DPA Project

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```
library(readxl)

WaterQualityData=data.frame()


for (x in 2017:2021) {
  path="C:/Users/SRINU/Desktop/DPA Project/WQ_"
  file=as.character(x)
  filetype=".xlsx"
  finalPath=paste(path,file,filetype,sep="")
  DataByYear=read_excel(finalPath)
  DataByYear=DataByYear[-1:-2,]
  DataByYear=data.frame(DataByYear,x)
  WaterQualityData=rbind(WaterQualityData,DataByYear)
}


colnames(WaterQualityData) =c('StateCode','StationName','State','TemperatureMin','TemperatureMax','Diss
```

```
library(readxl)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

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

```
library(zoo)
```

```
##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```r
AirQualityDataFrame=data.frame()

for (x in 2017:2019) {
  path="C:/Users/SRINU/Desktop/DPA Project/AQ_"
  file=as.character(x)
  filetype=".xlsx"
# Specify the Excel file path
file_path = paste(path,file,filetype,sep="")

# Read all sheet names from the Excel file
sheet_names = excel_sheets(file_path)

# Create an empty list to store data frames
all_sheets = list()

# Loop through all sheet names
for (sheet_name in sheet_names) {
  # Read the sheet into a data frame
  sheet_df = read_excel(file_path, sheet = sheet_name, range = NULL)

  # Check if the sheet is not blank (i.e., has rows and columns)
  if (!is.null(dim(sheet_df))) {
    measure=sheet_df[1,]

    sheet_df$measure=paste(na.omit(unlist(measure)), collapse = ", ")
    sheet_df = sheet_df[-c(1, 2), ]
    sheet_df = na.locf(sheet_df, na.rm = FALSE)
    sheet_df$year=as.character(x)

    #colnames(sheet_df)=c('State','City','Location','MonitoringDays','Min','Max','Average','measure','y
    # Add the data frame to the list of all sheets
    all_sheets[[sheet_name]] = sheet_df
  }
}

# Combine all non-blank sheets into a single data frame
merged_df = bind_rows(all_sheets)


AirQualityDataFrame=rbind(AirQualityDataFrame,merged_df)

}

colnames(AirQualityDataFrame)=c('State','City','Location','MonitoringDays','Min','Max','Average','measu


library(dplyr)

AirQualityDataFrame = AirQualityDataFrame %>%
  mutate(measure = case_when(
    measure == "PM_{2.5} Concentration in µg/m^{3}" ~ "PM2.5",
    measure == "PM_{10} Concentration in µg/m^{3}" ~ "PM10",
    measure == "NO_{2} Concentration in µg/m^{3}" ~ "NO2",
```

```
    measure == "SO_{2} Concentration in µg/m^{3}" ~ "SO2",
    measure =="State, SO_{2} Concentration in µg/m^{3}"~"SO2",
    measure =="PM_{10} concentrationµg/m^{3}"~"PM10",
    measure =="NO_{2} concentration in µg/m^{3}"~"NO2",
    measure =="PM_{2.5} concentration µg/m^{3}"~"PM2.5"
  ))


library(dplyr)


# Convert Average column to numeric data type
AirQualityDataFrame$Average = as.integer(AirQualityDataFrame$Average)

# Aggregate data by year, state, city, and measure
agg_AirQualityDataFrame = AirQualityDataFrame %>%
  group_by(year, State, City, measure) %>%
  summarize(Mean = mean(Average), .groups = "drop")


library(tidyr)

# Pivot the Type column into new columns
agg_AirQualityDataFrame = pivot_wider(agg_AirQualityDataFrame, names_from = measure, values_from = Mean

agg_AirQualityDataFrames=agg_AirQualityDataFrame[agg_AirQualityDataFrame$year==2017,]
```

```
library(dplyr)


# Group the data by year and calculate the mean of the PM10 column for each year
means_by_year = agg_AirQualityDataFrames %>%
  group_by(year) %>%
  summarize(mean_PM10 = mean(PM10, na.rm = TRUE))

# Join the means back to the original data frame by year
agg_AirQualityDataFrame_filled = left_join(agg_AirQualityDataFrames, means_by_year, by = "year")

# Fill missing PM10s in the PM10 column with the mean PM10 by year
agg_AirQualityDataFrame_filled$PM10[is.na(agg_AirQualityDataFrame_filled$PM10)] = agg_AirQualityDataFra

means_by_year = agg_AirQualityDataFrame_filled %>%
  group_by(year) %>%
  summarize(mean_NO2 = mean(NO2, na.rm = TRUE))

# Join the means back to the original data frame by year
agg_AirQualityDataFrame_filled = left_join(agg_AirQualityDataFrame_filled, means_by_year, by = "year")

# Fill missing NO2s in the NO2 column with the mean NO2 by year
agg_AirQualityDataFrame_filled$NO2[is.na(agg_AirQualityDataFrame_filled$NO2)] = agg_AirQualityDataFrame_


means_by_year = agg_AirQualityDataFrame_filled %>%
```

```
  group_by(year) %>%
  summarize(mean_SO2 = mean(SO2,na.rm = TRUE))

# Join the means back to the original data frame by year
agg_AirQualityDataFrame_filled = left_join(agg_AirQualityDataFrame_filled, means_by_year, by = "year")

# Fill missing SO2s in the SO2 column with the mean SO2 by year
agg_AirQualityDataFrame_filled$SO2[is.na(agg_AirQualityDataFrame_filled$SO2)] = agg_AirQualityDataFrame_

means_by_year = agg_AirQualityDataFrame_filled %>%
  group_by(year) %>%
  summarize(mean_PM2.5 = mean(PM2.5, na.rm = TRUE))

# Join the means back to the original data frame by year
agg_AirQualityDataFrame_filled = left_join(agg_AirQualityDataFrame_filled, means_by_year, by = "year")

# Fill missing PM2.5s in the PM2.5 column with the mean PM2.5 by year
agg_AirQualityDataFrame_filled$PM2.5[is.na(agg_AirQualityDataFrame_filled$PM2.5)] = agg_AirQualityDataF

AirQualityDF=agg_AirQualityDataFrame_filled[,c(-8,-9,-10,-11)]
```

```
library(readxl)

AQ_2021 = read_excel("C:/Users/SRINU/Desktop/DPA Project/AQ_2021.xlsx")

AQ_2021=AQ_2021[-1:-2,]

AQ_2021$year='2021'

AQ_2021 = AQ_2021[, c(7,1,2,3,4,5,6)]

AQ_2021[AQ_2021 == "-"] = NA


colnames(AQ_2021)=c('year','State','City','SO2','PM2.5','NO2','PM10')

AQ_2021$SO2     =as.numeric(AQ_2021$SO2)
AQ_2021$PM2.5   =as.numeric(AQ_2021$PM2.5)
AQ_2021$NO2     =as.numeric(AQ_2021$PM2.5)
AQ_2021$PM10    =as.numeric(AQ_2021$PM10)


AQ_2021$SO2[is.na(AQ_2021$SO2)] = mean(AQ_2021$SO2, na.rm = TRUE)
AQ_2021$PM10[is.na(AQ_2021$PM10)] = mean(AQ_2021$PM10, na.rm = TRUE)
AQ_2021$PM2.5[is.na(AQ_2021$PM2.5)] = mean(AQ_2021$PM2.5, na.rm = TRUE)
AQ_2021$NO2[is.na(AQ_2021$NO2)] = mean(AQ_2021$NO2, na.rm = TRUE)



AQ_2021 = AQ_2021[, c("year","State","City","NO2","PM10","SO2","PM2.5")]


AirQualityDataset = rbind(AirQualityDF, AQ_2021)
```

```r
library(stringr)
```

```r
View(WaterQualityData)
```

```r
WaterQualityData$StationName = ifelse(grepl("AT", WaterQualityData$StationName), sub(".*AT\\s+(\\w+).*"
```

```r
WaterQualityData$StationName = ifelse(grepl(",", WaterQualityData$StationName), sub(".+,\\s*(\\S+)$", "
```

```r
names(WaterQualityData)[2] = "City"
```

```r
WaterQualityData
```

```
##        StateCode
## 1           1448
## 2           2352
## 3           1393
## 4           2459
## 5           2460
## 6           2461
## 7           2462
## 8           2463
## 9           2464
## 10          2465
## 11          2466
## 12          1399
## 13          1400
## 14          1475
## 15          1476
## 16          1543
## 17          1544
## 18          1545
## 19          1546
## 20          1547
## 21          1548
## 22          2270
## 23          2271
## 24          2272
## 25          2273
## 26          2274
## 27          2275
## 28          2276
## 29          3181
## 30          3182
## 31          3183
## 32          3184
## 33          3190
## 34          3191
## 35          1148
## 36          1149
## 37          1150
```

```
## 38            1246
## 39            1434
## 40            1435
## 41            1436
## 42            1438
## 43            1860
## 44            1861
## 45            1862
## 46            1865
## 47            1980
## 48            2072
## 49            2082
## 50            3204
## 51            3205
## 52            1025
## 53            1026
## 54            1884
## 55            1885
## 56            1887
## 57            1871
## 58            2624
## 59            2625
## 60            3862
## 61            3863
## 62            3864
## 63            1444
## 64            1892
## 65            1894
## 66            2780
## 67            3562
## 68            3563
## 69              17
## 70              18
## 71              20
## 72              21
## 73              42
## 74              43
## 75            1154
## 76            1155
## 77            1156
## 78            1338
## 79            1339
## 80            1340
## 81            1341
## 82            1342
## 83            1384
## 84            1442
## 85            1443
## 86            1563
## 87            1564
## 88            1565
## 89            1566
## 90            1567
## 91            1568
```

```
## 92            1569
## 93            1570
## 94            1571
## 95            1572
## 96            1573
## 97            2284
## 98            2285
## 99            2286
## 100           2287
## 101           2288
## 102           2289
## 103           2290
## 104           2291
## 105           2292
## 106           2293
## 107           2294
## 108           2295
## 109           2296
## 110           2297
## 111           2298
## 112           2299
## 113           2300
## 114           2301
## 115           2302
## 116           2303
## 117           2304
## 118           2305
## 119           2306
## 120           2307
## 121           2319
## 122           2326
## 123           2331
## 124           2332
## 125           2333
## 126           2334
## 127           2335
## 128           2336
## 129           2337
## 130           2338
## 131           3458
## 132           3459
## 133           3460
## 134           3464
## 135           3465
## 136           3466
## 137           3468
## 138           3471
## 139           3473
## 140           1092
## 141           1093
## 142           1094
## 143           1151
## 144           1152
## 145           1461
```

```
## 146            1462
## 147            2162
## 148            2164
## 149            2168
## 150            2198
## 151            2199
## 152            2651
## 153            2653
## 154            2654
## 155            2670
## 156            2671
## 157            2672
## 158            2676
## 159            2685
## 160            2686
## 161            2687
## 162            2688
## 163            2689
## 164            2696
## 165            2701
## 166            2702
## 167            2703
## 168            2704
## 169            2706
## 170            2707
## 171            2708
## 172            2709
## 173            2712
## 174            2713
## 175            2714
## 176            1424
## 177            1457
## 178            1458
## 179            1624
## 180            1625
## 181            1626
## 182            1627
## 183            1628
## 184            1925
## 185            1926
## 186            1927
## 187            2852
## 188            2855
## 189            2856
## 190            2857
## 191            2858
## 192            2859
## 193            2860
## 194            2861
## 195            2862
## 196            2863
## 197            2864
## 198            2867
## 199            2868
```

```
## 200           2870
## 201           2872
## 202           2873
## 203           2874
## 204           2876
## 205           2877
## 206           2878
## 207           2879
## 208           2880
## 209           1427
## 210           1428
## 211           1631
## 212           1632
## 213           1633
## 214           3350
## 215           3351
## 216           3352
## 217           3353
## 218           3354
## 219           3355
## 220           3356
## 221           3357
## 222           3358
## 223           3359
## 224           3360
## 225           3361
## 226           3362
## 227           3363
## 228           3364
## 229           3365
## 230           3366
## 231           3375
## 232           3376
## 233           3379
## 234           3383
## 235           3384
## 236           2442
## 237           2443
## 238           2444
## 239           2445
## 240           1023
## 241           1024
## 242           1295
## 243           1473
## 244           1698
## 245           1699
## 246           1700
## 247           1701
## 248           1702
## 249           1703
## 250           1704
## 251           1705
## 252           2914
## 253           2947
```

```
## 254             2948
## 255             2949
## 256             1159
## 257             1160
## 258             1161
## 259             1162
## 260             1328
## 261             1329
## 262             1330
## 263             3025
## 264             3026
## 265             3027
## 266             3028
## 267             3029
## 268             1403
## 269             1404
## 270             1726
## 271             3397
## 272             3398
## 273             3399
## 274             3400
## 275             3401
## 276             3402
## 277             3403
## 278             3404
## 279             3405
## 280             3406
## 281             3407
## 282             3408
## 283             3409
## 284             3410
## 285             3411
## 286             3412
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## 293             3422
## 294             1448
## 295             2352
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## 297             2459
## 298             2460
## 299             2461
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## 301             2463
## 302             2464
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## 308          1476
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## 348          1025
## 349          1026
## 350          1884
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## 352          1887
## 353          1444
## 354          2780
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## 361            42
```

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## 362              43
## 363            1154
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## 365            1156
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## 370            1342
## 371            1384
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## 414            2334
## 415            2335
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## 416            2336
## 417            2337
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## 421            3460
## 422            3464
## 423            3465
## 424            3466
## 425            3468
## 426            3471
## 427            3473
## 428           10016
## 429           10017
## 430            1461
## 431            1462
## 432            1424
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## 434            1458
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## 437            1626
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## 439            1628
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## 442            1927
## 443            2852
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## 468            3350
## 469            3351
```

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## 470              3352
## 471              3353
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## 477              3359
## 478              3360
## 479              3361
## 480              3362
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## 482              3364
## 483              3365
## 484              3366
## 485              3375
## 486              3376
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## 491              1456
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## 500              1685
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## 502              2443
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## 504              2445
## 505              1023
## 506              1024
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## 508              1473
## 509              1698
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## 511              1700
## 512              1701
## 513              1702
## 514              1703
## 515              1704
## 516              1705
## 517              2914
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## 521              2947
## 522              2948
## 523              2949
```

```
## 524              4171
## 525              1159
## 526              1160
## 527              1161
## 528              1162
## 529              1328
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## 531              1330
## 532              1450
## 533              3025
## 534              3026
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## 536              3028
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## 538              1403
## 539              1404
## 540              1726
## 541              3397
## 542              3398
## 543              3399
## 544              3400
## 545              3401
## 546              3402
## 547              3403
## 548              3404
## 549              3405
## 550              3406
## 551              3407
## 552              3408
## 553              3409
## 554              3410
## 555              3411
## 556              3412
## 557              3413
## 558              3414
## 559              3415
## 560              3416
## 561              3420
## 562              3421
## 563              3422
## 564              4358
## 565              1448
## 566              4346
## 567              4347
## 568              4348
## 569              4351
## 570              4390
## 571              4357
## 572              4379
## 573              2352
## 574              4369
## 575              3760
## 576              3765
## 577              3785
```

```
## 578          3789
## 579          3820
## 580          3807
## 581          3821
## 582          3777
## 583          3763
## 584          3787
## 585          3788
## 586          3768
## 587          3791
## 588          3812
## 589          3799
## 590          3796
## 591          3810
## 592          3803
## 593          3783
## 594          3800
## 595          3782
## 596          3767
## 597          3808
## 598          3811
## 599          3798
## 600          3780
## 601          3814
## 602          3819
## 603          3774
## 604          3775
## 605          3784
## 606          3773
## 607          4405
## 608          4399
## 609          4400
## 610          4401
## 611         30017
## 612         30018
## 613         30020
## 614         30019
## 615         30008
## 616          1393
## 617          2459
## 618          2460
## 619          2461
## 620          2462
## 621          2463
## 622          2464
## 623          2465
## 624          2466
## 625          1548
## 626          2276
## 627          4410
## 628          2275
## 629          1543
## 630          1546
## 631          2270
```

```
## 632          2272
## 633          1545
## 634          1400
## 635          1476
## 636         10012
## 637          2274
## 638          2271
## 639          2273
## 640          3183
## 641          3184
## 642          4409
## 643          3190
## 644          3191
## 645          1547
## 646          1544
## 647          1399
## 648          1475
## 649          3181
## 650          3182
## 651          1148
## 652          1434
## 653          1980
## 654          1860
## 655          1436
## 656          1150
## 657          1246
## 658          1865
## 659          4420
## 660          1862
## 661          1149
## 662          1438
## 663          1435
## 664          1861
## 665          4423
## 666          2082
## 667          3204
## 668          3205
## 669          1025
## 670          1026
## 671          1884
## 672          1885
## 673          1887
## 674          4464
## 675          4465
## 676          4036
## 677          4023
## 678          4024
## 679          1871
## 680          2624
## 681          2625
## 682          3862
## 683          3863
## 684          3864
## 685          4025
```

```
## 686                4026
## 687                4038
## 688                4076
## 689                4079
## 690                4081
## 691                4742
## 692                4753
## 693                4754
## 694                4738
## 695                4739
## 696                4745
## 697                4747
## 698                4756
## 699                4499
## 700                4500
## 701                1444
## 702                2780
## 703                4497
## 704                1894
## 705                1892
## 706                3562
## 707                3563
## 708                1342
## 709                1443
## 710                3465
## 711                3466
## 712                2297
## 713                2319
## 714                2286
## 715                2331
## 716                2332
## 717                1154
## 718                  20
## 719                  21
## 720                3464
## 721                1572
## 722                1573
## 723                2295
## 724                1564
## 725                2287
## 726                1566
## 727                2293
## 728                2337
## 729                2338
## 730                  42
## 731                2294
## 732                3460
## 733                3458
## 734                1571
## 735                1155
## 736                3471
## 737                2289
## 738                2301
## 739                2291
```

```
## 740            2326
## 741            1569
## 742            2298
## 743            1567
## 744            1568
## 745            2285
## 746            1340
## 747            1384
## 748            3459
## 749            2307
## 750            1339
## 751            2304
## 752              43
## 753            1570
## 754            2302
## 755            1563
## 756            2284
## 757            2288
## 758            1341
## 759            1565
## 760           10016
## 761           10017
## 762            1156
## 763              17
## 764              18
## 765            1338
## 766            2333
## 767            2334
## 768            2335
## 769            2336
## 770            3468
## 771            2300
## 772            2303
## 773            2290
## 774            2299
## 775            2305
## 776            2296
## 777            2292
## 778            2306
## 779            3473
## 780            1442
## 781            4620
## 782            4619
## 783            4611
## 784            4613
## 785            4624
## 786            4606
## 787            4621
## 788            4612
## 789            4609
## 790            2651
## 791            1461
## 792            2653
## 793            2654
```

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## 794                1092
## 795                2670
## 796                1152
## 797                2198
## 798                2671
## 799                2672
## 800                2168
## 801                2676
## 802                1151
## 803                1462
## 804                2685
## 805                2686
## 806                2687
## 807                2688
## 808                2689
## 809                2696
## 810                2199
## 811                2701
## 812                2702
## 813                2703
## 814                2704
## 815                2706
## 816                2707
## 817                2708
## 818                2709
## 819                1093
## 820                1094
## 821                2162
## 822                2712
## 823                2164
## 824                2713
## 825                2714
## 826                1424
## 827                1457
## 828                1627
## 829                1628
## 830                2861
## 831                2862
## 832                2864
## 833                2874
## 834                1458
## 835                1624
## 836                2863
## 837                2873
## 838                1925
## 839                2877
## 840                1926
## 841                2878
## 842                2867
## 843                2852
## 844                2857
## 845                2879
## 846                1625
## 847                1626
```

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## 848            2858
## 849            2859
## 850            2860
## 851            2880
## 852            1927
## 853            2856
## 854            2870
## 855            2872
## 856            2855
## 857            2876
## 858            3383
## 859            3384
## 860            1632
## 861            4112
## 862            1428
## 863            3375
## 864            3376
## 865            1631
## 866            3379
## 867            1633
## 868            4111
## 869            4326
## 870            3353
## 871            3354
## 872            3355
## 873            3356
## 874            3350
## 875            3351
## 876            3352
## 877            3359
## 878            3360
## 879            3361
## 880            3362
## 881            3357
## 882            3358
## 883            3363
## 884            3364
## 885            3365
## 886            1427
## 887            3366
## 888            2444
## 889            2442
## 890            2443
## 891            2445
## 892            1023
## 893            1024
## 894            1295
## 895            1473
## 896            1698
## 897            1699
## 898            1700
## 899            1701
## 900            1702
## 901            1703
```

