health3[41, 15],
                     Health3[41, 16], Health3[41, 17], Health3[41, 18], Health3[41, 19],
                     Health3[41, 20], Health3[41, 21], Health3[41, 22])

data <- data.frame(x_China_Health3,y_China_Health3)

x_China_Financial_Sector1 <- c(2001:2019)
y_China_Financial_Sector1 <- c(Financial_Sector1[41, 4], Financial_Sector1[41, 5], Financial_Sector1[41, 6], Financial_Sector1[41, 7],
                                 Financial_Sector1[41, 8], Financial_Sector1[41, 9], Financial_Sector1[41, 10], Financial_Sector1[41, 11],
                                 Financial_Sector1[41, 12], Financial_Sector1[41, 13], Financial_Sector1[41, 14], Financial_Sector1[41, 15],
                                 Financial_Sector1[41, 16], Financial_Sector1[41, 17], Financial_Sector1[41, 18], Financial_Sector1[41, 19],
                                 Financial_Sector1[41, 20], Financial_Sector1[41, 21], Financial_Sector1[41, 22])

data <- data.frame(x_China_Financial_Sector1,y_China_Financial_Sector1)

x_China_Financial_Sector2 <- c(2001:2019)
y_China_Financial_Sector2 <- c(Financial_Sector2[41, 4], Financial_Sector2[41, 5], Financial_Sector2[41, 6], Financial_Sector2[41, 7],
                                 Financial_Sector2[41, 8], Financial_Sector2[41, 9], Financial_Sector2[41, 10], Financial_Sector2[41, 11],
                                 Financial_Sector2[41, 12], Financial_Sector2[41, 13], Financial_Sector2[41, 14], Financial_Sector2[41, 15],
                                 Financial_Sector2[41, 16], Financial_Sector2[41, 17], Financial_Sector2[41, 18], Financial_Sector2[41, 19],
                                 Financial_Sector2[41, 20], Financial_Sector2[41, 21], Financial_Sector2[41, 22])

data <- data.frame(x_China_Financial_Sector2,y_China_Financial_Sector2)

# Economic Growth Dataset
eco_growth <- read.csv('E:/Ryerson University/Data Analytics and Big Data Certificate Course/Data Analytics Project/WB/Fina

```

```
1/Economy and Growth/Economy & Growth - Use Case.csv' )  
eco_growth$Country.Name
```

```
## [1] "Aruba"
## [2] "Africa Eastern and Southern"
## [3] "Afghanistan"
## [4] "Africa Western and Central"
## [5] "Angola"
## [6] "Albania"
## [7] "Andorra"
## [8] "Arab World"
## [9] "United Arab Emirates"
## [10] "Argentina"
## [11] "Armenia"
## [12] "American Samoa"
## [13] "Antigua and Barbuda"
## [14] "Australia"
## [15] "Austria"
## [16] "Azerbaijan"
## [17] "Burundi"
## [18] "Belgium"
## [19] "Benin"
## [20] "Burkina Faso"
## [21] "Bangladesh"
## [22] "Bulgaria"
## [23] "Bahrain"
## [24] "Bahamas, The"
## [25] "Bosnia and Herzegovina"
## [26] "Belarus"
## [27] "Belize"
## [28] "Bermuda"
## [29] "Bolivia"
## [30] "Brazil"
## [31] "Barbados"
## [32] "Brunei Darussalam"
## [33] "Bhutan"
## [34] "Botswana"
## [35] "Central African Republic"
## [36] "Canada"
## [37] "Central Europe and the Baltics"
## [38] "Switzerland"
## [39] "Channel Islands"
## [40] "Chile"
## [41] "China"
## [42] "Cote d'Ivoire"
## [43] "Cameroon"
## [44] "Congo, Dem. Rep."
## [45] "Congo, Rep."
## [46] "Colombia"
## [47] "Comoros"
## [48] "Cabo Verde"
## [49] "Costa Rica"
## [50] "Caribbean small states"
## [51] "Cuba"
## [52] "Curacao"
## [53] "Cayman Islands"
## [54] "Cyprus"
```

