2020MCS120020_mini_project

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```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.4     v dplyr   1.0.2
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.0
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(ggplot2)
library(tidyr)
library(tidyverse)
library(dplyr)
library(leaflet)
```

Load covid data

```
raw_data_confirmed <- read.csv('dataset/time_series_covid19_confirmed_global.csv')
raw_data_deaths <- read.csv('dataset/time_series_covid19_deaths_global.csv')
raw_data_recovered <- read.csv('dataset/time_series_covid19_recovered_global.csv')
```

Find Number of rows , columns and column names

```
raw_data_confirmed = raw_data_confirmed[0:250]
raw_data_deaths = raw_data_deaths[0:250]
raw_data_recovered = raw_data_recovered[0:250]

glimpse(raw_data_confirmed)
```

```
## Rows: 267
## Columns: 250
## $ Province.State <chr> "", "", "", "", "", "", "", "", "Australian Capital ...
## $ Country.Region <chr> "Afghanistan", "Albania", "Algeria", "Andorra", "Ang...
## $ Lat            <dbl> 33.93911, 41.15330, 28.03390, 42.50630, -11.20270, 1...
## $ Long           <dbl> 67.709953, 20.168300, 1.659600, 1.521800, 17.873900,...
## $ X1.22.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ X1.23.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ X1.24.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ X1.25.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ X1.26.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 1, 0, 0, 0...
## $ X1.27.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0...
## $ X1.28.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0...
## $ X1.29.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 1, 0, 0, 0...
## $ X1.30.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 3, 0, 0, 2, 0, 0, 0...
## $ X1.31.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 0, 0, 3, 0, 0, 0...
## $ X2.1.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 3, 1, 0, 4, 0, 0, 0...
## $ X2.2.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 2, 0, 4, 0, 0, 0...
## $ X2.3.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 2, 2, 0, 4, 0, 0, 0...
## $ X2.4.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 3, 2, 0, 4, 0, 0, 0...
## $ X2.5.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 3, 2, 0, 4, 0, 0, 0...
## $ X2.6.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 2, 0, 4, 0, 0, 0...
## $ X2.7.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.8.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.9.20        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.10.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.11.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.12.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.13.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.14.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.15.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.16.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.17.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.18.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.19.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.20.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.21.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.22.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.23.20       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
## $ X2.24.20       <int> 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 0, 0...
```

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## $ X2.25.20       <int> 1, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 2, 0...
## $ X2.26.20       <int> 1, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 2, 0...
## $ X2.27.20       <int> 1, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 3, 0...
## $ X2.28.20       <int> 1, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 5, 2, 0, 4, 0, 3, 0...
## $ X2.29.20       <int> 1, 0, 1, 0, 0, 0, 0, 0, 0, 4, 0, 9, 3, 0, 7, 2, 9, 0...
## $ X3.1.20        <int> 1, 0, 1, 0, 0, 0, 0, 1, 0, 6, 0, 9, 3, 0, 7, 2, 14, ...
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## $ X3.13.20       <int> 7, 33, 26, 1, 0, 1, 31, 8, 1, 92, 1, 35, 16, 5, 36, ...
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## $ X4.9.20       <int> 484, 409, 1666, 583, 19, 19, 1795, 921, 100, 2773, 2...
## $ X4.10.20      <int> 521, 416, 1761, 601, 19, 19, 1975, 937, 103, 2822, 2...
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## $ X4.19.20      <int> 996, 562, 2629, 713, 24, 23, 2839, 1291, 103, 2957, ...