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## 902          1704
## 903          1705
## 904          4159
## 905          4160
## 906          4162
## 907          2948
## 908          2947
## 909          2949
## 910          1450
## 911          1159
## 912          1160
## 913          1161
## 914          1162
## 915          1328
## 916          1329
## 917          1330
## 918          3025
## 919          3026
## 920          3027
## 921          3028
## 922          3029
## 923         10062
## 924          3405
## 925          3422
## 926          3414
## 927          3415
## 928          3416
## 929          3410
## 930          3411
## 931          1403
## 932          1404
## 933          3406
## 934          3407
## 935          3408
## 936          3409
## 937          1726
## 938          3397
## 939          3401
## 940          3402
## 941          3403
## 942          3421
## 943          3398
## 944          3399
## 945          3400
## 946          3404
## 947          3420
## 948          3412
## 949          3413
## 950  STN\r\nCode
## 951          1448
## 952          2352
## 953          4346
## 954          4347
## 955          4348
```

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## 956             4351
## 957             4379
## 958             4390
## 959             4922
## 960             3760
## 961             3763
## 962             3765
## 963             3767
## 964             3768
## 965             3773
## 966             3774
## 967             3775
## 968             3777
## 969             3780
## 970             3782
## 971             3783
## 972             3784
## 973             3786
## 974             3788
## 975             3791
## 976             3796
## 977             3799
## 978             3803
## 979             3807
## 980             3810
## 981             3811
## 982             4399
## 983             4400
## 984             4401
## 985             4405
## 986             1393
## 987             2459
## 988             2460
## 989             2461
## 990             2462
## 991             2463
## 992             2464
## 993             2465
## 994             2466
## 995            30040
## 996             1399
## 997             1400
## 998             1475
## 999             1476
## 1000            1543
## 1001            1544
## 1002            1545
## 1003            1546
## 1004            1547
## 1005            1548
## 1006            2270
## 1007            2271
## 1008            2272
## 1009            2273
```

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## 1010           2274
## 1011           2275
## 1012           2276
## 1013           3181
## 1014           3182
## 1015           3183
## 1016           3184
## 1017           3190
## 1018           3191
## 1019           4409
## 1020           4410
## 1021          10012
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## 1023           1149
## 1024           1150
## 1025           1246
## 1026           1434
## 1027           1435
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## 1029           1438
## 1030           1860
## 1031           1861
## 1032           1862
## 1033           1865
## 1034           1980
## 1035           2072
## 1036           2082
## 1037           3204
## 1038           3205
## 1039          30039
## 1040           1025
## 1041           1026
## 1042           1884
## 1043           1885
## 1044           1887
## 1045          30007
## 1046          30014
## 1047          30017
## 1048          30018
## 1049          30020
## 1050           1871
## 1051           2624
## 1052           2625
## 1053           3862
## 1054           3864
## 1055           4023
## 1056           4024
## 1057           4025
## 1058           4026
## 1059           4027
## 1060           4028
## 1061           4036
## 1062           4037
## 1063           4038
```

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## 1064         4039
## 1065         4464
## 1066         4465
## 1067         4469
## 1068         4470
## 1069         4471
## 1070         4479
## 1071        30008
## 1072        30013
## 1073         4490
## 1074         4738
## 1075         4739
## 1076         4742
## 1077         4745
## 1078         4747
## 1079         4753
## 1080         4754
## 1081         1444
## 1082         1892
## 1083         1894
## 1084         2780
## 1085         3562
## 1086         3563
## 1087         4087
## 1088         4088
## 1089         4089
## 1090         4090
## 1091         4091
## 1092         4497
## 1093         4499
## 1094         4500
## 1095           17
## 1096           18
## 1097           20
## 1098           21
## 1099           42
## 1100           43
## 1101         1154
## 1102         1155
## 1103         1156
## 1104         1338
## 1105         1339
## 1106         1340
## 1107         1341
## 1108         1342
## 1109         1384
## 1110         1442
## 1111         1443
## 1112         1563
## 1113         1564
## 1114         1565
## 1115         1566
## 1116         1567
## 1117     Dsf;s;dl
```

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## 1118           1569
## 1119           1570
## 1120           1571
## 1121           1572
## 1122           1573
## 1123           2284
## 1124           2285
## 1125           2286
## 1126           2287
## 1127           2288
## 1128           2289
## 1129           2290
## 1130           2291
## 1131           2292
## 1132           2293
## 1133           2294
## 1134           2295
## 1135           2296
## 1136           2297
## 1137           2298
## 1138           2299
## 1139           2300
## 1140           2301
## 1141           2302
## 1142           2303
## 1143           2304
## 1144           2305
## 1145           2306
## 1146           2307
## 1147           2319
## 1148           2326
## 1149           2331
## 1150           2332
## 1151           2333
## 1152           2334
## 1153           2335
## 1154           2336
## 1155           2337
## 1156           2338
## 1157           3458
## 1158           3459
## 1159           3460
## 1160           3464
## 1161           3465
## 1162           3466
## 1163           3468
## 1164           3471
## 1165           3473
## 1166          10016
## 1167          10017
## 1168           4606
## 1169           4609
## 1170           4611
## 1171           4612
```

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## 1172          4613
## 1173          4616
## 1174          4619
## 1175          4620
## 1176          4621
## 1177          4623
## 1178          4624
## 1179          1092
## 1180          1093
## 1181          1094
## 1182          1151
## 1183          1152
## 1184          1461
## 1185          1462
## 1186          2162
## 1187          2164
## 1188          2168
## 1189          2198
## 1190          2199
## 1191          2651
## 1192          2653
## 1193          2654
## 1194          2670
## 1195          2671
## 1196          2672
## 1197          2676
## 1198          2685
## 1199          2686
## 1200          2687
## 1201          2688
## 1202          2689
## 1203          2696
## 1204          2701
## 1205          2702
## 1206          2703
## 1207          2704
## 1208          2706
## 1209          2707
## 1210          2708
## 1211          2709
## 1212          2712
## 1213          2713
## 1214          2714
## 1215          1424
## 1216          1457
## 1217          1458
## 1218          1624
## 1219          1625
## 1220          1626
## 1221          1627
## 1222          1628
## 1223          1925
## 1224          1926
## 1225          1927
```

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## 1226            2852
## 1227            2855
## 1228            2856
## 1229            2857
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## 1231            2859
## 1232            2860
## 1233            2861
## 1234            2862
## 1235            2863
## 1236            2864
## 1237            2867
## 1238            2870
## 1239            2872
## 1240            2873
## 1241            2876
## 1242            2877
## 1243            2878
## 1244            2879
## 1245            2880
## 1246            1427
## 1247            1428
## 1248            1631
## 1249            1632
## 1250            1633
## 1251            3350
## 1252            3351
## 1253            3352
## 1254            3353
## 1255            3354
## 1256            3355
## 1257            3356
## 1258            3357
## 1259            3358
## 1260            3359
## 1261            3360
## 1262            3361
## 1263            3362
## 1264            3363
## 1265            3364
## 1266            3365
## 1267            3366
## 1268            3375
## 1269            3376
## 1270            3379
## 1271            3383
## 1272            3384
## 1273            4111
## 1274            4112
## 1275            4326
## 1276            2442
## 1277            2443
## 1278            2444
## 1279            2445
```

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## 1280            1023
## 1281            1024
## 1282            1295
## 1283            1473
## 1284            1698
## 1285            1699
## 1286            1700
## 1287            1701
## 1288            1702
## 1289            1703
## 1290            1704
## 1291            1705
## 1292            4159
## 1293            4160
## 1294            4162
## 1295           30015
## 1296           30016
## 1297           30019
## 1298            2947
## 1299            2948
## 1300            2949
## 1301            4790
## 1302            1159
## 1303            1160
## 1304            1161
## 1305            1162
## 1306            1328
## 1307            1329
## 1308            1330
## 1309            1450
## 1310            3025
## 1311            3026
## 1312            3027
## 1313            3028
## 1314            3029
## 1315           10062
## 1316            1403
## 1317            1404
## 1318            1726
## 1319            3397
## 1320            3398
## 1321            3399
## 1322            3400
## 1323            3401
## 1324            3402
## 1325            3403
## 1326            3404
## 1327            3405
## 1328            3406
## 1329            3407
## 1330            3408
## 1331            3409
## 1332            3410
## 1333            3411
```

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## 1334         3412
## 1335         3413
## 1336         3414
## 1337         3415
## 1338         3416
## 1339         3420
## 1340         3421
## 1341         3422
## 1342 STN\r\nCode
## 1343         1448
## 1344         4351
## 1345         4346
## 1346         4347
## 1347         4348
## 1348         2352
## 1349         1393
## 1350         2461
## 1351         2460
## 1352         2463
## 1353         2465
## 1354         2462
## 1355         2466
## 1356         2459
## 1357        30040
## 1358         2464
## 1359         2276
## 1360         3189
## 1361         2275
## 1362         1543
## 1363         2270
## 1364         1546
## 1365         2272
## 1366         1545
## 1367         3185
## 1368         3186
## 1369         1400
## 1370        10012
## 1371         1476
## 1372         3187
## 1373         2274
## 1374         3183
## 1375         3184
## 1376         2273
## 1377         2271
## 1378         1547
## 1379         3188
## 1380         1544
## 1381         3181
## 1382         1399
## 1383         3182
## 1384         1475
## 1385         2081
## 1386         1148
## 1387         1434
```

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## 1388          1980
## 1389          1860
## 1390          1436
## 1391          2072
## 1392         30039
## 1393          1246
## 1394          1150
## 1395          1865
## 1396          1862
## 1397          1149
## 1398          1435
## 1399          1438
## 1400          1861
## 1401          2082
## 1402         30018
## 1403          1885
## 1404          1884
## 1405         30014
## 1406         30017
## 1407          1887
## 1408          1025
## 1409          1026
## 1410         30007
## 1411         30008
## 1412          1871
## 1413          2625
## 1414          3864
## 1415          3862
## 1416          2624
## 1417          1444
## 1418          2780
## 1419          1894
## 1420          3562
## 1421          3563
## 1422          1892
## 1423          1443
## 1424          3465
## 1425          3466
## 1426          1342
## 1427          2319
## 1428          2297
## 1429          2286
## 1430          2331
## 1431          2332
## 1432          1154
## 1433            21
## 1434            20
## 1435          3464
## 1436          1573
## 1437          2295
## 1438          2287
## 1439          1564
## 1440          2293
## 1441          2337
```

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## 1442          2338
## 1443            42
## 1444          2294
## 1445          3460
## 1446          3471
## 1447          1155
## 1448          1571
## 1449          2289
## 1450          2301
## 1451          2291
## 1452          2326
## 1453          2298
## 1454          1569
## 1455          1567
## 1456          1568
## 1457          2285
## 1458          1340
## 1459          1384
## 1460          3459
## 1461          2307
## 1462          1339
## 1463          2304
## 1464            43
## 1465          2302
## 1466          1570
## 1467          1563
## 1468          2284
## 1469          2288
## 1470          1156
## 1471          1341
## 1472         10017
## 1473          1565
## 1474         10016
## 1475            18
## 1476          2335
## 1477          3468
## 1478          2333
## 1479          2334
## 1480          2336
## 1481          1338
## 1482            17
## 1483          2300
## 1484          2303
## 1485          2290
## 1486          2299
## 1487          2305
## 1488          2296
## 1489          2292
## 1490          1566
## 1491          2306
## 1492          3473
## 1493          1442
## 1494          2651
## 1495          2653
```

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## 1496          1461
## 1497          2654
## 1498          1092
## 1499          2670
## 1500          2198
## 1501          2672
## 1502          1152
## 1503          2671
## 1504          2168
## 1505          2676
## 1506          2685
## 1507          2689
## 1508          2687
## 1509          2688
## 1510          1151
## 1511          2686
## 1512          1462
## 1513          2696
## 1514          2703
## 1515          2704
## 1516          2199
## 1517          2702
## 1518          2701
## 1519          2709
## 1520          2162
## 1521          1094
## 1522          1093
## 1523          2712
## 1524          2713
## 1525          2714
## 1526          2164
## 1527          2868
## 1528          2879
## 1529          1627
## 1530          1457
## 1531          1424
## 1532          1628
## 1533          2862
## 1534          2864
## 1535          2874
## 1536          2863
## 1537          1624
## 1538          2873
## 1539          1458
## 1540          2861
## 1541          1925
## 1542          2877
## 1543          1926
## 1544          2878
## 1545          2867
## 1546          2852
## 1547          2857
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## 1550           1625
## 1551           2860
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## 1553           1927
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## 1557           2870
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## 1560           2853
## 1561           2855
## 1562           2876
## 1563           3384
## 1564           3383
## 1565           1632
## 1566           4112
## 1567           1428
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## 1569           4316
## 1570           1631
## 1571           3355
## 1572           3353
## 1573           3356
## 1574           3354
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## 1577           3350
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## 1579           3361
## 1580           3362
## 1581           3360
## 1582           3364
## 1583           3363
## 1584           3365
## 1585           1427
## 1586           3366
## 1587           2051
## 1588           3754
## 1589           4121
## 1590           3736
## 1591           3734
## 1592           3709
## 1593           2050
## 1594           4118
## 1595           2053
## 1596           3717
## 1597           3715
## 1598           3714
## 1599           2052
## 1600           2424
## 1601           3943
## 1602           2423
## 1603           2425
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## 1604            1642
## 1605            2422
## 1606            1643
## 1607            3945
## 1608            1456
## 1609            1455
## 1610            3947
## 1611            3944
## 1612            2427
## 1613            2426
## 1614            1685
## 1615            2444
## 1616            2443
## 1617            2442
## 1618            2445
## 1619            4160
## 1620            1024
## 1621            1698
## 1622            1700
## 1623            1701
## 1624            1704
## 1625            1703
## 1626           30015
## 1627            1023
## 1628            1473
## 1629           30019
## 1630           30016
## 1631            1699
## 1632            1702
## 1633            1705
## 1634            1295
## 1635            4159
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## 1637            1330
## 1638            1159
## 1639            1160
## 1640            3025
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## 1642            1162
## 1643            1328
## 1644            1329
## 1645            3029
## 1646            3027
## 1647            1161
## 1648            3028
## 1649           10062
## 1650            3411
## 1651            3410
## 1652            3407
## 1653            1404
## 1654            3406
## 1655            3409
## 1656            3408
## 1657            1403
```

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## 1658        4640
## 1659        3397
## 1660        1726
## 1661        3401
## 1662        3403
## 1663        3402
## 1664        3412
## 1665        3413
##
## 1
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## 12
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## 17
## 18
## 19
## 20
## 21
## 22
## 23                                                  RIVER SAL PAZORKHONI,\r\nCUNCOLIM(NEAR CULVE
## 24
## 25
## 26                                                                              RIVER MAPUSA ON
## 27
## 28
## 29
## 30
## 31
## 32
## 33                                                                                    RIVER SINQ
## 34
## 35
## 36
## 37
## 38
## 39                                                                                 AMLAKHADI AFTE
## 40
## 41                                                         BHADAR D/S JETPUR VILL. AFTER C
## 42
## 43
## 44
## 45
```

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## 46
## 47
## 48                                                                       BH
## 49                                               TRIVENI SANGAM, NR. SOMNATH
## 50
## 51
## 52
## 53
## 54
## 55
## 56                                             GHAGGAR BEFORE OTTU WEIR (BEF
## 57
## 58
## 59                                                                MARKANDA
## 60
## 61                RAMPUR JATTAN MOGINAND NALA\r\nBEFORE CONFLUENCE TO RIVER\r\nMARKANDA
## 62                                                                       MA
## 63
## 64
## 65                                 KUMARADHARA - U/S OF UPPINAGADY\r\nTOWN BEFORE
## 66
## 67
## 68
## 69
## 70
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## 100
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## 564                                            RIVER GOWTHAMI (GODAVARI)\r\nGOVALANKA, INJARAM (V), NEAR G
## 565
## 566                         RIVER NAGAVALI NEAR NH- 16 BRIDGE,\r\nUPSTREAM (U/S) OF SRIKAKULAM\r\nTOWN,
## 567  RIVER NAGAVALI NEAR WATER PUMP\r\nHOUSE (KILLIPALEM) , DOWN STREAM\r\n(D/S) OF SRIKAKULAM TOWN
## 568 RIVER VAMSADHARA, IMMEDIATE\r\nBORDER BETWEEN ANDHRA PRADESH &\r\nORISSA STATES, NEAR LALITHAMB
## 569           RIVER NAGAVALI IMMEDIATE BORDER\r\nBETWEEN ANDHRA PRADESH & ORISSA\r\nSTATES, NEAR SI
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## 574                                               COLLING WATER BLOWDOWNS FROM\r\nANDHRA SUGARS LTD, TAN
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## 674                                                  ALHI RIVER-NOG(NEAR WATER SUPPLY\r\nSCHEME
## 675                                                         HARABAGH(INTAKE FROM BBMB\r\nSOU
## 676                                                                           KUNNI PUL, VIL
## 677                                                                                MANJHI
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## 683                                 RAMPUR JATTAN MOGINAND NALA\r\nBEFORE CONFLUENCE TO RIVER\r\nMARKAND
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## 953                        RIVER NAGAVALI NEAR NH- 16 BRIDGE,\r\nUPSTREAM (U/S) OF SRIKAKULAM TOWN,\
## 954  RIVER NAGAVALI NEAR WATER PUMP\r\nHOUSE (KILLIPALEM) , DOWN STREAM (D/S)\r\nOF SRIKAKULAM TOWN
## 955 RIVER VAMSADHARA, IMMEDIATE BORDER\r\nBETWEEN ANDHRA PRADESH & ORISSA\r\nSTATES, NEAR LALITHAMBA
## 956           RIVER NAGAVALI IMMEDIATE BORDER\r\nBETWEEN ANDHRA PRADESH & ORISSA\r\nSTATES, NEAR SI
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## 1065              RIVER ALHI NOG(NEAR WATER SUPPLY\r\nSCHEME
## 1066                  RIVER HARABAGH(INTAKE FROM BBMB\r\nSOU
## 1067               RIVER GAJ WATER SUPPLY SCHEME\r\nDHARAMSH
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## 1083                              RIVER KUMARADHARA - U/S OF\r\nUPPINAGADY TOWN BI
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## 1344            RIVER NAGAVALI IMMEDIATE BORDER BETWEEN ANDHRA\r\nPRADESH & ORISSA STATES, NEAR SIV
## 1345                      RIVER NAGAVALI NEAR NH- 16 BRIDGE, UPSTREAM (U/S) OF\r\nSRIKAKULAM TOWN,
## 1346     RIVER NAGAVALI NEAR WATER PUMP HOUSE (KILLIPALEM) ,\r\nDOWN STREAM (D/S) OF SRIKAKULAM TOWN
## 1347    RIVER VAMSADHARA, IMMEDIATE BORDER BETWEEN\r\nANDHRA PRADESH & ORISSA STATES, NEAR LALITHAMBA
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## 1558
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## 1566
## 1567                                                  RIVER KYRHUKHLA
## 1568
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## 1581
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## 1583
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## 1586
## 1587
## 1588
## 1589                                           RIVER TLAWNG RIVER, SUARPUI, BA
## 1590
## 1591
## 1592
## 1593
## 1594                                                         RIVER TU
## 1595
## 1596                                                    RIVER TUIRIAL
## 1597                                                     RIVER TUIRIA
## 1598                                                          RIVER TU
## 1599
## 1600
## 1601
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## 1612
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## 1615
## 1616                                                                                                RIV
## 1617                                                                                           RIVER GA
## 1618
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## 1658
## 1659
## 1660                                                                             RIVER HAORA D/S OF CHA
## 1661
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## 1664
## 1665
```

```
##                                       State TemperatureMin TemperatureMax
## 1                            ANDHRA PRADESH           26.0           31.0
## 2                            ANDHRA PRADESH           26.0           29.0
## 3        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           27.0           30.0
## 4        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           26.0           30.0
## 5        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           26.0           30.0
## 6        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           26.0           30.0
## 7        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           27.0           30.0
## 8        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           25.0           30.0
## 9        DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           27.0           30.0
## 10       DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           25.0           30.0
## 11       DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI           26.0           30.0
## 12                                      GOA           27.0           34.0
## 13                                      GOA           26.0           32.0
## 14                                      GOA           29.0           34.0
## 15                                      GOA           25.0           34.0
## 16                                      GOA           26.0           30.0
## 17                                      GOA           27.0           32.0
## 18                                      GOA           27.0           31.5
## 19                                      GOA           27.6           34.0
## 20                                      GOA           27.0           34.0
## 21                                      GOA           27.9           33.0
## 22                                      GOA           28.0           34.0
## 23                                      GOA           28.0           32.0
## 24                                      GOA           25.0           34.0
## 25                                      GOA           24.2           34.0
## 26                                      GOA           26.0           31.0
## 27                                      GOA           26.3           30.5
## 28                                      GOA           26.1           33.0
## 29                                      GOA           29.0           34.5
## 30                                      GOA           26.7           33.0
## 31                                      GOA           24.3           32.0
## 32                                      GOA           26.2           35.0
## 33                                      GOA           28.0           32.0
## 34                                      GOA           28.0           33.0
## 35                                  GUJARAT           24.0           33.0
## 36                                  GUJARAT           23.0           30.0
## 37                                  GUJARAT           23.0           30.0
## 38                                  GUJARAT           23.0           30.0
## 39                                  GUJARAT           28.0           32.0
## 40                                  GUJARAT           23.0           30.0
## 41                                  GUJARAT           27.0           31.0
## 42                                  GUJARAT           27.0           33.0
## 43                                  GUJARAT           27.0           34.0
## 44                                  GUJARAT           24.0           33.0
## 45                                  GUJARAT           24.0           33.0
## 46                                  GUJARAT           24.0           30.0
## 47                                  GUJARAT           28.0           35.0
## 48                                  GUJARAT           23.0           29.0
## 49                                  GUJARAT           22.0           25.0
## 50                                  GUJARAT           25.0           34.0
## 51                                  GUJARAT           23.0           30.0
## 52                                  HARYANA           <NA>           <NA>
## 53                                  HARYANA           <NA>           <NA>
```

```
## 54                                        HARYANA        <NA>           <NA>
## 55                                        HARYANA        <NA>           <NA>
## 56                                        HARYANA        <NA>           <NA>
## 57                               HIMACHAL PRADESH        13.0           21.0
## 58                               HIMACHAL PRADESH        15.0           25.0
## 59                               HIMACHAL PRADESH        15.0           25.0
## 60                               HIMACHAL PRADESH        13.0           23.0
## 61                               HIMACHAL PRADESH        15.0           24.0
## 62                               HIMACHAL PRADESH        13.0           24.0
## 63                                      KARNATAKA        26.0           28.0
## 64                                      KARNATAKA        27.0           33.0
## 65                                      KARNATAKA        28.0           33.0
## 66                                      KARNATAKA        25.0           28.0
## 67                                      KARNATAKA        28.0           33.0
## 68                                      KARNATAKA        28.0           33.0
## 69                                         KERALA        26.0           32.5
## 70                                         KERALA        26.0           29.7
## 71                                         KERALA        22.0           32.0
## 72                                         KERALA        25.0           32.0
## 73                                         KERALA        24.0           25.0
## 74                                         KERALA        27.0           30.0
## 75                                         KERALA        26.0           30.0
## 76                                         KERALA        30.0           33.0
## 77                                         KERALA        26.0           30.0
## 78                                         KERALA        26.0           30.1
## 79                                         KERALA        27.0           29.0
## 80                                         KERALA        27.0           30.0
## 81                                         KERALA        27.0           29.0
## 82                                         KERALA        25.0           28.0
## 83                                         KERALA        22.5           29.0
## 84                                         KERALA        30.0           33.0
## 85                                         KERALA        24.0           28.0
## 86                                         KERALA        29.0           33.0
## 87                                         KERALA        24.0           26.0
## 88                                         KERALA        27.0           29.0
## 89                                         KERALA        29.0           31.5
## 90                                         KERALA        26.0           32.0
## 91                                         KERALA        25.0           30.0
## 92                                         KERALA        25.0           32.0
## 93                                         KERALA        25.0           28.0
## 94                                         KERALA        24.0           28.0
## 95                                         KERALA        25.0           29.0
## 96                                         KERALA        26.0           39.0
## 97                                         KERALA        30.0           33.0
## 98                                         KERALA        30.0           33.0
## 99                                         KERALA        30.0           33.0
## 100                                        KERALA        21.0           25.0
## 101                                        KERALA        25.0           30.0
## 102                                        KERALA        27.0           32.0
## 103                                        KERALA        26.0           31.0
## 104                                        KERALA        26.0           32.0
## 105                                        KERALA        29.5           31.5
## 106                                        KERALA        29.0           31.5
## 107                                        KERALA        22.0           30.0
```