```
## [55] "Czech Republic"
## [56] "Germany"
## [57] "Djibouti"
## [58] "Dominica"
## [59] "Denmark"
## [60] "Dominican Republic"
## [61] "Algeria"
## [62] "East Asia & Pacific (excluding high income)"
## [63] "Early-demographic dividend"
## [64] "East Asia & Pacific"
## [65] "Europe & Central Asia (excluding high income)"
## [66] "Europe & Central Asia"
## [67] "Ecuador"
## [68] "Egypt, Arab Rep."
## [69] "Euro area"
## [70] "Eritrea"
## [71] "Spain"
## [72] "Estonia"
## [73] "Ethiopia"
## [74] "European Union"
## [75] "Fragile and conflict affected situations"
## [76] "Finland"
## [77] "Fiji"
## [78] "France"
## [79] "Faroe Islands"
## [80] "Micronesia, Fed. Sts."
## [81] "Gabon"
## [82] "United Kingdom"
## [83] "Georgia"
## [84] "Ghana"
## [85] "Gibraltar"
## [86] "Guinea"
## [87] "Gambia, The"
## [88] "Guinea-Bissau"
## [89] "Equatorial Guinea"
## [90] "Greece"
## [91] "Grenada"
## [92] "Greenland"
## [93] "Guatemala"
## [94] "Guam"
## [95] "Guyana"
## [96] "High income"
## [97] "Hong Kong SAR, China"
## [98] "Honduras"
## [99] "Heavily indebted poor countries (HIPC)"
## [100] "Croatia"
## [101] "Haiti"
## [102] "Hungary"
## [103] "IBRD only"
## [104] "IDA & IBRD total"
## [105] "IDA total"
## [106] "IDA blend"
## [107] "Indonesia"
## [108] "IDA only"
## [109] "Isle of Man"
```

```
## [110] "India"
## [111] "Not classified"
## [112] "Ireland"
## [113] "Iran, Islamic Rep."
## [114] "Iraq"
## [115] "Iceland"
## [116] "Israel"
## [117] "Italy"
## [118] "Jamaica"
## [119] "Jordan"
## [120] "Japan"
## [121] "Kazakhstan"
## [122] "Kenya"
## [123] "Kyrgyz Republic"
## [124] "Cambodia"
## [125] "Kiribati"
## [126] "St. Kitts and Nevis"
## [127] "Korea, Rep."
## [128] "Kuwait"
## [129] "Latin America & Caribbean (excluding high income)"
## [130] "Lao PDR"
## [131] "Lebanon"
## [132] "Liberia"
## [133] "Libya"
## [134] "St. Lucia"
## [135] "Latin America & Caribbean"
## [136] "Least developed countries: UN classification"
## [137] "Low income"
## [138] "Liechtenstein"
## [139] "Sri Lanka"
## [140] "Lower middle income"
## [141] "Low & middle income"
## [142] "Lesotho"
## [143] "Late-demographic dividend"
## [144] "Lithuania"
## [145] "Luxembourg"
## [146] "Latvia"
## [147] "Macao SAR, China"
## [148] "St. Martin (French part)"
## [149] "Morocco"
## [150] "Monaco"
## [151] "Moldova"
## [152] "Madagascar"
## [153] "Maldives"
## [154] "Middle East & North Africa"
## [155] "Mexico"
## [156] "Marshall Islands"
## [157] "Middle income"
## [158] "North Macedonia"
## [159] "Mali"
## [160] "Malta"
## [161] "Myanmar"
## [162] "Middle East & North Africa (excluding high income)"
## [163] "Montenegro"
## [164] "Mongolia"
```