## $ X4.20.20      <int> 1026, 584, 2718, 717, 24, 23, 2941, 1339, 104, 2963,...
## $ X4.21.20      <int> 1092, 609, 2811, 717, 24, 23, 3031, 1401, 104, 2969,...
## $ X4.22.20      <int> 1176, 634, 2910, 723, 25, 24, 3144, 1473, 104, 2971,...
## $ X4.23.20      <int> 1279, 663, 3007, 723, 25, 24, 3435, 1523, 104, 2976,...
## $ X4.24.20      <int> 1351, 678, 3127, 731, 25, 24, 3607, 1596, 105, 2982,...
## $ X4.25.20      <int> 1463, 712, 3256, 738, 25, 24, 3780, 1677, 106, 2994,...
## $ X4.26.20      <int> 1531, 726, 3382, 738, 26, 24, 3892, 1746, 106, 3002,...
## $ X4.27.20      <int> 1703, 736, 3517, 743, 27, 24, 4003, 1808, 106, 3004,...
## $ X4.28.20      <int> 1828, 750, 3649, 743, 27, 24, 4127, 1867, 106, 3016,...
## $ X4.29.20      <int> 1939, 766, 3848, 743, 27, 24, 4285, 1932, 106, 3016,...
## $ X4.30.20      <int> 2171, 773, 4006, 745, 27, 24, 4428, 2066, 106, 3025,...
## $ X5.1.20       <int> 2335, 782, 4154, 745, 30, 25, 4532, 2148, 106, 3030,...
## $ X5.2.20       <int> 2469, 789, 4295, 747, 35, 25, 4681, 2273, 106, 3035,...
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## $ X5.5.20       <int> 3224, 820, 4838, 751, 36, 25, 5020, 2619, 107, 3042,...
## $ X5.6.20       <int> 3392, 832, 4997, 751, 36, 25, 5208, 2782, 107, 3044,...
## $ X5.7.20       <int> 3563, 842, 5182, 752, 36, 25, 5371, 2884, 107, 3047,...
## $ X5.8.20       <int> 3778, 850, 5369, 752, 43, 25, 5611, 3029, 107, 3051,...
## $ X5.9.20       <int> 4033, 856, 5558, 754, 43, 25, 5776, 3175, 107, 3053,...
## $ X5.10.20      <int> 4402, 868, 5723, 755, 45, 25, 6034, 3313, 107, 3053,...
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## $ X5.19.20       <int> 7653, 949, 7377, 761, 52, 25, 8809, 5041, 107, 3081,...
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## $ X5.22.20       <int> 9216, 981, 7918, 762, 60, 25, 10649, 5928, 107, 3086...
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## $ X6.4.20        <int> 18054, 1197, 9831, 852, 86, 26, 20197, 11221, 107, 3...
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## $ X6.15.20       <int> 25527, 1590, 11031, 853, 142, 26, 32785, 17064, 108,...
## $ X6.16.20       <int> 26310, 1672, 11147, 854, 148, 26, 34159, 17489, 108,...
## $ X6.17.20       <int> 26874, 1722, 11268, 854, 155, 26, 35552, 18033, 108,...
## $ X6.18.20       <int> 27532, 1788, 11385, 855, 166, 26, 37510, 18698, 108,...
## $ X6.19.20       <int> 27878, 1838, 11504, 855, 172, 26, 39570, 19157, 108,...
## $ X6.20.20       <int> 28424, 1891, 11631, 855, 176, 26, 41204, 19708, 108,...
## $ X6.21.20       <int> 28833, 1962, 11771, 855, 183, 26, 42785, 20268, 108,...
## $ X6.22.20       <int> 29157, 1995, 11920, 855, 186, 26, 44931, 20588, 108,...
## $ X6.23.20       <int> 29481, 2047, 12076, 855, 189, 26, 47203, 21006, 108,...
## $ X6.24.20       <int> 29640, 2114, 12248, 855, 197, 26, 49851, 21717, 108,...
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## $ X6.29.20       <int> 31238, 2466, 13571, 855, 276, 69, 62268, 25127, 108,...
## $ X6.30.20       <int> 31517, 2535, 13907, 855, 284, 69, 64530, 25542, 108,...
## $ X7.1.20        <int> 31836, 2580, 14272, 855, 291, 69, 67197, 26065, 108,...
## $ X7.2.20        <int> 32022, 2662, 14657, 855, 315, 69, 69941, 26658, 108,...
## $ X7.3.20        <int> 32324, 2752, 15070, 855, 328, 68, 72786, 27320, 108,...
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## $ X7.6.20        <int> 33190, 2964, 16404, 855, 346, 70, 80447, 28936, 108,...
## $ X7.7.20        <int> 33384, 3038, 16879, 855, 386, 70, 83426, 29285, 111,...
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## $ X7.9.20        <int> 33908, 3188, 17808, 855, 396, 73, 90693, 30346, 113,...
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## $ X7.14.20       <int> 34740, 3667, 20216, 861, 541, 74, 106910, 32490, 113...
## $ X7.15.20       <int> 34994, 3752, 20770, 862, 576, 74, 111146, 33005, 113...
## $ X7.16.20       <int> 35070, 3851, 21355, 877, 607, 74, 114783, 33559, 113...
## $ X7.17.20       <int> 35229, 3906, 21948, 880, 638, 76, 119301, 34001, 113...
## $ X7.18.20       <int> 35301, 4008, 22549, 880, 687, 76, 122524, 34462, 113...
## $ X7.19.20       <int> 35475, 4090, 23084, 880, 705, 76, 126755, 34877, 113...
## $ X7.20.20       <int> 35526, 4171, 23691, 884, 749, 76, 130774, 34981, 113...
## $ X7.21.20       <int> 35615, 4290, 24278, 884, 779, 76, 136118, 35254, 113...
## $ X7.22.20       <int> 35727, 4358, 24872, 889, 812, 76, 141900, 35693, 113...
## $ X7.23.20       <int> 35928, 4466, 25484, 889, 851, 76, 148027, 36162, 113...
## $ X7.24.20       <int> 35981, 4570, 26159, 897, 880, 82, 153520, 36613, 113...
## $ X7.25.20       <int> 36036, 4637, 26764, 897, 916, 82, 158334, 36996, 113...
## $ X7.26.20       <int> 36157, 4763, 27357, 897, 932, 82, 162526, 37317, 113...
## $ X7.27.20       <int> 36263, 4880, 27973, 907, 950, 86, 167416, 37390, 113...
## $ X7.28.20       <int> 36368, 4997, 28615, 907, 1000, 86, 173355, 37629, 11...