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## 108                                    KERALA           24.0           31.0
## 109                                    KERALA           25.0           28.0
## 110                                    KERALA           24.0           29.0
## 111                                    KERALA           23.0           32.0
## 112                                    KERALA           26.0           31.0
## 113                                    KERALA           24.0           30.0
## 114                                    KERALA           24.0           30.0
## 115                                    KERALA           24.0           29.0
## 116                                    KERALA           24.0           29.0
## 117                                    KERALA           24.0           32.0
## 118                                    KERALA           24.0           29.0
## 119                                    KERALA           25.0           32.0
## 120                                    KERALA           24.0           30.0
## 121                                    KERALA           25.0           30.0
## 122                                    KERALA           28.0           31.0
## 123                                    KERALA           26.0           31.0
## 124                                    KERALA           26.0           30.0
## 125                                    KERALA           22.2           32.0
## 126                                    KERALA           26.0           32.0
## 127                                    KERALA           26.0           32.0
## 128                                    KERALA           26.0           31.0
## 129                                    KERALA           26.8           33.0
## 130                                    KERALA           26.0           32.0
## 131                                    KERALA           27.1           28.2
## 132                                    KERALA           26.8           28.2
## 133                                    KERALA           28.0           30.0
## 134                                    KERALA           24.0           32.0
## 135                                    KERALA           24.0           28.0
## 136                                    KERALA           25.0           28.0
## 137                                    KERALA           25.0           32.0
## 138                                    KERALA           27.0           33.0
## 139                                    KERALA           25.0           32.0
## 140                               MAHARASHTRA           27.0           35.0
## 141                               MAHARASHTRA           27.0           33.0
## 142                               MAHARASHTRA           26.0           33.0
## 143                               MAHARASHTRA           20.0           28.0
## 144                               MAHARASHTRA           25.0           28.0
## 145                               MAHARASHTRA           20.0           32.0
## 146                               MAHARASHTRA           20.0           28.0
## 147                               MAHARASHTRA           27.0           33.0
## 148                               MAHARASHTRA           22.0           24.0
## 149                               MAHARASHTRA           23.0           33.0
## 150                               MAHARASHTRA           25.0           28.0
## 151                               MAHARASHTRA           27.0           36.0
## 152                               MAHARASHTRA           25.0           28.0
## 153                               MAHARASHTRA           20.0           36.0
## 154                               MAHARASHTRA           21.0           38.0
## 155                               MAHARASHTRA           22.0           24.0
## 156                               MAHARASHTRA           25.0           28.0
## 157                               MAHARASHTRA           25.0           28.0
## 158                               MAHARASHTRA           21.0           37.0
## 159                               MAHARASHTRA           20.0           28.0
## 160                               MAHARASHTRA           20.0           28.0
## 161                               MAHARASHTRA           20.0           28.0
```

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## 162                                         MAHARASHTRA          20.0          28.0
## 163                                         MAHARASHTRA          20.0          28.0
## 164                                         MAHARASHTRA          27.0          34.0
## 165                                         MAHARASHTRA          26.0          36.0
## 166                                         MAHARASHTRA          26.0          35.0
## 167                                         MAHARASHTRA          26.0          36.0
## 168                                         MAHARASHTRA          27.0          36.0
## 169                                         MAHARASHTRA          25.0          30.0
## 170                                         MAHARASHTRA          25.0          30.0
## 171                                         MAHARASHTRA          25.0          32.0
## 172                                         MAHARASHTRA          23.0          26.0
## 173                                         MAHARASHTRA          24.0          30.0
## 174                                         MAHARASHTRA          22.0          24.0
## 175                                         MAHARASHTRA          22.0          24.0
## 176                                             MANIPUR          22.1          24.3
## 177                                             MANIPUR          21.0          24.1
## 178                                             MANIPUR          21.7          24.0
## 179                                             MANIPUR          21.3          24.0
## 180                                             MANIPUR          22.1          23.8
## 181                                             MANIPUR          22.4          23.2
## 182                                             MANIPUR          23.0          24.0
## 183                                             MANIPUR          22.3          22.6
## 184                                             MANIPUR          20.3          25.0
## 185                                             MANIPUR          21.4          24.2
## 186                                             MANIPUR          21.6          24.8
## 187                                             MANIPUR          21.0          22.0
## 188                                             MANIPUR          21.4          23.2
## 189                                             MANIPUR          21.0          23.1
## 190                                             MANIPUR          20.6          22.9
## 191                                             MANIPUR          21.8          22.7
## 192                                             MANIPUR          22.2          24.0
## 193                                             MANIPUR          21.4          23.1
## 194                                             MANIPUR          22.1          23.9
## 195                                             MANIPUR          22.3          23.8
## 196                                             MANIPUR          21.0          22.5
## 197                                             MANIPUR          21.0          22.5
## 198                                             MANIPUR          20.8          23.7
## 199                                             MANIPUR          20.9          23.1
## 200                                             MANIPUR          20.1          23.1
## 201                                             MANIPUR          20.0          22.6
## 202                                             MANIPUR          20.1          22.7
## 203                                             MANIPUR          19.0          21.6
## 204                                             MANIPUR          21.4          23.0
## 205                                             MANIPUR          20.0          22.5
## 206                                             MANIPUR          21.6          24.0
## 207                                             MANIPUR          21.0          22.6
## 208                                             MANIPUR          21.6          24.0
## 209                                           MEGHALAYA          17.0          25.0
## 210                                           MEGHALAYA          15.0          24.0
## 211                                           MEGHALAYA          15.0          22.0
## 212                                           MEGHALAYA          16.0          28.0
## 213                                           MEGHALAYA          17.0          28.0
## 214                                           MEGHALAYA          13.0          21.0
## 215                                           MEGHALAYA          15.0          24.0
```

```
## 216                                 MEGHALAYA          14.0          23.0
## 217                                 MEGHALAYA          13.0          22.0
## 218                                 MEGHALAYA          12.0          20.0
## 219                                 MEGHALAYA          15.0          21.0
## 220                                 MEGHALAYA          15.0          28.0
## 221                                 MEGHALAYA          13.0          21.0
## 222                                 MEGHALAYA          15.0          26.0
## 223                                 MEGHALAYA          13.0          22.0
## 224                                 MEGHALAYA          13.0          21.0
## 225                                 MEGHALAYA          13.0          24.0
## 226                                 MEGHALAYA          13.0          23.0
## 227                                 MEGHALAYA          10.0          21.0
## 228                                 MEGHALAYA          13.0          22.0
## 229                                 MEGHALAYA          13.0          23.5
## 230                                 MEGHALAYA          16.0          27.0
## 231                                 MEGHALAYA          15.0          25.0
## 232                                 MEGHALAYA          15.0          26.0
## 233                                 MEGHALAYA          14.0          23.0
## 234                                 MEGHALAYA          19.0          28.0
## 235                                 MEGHALAYA          20.0          32.0
## 236                                PUDUCHERRY          30.0          30.0
## 237                                PUDUCHERRY          30.0          30.0
## 238                                PUDUCHERRY          30.0          30.0
## 239                                PUDUCHERRY          28.0          28.0
## 240                                    PUNJAB          17.0          32.0
## 241                                    PUNJAB           9.0          28.0
## 242                                    PUNJAB          16.0          32.0
## 243                                    PUNJAB           8.0          29.0
## 244                                    PUNJAB          19.0          34.0
## 245                                    PUNJAB          16.0          31.0
## 246                                    PUNJAB          15.0          32.0
## 247                                    PUNJAB          16.0          33.0
## 248                                    PUNJAB          15.0          32.0
## 249                                    PUNJAB           9.0          28.5
## 250                                    PUNJAB          19.0          34.0
## 251                                    PUNJAB          18.0          33.0
## 252                                    PUNJAB          17.0          35.0
## 253                                 RAJASTHAN          13.0          30.0
## 254                                 RAJASTHAN          14.0          28.0
## 255                                 RAJASTHAN          12.0          29.0
## 256                                TAMIL NADU          21.0          29.0
## 257                                TAMIL NADU          22.0          31.0
## 258                                TAMIL NADU          23.0          30.0
## 259                                TAMIL NADU          29.0          29.0
## 260                                TAMIL NADU          22.0          31.0
## 261                                TAMIL NADU          21.0          29.0
## 262                                TAMIL NADU          29.0          29.0
## 263                                TAMIL NADU          29.0          29.0
## 264                                TAMIL NADU          21.0          30.0
## 265                                TAMIL NADU          29.0          29.0
## 266                                TAMIL NADU          23.0          29.0
## 267                                TAMIL NADU          24.0          29.0
## 268                                   TRIPURA          24.5          27.0
## 269                                   TRIPURA          23.5          27.0
```

```
## 270                                TRIPURA         25.0          27.0
## 271                                TRIPURA         25.0          27.0
## 272                                TRIPURA         24.5          27.0
## 273                                TRIPURA         24.5          27.0
## 274                                TRIPURA         25.0          27.0
## 275                                TRIPURA         25.0          27.0
## 276                                TRIPURA         25.0          27.0
## 277                                TRIPURA         25.0          27.0
## 278                                TRIPURA         25.0          27.0
## 279                                TRIPURA         25.0          27.0
## 280                                TRIPURA         25.0          27.0
## 281                                TRIPURA         25.0          27.0
## 282                                TRIPURA         24.0          27.0
## 283                                TRIPURA         25.0          27.0
## 284                                TRIPURA         25.0          27.0
## 285                                TRIPURA         25.0          27.0
## 286                                TRIPURA         25.0          27.0
## 287                                TRIPURA         25.0          27.0
## 288                                TRIPURA         24.5          27.0
## 289                                TRIPURA         24.5          27.0
## 290                                TRIPURA         24.5          27.0
## 291                                TRIPURA         25.0          27.0
## 292                                TRIPURA         25.0          27.0
## 293                                TRIPURA         25.0          27.0
## 294                         ANDHRA PRADESH         25.0          30.0
## 295                         ANDHRA PRADESH         25.0          30.0
## 296         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         27.6          32.1
## 297         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          31.4
## 298         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          31.2
## 299         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          32.1
## 300         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          32.0
## 301         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          33.0
## 302         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          32.2
## 303         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         28.0          32.0
## 304         DAMAN, DIU, DADRA\r\nNAGAR HAVELI         29.0          31.8
## 305                                    GOA         26.8          31.2
## 306                                    GOA         26.6          34.0
## 307                                    GOA         26.0          33.0
## 308                                    GOA         26.0          31.2
## 309                                    GOA         25.5          32.0
## 310                                    GOA         26.0          32.2
## 311                                    GOA         25.0          32.2
## 312                                    GOA         27.0          32.0
## 313                                    GOA         26.0          31.0
## 314                                    GOA         25.2          32.0
## 315                                    GOA         26.0          32.0
## 316                                    GOA         26.0          30.0
## 317                                    GOA         27.0          31.1
## 318                                    GOA         27.0          32.5
## 319                                    GOA         26.1          34.0
## 320                                    GOA         26.0          33.0
## 321                                    GOA         26.0          32.0
## 322                                    GOA         26.0          34.0
## 323                                    GOA         26.0          33.0
```

```
## 324                                     GOA        25.2        30.0
## 325                                     GOA        24.9        33.0
## 326                                     GOA        27.0        31.1
## 327                                     GOA        27.0        31.5
## 328                                     GOA        26.9        34.0
## 329                                 GUJARAT        26.0        34.0
## 330                                 GUJARAT        25.0        31.0
## 331                                 GUJARAT        20.0        31.0
## 332                                 GUJARAT        23.0        31.0
## 333                                 GUJARAT        28.0        33.0
## 334                                 GUJARAT        25.0        31.0
## 335                                 GUJARAT        28.0        31.0
## 336                                 GUJARAT        <NA>        35.0
## 337                                 GUJARAT        <NA>        36.0
## 338                                 GUJARAT        26.0        33.0
## 339                                 GUJARAT        26.0        34.0
## 340                                 GUJARAT        <NA>        30.0
## 341                                 GUJARAT        29.0        32.0
## 342                                 GUJARAT        25.0        35.0
## 343                                 GUJARAT        20.0        24.0
## 344                                 GUJARAT        <NA>        32.0
## 345                                 GUJARAT        <NA>        31.0
## 346                                 GUJARAT        <NA>        <NA>
## 347                                 GUJARAT        23.0        28.0
## 348                                 HARYANA        <NA>        <NA>
## 349                                 HARYANA        <NA>        <NA>
## 350                                 HARYANA        <NA>        <NA>
## 351                                 HARYANA        <NA>        <NA>
## 352                                 HARYANA        <NA>        <NA>
## 353                               KARNATAKA        26.0        31.7
## 354                               KARNATAKA        25.0        29.0
## 355                               KARNATAKA        26.0        31.0
## 356                               KARNATAKA        26.0        34.0
## 357                                  KERALA        24.0        32.0
## 358                                  KERALA        26.0        31.0
## 359                                  KERALA        24.0        33.0
## 360                                  KERALA        24.0        32.0
## 361                                  KERALA        23.0        29.0
## 362                                  KERALA        26.0        29.0
## 363                                  KERALA        26.0        32.0
## 364                                  KERALA        31.0        32.0
## 365                                  KERALA        27.0        30.0
## 366                                  KERALA        25.0        32.0
## 367                                  KERALA        25.0        28.0
## 368                                  KERALA        26.0        32.0
## 369                                  KERALA        27.0        30.0
## 370                                  KERALA        21.0        28.0
## 371                                  KERALA        26.0        32.0
## 372                                  KERALA        30.0        32.0
## 373                                  KERALA        23.0        28.0
## 374                                  KERALA        31.0        32.0
## 375                                  KERALA        22.0        28.0
## 376                                  KERALA        27.0        30.0
## 377                                  KERALA        28.0        31.0
```

```
## 378                                KERALA         27.0        33.0
## 379                                KERALA         25.0        30.0
## 380                                KERALA         24.0        31.0
## 381                                KERALA         27.0        32.0
## 382                                KERALA         28.0        32.0
## 383                                KERALA         28.0        32.0
## 384                                KERALA         26.0        30.0
## 385                                KERALA         30.0        32.0
## 386                                KERALA         30.0        32.0
## 387                                KERALA         31.0        32.0
## 388                                KERALA         20.0        30.0
## 389                                KERALA         23.0        30.0
## 390                                KERALA         27.0        32.0
## 391                                KERALA         26.0        31.0
## 392                                KERALA         29.0        31.0
## 393                                KERALA         28.0        31.5
## 394                                KERALA         28.0        31.5
## 395                                KERALA         28.0        32.0
## 396                                KERALA         26.0        31.0
## 397                                KERALA         25.0        29.0
## 398                                KERALA         24.0        32.0
## 399                                KERALA         24.0        30.0
## 400                                KERALA         25.0        32.0
## 401                                KERALA         26.0        31.0
## 402                                KERALA         25.0        30.0
## 403                                KERALA         28.0        32.0
## 404                                KERALA         28.0        34.0
## 405                                KERALA         26.0        32.0
## 406                                KERALA         28.0        31.0
## 407                                KERALA         27.0        34.0
## 408                                KERALA         27.0        32.0
## 409                                KERALA         24.0        32.0
## 410                                KERALA         24.0        33.0
## 411                                KERALA         27.0        31.0
## 412                                KERALA         27.0        32.0
## 413                                KERALA         25.0        33.0
## 414                                KERALA         25.0        30.0
## 415                                KERALA         25.0        31.0
## 416                                KERALA         25.0        30.0
## 417                                KERALA         26.0        30.0
## 418                                KERALA         27.0        30.0
## 419                                KERALA         25.0        31.0
## 420                                KERALA         25.0        32.0
## 421                                KERALA         25.0        32.0
## 422                                KERALA         26.0        32.0
## 423                                KERALA         20.0        30.0
## 424                                KERALA         22.0        30.0
## 425                                KERALA         25.0        32.0
## 426                                KERALA         31.0        34.0
## 427                                KERALA         24.0        32.0
## 428                                KERALA         27.0        31.0
## 429                                KERALA         27.0        31.0
## 430                           MAHARASHTRA         28.0        28.0
## 431                           MAHARASHTRA         27.0        27.0
```

```
## 432                                    MANIPUR        18.0        30.0
## 433                                    MANIPUR        17.0        29.0
## 434                                    MANIPUR        17.0        30.0
## 435                                    MANIPUR        19.0        28.0
## 436                                    MANIPUR        19.0        30.0
## 437                                    MANIPUR        19.0        30.0
## 438                                    MANIPUR        18.0        30.0
## 439                                    MANIPUR        17.0        29.0
## 440                                    MANIPUR        18.0        18.0
## 441                                    MANIPUR        18.0        18.0
## 442                                    MANIPUR        17.0        17.0
## 443                                    MANIPUR        16.3        29.1
## 444                                    MANIPUR        17.0        29.0
## 445                                    MANIPUR        17.0        28.0
## 446                                    MANIPUR        19.0        28.0
## 447                                    MANIPUR        18.0        29.0
## 448                                    MANIPUR         6.9        30.0
## 449                                    MANIPUR        17.3        29.0
## 450                                    MANIPUR        18.0        30.0
## 451                                    MANIPUR        19.0        29.4
## 452                                    MANIPUR        15.0        30.0
## 453                                    MANIPUR         7.3        28.3
## 454                                    MANIPUR        17.0        29.0
## 455                                    MANIPUR        19.2        19.2
## 456                                    MANIPUR        12.8        28.7
## 457                                    MANIPUR        18.0        29.0
## 458                                    MANIPUR        17.0        29.0
## 459                                    MANIPUR        18.0        30.7
## 460                                    MANIPUR        29.0        29.0
## 461                                    MANIPUR        18.0        29.7
## 462                                    MANIPUR        15.6        29.9
## 463                                  MEGHALAYA        16.0        26.0
## 464                                  MEGHALAYA        15.0        25.0
## 465                                  MEGHALAYA        10.0        22.0
## 466                                  MEGHALAYA        14.0        28.0
## 467                                  MEGHALAYA        15.0        31.0
## 468                                  MEGHALAYA         7.2        19.0
## 469                                  MEGHALAYA         6.9        25.0
## 470                                  MEGHALAYA        13.0        23.0
## 471                                  MEGHALAYA        10.0        21.0
## 472                                  MEGHALAYA        10.0        23.0
## 473                                  MEGHALAYA         9.0        21.0
## 474                                  MEGHALAYA        15.0        28.0
## 475                                  MEGHALAYA         9.0        21.0
## 476                                  MEGHALAYA        14.0        28.0
## 477                                  MEGHALAYA        10.0        22.0
## 478                                  MEGHALAYA        11.0        21.0
## 479                                  MEGHALAYA         9.0        22.0
## 480                                  MEGHALAYA         9.0        22.0
## 481                                  MEGHALAYA         8.0        20.0
## 482                                  MEGHALAYA         9.0        21.0
## 483                                  MEGHALAYA        10.0        22.0
## 484                                  MEGHALAYA        14.0        24.0
## 485                                  MEGHALAYA        15.0        26.0
```

```
## 486                               MEGHALAYA          16.0           26.0
## 487                               MEGHALAYA          15.0           24.0
## 488                               MEGHALAYA          18.0           30.0
## 489                               MEGHALAYA          18.0           30.0
## 490                                  ODISHA          10.0           26.0
## 491                                  ODISHA          10.0           26.0
## 492                                  ODISHA          18.0           31.0
## 493                                  ODISHA          16.0           28.0
## 494                                  ODISHA          18.0           31.0
## 495                                  ODISHA          14.0           31.0
## 496                                  ODISHA          16.0           28.0
## 497                                  ODISHA          12.0           26.0
## 498                                  ODISHA          19.0           32.0
## 499                                  ODISHA          15.0           33.0
## 500                              PUDUCHERRY          29.0           31.0
## 501                              PUDUCHERRY          31.0           31.0
## 502                              PUDUCHERRY          31.0           31.0
## 503                              PUDUCHERRY          31.0           31.0
## 504                              PUDUCHERRY          30.0           30.0
## 505                                  PUNJAB          14.0           29.0
## 506                                  PUNJAB          14.0           30.0
## 507                                  PUNJAB          15.0           28.0
## 508                                  PUNJAB          11.0           29.0
## 509                                  PUNJAB          15.0           28.0
## 510                                  PUNJAB          12.0           27.0
## 511                                  PUNJAB          12.0           28.0
## 512                                  PUNJAB          14.0           29.0
## 513                                  PUNJAB          15.0           29.0
## 514                                  PUNJAB          15.0           31.0
## 515                                  PUNJAB          14.0           30.0
## 516                                  PUNJAB          13.0           29.0
## 517                                  PUNJAB          20.0           33.0
## 518                               RAJASTHAN          10.0           27.0
## 519                               RAJASTHAN          25.3           25.3
## 520                               RAJASTHAN          26.6           26.6
## 521                               RAJASTHAN          12.0           29.0
## 522                               RAJASTHAN          13.0           18.0
## 523                               RAJASTHAN          11.0           28.5
## 524                               RAJASTHAN          13.5           28.5
## 525                              TAMIL NADU          22.0           24.0
## 526                              TAMIL NADU          23.0           27.0
## 527                              TAMIL NADU          24.0           28.0
## 528                              TAMIL NADU          29.0           29.0
## 529                              TAMIL NADU          23.0           25.0
## 530                              TAMIL NADU          23.0           24.0
## 531                              TAMIL NADU           6.9           29.0
## 532                              TAMIL NADU          24.0           24.0
## 533                              TAMIL NADU          29.0           29.0
## 534                              TAMIL NADU          23.0           25.0
## 535                              TAMIL NADU          29.0           29.0
## 536                              TAMIL NADU          24.0           28.0
## 537                              TAMIL NADU          25.0           28.0
## 538                                 TRIPURA          20.0           29.5
## 539                                 TRIPURA          20.5           29.0
```

```
## 540                                  TRIPURA          20.5          31.0
## 541                                  TRIPURA          20.0          29.5
## 542                                  TRIPURA          20.5          29.0
## 543                                  TRIPURA          20.5          29.0
## 544                                  TRIPURA          20.0          29.0
## 545                                  TRIPURA          20.5          29.5
## 546                                  TRIPURA          20.5          29.0
## 547                                  TRIPURA          20.5          28.5
## 548                                  TRIPURA          20.5          29.0
## 549                                  TRIPURA          20.0          29.5
## 550                                  TRIPURA          20.5          29.0
## 551                                  TRIPURA          20.5          29.0
## 552                                  TRIPURA          20.5          28.5
## 553                                  TRIPURA          20.5          29.0
## 554                                  TRIPURA          20.0          28.5
## 555                                  TRIPURA          20.0          29.0
## 556                                  TRIPURA          20.5          29.5
## 557                                  TRIPURA          20.5          29.0
## 558                                  TRIPURA          20.0          28.5
## 559                                  TRIPURA          20.5          28.5
## 560                                  TRIPURA          20.0          28.0
## 561                                  TRIPURA          20.0          28.5
## 562                                  TRIPURA          20.0          28.5
## 563                                  TRIPURA          20.0          28.5
## 564                           ANDHRA PRADESH          25.0          31.0
## 565                           ANDHRA PRADESH          24.0          36.0
## 566                           ANDHRA PRADESH          21.0          30.0
## 567                           ANDHRA PRADESH          21.0          30.0
## 568                           ANDHRA PRADESH          20.0          34.0
## 569                           ANDHRA PRADESH          24.0          34.0
## 570                           ANDHRA PRADESH          24.0          30.0
## 571                           ANDHRA PRADESH          25.0          32.0
## 572                           ANDHRA PRADESH          25.0          28.0
## 573                           ANDHRA PRADESH          20.0          33.0
## 574                           ANDHRA PRADESH          25.0          26.0
## 575                                    ASSAM          20.0          30.0
## 576                                    ASSAM          21.0          32.0
## 577                                    ASSAM          19.0          26.0
## 578                                    ASSAM          12.0          31.0
## 579                                    ASSAM          21.0          34.0
## 580                                    ASSAM          18.0          33.0
## 581                                    ASSAM          23.0          36.0
## 582                                    ASSAM          19.0          31.0
## 583                                    ASSAM          18.0          30.0
## 584                                    ASSAM          13.0          32.0
## 585                                    ASSAM          13.0          32.0
## 586                                    ASSAM          18.0          33.0
## 587                                    ASSAM          20.0          30.0
## 588                                    ASSAM          20.0          34.0
## 589                                    ASSAM          19.0          30.0
## 590                                    ASSAM          24.0          34.0
## 591                                    ASSAM          13.0          32.0
## 592                                    ASSAM          22.0          25.0
## 593                                    ASSAM          12.0          31.0
```

```
## 594                                            ASSAM         22.0         25.0
## 595                                            ASSAM         13.0         25.0
## 596                                            ASSAM         20.0         32.0
## 597                                            ASSAM         21.0         40.0
## 598                                            ASSAM         20.0         32.0
## 599                                            ASSAM         20.0         33.0
## 600                                            ASSAM         14.0         31.0
## 601                                            ASSAM         23.0         34.0
## 602                                            ASSAM         20.0         34.0
## 603                                            ASSAM         18.0         29.0
## 604                                            ASSAM         20.0         31.0
## 605                                            ASSAM         13.0         30.0
## 606                                            ASSAM         19.0         31.0
## 607                                            BIHAR         25.0         36.0
## 608                                            BIHAR         18.0         33.0
## 609                                            BIHAR         16.0         30.0
## 610                                            BIHAR         18.0         31.0
## 611                                          HARYANA            -            -
## 612                                          HARYANA            -            -
## 613                                          HARYANA            -            -
## 614                                           PUNJAB            -            -
## 615                             HIMACHAL\r\nPRADESH            -            -
## 616  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         28.0         33.0
## 617  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         28.0         34.0
## 618  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         29.0         34.0
## 619  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         28.0         33.0
## 620  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         27.5         34.0
## 621  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         27.5         33.0
## 622  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         28.0         34.0
## 623  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         27.5         33.0
## 624  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         28.0         33.0
## 625                                              GOA         27.0         31.0
## 626                                              GOA         27.0         31.0
## 627                                              GOA         27.0         30.0
## 628                                              GOA         27.0         30.0
## 629                                              GOA         27.0         30.0
## 630                                              GOA         27.0         31.0
## 631                                              GOA         27.0         31.0
## 632                                              GOA         27.0         37.0
## 633                                              GOA         27.0         31.0
## 634                                              GOA         27.0         31.0
## 635                                              GOA         27.0         30.0
## 636                                              GOA         27.0         31.0
## 637                                              GOA         27.0         31.0
## 638                                              GOA         27.0         30.0
## 639                                              GOA         28.0         31.0
## 640                                              GOA         28.0         30.0
## 641                                              GOA         27.0         31.0
## 642                                              GOA         27.0         29.0
## 643                                              GOA         27.0         33.0
## 644                                              GOA         26.0         32.0
## 645                                              GOA         27.0         32.0
## 646                                              GOA         27.0         31.0
## 647                                              GOA         27.0         32.0
```

```
## 648                    GOA     27.0     31.0
## 649                    GOA     27.0     31.0
## 650                    GOA     27.0     31.0
## 651                GUJARAT     25.0     35.0
## 652                GUJARAT     28.0     34.0
## 653                GUJARAT     28.0     33.0
## 654                GUJARAT     27.0     31.0
## 655                GUJARAT     25.0     31.0
## 656                GUJARAT     22.0     29.0
## 657                GUJARAT     22.0     33.0
## 658                GUJARAT     27.0     32.0
## 659                GUJARAT     27.0     32.0
## 660                GUJARAT     24.0     35.0
## 661                GUJARAT     24.0     32.0
## 662                GUJARAT     26.0     31.0
## 663                GUJARAT     24.0     31.0
## 664                GUJARAT     24.0     35.0
## 665                GUJARAT     30.0     30.0
## 666                GUJARAT     22.0     26.0
## 667                GUJARAT     20.0     29.0
## 668                GUJARAT     27.0     30.0
## 669                HARYANA     18.0     18.0
## 670                HARYANA        -        -
## 671                HARYANA     18.0     29.0
## 672                HARYANA     16.0     29.0
## 673                HARYANA        -        -
## 674 HIMACHAL\r\nPRADESH     19.0     25.0
## 675 HIMACHAL\r\nPRADESH     20.0     22.0
## 676 HIMACHAL\r\nPRADESH     20.0     20.6
## 677 HIMACHAL\r\nPRADESH      8.0     11.0
## 678 HIMACHAL\r\nPRADESH      9.0     12.0
## 679 HIMACHAL\r\nPRADESH     11.0     29.0
## 680 HIMACHAL\r\nPRADESH     12.0     32.0
## 681 HIMACHAL\r\nPRADESH     13.0     32.0
## 682 HIMACHAL\r\nPRADESH     12.0     32.0
## 683 HIMACHAL\r\nPRADESH     12.0     29.0
## 684 HIMACHAL\r\nPRADESH     13.0     33.0
## 685 HIMACHAL\r\nPRADESH     11.0     13.5
## 686 HIMACHAL\r\nPRADESH     11.5     13.5
## 687 HIMACHAL\r\nPRADESH      5.0     18.0
## 688  JAMMU &\r\nKASHMIR     22.0     22.0
## 689  JAMMU &\r\nKASHMIR     21.0     22.0
## 690  JAMMU &\r\nKASHMIR     16.0     16.0
## 691           JHARKHAND     19.5     33.0
## 692           JHARKHAND      8.0     27.0
## 693           JHARKHAND      9.0     28.0
## 694           JHARKHAND     16.0     35.5
## 695           JHARKHAND     16.0     38.0
## 696           JHARKHAND     15.0     27.0
## 697           JHARKHAND     19.0     35.0
## 698           JHARKHAND     12.0     25.0
## 699           KARNATAKA     27.0     30.0
## 700           KARNATAKA     26.0     29.0
## 701           KARNATAKA     23.0     29.0
```

```
## 702                                              KARNATAKA         23.0         26.0
## 703                                              KARNATAKA         25.0         27.0
## 704                                              KARNATAKA         25.0         31.0
## 705                                              KARNATAKA         25.0         32.0
## 706                                              KARNATAKA         26.0         30.0
## 707                                              KARNATAKA         25.0         30.0
## 708                                                 KERALA         19.0         24.0
## 709                                                 KERALA         19.0         24.0
## 710                                                 KERALA         20.0         23.0
## 711                                                 KERALA         20.0         23.0
## 712                                                 KERALA         23.0         33.0
## 713                                                 KERALA         22.0         32.0
## 714                                                 KERALA         27.0         33.0
## 715                                                 KERALA         22.0         32.0
## 716                                                 KERALA         22.0         33.0
## 717                                                 KERALA         26.0         31.0
## 718                                                 KERALA         22.0         31.0
## 719                                                 KERALA         23.0         31.0
## 720                                                 KERALA         20.0         32.0
## 721                                                 KERALA         29.0         34.0
## 722                                                 KERALA         25.0         30.0
## 723                                                 KERALA         26.0         32.0
## 724                                                 KERALA         18.0         23.0
## 725                                                 KERALA         19.0         24.0
## 726                                                 KERALA         22.0         33.0
## 727                                                 KERALA         22.0         33.0
## 728                                                 KERALA         26.0         31.0
## 729                                                 KERALA         26.0         31.0
## 730                                                 KERALA         18.0         25.0
## 731                                                 KERALA         23.0         34.0
## 732                                                 KERALA         24.0         31.0
## 733                                                 KERALA         27.0         32.0
## 734                                                 KERALA         25.0         32.0
## 735                                                 KERALA         28.0         37.0
## 736                                                 KERALA         28.0         37.0
## 737                                                 KERALA         26.0         32.0
## 738                                                 KERALA         22.0         32.0
## 739                                                 KERALA         23.0         32.0
## 740                                                 KERALA         25.0         37.0
## 741                                                 KERALA         24.0         31.0
## 742                                                 KERALA         21.0         32.0
## 743                                                 KERALA         26.0         32.0
## 744                                                 KERALA         24.0         30.0
## 745                                                 KERALA         28.0         34.0
## 746                                                 KERALA         26.0         32.0
## 747                                                 KERALA         26.0         32.0
## 748                                                 KERALA         26.0         34.0
## 749                                                 KERALA         27.0         30.0
## 750                                                 KERALA         27.0         31.0
## 751                                                 KERALA         28.0         32.0
## 752                                                 KERALA         28.0         32.0
## 753                                                 KERALA         26.0         32.0
## 754                                                 KERALA         26.0         34.0
## 755                                                 KERALA         28.0         35.0
```

```
## 756                                    KERALA          28.0           34.0
## 757                                    KERALA          18.0           24.0
## 758                                    KERALA          28.0           32.0
## 759                                    KERALA          27.0           32.0
## 760                                    KERALA          24.0           29.0
## 761                                    KERALA          25.0           30.0
## 762                                    KERALA          27.0           30.0
## 763                                    KERALA          27.0           32.0
## 764                                    KERALA          25.0           30.0
## 765                                    KERALA          24.0           31.0
## 766                                    KERALA          24.0           33.0
## 767                                    KERALA          24.0           31.0
## 768                                    KERALA          25.0           31.0
## 769                                    KERALA          26.0           31.0
## 770                                    KERALA          23.0           31.0
## 771                                    KERALA          22.0           32.0
## 772                                    KERALA          28.0           30.0
## 773                                    KERALA          22.0           32.0
## 774                                    KERALA          21.0           34.0
## 775                                    KERALA          28.0           31.0
## 776                                    KERALA          24.0           32.0
## 777                                    KERALA          22.0           34.0
## 778                                    KERALA          28.0           32.0
## 779                                    KERALA          24.0           32.0
## 780                                    KERALA          27.0           35.0
## 781                            MADHYA PRADESH          19.0           28.0
## 782                            MADHYA PRADESH          15.0           29.0
## 783                            MADHYA PRADESH          22.0           34.0
## 784                            MADHYA PRADESH          18.2           22.1
## 785                            MADHYA PRADESH          24.5           27.6
## 786                            MADHYA PRADESH          23.0           30.0
## 787                            MADHYA PRADESH          21.0           28.0
## 788                            MADHYA PRADESH          22.0           38.0
## 789                            MADHYA PRADESH          26.5           33.0
## 790                               MAHARASHTRA          25.0           38.0
## 791                               MAHARASHTRA          20.0           30.0
## 792                               MAHARASHTRA          16.0           39.0
## 793                               MAHARASHTRA          15.0           38.0
## 794                               MAHARASHTRA          24.0           30.0
## 795                               MAHARASHTRA          26.0           32.0
## 796                               MAHARASHTRA          25.0           28.0
## 797                               MAHARASHTRA          20.0           28.0
## 798                               MAHARASHTRA          20.0           28.0
## 799                               MAHARASHTRA          25.0           36.0
## 800                               MAHARASHTRA          22.0           37.0
## 801                               MAHARASHTRA          22.0           30.0
## 802                               MAHARASHTRA          28.0           29.0
## 803                               MAHARASHTRA          18.0           29.0
## 804                               MAHARASHTRA          18.0           29.0
## 805                               MAHARASHTRA          18.0           29.0
## 806                               MAHARASHTRA          28.0           29.0
## 807                               MAHARASHTRA          28.0           29.0
## 808                               MAHARASHTRA          26.0           29.0
## 809                               MAHARASHTRA          15.0           40.0
```

```
## 810                                                   MAHARASHTRA        17.0          35.0
## 811                                                   MAHARASHTRA        17.0          35.0
## 812                                                   MAHARASHTRA        17.0          35.0
## 813                                                   MAHARASHTRA        17.0          35.0
## 814                                                   MAHARASHTRA        17.0          35.0
## 815                                                   MAHARASHTRA        25.0          30.0
## 816                                                   MAHARASHTRA        25.0          31.0
## 817                                                   MAHARASHTRA        25.0          31.0
## 818                                                   MAHARASHTRA        21.0          32.0
## 819                                                   MAHARASHTRA        25.0          32.0
## 820                                                   MAHARASHTRA        24.0          32.0
## 821                                                   MAHARASHTRA        25.0          32.0
## 822                                                   MAHARASHTRA        22.0          32.0
## 823                                                   MAHARASHTRA        26.0          28.0
## 824                                                   MAHARASHTRA        26.0          28.0
## 825                                                   MAHARASHTRA        26.0          28.0
## 826                                                       MANIPUR        17.0          30.0
## 827                                                       MANIPUR        16.0          29.0
## 828                                                       MANIPUR        17.0          30.0
## 829                                                       MANIPUR        17.0          28.0
## 830                                                       MANIPUR        18.0          29.0
## 831                                                       MANIPUR        17.0          30.0
## 832                                                       MANIPUR        16.0          30.0
## 833                                                       MANIPUR        19.0          19.0
## 834                                                       MANIPUR        17.0          30.0
## 835                                                       MANIPUR        18.0          30.0
## 836                                                       MANIPUR        16.0          29.0
## 837                                                       MANIPUR        17.0          28.0
## 838                                                       MANIPUR        16.0          30.0
## 839                                                       MANIPUR        17.0          30.0
## 840                                                       MANIPUR        18.0          31.0
## 841                                                       MANIPUR        16.0          29.0
## 842                                                       MANIPUR        17.0          30.0
## 843                                                       MANIPUR        15.0          28.0
## 844                                                       MANIPUR        17.0          28.0
## 845                                                       MANIPUR        15.0          28.0
## 846                                                       MANIPUR        19.0          31.0
## 847                                                       MANIPUR        19.0          31.0
## 848                                                       MANIPUR        18.0          30.0
## 849                                                       MANIPUR        18.0          31.0
## 850                                                       MANIPUR        19.0          30.0
## 851                                                       MANIPUR        17.0          28.2
## 852                                                       MANIPUR        16.0          28.0
## 853                                                       MANIPUR        17.0          28.3
## 854                                                       MANIPUR        19.0          29.0
## 855                                                       MANIPUR        19.0          30.0
## 856                                                       MANIPUR        16.0          28.0
## 857                                                       MANIPUR        17.0          29.0
## 858                                                     MEGHALAYA        17.0          28.0
## 859                                                     MEGHALAYA        17.0          30.0
## 860                                                     MEGHALAYA        17.0          30.0
## 861                                                     MEGHALAYA        18.0          30.9
## 862                                                     MEGHALAYA        15.0          26.0
## 863                                                     MEGHALAYA        14.0          26.0
```

```
## 864                                          MEGHALAYA          15.0          32.0
## 865                                          MEGHALAYA          12.0          22.0
## 866                                          MEGHALAYA          14.0          27.0
## 867                                          MEGHALAYA          18.0          29.0
## 868                                          MEGHALAYA          17.0          30.2
## 869                                          MEGHALAYA          18.0          30.0
## 870                                          MEGHALAYA          10.0          19.0
## 871                                          MEGHALAYA           9.0          22.0
## 872                                          MEGHALAYA           9.0          21.0
## 873                                          MEGHALAYA          16.0          24.0
## 874                                          MEGHALAYA          13.0          19.0
## 875                                          MEGHALAYA          13.0          19.0
## 876                                          MEGHALAYA          13.0          19.0
## 877                                          MEGHALAYA           9.0          20.0
## 878                                          MEGHALAYA          10.0          19.0
## 879                                          MEGHALAYA           9.0          19.0
## 880                                          MEGHALAYA           9.0          19.0
## 881                                          MEGHALAYA          10.0          19.0
## 882                                          MEGHALAYA          18.0          26.0
## 883                                          MEGHALAYA           9.0          20.0
## 884                                          MEGHALAYA           9.0          19.0
## 885                                          MEGHALAYA           9.0          18.0
## 886                                          MEGHALAYA          16.5          29.0
## 887                                          MEGHALAYA          16.0          27.0
## 888                                         PUDUCHERRY          26.5          26.5
## 889                                         PUDUCHERRY          27.0          27.0
## 890                                         PUDUCHERRY          26.5          26.5
## 891                                         PUDUCHERRY          29.0          29.0
## 892                                             PUNJAB          12.0          35.0
## 893                                             PUNJAB          12.0          34.0
## 894                                             PUNJAB          12.0          35.0
## 895                                             PUNJAB          10.0          32.0
## 896                                             PUNJAB          14.0          34.0
## 897                                             PUNJAB          11.0          30.0
## 898                                             PUNJAB          12.0          29.0
## 899                                             PUNJAB          12.0          36.0
## 900                                             PUNJAB          13.0          34.0
## 901                                             PUNJAB          14.0          34.0
## 902                                             PUNJAB          14.0          33.0
## 903                                             PUNJAB          14.0          34.0
## 904                                             PUNJAB          13.0          34.0
## 905                                             PUNJAB          13.0          36.0
## 906                                             PUNJAB          13.0          35.0
## 907                                          RAJASTHAN          18.5          24.0
## 908                                          RAJASTHAN          14.0          31.5
## 909                                          RAJASTHAN          18.0          29.0
## 910                                         TAMIL NADU          24.0          31.0
## 911                                         TAMIL NADU          22.0          34.0
## 912                                         TAMIL NADU          25.0          27.0
## 913                                         TAMIL NADU          25.0          29.0
## 914                                         TAMIL NADU          24.0          29.0
## 915                                         TAMIL NADU          25.0          26.0
## 916                                         TAMIL NADU          23.0          24.0
## 917                                         TAMIL NADU          25.0          29.0
```

```
## 918                                  TAMIL NADU          25.0          29.0
## 919                                  TAMIL NADU          24.0          25.0
## 920                                  TAMIL NADU          26.0          29.0
## 921                                  TAMIL NADU          25.0          29.0
## 922                                  TAMIL NADU          25.0          30.0
## 923                                  TAMIL NADU          25.0          25.0
## 924                                     TRIPURA          21.0          28.0
## 925                                     TRIPURA          21.0          27.0
## 926                                     TRIPURA          20.0          28.0
## 927                                     TRIPURA          20.5          28.0
## 928                                     TRIPURA          21.0          27.5
## 929                                     TRIPURA          21.0          28.0
## 930                                     TRIPURA          21.0          28.0
## 931                                     TRIPURA          20.5          27.5
## 932                                     TRIPURA          20.5          27.5
## 933                                     TRIPURA          21.5          28.5
## 934                                     TRIPURA          21.0          28.0
## 935                                     TRIPURA          20.5          27.5
## 936                                     TRIPURA          21.5          27.5
## 937                                     TRIPURA          21.0          28.0
## 938                                     TRIPURA          22.0          28.0
## 939                                     TRIPURA          21.5          27.5
## 940                                     TRIPURA          21.0          28.0
## 941                                     TRIPURA          21.0          28.0
## 942                                     TRIPURA          20.0          27.0
## 943                                     TRIPURA          21.0          27.5
## 944                                     TRIPURA          21.5          28.0
## 945                                     TRIPURA          21.5          27.5
## 946                                     TRIPURA          21.0          27.5
## 947                                     TRIPURA          21.0          27.0
## 948                                     TRIPURA          21.5          28.0
## 949                                     TRIPURA          21.0          28.0
## 950                                  State Name           Min           Max
## 951                              ANDHRA PRADESH            25            30
## 952                              ANDHRA PRADESH            24            32
## 953                              ANDHRA PRADESH            24            33
## 954                              ANDHRA PRADESH            24            31
## 955                              ANDHRA PRADESH            22            33
## 956                              ANDHRA PRADESH            24            29
## 957                              ANDHRA PRADESH            25            27
## 958                              ANDHRA PRADESH            24            28
## 959                              ANDHRA PRADESH            25            25
## 960                                       ASSAM            18            32
## 961                                       ASSAM            18            30
## 962                                       ASSAM            20            32
## 963                                       ASSAM            19            32
## 964                                       ASSAM            19            29
## 965                                       ASSAM            17            29
## 966                                       ASSAM            17            29
## 967                                       ASSAM            18            32
## 968                                       ASSAM            18            30
## 969                                       ASSAM            20            26
## 970                                       ASSAM            24            25
## 971                                       ASSAM            20            26
```

```
## 972                                         ASSAM             21              25
## 973                                         ASSAM             19              25
## 974                                         ASSAM             20              28
## 975                                         ASSAM             20              30
## 976                                         ASSAM             24              33
## 977                                         ASSAM             17              31
## 978                                         ASSAM             20              25
## 979                                         ASSAM             19              30
## 980                                         ASSAM             19              32
## 981                                         ASSAM             19              34
## 982                                         BIHAR             16              28
## 983                                         BIHAR             17              32
## 984                                         BIHAR             16              28
## 985                                         BIHAR             19              29
## 986  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             28              32
## 987  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             29              33
## 988  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             29              30
## 989  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             28              32
## 990  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             28              33
## 991  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             28              32
## 992  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             28              32
## 993  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             29              32
## 994  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             29              32
## 995  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI             26              27
## 996                                           GOA             26              32
## 997                                           GOA             28              32
## 998                                           GOA             27              31
## 999                                           GOA             26              30
## 1000                                          GOA             26              31
## 1001                                          GOA             27              30
## 1002                                          GOA             28              31
## 1003                                          GOA             27              31
## 1004                                          GOA             27              30
## 1005                                          GOA             27              30
## 1006                                          GOA             27              31
## 1007                                          GOA             27              30
## 1008                                          GOA             27              31
## 1009                                          GOA             28              30
## 1010                                          GOA             27              32
## 1011                                          GOA             26              31
## 1012                                          GOA             26              31
## 1013                                          GOA             28              31
## 1014                                          GOA             27              31
## 1015                                          GOA             28              30
## 1016                                          GOA             28              30
## 1017                                          GOA             26              30
## 1018                                          GOA             26              30
## 1019                                          GOA             26              30
## 1020                                          GOA             27              30
## 1021                                          GOA             28              32
## 1022                                      GUJARAT             24              35
## 1023                                      GUJARAT             22              30
## 1024                                      GUJARAT             22              28
## 1025                                      GUJARAT             22              30
```

```
## 1026                GUJARAT   28   32
## 1027                GUJARAT   22   30
## 1028                GUJARAT   18   30
## 1029                GUJARAT   26   32
## 1030                GUJARAT   26   31
## 1031                GUJARAT   24   34
## 1032                GUJARAT   24   35
## 1033                GUJARAT   25   31
## 1034                GUJARAT   28   32
## 1035                GUJARAT   24   32
## 1036                GUJARAT   24   30
## 1037                GUJARAT   22   33
## 1038                GUJARAT   22   33
## 1039                GUJARAT   26   27
## 1040                HARYANA    -    -
## 1041                HARYANA    -    -
## 1042                HARYANA   11   29
## 1043                HARYANA   14   29
## 1044                HARYANA    -    -
## 1045                HARYANA    -    -
## 1046                HARYANA    -    -
## 1047                HARYANA    -    -
## 1048                HARYANA    -    -
## 1049                HARYANA    -    -
## 1050     HIMACHAL\r\nPRADESH   20   33
## 1051     HIMACHAL\r\nPRADESH   20   29
## 1052     HIMACHAL\r\nPRADESH   25   25
## 1053     HIMACHAL\r\nPRADESH   21   26
## 1054     HIMACHAL\r\nPRADESH   20   28
## 1055     HIMACHAL\r\nPRADESH    8   18
## 1056     HIMACHAL\r\nPRADESH    9   20
## 1057     HIMACHAL\r\nPRADESH    9   23
## 1058     HIMACHAL\r\nPRADESH    9   24
## 1059     HIMACHAL\r\nPRADESH   13   25
## 1060     HIMACHAL\r\nPRADESH   13   26
## 1061     HIMACHAL\r\nPRADESH   16   19
## 1062     HIMACHAL\r\nPRADESH    3   13
## 1063     HIMACHAL\r\nPRADESH    6   16
## 1064     HIMACHAL\r\nPRADESH   11   23
## 1065     HIMACHAL\r\nPRADESH   16   23
## 1066     HIMACHAL\r\nPRADESH   16   22
## 1067     HIMACHAL\r\nPRADESH    9   16
## 1068     HIMACHAL\r\nPRADESH    8   15
## 1069     HIMACHAL\r\nPRADESH   10   16
## 1070     HIMACHAL\r\nPRADESH   17   19
## 1071     HIMACHAL\r\nPRADESH    -    -
## 1072     HIMACHAL\r\nPRADESH    -    -
## 1073              JHARKHAND   16   36
## 1074              JHARKHAND   18   30
## 1075              JHARKHAND   19   26
## 1076              JHARKHAND   17   29
## 1077              JHARKHAND   12   31
## 1078              JHARKHAND   21   27
## 1079              JHARKHAND    9   27
```

```
## 1080                                            JHARKHAND               9              26
## 1081                                            KARNATAKA              26              28
## 1082                                            KARNATAKA              25              33
## 1083                                            KARNATAKA              25              31
## 1084                                            KARNATAKA              24              29
## 1085                                            KARNATAKA              26              31
## 1086                                            KARNATAKA              25              31
## 1087                                            KARNATAKA              25              29
## 1088                                            KARNATAKA              24              28
## 1089                                            KARNATAKA              25              30
## 1090                                            KARNATAKA              25              29
## 1091                                            KARNATAKA              24              29
## 1092                                            KARNATAKA              22              28
## 1093                                            KARNATAKA              25              30
## 1094                                            KARNATAKA              26              31
## 1095                                               KERALA              26              32
## 1096                                               KERALA              24              31
## 1097                                               KERALA              22              33
## 1098                                               KERALA              24              30
## 1099                                               KERALA              21              23
## 1100                                               KERALA              26              32
## 1101                                               KERALA              27              31
## 1102                                               KERALA              26              29
## 1103                                               KERALA              26              30
## 1104                                               KERALA              27              31
## 1105                                               KERALA              26              32
## 1106                                               KERALA              25              31
## 1107                                               KERALA              27              32
## 1108                                               KERALA              20              23
## 1109                                               KERALA              25              31
## 1110                                               KERALA              26              29
## 1111                                               KERALA              20              22
## 1112                                               KERALA              26              29
## 1113                                               KERALA              20              24
## 1114                                               KERALA              27              31
## 1115                                               KERALA              22              24
## 1116                                               KERALA              22              31
## 1117                                               KERALA              22              31
## 1118                                               KERALA              26              30
## 1119                                               KERALA              28              30
## 1120                                               KERALA              27              31
## 1121                                               KERALA              27              30
## 1122                                               KERALA              27              31
## 1123                                               KERALA              25              29
## 1124                                               KERALA              26              29
## 1125                                               KERALA              26              29
## 1126                                               KERALA              20              23
## 1127                                               KERALA              20              23
## 1128                                               KERALA              20              31
## 1129                                               KERALA              22              32
## 1130                                               KERALA              20              31
## 1131                                               KERALA              22              23
## 1132                                               KERALA              22              24
## 1133                                               KERALA              23              31
```

```
## 1134            KERALA   25   31
## 1135            KERALA   24   29
## 1136            KERALA   24   29
## 1137            KERALA   24   28
## 1138            KERALA   25   30
## 1139            KERALA   24   29
## 1140            KERALA   24   30
## 1141            KERALA   27   30
## 1142            KERALA   27   29
## 1143            KERALA   26   29
## 1144            KERALA   27   29
## 1145            KERALA   27   29
## 1146            KERALA   26   29
## 1147            KERALA   25   29
## 1148            KERALA   25   30
## 1149            KERALA   26   32
## 1150            KERALA   26   32
## 1151            KERALA   26   31
## 1152            KERALA   28   32
## 1153            KERALA   26   31
## 1154            KERALA   26   30
## 1155            KERALA   27   31
## 1156            KERALA   27   30
## 1157            KERALA   22   33
## 1158            KERALA   20   34
## 1159            KERALA   24   28
## 1160            KERALA   23   31
## 1161            KERALA   20   23
## 1162            KERALA   20   24
## 1163            KERALA   27   30
## 1164            KERALA   25   28
## 1165            KERALA   25   30
## 1166            KERALA   26   32
## 1167            KERALA   27   32
## 1168    MADHYA PRADESH   20   30
## 1169    MADHYA PRADESH   20   32
## 1170    MADHYA PRADESH   20   26
## 1171    MADHYA PRADESH   27   28
## 1172    MADHYA PRADESH   18   25
## 1173    MADHYA PRADESH   17   27
## 1174    MADHYA PRADESH   19   25
## 1175    MADHYA PRADESH   17   26
## 1176    MADHYA PRADESH   20   25
## 1177    MADHYA PRADESH   25   28
## 1178    MADHYA PRADESH   26   27
## 1179       MAHARASHTRA   27   30
## 1180       MAHARASHTRA   27   30
## 1181       MAHARASHTRA   27   30
## 1182       MAHARASHTRA   28   35
## 1183       MAHARASHTRA   25   35
## 1184       MAHARASHTRA   26   30
## 1185       MAHARASHTRA   28   36
## 1186       MAHARASHTRA   27   30
## 1187       MAHARASHTRA   25   39
```

```
## 1188                                  MAHARASHTRA            24             30
## 1189                                  MAHARASHTRA            23             35
## 1190                                  MAHARASHTRA            25             34
## 1191                                  MAHARASHTRA            23             35
## 1192                                  MAHARASHTRA            20             32
## 1193                                  MAHARASHTRA            22             31
## 1194                                  MAHARASHTRA            31             32
## 1195                                  MAHARASHTRA            25             35
## 1196                                  MAHARASHTRA            23             35
## 1197                                  MAHARASHTRA            24             34
## 1198                                  MAHARASHTRA            28             35
## 1199                                  MAHARASHTRA            28             35
## 1200                                  MAHARASHTRA            27             35
## 1201                                  MAHARASHTRA            26             35
## 1202                                  MAHARASHTRA            28             35
## 1203                                  MAHARASHTRA            22             34
## 1204                                  MAHARASHTRA            25             34
## 1205                                  MAHARASHTRA            25             34
## 1206                                  MAHARASHTRA            25             34
## 1207                                  MAHARASHTRA            25             34
## 1208                                  MAHARASHTRA            25             27
## 1209                                  MAHARASHTRA            25             27
## 1210                                  MAHARASHTRA            25             27
## 1211                                  MAHARASHTRA            20             28
## 1212                                  MAHARASHTRA            18             28
## 1213                                  MAHARASHTRA            25             39
## 1214                                  MAHARASHTRA            25             38
## 1215                                      MANIPUR            17             30
## 1216                                      MANIPUR            17             30
## 1217                                      MANIPUR            16             29
## 1218                                      MANIPUR            19             29
## 1219                                      MANIPUR             3             30
## 1220                                      MANIPUR            19             31
## 1221                                      MANIPUR            17             30
## 1222                                      MANIPUR            18             31
## 1223                                      MANIPUR            20             29
## 1224                                      MANIPUR            20             29
## 1225                                      MANIPUR            19             29
## 1226                                      MANIPUR            11             28
## 1227                                      MANIPUR            22             28
## 1228                                      MANIPUR            19             28
## 1229                                      MANIPUR            19             28
## 1230                                      MANIPUR            23             28
## 1231                                      MANIPUR            23             27
## 1232                                      MANIPUR            21             29
## 1233                                      MANIPUR            20             28
## 1234                                      MANIPUR            21             28
## 1235                                      MANIPUR            18             29
## 1236                                      MANIPUR            19             32
## 1237                                      MANIPUR            20             28
## 1238                                      MANIPUR            18             27
## 1239                                      MANIPUR            19             29
## 1240                                      MANIPUR            27             29
## 1241                                      MANIPUR            20             28
```

```
## 1242                                        MANIPUR            19            28
## 1243                                        MANIPUR            21            27
## 1244                                        MANIPUR            19            28
## 1245                                        MANIPUR            20            28
## 1246                                      MEGHALAYA            16            27
## 1247                                      MEGHALAYA            10            26
## 1248                                      MEGHALAYA             8            22
## 1249                                      MEGHALAYA            19            31
## 1250                                      MEGHALAYA            19            31
## 1251                                      MEGHALAYA            16            26
## 1252                                      MEGHALAYA            16            22
## 1253                                      MEGHALAYA            16            23
## 1254                                      MEGHALAYA            14            24
## 1255                                      MEGHALAYA             9            22
## 1256                                      MEGHALAYA            10            22
## 1257                                      MEGHALAYA            18            28
## 1258                                      MEGHALAYA            14            22
## 1259                                      MEGHALAYA            13            27
## 1260                                      MEGHALAYA            13            24
## 1261                                      MEGHALAYA            13            26
## 1262                                      MEGHALAYA            14            24
## 1263                                      MEGHALAYA            15            25
## 1264                                      MEGHALAYA            12            22
## 1265                                      MEGHALAYA            13            24
## 1266                                      MEGHALAYA            13            23
## 1267                                      MEGHALAYA            15            26
## 1268                                      MEGHALAYA            15            28
## 1269                                      MEGHALAYA            16            28
## 1270                                      MEGHALAYA            13            27
## 1271                                      MEGHALAYA             8            31
## 1272                                      MEGHALAYA            17            31
## 1273                                      MEGHALAYA             7            31
## 1274                                      MEGHALAYA            19            30
## 1275                                      MEGHALAYA            18            31
## 1276                                     PUDUCHERRY            26            26
## 1277                                     PUDUCHERRY            26            26
## 1278                                     PUDUCHERRY            26            26
## 1279                                     PUDUCHERRY            26            26
## 1280                                         PUNJAB            10            30
## 1281                                         PUNJAB            12            29
## 1282                                         PUNJAB            12            29
## 1283                                         PUNJAB            11            29
## 1284                                         PUNJAB            11            28
## 1285                                         PUNJAB            10            29
## 1286                                         PUNJAB             9            29
## 1287                                         PUNJAB            12            30
## 1288                                         PUNJAB            12            29
## 1289                                         PUNJAB            12            29
## 1290                                         PUNJAB            11            37
## 1291                                         PUNJAB            10            36
## 1292                                         PUNJAB            13            29
## 1293                                         PUNJAB            13            29
## 1294                                         PUNJAB            11            29
## 1295                                         PUNJAB             -             -
```

```
## 1296                                      PUNJAB            -            -
## 1297                                      PUNJAB            -            -
## 1298                                   RAJASTHAN           17           30
## 1299                                   RAJASTHAN           18           22
## 1300                                   RAJASTHAN           15           30
## 1301                                   RAJASTHAN           19           29
## 1302                                  TAMIL NADU           22           28
## 1303                                  TAMIL NADU           25           27
## 1304                                  TAMIL NADU           25           29
## 1305                                  TAMIL NADU           26           32
## 1306                                  TAMIL NADU           25           28
## 1307                                  TAMIL NADU            3           27
## 1308                                  TAMIL NADU           24           30
## 1309                                  TAMIL NADU           24           24
## 1310                                  TAMIL NADU           25           30
## 1311                                  TAMIL NADU           24           28
## 1312                                  TAMIL NADU           26           31
## 1313                                  TAMIL NADU           25           27
## 1314                                  TAMIL NADU           25           28
## 1315                                  TAMIL NADU           25           27
## 1316                                     TRIPURA           22           29
## 1317                                     TRIPURA           23           30
## 1318                                     TRIPURA           23           31
## 1319                                     TRIPURA           22           30
## 1320                                     TRIPURA           22           29
## 1321                                     TRIPURA           22           28
## 1322                                     TRIPURA           22           29
## 1323                                     TRIPURA           22           30
## 1324                                     TRIPURA           22           29
## 1325                                     TRIPURA           22           29
## 1326                                     TRIPURA           22           28
## 1327                                     TRIPURA           23           30
## 1328                                     TRIPURA           23           29
## 1329                                     TRIPURA           22           29
## 1330                                     TRIPURA           22           28
## 1331                                     TRIPURA           22           29
## 1332                                     TRIPURA           22           30
## 1333                                     TRIPURA           22           29
## 1334                                     TRIPURA           22           29
## 1335                                     TRIPURA           22           29
## 1336                                     TRIPURA           22           28
## 1337                                     TRIPURA           22           28
## 1338                                     TRIPURA           22           28
## 1339                                     TRIPURA           22           28
## 1340                                     TRIPURA           22           28
## 1341                                     TRIPURA           22           28
## 1342                                  State Name          Min          Max
## 1343                              ANDHRA PRADESH         23.0         32.0
## 1344                              ANDHRA PRADESH         24.0         32.0
## 1345                              ANDHRA PRADESH         24.0         32.0
## 1346                              ANDHRA PRADESH         24.0         32.0
## 1347                              ANDHRA PRADESH         22.0         28.0
## 1348                              ANDHRA PRADESH         24.0         32.0
## 1349 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI         26.2         30.0
```

```
## 1350 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           27.1            29.0
## 1351 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           27.1            30.0
## 1352 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           26.8            30.0
## 1353 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           26.4            30.5
## 1354 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           26.7            30.4
## 1355 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           27.1            30.0
## 1356 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           26.9            29.2
## 1357 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           20.0            27.0
## 1358 DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI           26.8            29.8
## 1359                                          GOA           28.0            32.0
## 1360                                          GOA           28.0            31.0
## 1361                                          GOA           27.0            29.0
## 1362                                          GOA           27.0            29.0
## 1363                                          GOA           26.0            31.0
## 1364                                          GOA           26.5            31.0
## 1365                                          GOA           28.0            32.0
## 1366                                          GOA           27.0            33.0
## 1367                                          GOA           27.0            30.0
## 1368                                          GOA           27.0            32.0
## 1369                                          GOA           27.0            31.0
## 1370                                          GOA           27.0            30.0
## 1371                                          GOA           27.0            30.0
## 1372                                          GOA           27.0            32.0
## 1373                                          GOA           28.0            30.0
## 1374                                          GOA           27.0            31.0
## 1375                                          GOA           27.0            31.0
## 1376                                          GOA           27.0            32.0
## 1377                                          GOA           28.0            31.0
## 1378                                          GOA           28.0            33.0
## 1379                                          GOA           27.0            31.0
## 1380                                          GOA           28.0            33.0
## 1381                                          GOA           27.0            30.0
## 1382                                          GOA           25.0            33.0
## 1383                                          GOA           28.0            30.0
## 1384                                          GOA           27.0            30.0
## 1385                                      GUJARAT           25.0            32.0
## 1386                                      GUJARAT           29.0            32.0
## 1387                                      GUJARAT           27.0            32.0
## 1388                                      GUJARAT           25.0            34.0
## 1389                                      GUJARAT           20.0            32.0
## 1390                                      GUJARAT           24.0            34.0
## 1391                                      GUJARAT           20.0            31.0
## 1392                                      GUJARAT           22.0            30.0
## 1393                                      GUJARAT           26.0            29.0
## 1394                                      GUJARAT           24.0            28.0
## 1395                                      GUJARAT           27.0            30.0
## 1396                                      GUJARAT           29.0            33.0
## 1397                                      GUJARAT           23.0            29.0
## 1398                                      GUJARAT           22.0            29.0
## 1399                                      GUJARAT           20.0            33.0
## 1400                                      GUJARAT           28.0            31.0
## 1401                                      GUJARAT           22.0            29.0
## 1402                                      HARYANA           23.0            33.0
## 1403                                      HARYANA              -               -
```

```
## 1404                          HARYANA          -          -
## 1405                          HARYANA       13.0       33.0
## 1406                          HARYANA       22.0       32.0
## 1407                          HARYANA          -          -
## 1408                          HARYANA          -          -
## 1409                          HARYANA          -          -
## 1410                          HARYANA       25.0       33.0
## 1411             HIMACHAL\r\nPRADESH       15.0       32.0
## 1412             HIMACHAL\r\nPRADESH       19.0       25.0
## 1413             HIMACHAL\r\nPRADESH       17.0       26.0
## 1414             HIMACHAL\r\nPRADESH       18.0       26.0
## 1415             HIMACHAL\r\nPRADESH       16.0       26.0
## 1416             HIMACHAL\r\nPRADESH       19.0       25.0
## 1417                        KARNATAKA       25.0       29.0
## 1418                        KARNATAKA       25.0       28.0
## 1419                        KARNATAKA       25.0       32.0
## 1420                        KARNATAKA       25.0       32.0
## 1421                        KARNATAKA       25.0       32.0
## 1422                        KARNATAKA       25.0       32.0
## 1423                           KERALA       20.0       25.0
## 1424                           KERALA       21.0       23.0
## 1425                           KERALA       21.0       25.0
## 1426                           KERALA       22.0       30.0
## 1427                           KERALA       25.0       30.0
## 1428                           KERALA       25.0       29.0
## 1429                           KERALA       26.0       27.0
## 1430                           KERALA       25.0       33.0
## 1431                           KERALA       21.0       30.0
## 1432                           KERALA       28.0       33.0
## 1433                           KERALA       28.0       30.0
## 1434                           KERALA       28.0       31.0
## 1435                           KERALA       26.0       34.0
## 1436                           KERALA       28.0       31.0
## 1437                           KERALA       26.0       31.0
## 1438                           KERALA       22.0       24.0
## 1439                           KERALA       21.0       24.0
## 1440                           KERALA       22.0       24.0
## 1441                           KERALA       28.0       31.0
## 1442                           KERALA       27.0       32.0
## 1443                           KERALA       20.0       23.0
## 1444                           KERALA       29.0       32.0
## 1445                           KERALA       25.0       29.0
## 1446                           KERALA       26.0       28.0
## 1447                           KERALA       26.0       27.0
## 1448                           KERALA       27.0       29.0
## 1449                           KERALA       23.0       28.0
## 1450                           KERALA       26.0       29.0
## 1451                           KERALA       23.0       30.0
## 1452                           KERALA       24.0       31.0
## 1453                           KERALA       25.0       29.0
## 1454                           KERALA       25.0       30.0
## 1455                           KERALA       26.0       33.0
## 1456                           KERALA       26.0       32.0
## 1457                           KERALA       26.0       28.0
```

```
## 1458                                    KERALA         28.0          30.0
## 1459                                    KERALA         28.0          30.0
## 1460                                    KERALA         27.0          33.0
## 1461                                    KERALA         27.0          28.0
## 1462                                    KERALA         24.0          34.0
## 1463                                    KERALA         28.0          29.0
## 1464                                    KERALA         25.0          29.0
## 1465                                    KERALA         27.0          29.0
## 1466                                    KERALA         27.0          29.0
## 1467                                    KERALA         26.0          27.0
## 1468                                    KERALA         26.0          28.0
## 1469                                    KERALA         21.0          23.0
## 1470                                    KERALA         26.0          30.0
## 1471                                    KERALA         27.0          32.0
## 1472                                    KERALA         27.0          30.0
## 1473                                    KERALA         27.0          32.0
## 1474                                    KERALA         26.0          29.0
## 1475                                    KERALA         27.0          31.0
## 1476                                    KERALA         26.0          35.0
## 1477                                    KERALA         29.0          31.0
## 1478                                    KERALA         26.0          33.0
## 1479                                    KERALA         26.0          30.0
## 1480                                    KERALA         27.0          31.0
## 1481                                    KERALA         28.0          30.0
## 1482                                    KERALA         27.0          32.0
## 1483                                    KERALA         25.0          29.0
## 1484                                    KERALA         23.0          28.0
## 1485                                    KERALA         23.0          31.0
## 1486                                    KERALA         25.0          30.0
## 1487                                    KERALA         27.0          28.0
## 1488                                    KERALA         25.0          28.0
## 1489                                    KERALA         22.0          24.0
## 1490                                    KERALA         22.0          24.0
## 1491                                    KERALA         27.0          29.0
## 1492                                    KERALA         26.0          29.0
## 1493                                    KERALA         26.0          27.0
## 1494                               MAHARASHTRA         28.0          36.0
## 1495                               MAHARASHTRA         19.0          34.0
## 1496                               MAHARASHTRA         28.0          34.0
## 1497                               MAHARASHTRA         18.0          33.0
## 1498                               MAHARASHTRA         21.0          28.0
## 1499                               MAHARASHTRA            -             -
## 1500                               MAHARASHTRA         28.0          36.0
## 1501                               MAHARASHTRA         27.0          36.0
## 1502                               MAHARASHTRA         27.0          36.0
## 1503                               MAHARASHTRA         27.0          36.0
## 1504                               MAHARASHTRA         25.0          28.0
## 1505                               MAHARASHTRA         22.0          34.0
## 1506                               MAHARASHTRA         26.0          30.0
## 1507                               MAHARASHTRA         26.0          30.0
## 1508                               MAHARASHTRA         28.0          30.0
## 1509                               MAHARASHTRA         28.0          30.0
## 1510                               MAHARASHTRA         27.0          30.0
## 1511                               MAHARASHTRA         27.0          30.0
```

```
## 1512                                   MAHARASHTRA         26.0          30.0
## 1513                                   MAHARASHTRA         21.0          38.0
## 1514                                   MAHARASHTRA         25.0          34.0
## 1515                                   MAHARASHTRA         26.0          35.0
## 1516                                   MAHARASHTRA         26.0          35.0
## 1517                                   MAHARASHTRA         26.0          40.0
## 1518                                   MAHARASHTRA         26.0          40.0
## 1519                                   MAHARASHTRA         19.0          24.0
## 1520                                   MAHARASHTRA         27.0          27.0
## 1521                                   MAHARASHTRA         27.0          27.0
## 1522                                   MAHARASHTRA         27.0          27.0
## 1523                                   MAHARASHTRA         20.0          25.0
## 1524                                   MAHARASHTRA         25.0          38.0
## 1525                                   MAHARASHTRA         25.0          38.0
## 1526                                   MAHARASHTRA         25.0          38.0
## 1527                                       MANIPUR         18.0          26.0
## 1528                                       MANIPUR         19.0          28.0
## 1529                                       MANIPUR         20.0          29.0
## 1530                                       MANIPUR         19.0          28.0
## 1531                                       MANIPUR         21.0          29.0
## 1532                                       MANIPUR         20.0          28.0
## 1533                                       MANIPUR         20.0          29.0
## 1534                                       MANIPUR         21.0          28.0
## 1535                                       MANIPUR         19.0          27.0
## 1536                                       MANIPUR         16.0          28.0
## 1537                                       MANIPUR         20.0          28.0
## 1538                                       MANIPUR         21.0          28.0
## 1539                                       MANIPUR         18.0          28.0
## 1540                                       MANIPUR         21.0          28.0
## 1541                                       MANIPUR         18.4          28.0
## 1542                                       MANIPUR         20.0          27.0
## 1543                                       MANIPUR         21.0          29.0
## 1544                                       MANIPUR         17.0          28.0
## 1545                                       MANIPUR         18.0          28.0
## 1546                                       MANIPUR         20.0          28.0
## 1547                                       MANIPUR         20.0          28.0
## 1548                                       MANIPUR         17.0          28.0
## 1549                                       MANIPUR         21.0          29.0
## 1550                                       MANIPUR         23.0          30.0
## 1551                                       MANIPUR         24.0          28.0
## 1552                                       MANIPUR         20.0          27.0
## 1553                                       MANIPUR         19.0          29.0
## 1554                                       MANIPUR         19.0          28.0
## 1555                                       MANIPUR         19.0          28.0
## 1556                                       MANIPUR         19.0          27.0
## 1557                                       MANIPUR         19.0          28.0
## 1558                                       MANIPUR          0.6          28.0
## 1559                                       MANIPUR         21.0          27.0
## 1560                                       MANIPUR         20.0          28.0
## 1561                                       MANIPUR         19.0          28.0
## 1562                                       MANIPUR         19.0          28.0
## 1563                                     MEGHALAYA         18.1          30.0
## 1564                                     MEGHALAYA         18.0          30.0
## 1565                                     MEGHALAYA         18.0          29.0
```

```
## 1566                                    MEGHALAYA          20.0          29.0
## 1567                                    MEGHALAYA          14.6          23.0
## 1568                                    MEGHALAYA          13.2          31.0
## 1569                                    MEGHALAYA          13.0          24.0
## 1570                                    MEGHALAYA          14.0          22.0
## 1571                                    MEGHALAYA          11.0          21.0
## 1572                                    MEGHALAYA          12.0          21.0
## 1573                                    MEGHALAYA          17.5          28.0
## 1574                                    MEGHALAYA          11.0          21.0
## 1575                                    MEGHALAYA          15.0          22.0
## 1576                                    MEGHALAYA          13.0          20.0
## 1577                                    MEGHALAYA          14.0          21.0
## 1578                                    MEGHALAYA          14.0          22.0
## 1579                                    MEGHALAYA          15.0          24.0
## 1580                                    MEGHALAYA          14.0          24.0
## 1581                                    MEGHALAYA          14.0          24.0
## 1582                                    MEGHALAYA          13.0          22.0
## 1583                                    MEGHALAYA          13.0          22.0
## 1584                                    MEGHALAYA          14.0          22.0
## 1585                                    MEGHALAYA          15.0          26.1
## 1586                                    MEGHALAYA          15.0          24.1
## 1587                                      MIZORAM          18.0          27.0
## 1588                                      MIZORAM          16.0          28.0
## 1589                                      MIZORAM          13.0          27.0
## 1590                                      MIZORAM          16.0          26.0
## 1591                                      MIZORAM          15.0          27.0
## 1592                                      MIZORAM          19.0          30.0
## 1593                                      MIZORAM          18.0          27.0
## 1594                                      MIZORAM          18.0          25.0
## 1595                                      MIZORAM          18.0          29.0
## 1596                                      MIZORAM          18.0          30.0
## 1597                                      MIZORAM          19.0          29.0
## 1598                                      MIZORAM          10.0          19.0
## 1599                                      MIZORAM          18.0          29.0
## 1600                                       ODISHA          20.0          30.0
## 1601                                       ODISHA          22.0          29.0
## 1602                                       ODISHA          22.0          31.0
## 1603                                       ODISHA          13.0          30.0
## 1604                                       ODISHA          14.0          28.0
## 1605                                       ODISHA          15.0          29.0
## 1606                                       ODISHA          12.0          26.0
## 1607                                       ODISHA          15.0          31.0
## 1608                                       ODISHA          13.0          31.0
## 1609                                       ODISHA          15.0          32.0
## 1610                                       ODISHA          14.0          32.0
## 1611                                       ODISHA          15.0          32.0
## 1612                                       ODISHA          12.0          33.0
## 1613                                       ODISHA          15.0          32.0
## 1614                                   PUDUCHERRY          24.5          28.2
## 1615                                   PUDUCHERRY          27.0          27.0
## 1616                                   PUDUCHERRY          26.5          26.5
## 1617                                   PUDUCHERRY          27.0          27.0
## 1618                                   PUDUCHERRY          29.0          29.0
## 1619                                       PUNJAB          10.0          36.0
```

```
## 1620                                          PUNJAB           10.0           37.0
## 1621                                          PUNJAB           14.0           32.0
## 1622                                          PUNJAB           13.0           30.0
## 1623                                          PUNJAB           13.0           32.0
## 1624                                          PUNJAB           14.0           38.0
## 1625                                          PUNJAB           12.0           37.0
## 1626                                          PUNJAB           18.2           33.0
## 1627                                          PUNJAB           13.0           36.0
## 1628                                          PUNJAB           10.0           36.0
## 1629                                          PUNJAB           22.0           33.0
## 1630                                          PUNJAB           25.0           32.0
## 1631                                          PUNJAB           13.0           31.0
## 1632                                          PUNJAB           15.0           30.0
## 1633                                          PUNJAB           11.0           38.0
## 1634                                          PUNJAB           13.0           32.0
## 1635                                          PUNJAB           11.0           36.0
## 1636                                      TAMIL NADU           23.0           26.0
## 1637                                      TAMIL NADU           24.0           28.0
## 1638                                      TAMIL NADU           23.0           28.0
## 1639                                      TAMIL NADU           25.0           28.0
## 1640                                      TAMIL NADU           25.0           29.0
## 1641                                      TAMIL NADU           24.0           27.0
## 1642                                      TAMIL NADU           26.0           29.0
## 1643                                      TAMIL NADU           25.0           27.0
## 1644                                      TAMIL NADU           23.0           29.0
## 1645                                      TAMIL NADU           25.0           28.0
## 1646                                      TAMIL NADU           25.0           29.0
## 1647                                      TAMIL NADU           25.0           29.0
## 1648                                      TAMIL NADU           25.0           35.0
## 1649                                      TAMIL NADU           25.0           28.0
## 1650                                         TRIPURA           18.0           29.0
## 1651                                         TRIPURA           18.5           29.0
## 1652                                         TRIPURA           18.0           29.0
## 1653                                         TRIPURA           19.0           31.0
## 1654                                         TRIPURA           18.5           29.0
## 1655                                         TRIPURA           19.0           29.0
## 1656                                         TRIPURA           17.5           28.5
## 1657                                         TRIPURA           18.0           27.5
## 1658                                         TRIPURA           19.0           30.0
## 1659                                         TRIPURA           19.5           31.0
## 1660                                         TRIPURA           19.0           29.5
## 1661                                         TRIPURA           19.5           31.0
## 1662                                         TRIPURA           18.0           29.0
## 1663                                         TRIPURA           18.0           29.0
## 1664                                         TRIPURA           18.5           28.5
## 1665                                         TRIPURA           18.5           28.0
##      DissolvedO2Min DissolvedO2Max pHMin pHMax ConductivityMin ConductivityMax
## 1               6.0            8.0   6.6   7.8             369             640
## 2               6.2            8.2   6.2   8.2             339             502
## 3               6.0           16.9   7.8   8.4             143             233
## 4               4.2            6.6   7.3   8.6             163           58350
## 5               4.3            6.2   7.3   8.1            1867           66950
## 6               5.2            6.8   7.2   8.4            1823           65980
## 7               4.6           12.8   7.4   8.9             163             418
```

```
## 8                 5.2             6.9  7.9  8.4            199              318
## 9                 4.5             6.6  7.9  8.3            193              353
## 10                5.6             7.3  7.9  8.7            156              256
## 11                4.4             8.6  7.4  8.2            301            45740
## 12                4.9             7.6  6.8  8.2           6755            57760
## 13                4.5             7.8  6.9  8.0           1485            59470
## 14                4.2             7.5  6.0  7.8              7            26350
## 15                4.3             7.8  5.9  7.5            116            47730
## 16                6.4             7.7  6.1  7.3             40               93
## 17                6.3             8.3  6.0  7.2             46              168
## 18                6.0             8.4  6.0  7.7             61              207
## 19                6.8             7.6  6.1  7.6             42              111
## 20                4.9             8.1  5.8  9.2             57              174
## 21                5.7             7.4  5.8  7.1             49              138
## 22                6.7             7.7  6.1  7.4             41              108
## 23                4.9             7.0  5.9  7.3             80              231
## 24                7.0             7.8  6.0  7.3             50              478
## 25                2.8             9.6  7.1  8.3          37020            65120
## 26                2.7             8.1  6.2  7.8            159            16380
## 27                6.0             7.8  6.3  7.6              5             4770
## 28                5.6            12.0  5.6  7.5             76             2432
## 29                4.6             7.6  6.2  7.8            275            58190
## 30                4.6             7.8  7.3  8.2           4669            75840
## 31                0.7             7.6  6.0  8.0            125              778
## 32                3.9             9.9  6.1  8.8             38            43800
## 33                3.9             7.0  7.6  8.4           9666            79480
## 34                3.9             7.7  7.5  8.0           7915            83240
## 35                5.5             6.8  7.4  8.3            326            67670
## 36                4.8             6.4  7.1  7.9            298            10880
## 37                6.8             7.5  7.7  8.0            222              344
## 38                5.6             6.5  7.3  8.0            352            50320
## 39                0.9             5.2  7.1  8.2            778             2280
## 40                6.5             7.2  7.4  8.0             78            53810
## 41                2.9             3.1  7.3  8.2           1090             6110
## 42                3.6             6.0  5.9  8.0            704             3495
## 43                4.7             6.4  7.1  8.2            433             1738
## 44                5.2             6.8  7.2  8.1            358             7633
## 45                5.2             6.5  7.4  8.2            398            64670
## 46                1.5             4.4  7.1  8.3            538             3360
## 47                3.2             5.3  7.2  8.4            740             2600
## 48                2.4             6.0  7.2  7.7            560             2280
## 49                5.0             6.7  7.2  8.4            992            28800
## 50                0.4             6.9  6.5  8.1            495             2140
## 51                4.1             7.9  7.5  8.3            300              646
## 52                2.6             4.2  6.7  8.5            564             2640
## 53                2.7             4.2  6.7  8.7            561             2910
## 54                2.3             6.8  4.9  7.9            327             3160
## 55                6.9             8.2  7.0  8.2            283              574
## 56                2.4             4.1  6.4  8.2            540             3140
## 57                7.2             7.9  7.5  8.3            528              764
## 58                6.9             8.0  7.4  8.1            496              716
## 59                3.2             7.7  7.2  8.3            466              768
## 60                6.6             8.3  7.2  8.2            486             2361
## 61                2.1             5.7  2.8  8.0             92             1980
```