```
## [165] "Northern Mariana Islands"
## [166] "Mozambique"
## [167] "Mauritania"
## [168] "Mauritius"
## [169] "Malawi"
## [170] "Malaysia"
## [171] "North America"
## [172] "Namibia"
## [173] "New Caledonia"
## [174] "Niger"
## [175] "Nigeria"
## [176] "Nicaragua"
## [177] "Netherlands"
## [178] "Norway"
## [179] "Nepal"
## [180] "Nauru"
## [181] "New Zealand"
## [182] "OECD members"
## [183] "Oman"
## [184] "Other small states"
## [185] "Pakistan"
## [186] "Panama"
## [187] "Peru"
## [188] "Philippines"
## [189] "Palau"
## [190] "Papua New Guinea"
## [191] "Poland"
## [192] "Pre-demographic dividend"
## [193] "Puerto Rico"
## [194] "Korea, Dem. People's Rep."
## [195] "Portugal"
## [196] "Paraguay"
## [197] "West Bank and Gaza"
## [198] "Pacific island small states"
## [199] "Post-demographic dividend"
## [200] "French Polynesia"
## [201] "Qatar"
## [202] "Romania"
## [203] "Russian Federation"
## [204] "Rwanda"
## [205] "South Asia"
## [206] "Saudi Arabia"
## [207] "Sudan"
## [208] "Senegal"
## [209] "Singapore"
## [210] "Solomon Islands"
## [211] "Sierra Leone"
## [212] "El Salvador"
## [213] "San Marino"
## [214] "Somalia"
## [215] "Serbia"
## [216] "Sub-Saharan Africa (excluding high income)"
## [217] "South Sudan"
## [218] "Sub-Saharan Africa"
## [219] "Small states"
```

```
## [220] "Sao Tome and Principe"
## [221] "Suriname"
## [222] "Slovak Republic"
## [223] "Slovenia"
## [224] "Sweden"
## [225] "Eswatini"
## [226] "Sint Maarten (Dutch part)"
## [227] "Seychelles"
## [228] "Syrian Arab Republic"
## [229] "Turks and Caicos Islands"
## [230] "Chad"
## [231] "East Asia & Pacific (IDA & IBRD countries)"
## [232] "Europe & Central Asia (IDA & IBRD countries)"
## [233] "Togo"
## [234] "Thailand"
## [235] "Tajikistan"
## [236] "Turkmenistan"
## [237] "Latin America & the Caribbean (IDA & IBRD countries)"
## [238] "Timor-Leste"
## [239] "Middle East & North Africa (IDA & IBRD countries)"
## [240] "Tonga"
## [241] "South Asia (IDA & IBRD)"
## [242] "Sub-Saharan Africa (IDA & IBRD countries)"
## [243] "Trinidad and Tobago"
## [244] "Tunisia"
## [245] "Turkey"
## [246] "Tuvalu"
## [247] "Tanzania"
## [248] "Uganda"
## [249] "Ukraine"
## [250] "Upper middle income"
## [251] "Uruguay"
## [252] "United States"
## [253] "Uzbekistan"
## [254] "St. Vincent and the Grenadines"
## [255] "Venezuela, RB"
## [256] "British Virgin Islands"
## [257] "Virgin Islands (U.S.)"
## [258] "Vietnam"
## [259] "Vanuatu"
## [260] "World"
## [261] "Samoa"
## [262] "Kosovo"
## [263] "Yemen, Rep."
## [264] "South Africa"
## [265] "Zambia"
## [266] "Zimbabwe"
```

```

eco_growth <- eco_growth[,-23]

#Canada
GDP_Canada <- c(eco_growth[36, 4], eco_growth[36, 5], eco_growth[36, 6], eco_growth[36, 7],
                 eco_growth[36, 8], eco_growth[36, 9], eco_growth[36, 10], eco_growth[36, 11],
                 eco_growth[36, 12], eco_growth[36, 13], eco_growth[36, 14], eco_growth[36, 15],
                 eco_growth[36, 16], eco_growth[36, 17], eco_growth[36, 18], eco_growth[36, 19],
                 eco_growth[36, 20], eco_growth[36, 21], eco_growth[36, 22])

df_x_value <- c(2001:2019)
Canada_data_frame <- data.frame(df_x_value,GDP_Canada)