## $ X7.29.20       <int> 36471, 5105, 29229, 918, 1078, 91, 178996, 37937, 11...
## $ X7.30.20       <int> 36542, 5197, 29831, 922, 1109, 91, 185373, 38196, 11...
## $ X7.31.20       <int> 36675, 5276, 30394, 925, 1148, 91, 191302, 38550, 11...
## $ X8.1.20        <int> 36710, 5396, 30950, 925, 1164, 91, 196543, 38841, 11...
## $ X8.2.20        <int> 36710, 5519, 31465, 925, 1199, 91, 201919, 39050, 11...
## $ X8.3.20        <int> 36747, 5620, 31972, 937, 1280, 92, 206743, 39102, 11...
## $ X8.4.20        <int> 36782, 5750, 32504, 939, 1344, 92, 213535, 39298, 11...
## $ X8.5.20        <int> 36829, 5889, 33055, 939, 1395, 92, 220682, 39586, 11...
## $ X8.6.20        <int> 36896, 6016, 33626, 944, 1483, 92, 228195, 39819, 11...
```

```
## $ X8.7.20       <int> 37015, 6151, 34155, 955, 1538, 92, 235677, 39985, 11...
## $ X8.8.20       <int> 37054, 6275, 34693, 955, 1572, 92, 241811, 40185, 11...
## $ X8.9.20       <int> 37054, 6411, 35160, 955, 1672, 92, 246499, 40410, 11...
## $ X8.10.20      <int> 37162, 6536, 35712, 963, 1679, 92, 253868, 40433, 11...
## $ X8.11.20      <int> 37269, 6676, 36204, 963, 1735, 92, 260911, 40593, 11...
## $ X8.12.20      <int> 37345, 6817, 36699, 977, 1762, 92, 268574, 40794, 11...
## $ X8.13.20      <int> 37424, 6971, 37187, 981, 1815, 92, 276072, 41023, 11...
## $ X8.14.20      <int> 37431, 7117, 37664, 989, 1852, 93, 282437, 41299, 11...
## $ X8.15.20      <int> 37551, 7260, 38133, 989, 1879, 93, 289100, 41495, 11...
## $ X8.16.20      <int> 37596, 7380, 38583, 989, 1906, 93, 294569, 41663, 11...
## $ X8.17.20      <int> 37599, 7499, 39025, 1005, 1935, 93, 299126, 41701, 1...
## $ X8.18.20      <int> 37599, 7654, 39444, 1005, 1966, 93, 305966, 41846, 1...
## $ X8.19.20      <int> 37599, 7812, 39847, 1024, 2015, 94, 312659, 42056, 1...
## $ X8.20.20      <int> 37856, 7967, 40258, 1024, 2044, 94, 320884, 42319, 1...
## $ X8.21.20      <int> 37894, 8119, 40667, 1045, 2068, 94, 329043, 42477, 1...
## $ X8.22.20      <int> 37953, 8275, 41068, 1045, 2134, 94, 336802, 42616, 1...
## $ X8.23.20      <int> 37999, 8427, 41460, 1045, 2171, 94, 342154, 42792, 1...
## $ X8.24.20      <int> 38054, 8605, 41858, 1060, 2222, 94, 350867, 42825, 1...
## $ X8.25.20      <int> 38070, 8759, 42228, 1060, 2283, 94, 359638, 42936, 1...
## $ X8.26.20      <int> 38113, 8927, 42619, 1098, 2332, 94, 370188, 43067, 1...
## $ X8.27.20      <int> 38129, 9083, 43016, 1098, 2415, 94, 380292, 43270, 1...
## $ X8.28.20      <int> 38140, 9195, 43403, 1124, 2471, 94, 392009, 43451, 1...
## $ X8.29.20      <int> 38143, 9279, 43781, 1124, 2551, 94, 401239, 43626, 1...
## $ X8.30.20      <int> 38162, 9380, 44146, 1124, 2624, 94, 408426, 43750, 1...
## $ X8.31.20      <int> 38165, 9513, 44494, 1176, 2654, 94, 417735, 43781, 1...
## $ X9.1.20       <int> 38196, 9606, 44833, 1184, 2729, 94, 428239, 43878, 1...
## $ X9.2.20       <int> 38243, 9728, 45158, 1199, 2777, 94, 439172, 44075, 1...
## $ X9.3.20       <int> 38288, 9844, 45469, 1199, 2805, 95, 451198, 44271, 1...
## $ X9.4.20       <int> 38304, 9967, 45773, 1215, 2876, 95, 461882, 44461, 1...
## $ X9.5.20       <int> 38324, 10102, 46071, 1215, 2935, 95, 471806, 44649, ...
## $ X9.6.20       <int> 38398, 10255, 46364, 1215, 2965, 95, 478792, 44783, ...
## $ X9.7.20       <int> 38494, 10406, 46653, 1261, 2981, 95, 488007, 44845, ...
## $ X9.8.20       <int> 38520, 10553, 46938, 1261, 3033, 95, 500034, 44953, ...
## $ X9.9.20       <int> 38544, 10704, 47216, 1301, 3092, 95, 512293, 45152, ...
## $ X9.10.20      <int> 38572, 10860, 47488, 1301, 3217, 95, 524198, 45326, ...
## $ X9.11.20      <int> 38606, 11021, 47752, 1344, 3279, 95, 535705, 45503, ...
## $ X9.12.20      <int> 38641, 11185, 48007, 1344, 3335, 95, 546481, 45675, ...
## $ X9.13.20      <int> 38716, 11353, 48254, 1344, 3388, 95, 555537, 45862, ...
## $ X9.14.20      <int> 38772, 11520, 48496, 1438, 3439, 95, 565446, 45969, ...
## $ X9.15.20      <int> 38815, 11672, 48734, 1438, 3569, 95, 577338, 46119, ...
## $ X9.16.20      <int> 38855, 11816, 48966, 1483, 3675, 95, 589012, 46376, ...
```

```
## $ X9.17.20       <int> 38872, 11948, 49194, 1483, 3789, 95, 601713, 46671, ...
## $ X9.18.20       <int> 38883, 12073, 49413, 1564, 3848, 95, 613658, 46910, ...
## $ X9.19.20       <int> 38919, 12226, 49623, 1564, 3901, 96, 622934, 47154, ...
## $ X9.20.20       <int> 39044, 12385, 49826, 1564, 3991, 96, 631365, 47431, ...
## $ X9.21.20       <int> 39074, 12535, 50023, 1681, 4117, 96, 640147, 47552, ...
## $ X9.22.20       <int> 39096, 12666, 50214, 1681, 4236, 96, 652174, 47667, ...
## $ X9.23.20       <int> 39145, 12787, 50400, 1753, 4363, 97, 664799, 47877, ...
```

```
# glimpse(raw_data_deaths)
# glimpse(raw_data_recovered)
```