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## 62                  6.4            7.3   6.9   8.3              482              987
## 63                  6.8            7.8   6.8   7.8               60              100
## 64                  6.2            6.7   6.7   7.8              126              366
## 65                  6.2            6.7   6.7   7.8              116              163
## 66                  7.2            7.9   6.8   8.4               52               92
## 67                  6.2            7.0   6.7   7.6              124              152
## 68                  6.0            7.0   6.7   7.6              131              168
## 69                  4.1            7.0   6.4   7.6              100            39410
## 70                  4.7            7.8   6.4   7.6               30               63
## 71                  4.2            8.0   6.6   8.3               35               90
## 72                  4.6            8.7   6.5   7.8               55            41000
## 73                  6.5            7.8   6.8   7.6               92              131
## 74                  5.5            6.9   6.5   7.9               54              700
## 75                  3.9            7.6   6.1   7.0               47              251
## 76                  1.5            1.9   6.6   7.3              600             1100
## 77                  1.5            7.1   5.6   6.7               42               63
## 78                  3.9            7.1   6.3   7.1               33               64
## 79                  6.1            7.3   6.4   7.7               40               92
## 80                  3.5            8.0   5.4   8.3               58              190
## 81                  1.0            6.1   5.3   7.2               45               83
## 82                  6.1            7.2   6.7   7.5              110              130
## 83                  5.8            7.2   6.5   8.2               58              239
## 84                  4.8            6.9   6.0   6.8              100              470
## 85                  5.5            7.3   6.6   7.5              110              144
## 86                  6.0            6.6   6.2   6.8               76              120
## 87                  4.5            7.1   6.8   7.7              110              158
## 88                  1.7            6.7   5.9   7.1               49               73
## 89                  5.8            7.0   6.5   7.2               62              280
## 90                  5.1            8.0   6.5   7.3               20               34
## 91                  5.3            7.8   6.1   7.3               28               98
## 92                  4.6            8.1   5.7   7.5               94            47000
## 93                  3.2            7.0   6.2   7.9               95            50000
## 94                  6.7            8.1   5.4   8.1               47               98
## 95                  7.0            8.4   6.4   7.7               51               80
## 96                  0.6            5.5   6.2   7.2              118             9700
## 97                  6.8            7.3   6.6   7.0               70              162
## 98                  6.4            7.2   6.3   6.9               77              120
## 99                  6.4            7.0   6.0   6.8               89              130
## 100                 5.1            7.2   6.6   7.5            12230            16820
## 101                 5.4            7.1   6.9   7.5              124              160
## 102                 5.1            8.0   6.9   7.6               35              146
## 103                 2.4            7.4   6.6   7.8               85              230
## 104                 4.9            8.5   6.8   7.8               91              240
## 105                 3.1            6.4   6.3   7.4               48            30750
## 106                 5.1            8.0   6.5   7.5               58              143
## 107                 1.1            4.3   6.8   8.0              767            50980
## 108                 2.4            7.8   6.8   7.8              329            40360
## 109                 3.6            8.3   6.2   7.2               57             1200
## 110                 3.5            9.0   6.1   7.3               42              211
## 111                 6.5            8.7   6.3   7.5               36               99
## 112                 2.5            8.4   5.9   7.7              118            59900
## 113                 3.9            8.1   5.8   7.4               32              120
## 114                 3.6            7.7   5.1   7.7               38             3549
## 115                 3.9            8.3   6.7   8.3               75            40000
```

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## 116          6.9           8.2  6.1  7.8          43           82
## 117          4.5           7.5  6.1  7.8         252        51000
## 118          5.9           8.5  6.1  7.7          53           84
## 119          4.3           7.7  6.4  7.9         105        52110
## 120          3.7           8.2  6.4  8.2          70          150
## 121          4.8           8.0  6.2  7.4          50        32860
## 122          0.5          10.3  7.1  8.2         355          955
## 123          6.6           9.4  6.6  8.0          10          848
## 124          6.8           8.8  6.2  8.3         175          340
## 125          4.7           6.6  6.3  7.2          45          148
## 126          2.6           9.2  6.4  8.1          23        32500
## 127          1.4           6.1  6.3  7.0          56          170
## 128          5.1           7.9  6.5  7.5          48        19000
## 129          0.0           2.2  6.0  7.1          80          189
## 130          0.0           3.6  6.1  7.3          71          132
## 131          5.6           7.7  6.5  7.5          97          141
## 132          5.6           7.0  6.4  7.6          86          178
## 133          4.3           7.2  7.2  8.2         187          365
## 134          5.6           7.8  6.8  8.0          28          114
## 135          6.5           7.4  7.1  7.8         102          164
## 136          6.4           7.7  6.3  7.3          89          128
## 137          4.3           7.2  6.4  7.3          34           70
## 138          7.1           8.9  6.4  7.3          42           99
## 139          1.6           8.0  6.2  7.9          86        50000
## 140          BDL           7.3  6.4  7.8         121        15450
## 141          6.0           7.4  7.0  8.0         139          236
## 142          6.2           7.5  6.3  8.1          94          168
## 143          6.0           7.3  6.7  7.7          62          193
## 144          6.3           7.4  6.8  8.1          71          287
## 145          6.2           7.5  6.7  8.3          76          655
## 146          6.1           7.2  6.6  8.3          68          196
## 147          6.3           7.4  7.2  8.0         110          170
## 148          5.7           7.1  6.5  8.3          62          551
## 149          BDL           5.6  6.6  7.6         297         2139
## 150          5.0           7.2  6.7  8.3         109        21540
## 151          5.4           7.1  6.8  8.0         162        41360
## 152          6.0           7.4  7.0  8.1          70          147
## 153          5.4           7.3  6.5  8.1          70          112
## 154          6.4           7.7  6.5  8.3          67          103
## 155          4.4           6.6  7.8  8.4         367          613
## 156          3.5           6.0  6.7  7.9        4124        69610
## 157          6.4           7.6  6.9  7.9          63           84
## 158          6.5           7.0  7.2  8.8          83         1008
## 159          3.3           7.0  6.1  7.7         113        59681
## 160          5.6           7.3  6.6  7.4          71          195
## 161          6.0           7.4  6.7  7.7          72          194
## 162          5.8           7.5  6.6  8.0          69          299
## 163          5.0           7.2  6.5  8.0          62          187
## 164          6.5           7.5  6.8  8.2         117         2328
## 165          6.5           7.1  6.5  7.9         104          425
## 166          5.8           7.0  6.7  7.9         109        24440
## 167          5.0           7.0  6.5  8.0          98        32500
## 168          5.7           7.0  6.7  7.8         104        36750
## 169          6.3           7.6  7.1  8.3         135         1170
```