GDP_Canada

```

```

## [1] 1.06e+12 1.10e+12 1.14e+12 1.18e+12 1.24e+12 1.30e+12 1.38e+12 1.40e+12
## [9] 1.36e+12 1.40e+12 1.44e+12 1.47e+12 1.50e+12 1.55e+12 1.56e+12 1.57e+12
## [17] 1.62e+12 1.66e+12 1.69e+12

```

```

min_val <- min(GDP_Canada)
max_val <- max(GDP_Canada)

for (i in 1:19){
  GDP_Canada[i] <- ((GDP_Canada[i]-min_val)/(max_val-min_val))
}

#Bhutan
GDP_Bhutan <- c(eco_growth[33, 4], eco_growth[33, 5], eco_growth[33, 6], eco_growth[33, 7],
                  eco_growth[33, 8], eco_growth[33, 9], eco_growth[33, 10], eco_growth[33, 11],
                  eco_growth[33, 12], eco_growth[33, 13], eco_growth[33, 14], eco_growth[33, 15],
                  eco_growth[33, 16], eco_growth[33, 17], eco_growth[33, 18], eco_growth[33, 19],
                  eco_growth[33, 20], eco_growth[33, 21], eco_growth[33, 22])

df_x_value <- c(2001:2019)
Bhutan_data_frame <- data.frame(df_x_value,GDP_Bhutan)

GDP_Bhutan

```

```

## [1] 709797744 787820713 849454309 900495829 966117205 1033742879
## [7] 1223546901 1282270552 1368802449 1532318166 1654637257 1739328224
## [13] 1776201506 1878803710 2003598213 2166431312 2267210115 2336476327
## [19] 2470944512

```

```
min_val <- min(GDP_Bhutan)
max_val <- max(GDP_Bhutan)

for (i in 1:19){
  GDP_Bhutan[i] <- ((GDP_Bhutan[i]-min_val)/(max_val-min_val))
}

#China
GDP_China <- c(eco_growth[41, 4], eco_growth[41, 5], eco_growth[41, 6], eco_growth[41, 7],
               eco_growth[41, 8], eco_growth[41, 9], eco_growth[41, 10], eco_growth[41, 11],
               eco_growth[41, 12], eco_growth[41, 13], eco_growth[41, 14], eco_growth[41, 15],
               eco_growth[41, 16], eco_growth[41, 17], eco_growth[41, 18], eco_growth[41, 19],
               eco_growth[41, 20], eco_growth[41, 21], eco_growth[41, 22])

df_x_value <- c(2001:2019)
China_data_frame <- data.frame(df_x_value,GDP_China)

GDP_China
```

```
## [1] 3.00e+12 3.28e+12 3.60e+12 3.97e+12 4.42e+12 4.98e+12 5.69e+12 6.24e+12
## [9] 6.83e+12 7.55e+12 8.28e+12 8.93e+12 9.62e+12 1.03e+13 1.11e+13 1.18e+13
## [17] 1.26e+13 1.35e+13 1.43e+13
```

```

min_val <- min(GDP_China)
max_val <- max(GDP_China)

for (i in 1:19){
  GDP_China[i] <- ((GDP_China[i]-min_val)/(max_val-min_val))
}

df_Can <- as.data.frame((cbind(GDP_Canada, y_Canada_Education1, y_Canada_Education2, y_Canada_Health1, y_Canada_Health2, y_Canada_Health3,
                                y_Canada_Financial_Sector1, y_Canada_Financial_Sector2)))

df_Bhutan <- as.data.frame(cbind(GDP_Bhutan, y_Bhutan_Education1, y_Bhutan_Education2, y_Bhutan_Health1, y_Bhutan_Health2, y_Bhutan_Health3,
                                   y_Bhutan_Financial_Sector1, y_Bhutan_Financial_Sector2))