Find total confirmed cases till 9.23.20

```
sum(raw_data_confirmed$X9.23.20)
```

```
## [1] 31875596
```

Find total deaths till 10.09.2020

```
sum(raw_data_deaths$X9.23.20)
```

```
## [1] 976362
```

Find total recovered cases till 10.09.2020

```
sum(raw_data_recovered$X9.23.20)
```

```
## [1] 21981930
```

Get all dates from dataset

```
dates <- names(raw_data_confirmed)[5:245] %>% substr(2,8) %>% mdy()

dates
```

```
##   [1] "2020-01-22" "2020-01-23" "2020-01-24" "2020-01-25" "2020-01-26"
##   [6] "2020-01-27" "2020-01-28" "2020-01-29" "2020-01-30" "2020-01-31"
##  [11] "2020-02-01" "2020-02-02" "2020-02-03" "2020-02-04" "2020-02-05"
##  [16] "2020-02-06" "2020-02-07" "2020-02-08" "2020-02-09" "2020-02-10"
##  [21] "2020-02-11" "2020-02-12" "2020-02-13" "2020-02-14" "2020-02-15"
##  [26] "2020-02-16" "2020-02-17" "2020-02-18" "2020-02-19" "2020-02-20"
##  [31] "2020-02-21" "2020-02-22" "2020-02-23" "2020-02-24" "2020-02-25"
##  [36] "2020-02-26" "2020-02-27" "2020-02-28" "2020-02-29" "2020-03-01"
##  [41] "2020-03-02" "2020-03-03" "2020-03-04" "2020-03-05" "2020-03-06"
##  [46] "2020-03-07" "2020-03-08" "2020-03-09" "2020-03-10" "2020-03-11"
##  [51] "2020-03-12" "2020-03-13" "2020-03-14" "2020-03-15" "2020-03-16"
##  [56] "2020-03-17" "2020-03-18" "2020-03-19" "2020-03-20" "2020-03-21"
##  [61] "2020-03-22" "2020-03-23" "2020-03-24" "2020-03-25" "2020-03-26"
##  [66] "2020-03-27" "2020-03-28" "2020-03-29" "2020-03-30" "2020-03-31"
##  [71] "2020-04-01" "2020-04-02" "2020-04-03" "2020-04-04" "2020-04-05"
##  [76] "2020-04-06" "2020-04-07" "2020-04-08" "2020-04-09" "2020-04-10"
##  [81] "2020-04-11" "2020-04-12" "2020-04-13" "2020-04-14" "2020-04-15"
##  [86] "2020-04-16" "2020-04-17" "2020-04-18" "2020-04-19" "2020-04-20"
##  [91] "2020-04-21" "2020-04-22" "2020-04-23" "2020-04-24" "2020-04-25"
##  [96] "2020-04-26" "2020-04-27" "2020-04-28" "2020-04-29" "2020-04-30"
## [101] "2020-05-01" "2020-05-02" "2020-05-03" "2020-05-04" "2020-05-05"
## [106] "2020-05-06" "2020-05-07" "2020-05-08" "2020-05-09" "2020-05-10"
## [111] "2020-05-11" "2020-05-12" "2020-05-13" "2020-05-14" "2020-05-15"
## [116] "2020-05-16" "2020-05-17" "2020-05-18" "2020-05-19" "2020-05-20"
## [121] "2020-05-21" "2020-05-22" "2020-05-23" "2020-05-24" "2020-05-25"
## [126] "2020-05-26" "2020-05-27" "2020-05-28" "2020-05-29" "2020-05-30"
## [131] "2020-05-31" "2020-06-01" "2020-06-02" "2020-06-03" "2020-06-04"
## [136] "2020-06-05" "2020-06-06" "2020-06-07" "2020-06-08" "2020-06-09"
## [141] "2020-06-10" "2020-06-11" "2020-06-12" "2020-06-13" "2020-06-14"
## [146] "2020-06-15" "2020-06-16" "2020-06-17" "2020-06-18" "2020-06-19"
## [151] "2020-06-20" "2020-06-21" "2020-06-22" "2020-06-23" "2020-06-24"
## [156] "2020-06-25" "2020-06-26" "2020-06-27" "2020-06-28" "2020-06-29"
## [161] "2020-06-30" "2020-07-01" "2020-07-02" "2020-07-03" "2020-07-04"
## [166] "2020-07-05" "2020-07-06" "2020-07-07" "2020-07-08" "2020-07-09"
## [171] "2020-07-10" "2020-07-11" "2020-07-12" "2020-07-13" "2020-07-14"
## [176] "2020-07-15" "2020-07-16" "2020-07-17" "2020-07-18" "2020-07-19"
## [181] "2020-07-20" "2020-07-21" "2020-07-22" "2020-07-23" "2020-07-24"
## [186] "2020-07-25" "2020-07-26" "2020-07-27" "2020-07-28" "2020-07-29"
## [191] "2020-07-30" "2020-07-31" "2020-08-01" "2020-08-02" "2020-08-03"
## [196] "2020-08-04" "2020-08-05" "2020-08-06" "2020-08-07" "2020-08-08"
```

```
## [201] "2020-08-09" "2020-08-10" "2020-08-11" "2020-08-12" "2020-08-13"
## [206] "2020-08-14" "2020-08-15" "2020-08-16" "2020-08-17" "2020-08-18"
## [211] "2020-08-19" "2020-08-20" "2020-08-21" "2020-08-22" "2020-08-23"
## [216] "2020-08-24" "2020-08-25" "2020-08-26" "2020-08-27" "2020-08-28"
## [221] "2020-08-29" "2020-08-30" "2020-08-31" "2020-09-01" "2020-09-02"
## [226] "2020-09-03" "2020-09-04" "2020-09-05" "2020-09-06" "2020-09-07"
## [231] "2020-09-08" "2020-09-09" "2020-09-10" "2020-09-11" "2020-09-12"
## [236] "2020-09-13" "2020-09-14" "2020-09-15" "2020-09-16" "2020-09-17"
## [241] "2020-09-18"
```

Data cleaning and Preprocessing

```
#Convert wide to long

preConfirmedData <- raw_data_confirmed %>% select (-c(Province.State,Lat,Long)) %>% rename(country= Country.Region) %>% gath
er(key= date, value = Confirmed, -country) %>% mutate(date = date %>% substr(2,8) %>% mdy())
preConfirmedData
```

country <chr>	date <date>	Confirmed <int>
Afghanistan	2020-01-22	0
Albania	2020-01-22	0
Algeria	2020-01-22	0
Andorra	2020-01-22	0
Angola	2020-01-22	0
Antigua and Barbuda	2020-01-22	0
Argentina	2020-01-22	0
Armenia	2020-01-22	0
Australia	2020-01-22	0
Australia	2020-01-22	0

1-10 of 10,000 rows Previous **1** 2 3 4 5 6 … 1000 Next

Group by Country and date

```
preConfirmedData = preConfirmedData %>% group_by(country, date) %>% summarise(Confirmed=sum(Confirmed, na.rm=TRUE), .groups
 = 'drop')%>% as.data.frame()
preConfirmedData
```

country <chr>	**date** <date>	**Confirmed** <int>
Afghanistan	2020-01-22	0
Afghanistan	2020-01-23	0
Afghanistan	2020-01-24	0
Afghanistan	2020-01-25	0
Afghanistan	2020-01-26	0
Afghanistan	2020-01-27	0
Afghanistan	2020-01-28	0
Afghanistan	2020-01-29	0
Afghanistan	2020-01-30	0
Afghanistan	2020-01-31	0

1-10 of 10,000 rows Previous **1** 2 3 4 5 6 … 1000 Next

Clean raw_data_death dataset

```
preDeathData <- raw_data_deaths %>% select (-c(Province.State,Lat,Long)) %>% rename(country= Country.Region) %>% gather(key=
date, value = death, -country) %>% mutate(date = date %>% substr(2,8) %>% mdy())

preDeathData = preDeathData %>% group_by(country, date) %>% summarise(death=sum(death, na.rm=TRUE), .groups = 'drop')%>% as.
data.frame()
```

Clean raw_data_recovered dataset

```
preRecoveredData <- raw_data_recovered %>% select (-c(Province.State,Lat,Long)) %>% rename(country= Country.Region) %>% gath
er(key= date, value = recover, -country) %>% mutate(date = date %>% substr(2,8) %>% mdy())

preRecoveredData = preRecoveredData %>% group_by(country, date) %>% summarise(recover=sum(recover, na.rm=TRUE), .groups = 'd
rop')%>% as.data.frame()
```

Merge all dataset into single dataset

```
mergeddata <- preConfirmedData %>% merge(preDeathData, all=T) %>% merge(preRecoveredData, all=T)
mergeddata
```

country <chr>	date <date>	Confirmed <int>	death <int>	recover <int>
Afghanistan	2020-01-22	0	0	0
Afghanistan	2020-01-23	0	0	0
Afghanistan	2020-01-24	0	0	0
Afghanistan	2020-01-25	0	0	0
Afghanistan	2020-01-26	0	0	0
Afghanistan	2020-01-27	0	0	0
Afghanistan	2020-01-28	0	0	0
Afghanistan	2020-01-29	0	0	0

country <chr>	date <date>	Confirmed <int>	death <int>	recover <int>
Afghanistan	2020-01-30	0	0	0
Afghanistan	2020-01-31	0	0	0

1-10 of 10,000 rows Previous **1** 2 3 4 5 6 … 1000 Next

```
countries <- mergeddata %>% pull(country) %>% setdiff('Cruise Ship')
```