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## 170                6.2            7.6  7.5  8.3            134            1180
## 171                6.4            7.5  7.4  8.3            133            1202
## 172                6.4            7.4  7.3  8.0            113             276
## 173                6.8            7.3  7.0  7.9            107             270
## 174                5.8            7.1  6.8  8.2             68             234
## 175                6.7            7.1  6.7  8.0             75             181
## 176                5.4            6.3  7.2  7.4            320             368
## 177                5.9            6.1  7.1  7.2            390             532
## 178                5.8            6.1  7.3  7.8            565             576
## 179                5.9            6.7  5.9  6.9            290             373
## 180                2.1            6.2  6.5  6.8            590             694
## 181                2.3            4.4  6.6  7.1            610             630
## 182                3.9            6.4  6.7  6.9            420             568
## 183                4.3            6.8  7.0  7.3            250             396
## 184                6.2            7.1  7.2  7.4            300             495
## 185                7.2            7.6  7.2  7.4            196             350
## 186                6.7            7.9  7.0  7.6            135             301
## 187                6.0            6.5  6.1  7.8            155             251
## 188                7.4            7.9  7.3  7.5              3             275
## 189                7.1            7.8  7.1  7.6            169             280
## 190                7.3            7.9  6.2  7.4            150             290
## 191                6.4            6.9  6.2  6.7            450             705
## 192                6.2            6.9  6.9  9.0            120             212
## 193                6.1            6.5  6.8  7.7            430             689
## 194                6.0            6.3  7.1  7.8            230             582
## 195                6.2            6.3  7.2  7.9            250             526
## 196                6.3            6.5  6.2  7.8            270             510
## 197                6.6            7.2  6.5  7.4            200             306
## 198                7.3            8.2  7.1  7.6            200             380
## 199                7.2            8.4  7.1  7.4            180             230
## 200                7.1            7.9  6.3  7.4            100             175
## 201                7.2            7.8  7.1  7.9            100             180
## 202                6.4            6.9  7.1  7.4            125             190
## 203                7.2            7.9  2.4  7.6             95             169
## 204                7.2            7.9  6.3  7.2            140             340
## 205                6.3            6.5  7.3  7.6            125             259
## 206                7.1            7.3  7.1  7.2            150             303
## 207                6.1            7.2  6.3  6.9            350             583
## 208                5.9            7.2  6.1  7.2            355             552
## 209                5.6            7.6  7.0  7.4             55             102
## 210                4.2            7.9  2.8  3.7            330             980
## 211                5.6            7.0  6.7  7.3             50              97
## 212                6.9            8.1  7.1  8.0             58             143
## 213                6.8            8.3  7.1  7.9             58             140
## 214                6.2            7.5  7.0  7.2             48              65
## 215                5.9            8.5  6.8  7.6             36              69
## 216                6.3            8.4  7.1  7.7             40              69
## 217                5.6            7.6  6.7  7.2             43              96
## 218                5.8            8.0  6.7  7.5             36              71
## 219                6.9            8.2  7.0  7.5             32              57
## 220                7.0            7.8  7.4  8.0             45             132
## 221                6.4            8.5  6.5  7.3             33              63
## 222                0.3            8.0  6.8  7.5             33              83
## 223                1.0            6.8  6.8  7.8            136             620
```