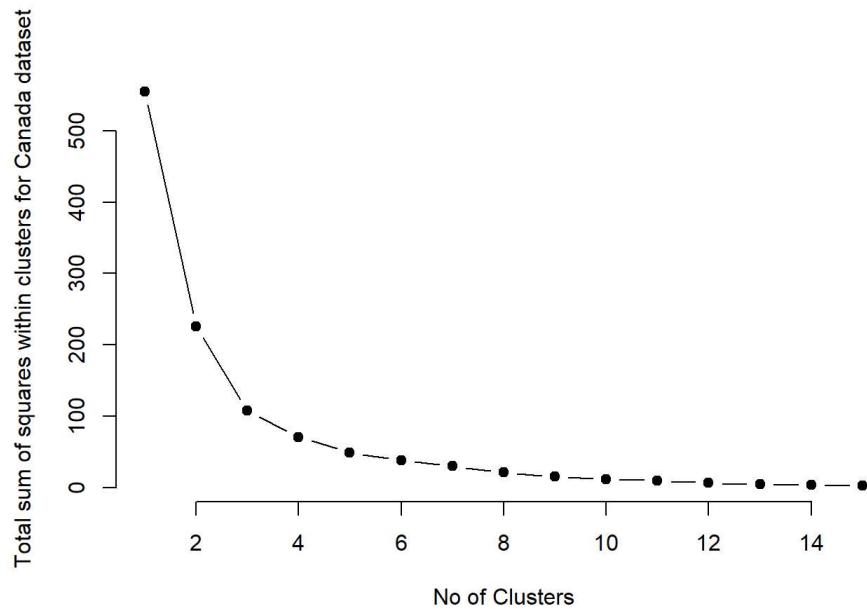
df_China <- as.data.frame(cbind(GDP_China, y_China_Education1, y_China_Education2, y_China_Health1, y_China_Health2, y_China_Health3,
                                 y_China_Financial_Sector1, y_China_Financial_Sector2))

#K Means Algorithm
library(purrr)

wss <- function(k){
  kmeans(df_Can, k, nstart=25)$tot.withinss
}
k.values <- 1:15

wss_values <- map_dbl(k.values, wss)
plot(k.values, wss_values, type="b", pch=19, frame=FALSE, xlab="No of Clusters",
     ylab="Total sum of squares within clusters for Canada dataset")

```



```
algo <- kmeans(df_Can, centers = 4, nstart = 25)
print(algo)
```

```
## K-means clustering with 4 clusters of sizes 4, 2, 11, 2
##
## Cluster means:
##   GDP_Canada y_Canada_Education1 y_Canada_Education2 y_Canada_Health1
## 1 0.42857143    77.23560    93.79863    80.44390
## 2 0.15873016    75.25305    91.24093    79.81707
## 3 0.74458874    82.73546    91.31921    81.69867
## 4 0.03174603    76.86591    96.72715    79.41463
##   y_Canada_Health2 y_Canada_Health3 y_Canada_Financial_Sector1
## 1      99.72324     2.030711      3.729276
## 2      99.85983     2.091255      11.940933
## 3      99.31038     2.357344      4.976290
## 4      99.85881     1.892000     13.949062
##   y_Canada_Financial_Sector2
## 1      2.181058
## 2      2.307911
## 3      1.610678
## 4      2.391757
##
## Clustering vector:
## [1] 4 4 2 2 1 1 1 3 3 3 3 3 3 3 3 3 3 3
##
## Within cluster sum of squares by cluster:
## [1] 13.566881 8.814497 45.149488 3.235498
## (between_SS / total_SS =  87.2 %)
##
## Available components:
##
## [1] "cluster"      "centers"       "totss"        "withinss"      "tot.withinss"
## [6] "betweenss"    "size"          "iter"          "ifault"
```