Find Wolrd confirmed , deaths, recovered cases by date

```
data.world <- mergeddata %>% group_by(date) %>%
summarise(country='World',
confirmed = sum(Confirmed, na.rm=T),
deaths = sum(death, na.rm=T),
recovered = sum(recover, na.rm=T))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
data.world
```

date <date>	country <chr>	confirmed <int>	deaths <int>	recovered <int>
2020-01-22	World	555	17	28
2020-01-23	World	654	18	30
2020-01-24	World	941	26	36
2020-01-25	World	1434	42	39
2020-01-26	World	2118	56	52
2020-01-27	World	2927	82	61

date <date>	country <chr>	confirmed <int>	deaths <int>	recovered <int>
2020-01-28	World	5578	131	107
2020-01-29	World	6167	133	126
2020-01-30	World	8235	171	143
2020-01-31	World	9927	213	222

1-10 of 246 rows Previous **1** 2 3 4 5 6 … 25 Next

Find confirmed case Ranking of all countries

```
countryConfirmedPosition <- mergeddata %>% filter(date == max(date)) %>%
select(country, date,
Confirmed,
recover, death) %>%
mutate(position = dense_rank(desc(Confirmed)))
countryConfirmedPosition
```

country <chr>	date <date>	Confirmed <int>	recover <int>	death <int>	position <int>
Afghanistan	2020-09-23	39145	32610	1446	66
Albania	2020-09-23	12787	7139	370	92
Algeria	2020-09-23	50400	35428	1698	59
Andorra	2020-09-23	1753	1203	53	148
Angola	2020-09-23	4363	1473	159	124
Antigua and Barbuda	2020-09-23	97	92	3	175
Argentina	2020-09-23	664799	525486	14376	10
Armenia	2020-09-23	47877	43026	942	61
Australia	2020-09-23	26980	24448	861	75

country <chr>	date <date>	Confirmed <int>	recover <int>	death <int>	position <int>
Austria	2020-09-23	39984	30949	777	64

1-10 of 189 rows Previous **1** 2 3 4 5 6 … 19 Next

Sort by Ranking

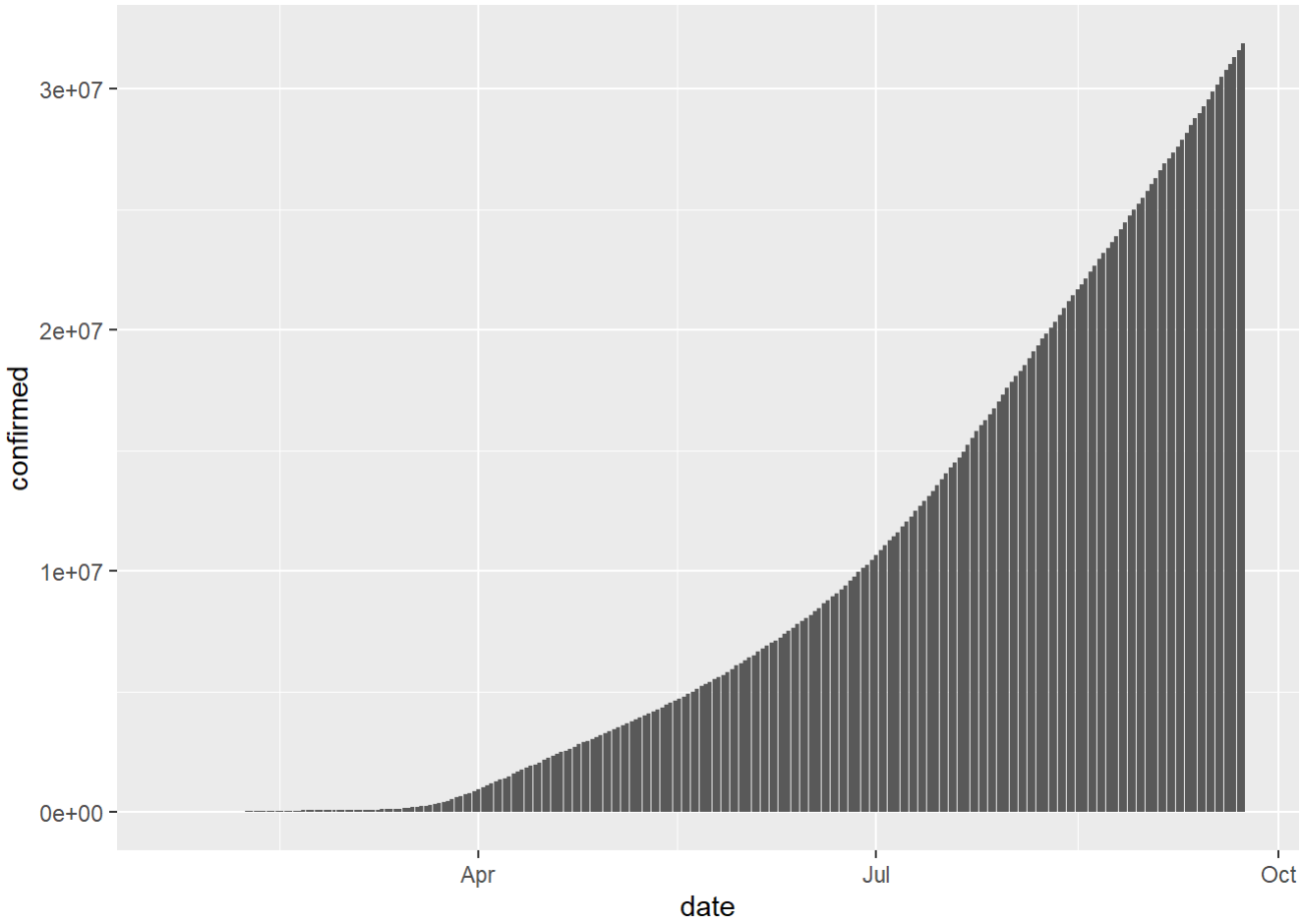
```
countryConfirmedPosition <- countryConfirmedPosition %>% arrange(position)
countryConfirmedPosition
```

country <chr>	date <date>	Confirmed <int>	recover <int>	death <int>	position <int>
US	2020-09-23	6940214	2670256	201885	1
India	2020-09-23	5732518	4674987	91149	2
Brazil	2020-09-23	4591364	4046827	138105	3
Russia	2020-09-23	1117487	920602	19720	4
Colombia	2020-09-23	784268	662277	24746	5
Peru	2020-09-23	776546	636489	31568	6
Mexico	2020-09-23	710049	601611	74949	7
Spain	2020-09-23	693556	150376	31034	8
South Africa	2020-09-23	665188	594229	16206	9
Argentina	2020-09-23	664799	525486	14376	10