```
## 224                3.0              6.6   7.2   7.6          180            335
## 225                1.2              7.8   7.2   7.3          220            520
## 226                0.4              5.0   6.8   7.5          300            790
## 227                6.4              7.6   6.8   7.2           30            444
## 228                0.5              5.4   6.6   7.2          149            589
## 229                2.5              7.0   7.0   7.3          110            354
## 230                6.0              8.6   7.1   7.5           36             55
## 231                3.9              7.6   2.8   4.4          370           1420
## 232                6.3              8.1   6.7   7.6           68            395
## 233                5.8              8.4   5.0   6.5           32             69
## 234                6.8              7.6   7.3   7.9           68            155
## 235                6.9              7.5   7.4   8.0           65            162
## 236                9.4              9.4   8.5   8.5         6190           6190
## 237                8.5              8.5   8.3   8.3        10160          10160
## 238                7.1              7.1   8.4   8.4         6960           6960
## 239                6.6              6.6   7.1   7.1          324            324
## 240                3.8              6.4   7.4   8.2          320            664
## 241                BDL              4.3   7.4   8.2          337           1833
## 242                2.2              5.0   7.0   7.9          442            990
## 243                1.0              4.4   7.3   8.0          466           1533
## 244                3.4              5.2   7.3   7.9            8            783
## 245                2.1              4.2   7.3   8.0          422            977
## 246                1.8              4.0   7.4   8.2          448           1304
## 247                1.2              4.0   7.3   8.0          416           1510
## 248                2.6              4.1   7.2   8.0          350            944
## 249                1.1              4.2   7.3   8.2          410           1368
## 250                0.6              4.2   7.7   8.3          351           1490
## 251                0.8              4.9   7.6   8.1          316           1485
## 252                0.0              0.0   7.2   7.5         1551           2346
## 253                4.7              5.7   7.6   8.4          270            680
## 254                4.5              5.9   7.7   8.3          280            930
## 255                4.9              5.6   7.8   8.4          300            940
## 256                5.5              7.5   6.6   7.6           64            421
## 257                6.2              7.8   7.1   8.1           98            231
## 258                6.0              7.2   7.2   8.2           33           1161
## 259                6.5              7.5   6.7   8.3          115            374
## 260                5.2              7.7   7.0   7.8           88            167
## 261                6.0              7.2   6.8   7.7           76            128
## 262                6.0              7.5   7.7   8.5          549          57900
## 263                6.2              7.6   7.4   8.8          188            546
## 264                6.3              9.8   7.0   7.7           85            139
## 265                6.2              8.2   7.5   8.4          128            357
## 266                5.9              7.2   7.2   8.2          121            252
## 267                6.0              7.5   7.3   8.3          145            264
## 268                5.3              7.0   7.3   8.5           91            197
## 269                5.7              7.0   6.8   8.0           92            194
## 270                6.6              8.4   6.9   8.0           92            195
## 271                4.8              6.3   6.7   7.9           81            168
## 272                3.8              5.4   6.2   7.5           92            184
## 273                3.9              6.1   6.4   8.0          101            189
## 274                4.6              5.9   6.6   7.6          105            178
## 275                5.3              6.6   7.4   8.2          101            215
## 276                6.9              8.0   7.4   8.9          108            191
## 277                7.3              8.7   7.0   8.0           96            198
```