```
algo$totss
```

```
## [1] 554.3138
```

```
algo$cluster
```

```
## [1] 4 4 2 2 1 1 1 3 3 3 3 3 3 3 3 3 3 3 3
```

```
algo$withinss
```

```
## [1] 13.566881 8.814497 45.149488 3.235498
```

```
algo$tot.withinss
```

```
## [1] 70.76636
```

```
str(algo)
```

```

## List of 9
## $ cluster      : int [1:19] 4 4 2 2 1 1 1 1 3 3 ...
## $ centers      : num [1:4, 1:8] 0.4286 0.1587 0.7446 0.0317 77.2356 ...
## ..- attr(*, "dimnames")=List of 2
## ... .$. : chr [1:4] "1" "2" "3" "4"
## ... .$. : chr [1:8] "GDP_Canada" "y_Canada_Education1" "y_Canada_Education2" "y_Canada_Health1" ...
## $ totss        : num 554
## $ withinss     : num [1:4] 13.57 8.81 45.15 3.24
## $ tot.withinss: num 70.8
## $ betweenss    : num 484
## $ size         : int [1:4] 4 2 11 2
## $ iter         : int 2
## $ ifault       : int 0
## - attr(*, "class")= chr "kmeans"

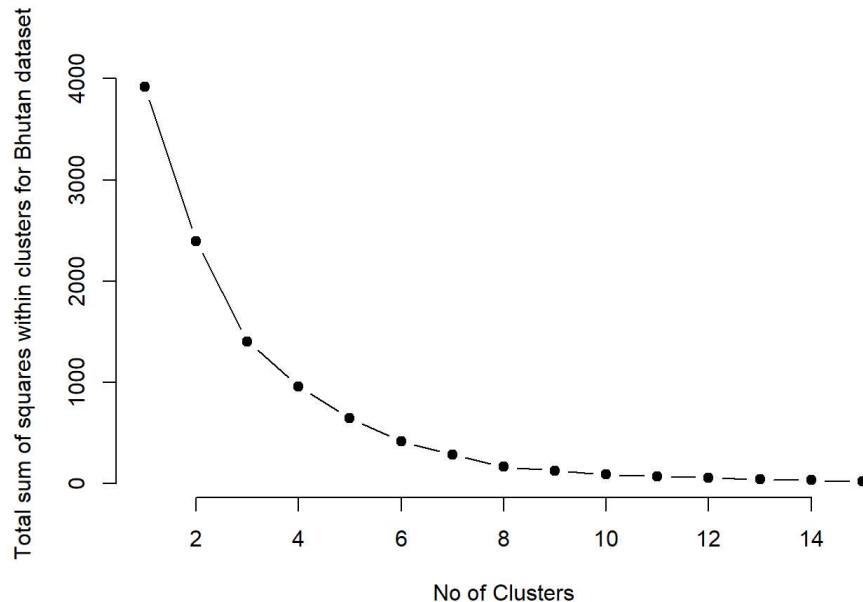
```

```

wss <- function(k){
  kmeans(df_Bhutan, k, nstart=25)$tot.withinss
}
k.values <- 1:15

wss_values <- map_dbl(k.values, wss)
plot(k.values, wss_values, type="b", pch=19, frame=FALSE, xlab="No of Clusters", ylab="Total sum of squares within clusters for Bhutan dataset")

```