1-10 of 189 rows Previous **1** 2 3 4 5 6 … 19 Next

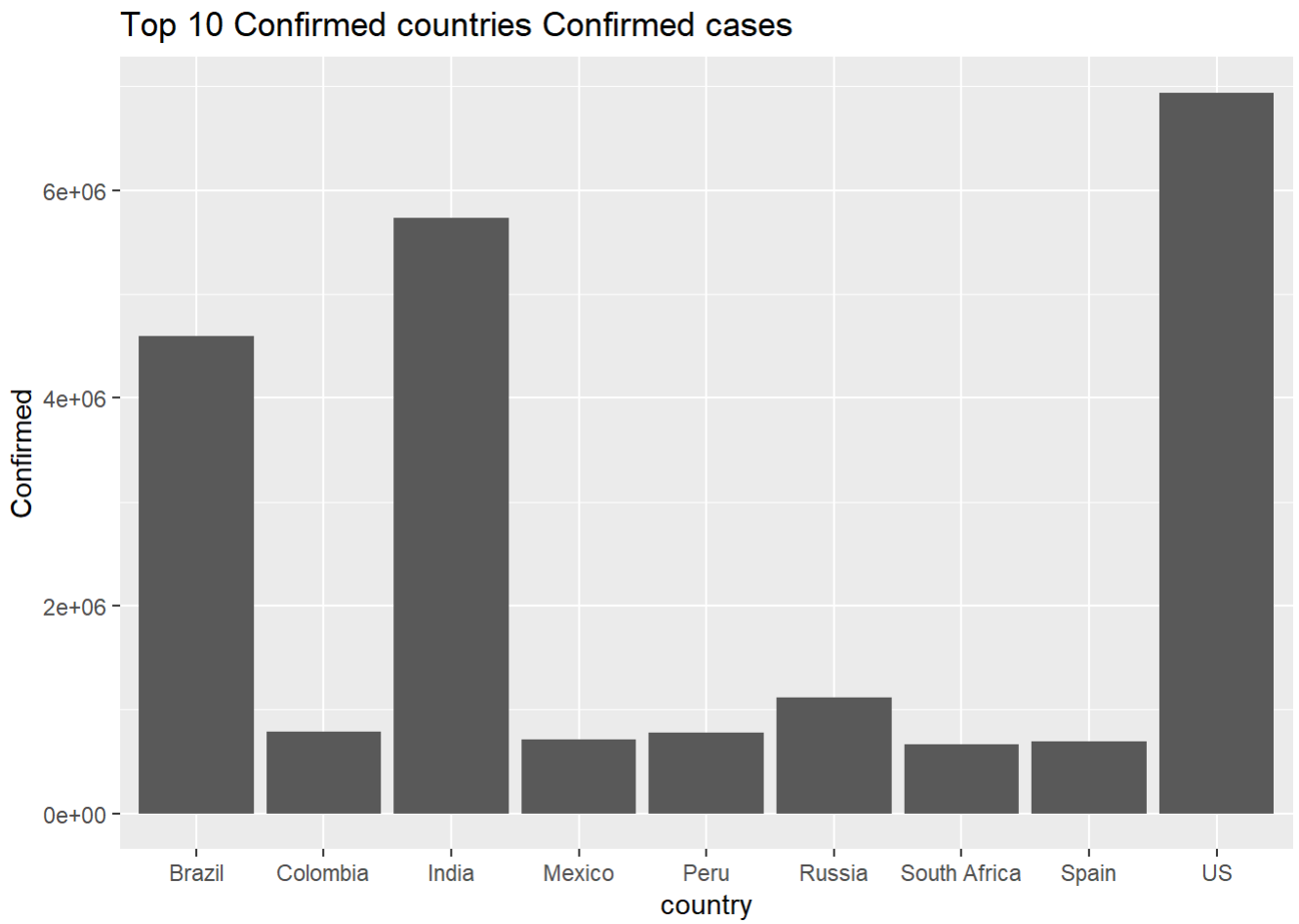
Plot world confirmed bar chart

```
ggplot(data.world, aes(x=date, y=confirmed)) +
geom_bar(stat='identity')
```



Plot TOP 10 Confirmed countries with count

```
countryConfirmedPosition %>% filter(position<10) %>%
ggplot(aes(x=country, y=Confirmed)) +
geom_bar(stat='identity')+
ggtitle("Top 10 Confirmed countries Confirmed cases")
```



convert from wide to long format

```
data.long<- mergeddata %>%
select(c(country, date, Confirmed, recover, death)) %>%
gather(key=type, value=count, -c(country, date))


data.long
```

country	date	type	count
<chr>	<date>	<chr>	<int>

country <chr>	date <date>	type <chr>	count <int>
Afghanistan	2020-01-22	Confirmed	0
Afghanistan	2020-01-23	Confirmed	0
Afghanistan	2020-01-24	Confirmed	0
Afghanistan	2020-01-25	Confirmed	0
Afghanistan	2020-01-26	Confirmed	0
Afghanistan	2020-01-27	Confirmed	0
Afghanistan	2020-01-28	Confirmed	0
Afghanistan	2020-01-29	Confirmed	0
Afghanistan	2020-01-30	Confirmed	0
Afghanistan	2020-01-31	Confirmed	0