```
## 278              4.1           5.3  6.4  7.6           103          195
## 279              7.3           8.5  7.3  8.7           108          199
## 280              7.1           8.0  6.0  7.0            72          143
## 281              6.5           7.8  7.1  8.2            92          179
## 282              5.1           6.8  7.4  8.5            65          157
## 283              7.9           9.2  8.1  8.9            72          185
## 284              6.1           7.2  6.3  7.5            95          181
## 285              5.3           7.0  6.5  7.9            81          187
## 286              5.9           7.4  7.6  8.7            89          183
## 287              6.5           8.0  5.6  7.3            82          157
## 288              3.6           5.4  6.4  7.4            84          174
## 289              5.3           6.8  6.4  7.3            82          177
## 290              5.9           7.6  6.8  7.9            83          179
## 291              6.1           7.3  6.8  7.9            88          187
## 292              8.5          10.1  6.6  7.8            62          167
## 293              3.8           5.0  6.3  7.7            73          189
## 294              5.2           7.2  6.0  8.0           277         1342
## 295              5.1           7.2  6.9  8.0           248         7526
## 296              5.1           6.7  7.2  8.2           163          290
## 297              3.8           6.6  7.1  8.1           547        10794
## 298              4.1           6.8  7.3  8.4          7650        39705
## 299              4.6           7.2  6.9  7.9          6180        59212
## 300              4.9           6.5  7.1  8.4           207          374
## 301              4.8           6.8  7.4  8.4           184          385
## 302              5.2           7.0  7.4  8.1           199          411
## 303              5.1           7.0  7.7  8.5           182          304
## 304              4.5           6.6  7.0  8.5           288         5042
## 305              4.7           8.0  6.6  7.6           386        53780
## 306              4.8           8.9  6.9  7.9            49        52720
## 307              4.9           7.6  6.4  8.1            87        23360
## 308              4.7           7.7  6.5  7.4            40        40130
## 309              5.0           7.8  6.8  7.9            55          152
## 310              6.5           8.4  6.5  8.0            54          198
## 311              5.8           8.1  6.4  7.7            55          227
## 312              6.5           7.9  6.3  8.1            48          221
## 313              6.7           8.1  6.2  7.9            59          213
## 314              5.5           7.8  6.3  8.3            45          190
## 315              5.2           8.1  6.5  8.4            44          228
## 316              4.6           7.7  6.0  7.8            72         1196
## 317              5.9           7.8  6.5  7.6            47          220
## 318              4.8           8.0  7.0  8.1            56        55620
## 319              2.3           5.1  6.5  7.4           184        11890
## 320              4.8           7.9  6.6  8.2            66         7108
## 321              5.2          13.0  6.1  8.8            48          411
## 322              4.4           7.9  6.6  7.9           116        46920
## 323              4.0           7.8  6.5  7.7           115        53770
## 324              0.3           3.6  6.6  7.4           133          463
## 325              3.7           6.7  6.7  7.6            30        35490
## 326              4.7           6.5  6.7  8.0         16210        55000
## 327              5.1           6.5  6.7  7.9         20170        54680
## 328              5.2           8.5  6.4  7.8          3007        51100
## 329              5.7           7.1  7.1  8.6           402        34210
## 330              4.0           6.6  7.0  8.1           340        15050
## 331              6.9           7.1  7.1  8.1           282          395
```

```
## 332                 3.8            6.4  7.1  7.9           264         39570
## 333                 0.0            3.0  7.3  7.7           734          2350
## 334                 5.3            6.8  7.1  8.0           380         24370
## 335                 0.0            0.6  7.0  8.6          1524          6190
## 336                 4.6            6.9  7.1  7.9           560          4060
## 337                 5.0            6.9  7.0  8.1           335          1679
## 338                 5.9            7.2  6.9  8.2           410         12470
## 339                 6.4            7.1  7.2  8.4           465         35550
## 340                 0.0            3.4  6.9  8.1           799          1684
## 341                 0.0            2.4  7.3  8.0          1390          3400
## 342                 0.0            5.8  7.2  7.9           530          2332
## 343                 3.2            6.5  7.0  8.1           556          6410
## 344                 0.0            4.1  6.5  8.0          1283          1970
## 345                 6.9            8.3  7.8  8.5           379          1260
## 346                 6.4            8.4  7.9  8.9           231           235
## 347                 2.4            5.0  7.7  8.2          1190          6764
## 348                 3.4            4.2  7.7  8.6           895          1396
## 349                 3.2            4.9  7.5  8.6           685          1490
## 350                 5.4            5.4  6.8  8.0           541          2250
## 351                 4.2            4.2  7.6  8.2           312           581
## 352                 3.0            4.1  7.5  8.3           980          6670
## 353                 6.9            8.2  6.5  8.0            53           117
## 354                 6.0            8.0  6.5  8.1            47            97
## 355                 6.2            7.8  6.9  7.2           112           162
## 356                 6.0            7.9  6.8  7.2           120           158
## 357                 1.2            6.9  5.9  7.2            56         26600
## 358                 5.3            8.0  6.4  6.9            32            55
## 359                 5.2            8.6  6.7  8.4            56            88
## 360                 5.1            7.8  6.6  7.6            60         50800
## 361                 6.2            7.4  6.9  7.4            80           108
## 362                 5.4            7.1  7.0  7.6            53            74
## 363                 5.6            8.2  6.3  6.9            41           410
## 364                 0.0            6.8  6.2  6.7           662           909
## 365                 4.5            6.4  6.1  7.4            40            74
## 366                 4.9            7.4  6.2  6.8            40            77
## 367                 6.2            7.4  6.7  7.3            45            66
## 368                 5.0            7.9  6.8  7.8            55           360
## 369                 2.6            6.2  6.1  6.9            65            95
## 370                 5.3            6.8  7.1  7.4            90           136
## 371                 3.7            7.9  6.7  7.6            79           240
## 372                 3.9            6.8  6.1  6.9           196           255
## 373                 5.6            6.8  6.5  6.8           108           130
## 374                 5.6            6.4  6.3  6.7            88           130
## 375                 6.0            6.9  7.0  7.8           100           120
## 376                 2.2            7.3  5.1  7.1            56            82
## 377                 4.3            8.0  6.4  7.2            68           132
## 378                 7.7            9.3  6.5  7.9            23            45
## 379                 5.4            8.2  6.1  7.2            25            81
## 380                 4.2            8.2  6.5  7.9            76         39800
## 381                 4.3            7.9  6.6  7.4           110         48000
## 382                 7.3            8.0  6.7  8.3            40            90
## 383                 7.1            8.4  6.6  7.8            52            80
## 384                 1.5            6.1  5.3  7.2            91         14830
## 385                 5.6            7.7  6.4  6.9            95           165
```

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## 386             6.6          7.5  6.4  6.8          100           140
## 387             5.2          6.9  6.4  6.9          122           160
## 388             5.8          6.9  7.0  7.4         9790         13106
## 389             6.0          6.8  6.7  7.4          110           132
## 390             4.0          6.9  6.3  7.1           46           144
## 391             2.0          9.6  6.2  7.3          108           183
## 392             1.5          8.9  6.1  7.4          108           168
## 393             3.1          7.1  6.4  7.5           75         23350
## 394             5.0          8.6  6.5  7.3           60           141
## 395             1.7          5.3  6.5  8.3          336         54800
## 396             4.1          7.6  6.6  7.7          199         44800
## 397             3.3          8.1  6.4  7.6           59           108
## 398             5.2          8.3  6.3  7.7           50           110
## 399             6.4          8.2  6.2  7.7           38           130
## 400             3.9          8.0  6.0  7.9          136         42000
## 401             4.3          7.9  6.1  7.7           38            73
## 402             3.9          8.1  6.0  7.5           33           140
## 403             6.2          8.0  6.7  8.0           53          2500
## 404             4.0          7.7  6.4  8.3           40            96
## 405             3.8          7.8  6.1  7.7          300         56000
## 406             7.1          8.8  6.5  8.0           60            80
## 407             3.0          8.0  6.5  7.9           80         59000
## 408             6.0          8.3  6.4  8.0           69           140
## 409             5.4          8.1  6.5  7.8           54         26700
## 410             3.8          8.4  7.4  8.1          200          1356
## 411             6.2          9.3  7.0  8.2          101           229
## 412             6.0          8.9  6.2  7.9          109           440
## 413             5.0          7.1  6.0  6.9           36            96
## 414             3.8          7.4  6.2  7.2           37         16700
## 415             1.1          6.8  6.0  6.6           47           407
## 416             3.0          7.3  6.5  7.7           37         33600
## 417             0.8          3.4  5.7  6.9           80           600
## 418             1.2          3.4  6.0  6.9           70           233
## 419             5.4          8.3  6.3  7.9           85           148
## 420             2.1          7.2  6.1  7.3           75           180
## 421             3.8          8.2  7.2  8.3          139          1082
## 422             6.3          8.1  6.7  7.8           48           101
## 423             6.3          7.4  7.1  7.4          100           120
## 424             5.8          6.8  6.4  6.8           90           118
## 425             5.8          7.5  6.5  6.9           36            66
## 426             6.1          8.4  6.1  6.9          102           150
## 427             5.8          7.3  6.9  7.8           62         45000
## 428             5.8          8.3  5.8  7.3           40            93
## 429             1.6          8.0  6.1  7.6           60           126
## 430             7.0          7.0  7.7  7.7          244           244
## 431             6.5          6.5  7.2  7.2          241           241
## 432             4.5          8.7  3.9  7.6           98          5951
## 433             5.2          9.3  6.9  7.6           79           751
## 434             4.6          9.9  7.1  8.2          148          1045
## 435             5.6          7.9  7.2  7.5          156           228
## 436             0.2         12.2  6.6  7.9          260          2216
## 437             0.4          9.7  6.5  8.3          116          2851
## 438             5.8          9.5  6.7  7.7          113           956
## 439             2.9          8.5  6.7  7.8          103           953
```