```

algo <- kmeans(df_Bhutan, centers = 6, nstart = 25)
print(algo)

```

```

## K-means clustering with 6 clusters of sizes 1, 5, 3, 7, 2, 1
##
## Cluster means:
##   GDP_Bhutan y_Bhutan_Education1 y_Bhutan_Education2 y_Bhutan_Health1
## 1 0.10828063    77.24002     91.20976    64.48300
## 2 0.32838742    79.14646     90.47523    67.26620
## 3 0.04120034    75.66597     90.29929    62.72000
## 4 0.75587994    83.56601     90.53749    70.42643
## 5 0.36506042    54.06612     90.08426    67.27600
## 6 0.88431720    66.56115     92.78021    71.12900
##   y_Bhutan_Health2 y_Bhutan_Health3 y_Bhutan_Financial_Sector1
## 1      52.90040     0.1847000    11.481873
## 2      59.47284     1.3173578    9.286544
## 3      49.22546     2.2823636   13.432706
## 4      70.00789     0.6527662   15.385523
## 5      60.13968     1.2026126   13.081330
## 6      72.62360     0.4024000   12.971098
##   y_Bhutan_Financial_Sector2
## 1      -18.108630
## 2       5.976246
## 3       2.486663
## 4       5.334933
## 5       8.115585
## 6       4.955084
##
## Clustering vector:
## [1] 3 3 3 1 5 2 2 2 2 4 5 4 4 4 4 6 4 4
##
## Within cluster sum of squares by cluster:
## [1] 0.00000 63.66919 25.85870 205.18823 120.09024 0.00000
## (between_SS / total_SS =  89.4 %)
##
## Available components:
##
## [1] "cluster"      "centers"       "totss"        "withinss"      "tot.withinss"
## [6] "betweenss"    "size"          "iter"          "ifault"

```

```
algo$totss
```

```
## [1] 3916.102
```

```
algo$cluster
```

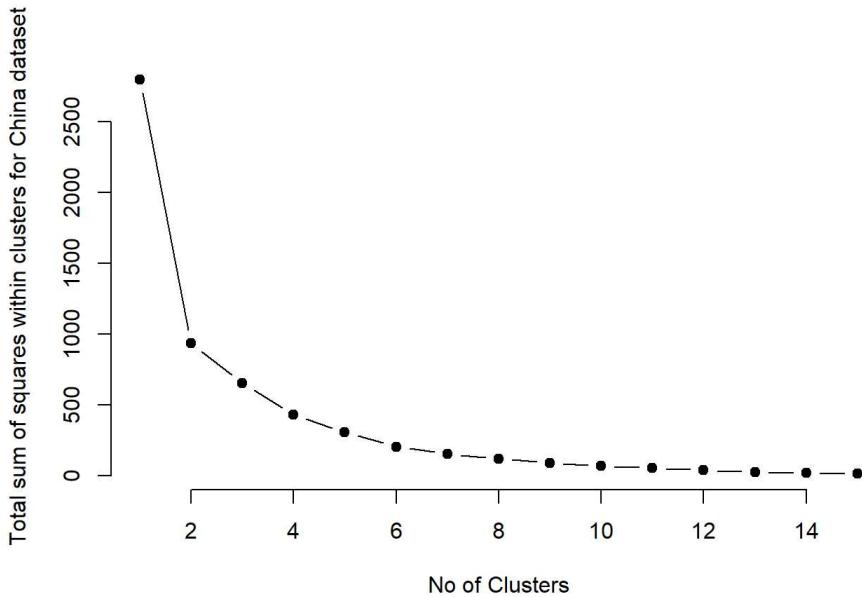
```
## [1] 3 3 3 1 5 2 2 2 2 4 5 4 4 4 4 6 4 4
```

```
algo$withinss
```

```
## [1] 0.00000 63.66919 25.85870 205.18823 120.09024 0.00000
```

```
algo$tot.withinss  
  
## [1] 414.8064  
  
str(algo)  
  