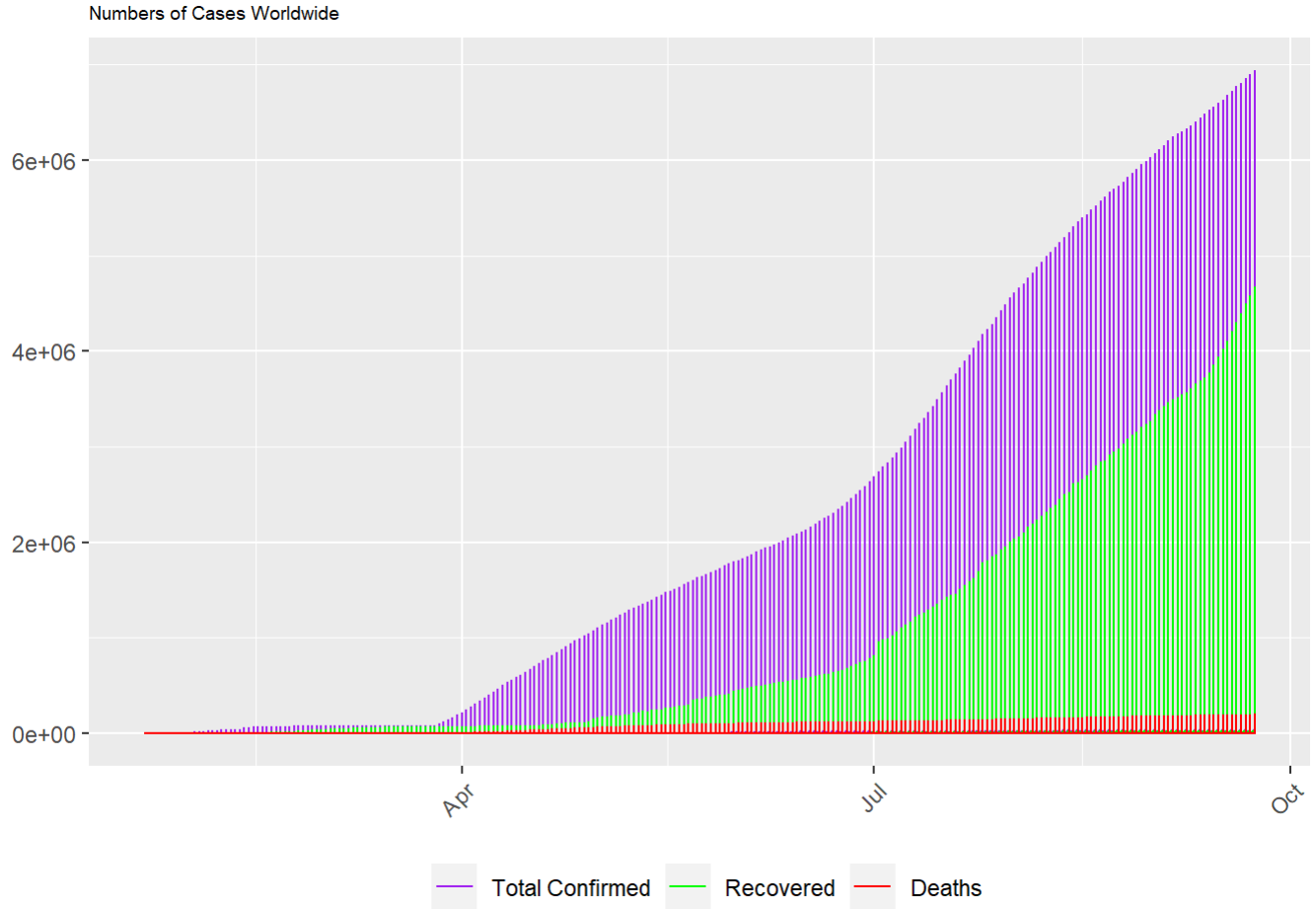
1-10 of 10,000 rows Previous **1** 2 3 4 5 6 … 1000 Next

Convert type column to factor

```
data.long <-data.long %>% mutate(type=recode_factor(type, Confirmed='Total Confirmed',
recover='Recovered',
death='Deaths'))
```

Plot a graph number of cases worldwide

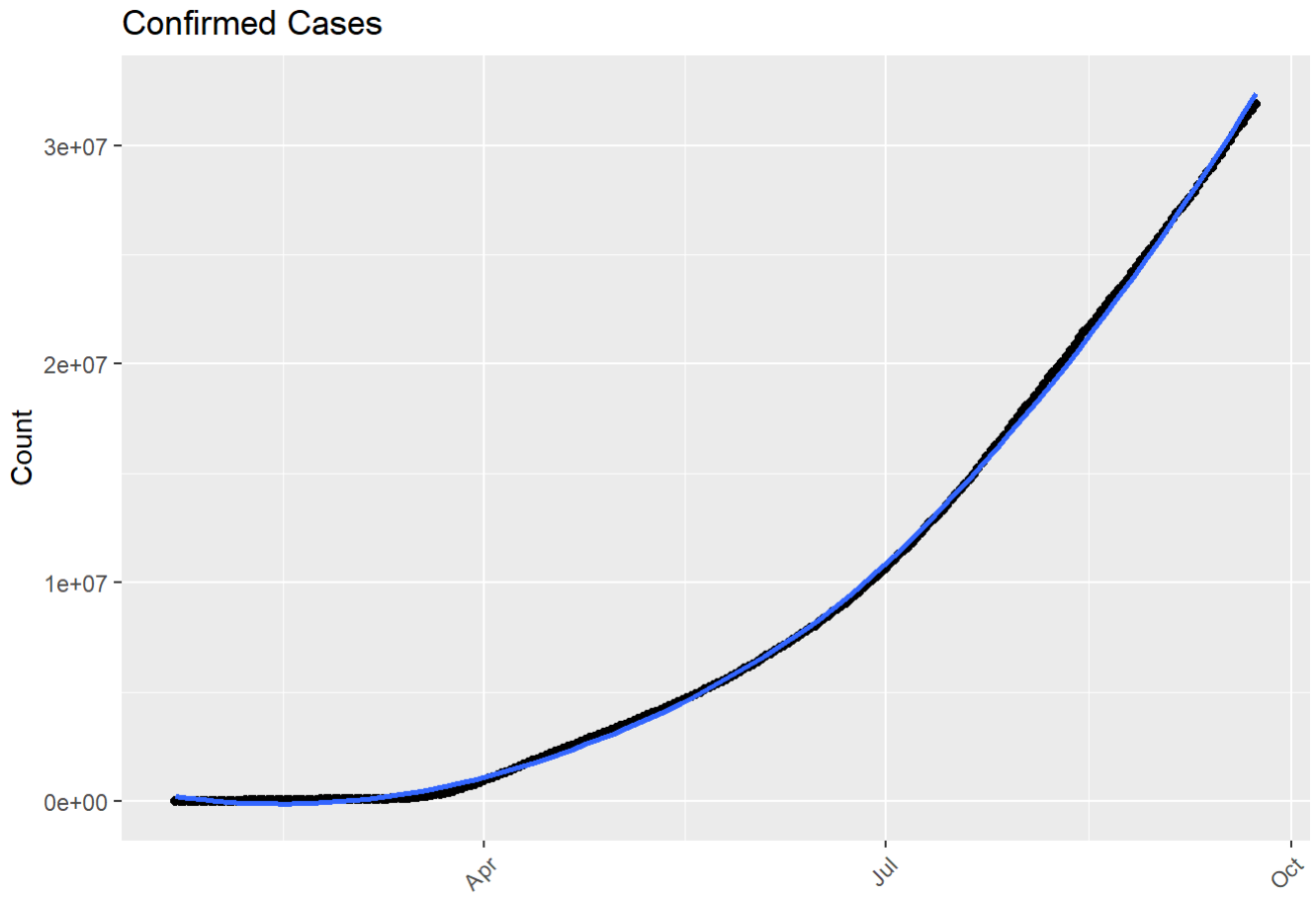
```
data.long %>%
ggplot(aes(x=date, y=count)) +
geom_line(aes(color=type)) +
labs(title=paste0('Numbers of Cases Worldwide')) +
scale_color_manual(values=c('purple','green','red')) +
theme(legend.title=element_blank(), legend.position='bottom',
plot.title = element_text(size=7),
axis.title.x=element_blank(),
axis.title.y=element_blank(),
axis.text.x=element_text(angle=45, hjust=1))
```



Plot world confirmed case graph by dates

```
ggplot(data.world, aes(x=date, y=confirmed)) +
geom_point() + geom_smooth() +
xlab('') + ylab('Count') + labs(title='Confirmed Cases') +
theme(axis.text.x=element_text(angle=45, hjust=1))
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```



find Top 10 covid confirmed countries

```
data.top10 <-countryConfirmedPosition %>% filter(position<10) %>%select(c(country, Confirmed, death, recover))
data.top10
```

country <chr>	Confirmed <int>	death <int>	recover <int>
US	6940214	201885	2670256
India	5732518	91149	4674987
Brazil	4591364	138105	4046827
Russia	1117487	19720	920602
Colombia	784268	24746	662277
Peru	776546	31568	636489
Mexico	710049	74949	601611
Spain	693556	31034	150376
South Africa	665188	16206	594229

9 rows

Convert wide to long

```
data.top10.long <- data.top10 %>%
gather(key=type, value=count, -country)
data.top10.long
```

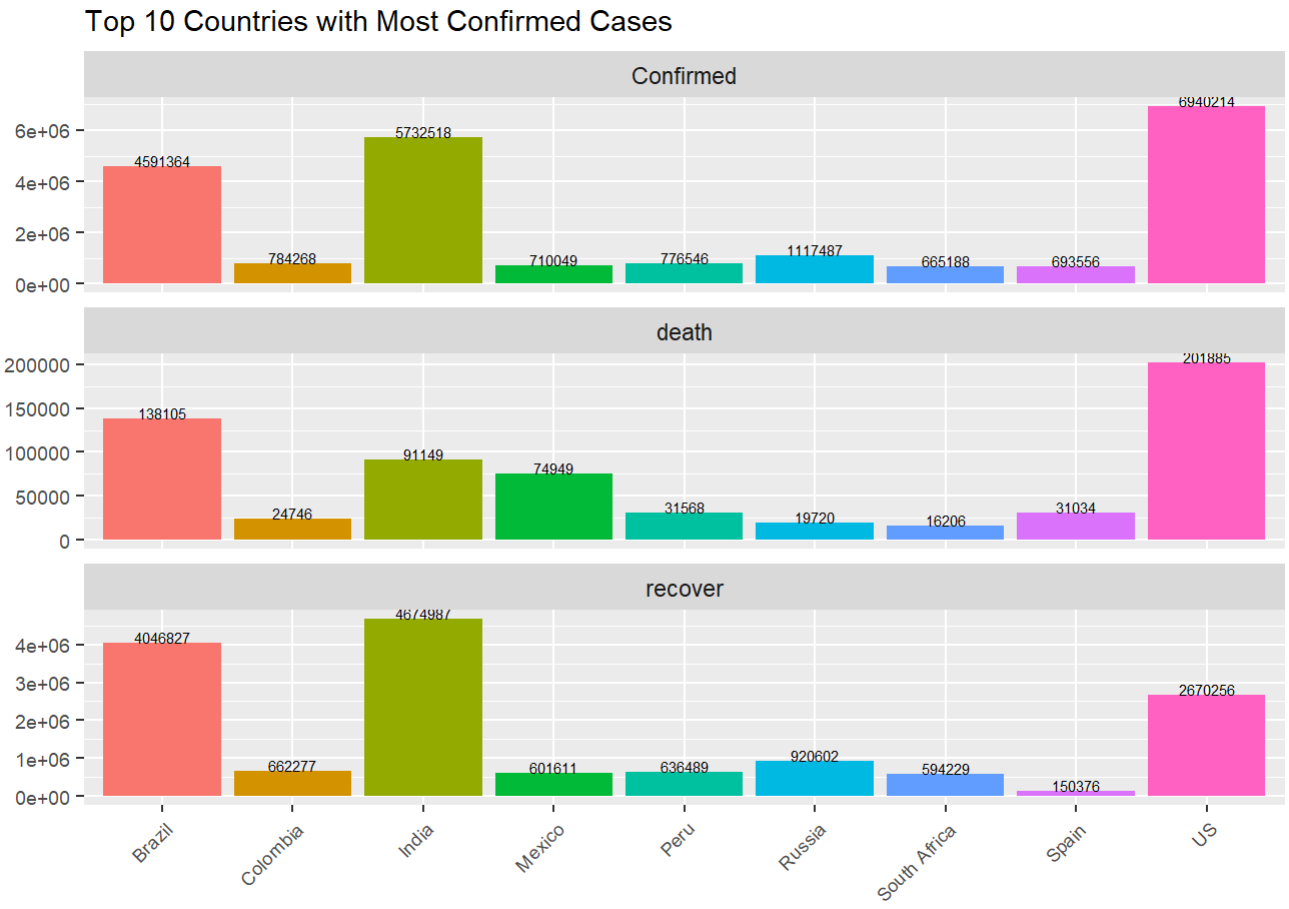
country <chr>	type <chr>	count <int>
US	Confirmed	6940214
India	Confirmed	5732518
Brazil	Confirmed	4591364

country <chr>	type <chr>	count <int>
Russia	Confirmed	1117487
Colombia	Confirmed	784268
Peru	Confirmed	776546
Mexico	Confirmed	710049
Spain	Confirmed	693556
South Africa	Confirmed	665188
US	death	201885

1-10 of 27 rows Previous **1** 2 3 Next

Drow Top 10 countries confirmed, death, recovered graph

```
## bar chart
data.top10.long %>% ggplot(aes(x=country, y=count, fill=country, group=country)) +
geom_bar(stat='identity') +
geom_text(aes(label=count, y=count), size=2, vjust=0) +
xlab('') + ylab('') +
labs(title=paste0('Top 10 Countries with Most Confirmed Cases')) +
scale_fill_discrete(name='Country', labels=aes(count)) +
theme(legend.title=element_blank(),
legend.position='none',
plot.title=element_text(size=11),
axis.text=element_text(size=7),
axis.text.x=element_text(angle=45, hjust=1)) +
facet_wrap(~type, ncol=1, scales='free_y')
```



World Map with Covid confirmed cases

```
library(leaflet)

lat<-median(raw_data_confirmed$Lat)
lon<-median(raw_data_confirmed$Long)

raw_data_confirmed %>%
  leaflet(options = leafletOptions(dragging = TRUE))  %>%
  addTiles()%>%
  addCircleMarkers(raw_data_confirmed$Long,raw_data_confirmed$Lat,color='red', fillOpacity=0.3, radius=0.003*sqrt(raw_data_c
onfirmed$X9.23.20), popup=~paste0(Province.State , Country.Region ,"<br/> Total confirmed case : ", X9.23.20))
```