## List of 9  
## $ cluster : int [1:19] 3 3 3 1 5 2 2 2 2 2 ...  
## $ centers : num [1:6, 1:8] 0.1083 0.3284 0.0412 0.7559 0.3651 ...  
## ..- attr(*, "dimnames")=List of 2  
## ... .$. : chr [1:6] "1" "2" "3" "4" ...  
## ... .$. : chr [1:8] "GDP_Bhutan" "y_Bhutan_Education1" "y_Bhutan_Education2" "y_Bhutan_Health1" ...  
## $ totss : num 3916  
## $ withinss : num [1:6] 0 63.7 25.9 205.2 120.1 ...  
## $ tot.withinss: num 415  
## $ betweenss : num 3501  
## $ size : int [1:6] 1 5 3 7 2 1  
## $ iter : int 3  
## $ ifault : int 0  
## - attr(*, "class")= chr "kmeans"
```

```
wss <- function(k){  
  kmeans(df_China, k, nstart=25)$tot.withinss  
}  
k.values <- 1:15  
  
wss_values <- map_dbl(k.values, wss)  
plot(k.values, wss_values, type="b", pch=19, frame=FALSE, xlab="No of Clusters", ylab="Total sum of squares within clusters  
for China dataset")
```



```
algo <- kmeans(df_China, centers = 6, nstart = 25)
print(algo)
```

```

## K-means clustering with 6 clusters of sizes 3, 1, 4, 5, 1, 5
##
## Cluster means:
##   GDP_China y_China_Education1 y_China_Education2 y_China_Health1
## 1 0.0259587    75.66597     90.29929    72.05800
## 2 0.9292035    96.84089     92.50057    76.70400
## 3 0.4792035    81.92240     89.96266    74.79025
## 4 0.7982301    83.69416     91.95915    76.22980
## 5 0.4026549    95.12448     89.99410    74.40900
## 6 0.1823009    77.23648     90.80060    73.26660
##   y_China_Health2 y_China_Health3 y_China_Financial_Sector1
## 1      59.83929     1.175633    13.432706
## 2      89.29564     2.446160     9.070189
## 3      77.91228     1.505425    10.023139
## 4      86.36507     1.865361     8.328700
## 5      75.68897     1.433400    10.031967
## 6      68.01105     1.246680     9.700711
##   y_China_Financial_Sector2
## 1      0.3715861
## 2      2.0747904
## 3      2.5165770
## 4      1.9702075
## 5      3.1753248
## 6      3.5985003
##
## Clustering vector:
##  [1] 1 1 1 6 6 6 6 3 5 3 3 4 4 4 4 2 4
##
## Within cluster sum of squares by cluster:
## [1] 26.58595  0.00000 57.43522 52.00396  0.00000 67.89539
## (between_SS / total_SS =  92.7 %)
##
## Available components:
##
## [1] "cluster"      "centers"       "totss"        "withinss"      "tot.withinss"
## [6] "betweenss"    "size"          "iter"          "ifault"

```

```
algo$totss
```

```
## [1] 2794.968
```

```
algo$cluster
```

```
## [1] 1 1 1 6 6 6 6 3 5 3 3 4 4 4 4 2 4
```

```
algo$withinss
```

```
## [1] 26.58595  0.00000 57.43522 52.00396  0.00000 67.89539
```

```
algo$tot.withinss  
  
## [1] 203.9205  
  
str(algo)  
  
## List of 9  
## $ cluster : int [1:19] 1 1 1 6 6 6 6 3 5 ...  
## $ centers : num [1:6, 1:8] 0.026 0.929 0.479 0.798 0.403 ...  
## ..- attr(*, "dimnames")=List of 2  
## ... .$. : chr [1:6] "1" "2" "3" "4" ...  
## ... .$. : chr [1:8] "GDP_China" "y_China_Education1" "y_China_Education2" "y_China_Health1" ...  
## $ totss : num 2795  
## $ withinss : num [1:6] 26.6 0 57.4 52 0 ...  
## $ tot.withinss: num 204  
## $ betweenss : num 2591  
## $ size : int [1:6] 3 1 4 5 1 5  
## $ iter : int 3  
## $ ifault : int 0  
## - attr(*, "class")= chr "kmeans"
```