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## 440                7.4            7.4  6.6  6.6            233            233
## 441                6.2            6.2  7.2  7.2            282            282
## 442                7.7            7.7  7.2  7.2            223            223
## 443                5.1            8.9  7.2  8.2            146            770
## 444                6.5            9.1  7.1  8.2            170            730
## 445                5.9           10.5  6.1  7.8            176           1035
## 446                6.1            9.9  7.0  7.5            151            289
## 447                1.5           13.2  6.7  8.0            192           1015
## 448                3.5           17.8  6.9  8.6             55            524
## 449                1.4           13.6  6.5  7.9            149           2192
## 450                4.7           10.1  6.8  8.2            308           1168
## 451                4.9            9.5  6.5  8.2            108           1050
## 452                3.6            8.9  6.9  8.1            161           1095
## 453                5.4            9.7  7.0  7.8             94            856
## 454                4.2            8.2  7.1  7.5            112            531
## 455                7.8            7.8  7.1  7.1            934            934
## 456                7.1           11.3  7.1  8.4             10            959
## 457                6.0            9.6  7.0  7.8            172           1211
## 458                6.3            9.3  6.9  8.4            164            910
## 459                6.4           12.2  7.0  8.7            113            485
## 460                6.2            6.2  7.4  7.4            198            198
## 461                2.4           10.3  7.0  8.2            124            949
## 462                5.2            7.6  6.8  7.7            108            921
## 463                6.0            7.4  7.0  7.4             67             90
## 464                6.2            7.4  2.4  4.1            610           1240
## 465                5.0            7.5  6.7  7.4             53             73
## 466                7.2            8.4  7.1  7.5             68             80
## 467                3.8            8.6  7.2  7.5             57             95
## 468                6.6            7.5  6.9  7.4             47             74
## 469                6.4            8.6  6.7  7.5             40             55
## 470                6.2            8.0  7.4  7.5             42             63
## 471                5.6            7.2  6.6  7.2             50             83
## 472                6.2            8.0  6.8  7.5             41            650
## 473                6.9            8.6  7.0  7.4             39             70
## 474                7.3            8.4  7.3  7.8             90            158
## 475                5.6            7.9  6.5  7.2             36            440
## 476                6.8            8.7  6.9  7.6             47             73
## 477                1.5            3.8  6.9  7.6             34            465
## 478                3.5            6.0  7.1  7.8            245            300
## 479                0.8            2.4  7.2  7.6            370            480
## 480                1.0            3.0  7.1  7.7            398            662
## 481                6.4            8.6  6.8  7.3             36             59
## 482                1.4            2.7  7.0  7.5            280            400
## 483                3.8            5.8  7.1  7.6            155            318
## 484                6.8            8.6  6.7  7.5             40            470
## 485                5.7            8.9  2.6 17.0            805           1450
## 486                7.1            9.0  7.0  7.8            110            374
## 487                6.8            8.3  4.9  6.2             42             75
## 488                0.5            8.0  7.3  7.5             72            138
## 489                7.1            8.0  7.4  7.6             76            100
## 490                6.2           10.5  7.4  8.4            260           2005
## 491                6.8           10.1  7.5  8.4            436          34020
## 492                6.3            7.0  6.7  8.4            171           2407
## 493                7.0            7.6  6.6  8.4            184            435
```

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## 494              6.9           7.8  6.4  8.3          154          228
## 495              6.8           9.6  6.8  8.5          132          305
## 496              5.2           8.2  7.0  8.4          184          422
## 497              0.3           7.8  7.1  8.1           68          371
## 498              6.7           7.9  6.6  8.4          154          311
## 499              7.1           8.1  6.6  8.4          135          261
## 500              4.5           8.1  7.5  8.4          268          792
## 501              7.0           7.0  8.1  8.1        28200        28200
## 502              6.5           6.5  7.9  7.9        31400        31400
## 503              6.3           6.3  7.8  7.8        28000        28000
## 504              6.3           6.3  6.7  6.7          932          932
## 505              4.0          53.0  7.3  8.2          415         1013
## 506              BDL           3.4  7.2  7.9          607         2066
## 507              2.6           5.5  7.0  7.8          506         1349
## 508              BDL           4.0  7.1  8.0          607         2187
## 509              1.2           6.4  7.1  7.9          470         1223
## 510              2.1           4.3  7.2  8.1          490         1196
## 511              1.7           4.1  7.3  7.9          557         1307
## 512              1.0           3.7  7.1  8.3          756         1546
## 513              1.3           4.4  7.2  7.9          399         1320
## 514              BDL          24.0  6.6  8.0          418         1775
## 515              1.0           5.2  7.3  8.1          507         1710
## 516              1.2           5.6  7.1  8.1          498         1624
## 517              0.0           BDL  7.1  7.8         1290         2078
## 518              5.0           6.9  7.1  8.5          120         1260
## 519              5.5           5.5  7.5  7.5          540          540
## 520              4.3           4.3  7.4  7.4          490          490
## 521              4.4           6.6  7.7  8.2          230          580
## 522              3.8           5.2  8.1  8.3          640          780
## 523              2.9           6.8  8.3  8.5          340         1040
## 524              0.7           4.3  8.0  8.8         8000        15600
## 525              6.5           7.6  6.6  8.5           36          118
## 526              6.4           7.2  6.5  8.2           71          171
## 527              5.1           7.2  6.6  8.2           59          209
## 528              6.5           7.5  6.8  8.7           82          690
## 529              6.0           7.0  6.5  8.2           39          130
## 530              6.6           7.3  6.5  8.6           40           98
## 531              6.4           7.5  6.9  8.9          181         1138
## 532              6.3           6.3  7.5  7.5          774          774
## 533              6.3           7.5  7.0  8.7          163          482
## 534              6.4           7.5  6.5  8.5           40          112
## 535              6.1           7.5  7.4  8.7          109          442
## 536              4.2           6.9  6.7  8.2           70          240
## 537              4.0           7.3  6.7  8.2           71          245
## 538              5.1           7.0  7.0  8.9           78          161
## 539              5.0           6.9  6.2  8.0           89          169
## 540              5.7           8.4  6.0  8.0           77          157
## 541              5.1           6.8  6.2  7.6           84          157
## 542              4.5           6.8  6.1  7.9           94          169
## 543              4.3           7.2  6.3  8.2           79          169
## 544              5.2           7.2  6.0  7.4           88          173
## 545              5.1           7.4  6.1  7.7          107          179
## 546              6.2           7.9  7.0  9.0           92          164
## 547              6.9           8.9  6.6  7.9           82          161
```

```
## 548              5.1          7.1  6.1  8.0          81          177
## 549              6.8          8.8  6.3  8.5          92          164
## 550              6.2          7.9  5.8  7.1          71          140
## 551              6.5          8.2  6.7  8.6          88          148
## 552              5.3          7.5  6.6  8.5          89          167
## 553              6.3          8.9  7.0  8.8          91          159
## 554              6.1          7.8  6.2  7.9          72          155
## 555              5.6          7.6  6.1  8.2          88          159
## 556              6.1          7.9  6.9  8.5          81          149
## 557              6.5          8.6  5.8  7.2          73          161
## 558              4.6          6.9  6.2  8.0          85          149
## 559              5.1          7.0  6.1  7.9          83          166
## 560              5.4          8.0  6.3  8.1          79          157
## 561              5.8          7.8  6.8  8.6          83          159
## 562              6.6         10.0  7.0  8.4          82          159
## 563              5.1          7.1  5.9  7.6          83          148
## 564              5.8          6.8  7.1  8.4         228        60900
## 565              5.7          8.1  6.7  8.4         200          585
## 566              5.0          8.5  7.2  8.7         234          631
## 567              4.6          7.0  7.1  8.5         302         1090
## 568              6.5          8.1  6.7  8.3         254          384
## 569              5.4          8.2  6.7  8.6         240          462
## 570              6.4          7.2  7.1  8.0          50          100
## 571              5.0          7.0  7.2  8.4        5000        85900
## 572              4.1          5.8  7.7  7.9       28800        34100
## 573              5.5          8.6  7.0  8.2         225          375
## 574              6.0          8.0  7.4  8.6         197          652
## 575              4.8          6.8  6.8  8.1          52          130
## 576              5.8          6.8  7.4  8.1          73          131
## 577                -            -  7.3  7.5         158          169
## 578              2.0          9.4  7.3  8.6          48          193
## 579                -            -  6.8  7.7         283          468
## 580              5.0          8.6  6.7  7.4          34           70
## 581              3.3          5.6  6.6  7.7          20           43
## 582              4.3          6.5  6.4  7.8          72          212
## 583              5.2          6.6  7.5  8.0          72          106
## 584              3.8         10.0  6.6  7.6          58           85
## 585              4.3          9.2  7.4  8.1          66          209
## 586              3.7          7.0  6.9  7.7          75          192
## 587              6.7          9.9  6.8  8.0          25           41
## 588              0.8          1.4  6.9  7.5         781         2890
## 589              4.1          9.8  7.3  7.9          19           63
## 590              4.9          5.9  7.1  7.8          27          188
## 591              7.0          9.8  6.9  7.8          25           84
## 592              5.6          5.8  6.9  7.3          90          116
## 593              5.8         10.0  7.1  7.8          60          136
## 594              2.0          5.2  5.8  6.5         112          198
## 595                -            -  7.4  7.6          84           86
## 596              5.4          6.8  7.3  8.1          71          102
## 597              4.6          7.6  6.0  7.5          80          404
## 598              6.8         10.5  7.3  8.1          70          211
## 599              4.3          8.8  7.0  9.3          69          149
## 600              5.1          9.4  6.8  7.9          45          180
## 601              1.0          1.5  7.0  7.8          62          627
```

## 602	-	-	7.0	7.4	280	464
## 603	5.4	7.8	5.8	7.8	115	301
## 604	4.5	7.5	6.3	7.5	25	38
## 605	5.0	10.2	6.7	7.8	54	145
## 606	5.1	7.7	6.4	7.6	78	127
## 607	4.8	8.7	7.2	8.0	199	493
## 608	3.7	7.6	7.5	8.1	205	462
## 609	6.1	7.5	7.4	8.1	359	561
## 610	3.5	6.3	7.1	7.8	436	1160
## 611	1.6	1.6	7.8	7.8	1240	1240
## 612	-	-	7.1	7.1	1430	1430
## 613	-	-	7.9	7.9	1420	1420
## 614	3.4	3.4	7.7	7.7	1220	1220
## 615	10.0	10.0	7.9	7.9	458	458
## 616	4.2	7.2	7.3	7.9	136	2402
## 617	3.6	6.1	6.7	7.9	228	47020
## 618	4.3	6.2	7.6	8.3	13330	52350
## 619	5.1	6.7	7.4	8.4	2030	55740
## 620	4.1	6.9	7.4	8.6	199	572
## 621	4.5	6.8	7.2	8.3	210	5843
## 622	5.4	7.3	7.2	9.3	216	600
## 623	6.0	7.3	7.5	8.9	198	3584
## 624	3.4	6.2	7.3	7.9	237	47400
## 625	6.4	9.3	6.1	7.8	45	90
## 626	5.7	11.0	6.2	7.5	14	2851
## 627	7.0	8.3	6.7	7.4	56	460
## 628	4.0	8.2	6.1	8.1	27	48300
## 629	6.1	8.0	6.4	7.9	18	6725
## 630	6.1	7.8	6.1	7.8	51	1132
## 631	6.9	8.6	6.3	7.4	37	1013
## 632	5.1	8.3	6.4	8.0	23	47750
## 633	6.9	8.6	6.2	8.5	41	126
## 634	4.9	7.2	6.6	8.1	283	48800
## 635	4.7	7.2	6.5	7.5	121	46370
## 636	4.7	7.0	6.6	7.9	210	45470
## 637	2.6	9.3	6.2	7.5	87	11180
## 638	5.1	7.3	6.3	7.7	68	276
## 639	5.1	7.2	6.8	8.0	4810	52590
## 640	BDL	4.1	6.3	7.9	97	478
## 641	4.0	7.7	6.5	7.9	242	34780
## 642	6.2	7.2	5.9	7.1	32	269
## 643	5.0	6.4	6.1	8.0	7580	53160
## 644	5.0	6.3	6.1	7.9	7600	53220
## 645	6.6	8.4	6.2	7.8	42	5789
## 646	7.3	8.7	6.3	7.6	42	66
## 647	4.3	7.4	6.3	8.1	37	48600
## 648	5.0	7.7	6.4	7.6	84	23600
## 649	4.5	7.7	6.2	7.7	211	38490
## 650	4.6	7.4	6.0	7.8	891	51740
## 651	6.1	7.2	7.2	8.1	245	51530
## 652	BDL	4.4	7.2	8.1	865	2720
## 653	BDL	4.4	7.1	7.8	876	3230
## 654	5.3	7.0	7.1	8.2	290	1969
## 655	BDL	6.7	7.4	8.8	717	11920

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## 656          6.4          7.5  7.1  7.9       218        299
## 657          2.4          6.9  7.4  8.0        92      38138
## 658          BDL          1.8  7.1  7.9       530       1673
## 659          6.7          6.7  8.3  8.5       168        381
## 660          6.0          7.3  7.1  8.0       255      73685
## 661          3.8          5.4  7.2  8.0       174      14870
## 662          BDL          6.7  7.2  7.4       633       4238
## 663          5.2          7.2  7.1  7.9       668      46892
## 664          6.1          7.2  7.1  8.2       381      20490
## 665          7.1          7.1  7.5  7.5      1313       1313
## 666          5.0          6.5  7.1  8.4       757      46400
## 667          BDL          3.1  7.0  7.8       305       1554
## 668          6.3          7.7  7.5  8.4       248        637
## 669          1.7          6.8  7.6 10.3       337      17900
## 670          2.8          4.9  8.2  9.3       800      16900
## 671          2.5          6.8  2.8  8.0       352       3570
## 672          4.6          8.2  7.0  8.4       324        667
## 673          1.9          4.4  8.0 10.4       782      21600
## 674          7.8          9.4  8.1  8.6       381        418
## 675          7.6         11.0  7.4  8.3       211        623
## 676          5.2          9.5  7.4  8.4       201       3550
## 677          7.1          8.9  7.2  8.1        57        236
## 678          7.2          8.4  7.0  8.1        83        254
## 679          5.7          8.4  6.4  8.3       368       4690
## 680          6.0          9.2  7.0  8.2       375        587
## 681          6.4          9.6  7.1  8.3       378        592
## 682          5.6          9.9  7.0  8.0       369       4640
## 683          3.0          7.5  6.5  8.2       386       1033
## 684          5.8          9.0  6.9  8.2       362       6170
## 685          8.2          8.6  7.1  8.1       109       1230
## 686          8.1          8.6  7.0  8.5         7        246
## 687          8.5         11.6  7.6  8.2        62        122
## 688          8.2          8.2  8.4  8.4       188        188
## 689          7.4          8.2  7.6  8.3        96        136
## 690          8.5          8.5  8.1  8.1       119        119
## 691          4.6          7.2  6.8  7.6       202        282
## 692            -            -  6.0  6.6         -          -
## 693          6.8          6.8  6.5  7.5         -          -
## 694          7.2          7.5  7.2  7.6         -          -
## 695          7.0          7.6  7.2  7.5         -          -
## 696          3.5          6.2  7.3  7.6       235        332
## 697          7.2          7.7  7.4  7.5       202        238
## 698          8.3          8.5  7.3  7.5         -          -
## 699          6.5          7.8  8.0  8.2       338        740
## 700          6.4          7.4  8.0  8.3       450        585
## 701          7.2          8.2  6.9  7.6        50        110
## 702          7.6          8.1  7.0  7.4        47        108
## 703          6.9          7.8  6.9  7.8        59        119
## 704          6.2          7.0  6.8  7.3       134        180
## 705          6.0          6.7  6.8  7.4       136        178
## 706          6.0          7.0  6.9  7.4       130        176
## 707          6.0          7.0  6.8  7.3       138        172
## 708          5.3          6.5  6.5  7.3       114        134
## 709          5.1          6.3  6.0  7.1       116        132
```

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## 710            6.0         7.4  6.0  7.3         102          128
## 711            5.4         7.2  6.5  7.4         102          124
## 712            4.2         8.0  6.4  7.4          48          135
## 713            4.6         8.8  6.1  7.4          56        22000
## 714            1.5         6.4  5.9  7.7         100          182
## 715            5.3         7.2  6.0  8.2          96          360
## 716            5.7         7.1  6.5  8.2         160          508
## 717            3.6         8.6  6.0  7.4          40          375
## 718            6.1         8.7  6.2  7.9          26          128
## 719            5.1         9.2  6.1  7.7          34        42100
## 720            6.0         8.2  6.1  8.1          28          160
## 721            6.3         8.7  6.3  8.1          39          120
## 722            1.4         7.1  6.4  7.1         149         6500
## 723            4.1         7.9  6.4  7.9         218        33250
## 724            6.0         6.9  7.0  7.6         118          130
## 725            5.9         6.8  6.8  7.8        9140         9890
## 726            4.0         8.0  6.0  7.9          65          158
## 727            4.6         8.3  6.5  7.6          60          140
## 728            0.8         4.8  6.5  7.3          94          210
## 729            0.8         8.4  6.5  7.6          88          160
## 730            6.2         7.1  6.5  7.4         104          118
## 731            2.1         5.8  7.0  7.9         126        52300
## 732            2.1         6.9  6.6  8.1         133         1296
## 733            5.1         8.0  6.5  7.1         100          190
## 734            4.1         8.7  6.4  8.1          54          105
## 735            0.1         2.8  6.4  7.2         405          935
## 736            5.0         7.7  6.0  7.3          70          186
## 737            5.0         7.5  6.0  7.5          65          121
## 738            3.6         6.3  5.8  7.3          42        20700
## 739            4.9         7.1  6.0  7.8          88          195
## 740            5.4         7.3  6.2  8.0         300         1524
## 741            4.9         8.2  6.2  7.5          64        41800
## 742            4.8         8.0  6.8  7.8          32          125
## 743            6.8         9.9  6.2  7.7          24           44
## 744            5.7         8.6  6.4  7.7          33          102
## 745            4.1         7.4  6.1  7.8         102          189
## 746            5.4         8.1  6.9  7.9          80          330
## 747            5.8         8.0  6.8  7.6          84          304
## 748            4.2         7.1  6.5  7.6          66          199
## 749            3.0         8.5  6.2  8.8          54          228
## 750            6.0         7.7  6.8  7.9          44          103
## 751            4.1         7.8  6.2  7.9         199        49800
## 752            5.7         7.8  6.9  7.9          54           86
## 753            3.0         8.2  6.3  8.1          75        40000
## 754            5.9         8.2  6.2  8.1          53          820
## 755            3.6         7.0  6.0  7.3          80          157
## 756            4.1         7.1  6.1  7.6          92          147
## 757            6.0         7.1  6.5  7.2         120          132
## 758            3.1         5.8  6.1  7.0          68          100
## 759            2.1         6.6  6.3  6.9          56           88
## 760            6.1         8.0  6.4  8.1          46           90
## 761            5.2         7.3  6.1  7.9          59          115
## 762            5.3         8.0  6.1  6.8          43           72
## 763            4.4         9.6  6.6  7.7          90        33000
```

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## 764    4.0    8.2  6.6  7.6     32     56
## 765    4.8    7.7  4.1  7.3     38     78
## 766    4.5    7.9  6.8  7.7     35     92
## 767    4.7    9.1  6.5  7.2     44  29000
## 768    0.9    7.4  6.3  7.3     41    135
## 769    5.3    7.2  6.7  7.7     49   9600
## 770    5.3    8.8  6.5  7.5     30     64
## 771    4.4    7.1  6.3  7.3     39   1100
## 772    4.9    9.1  5.2  8.2     37     78
## 773    5.0    7.5  5.8  7.7     85    182
## 774    3.2    8.3  6.1  7.7    131  53500
## 775    7.0    9.7  6.1  7.0     39     66
## 776    1.3    8.0  6.2  7.4     24    122
## 777    2.1    6.7  6.0  7.5     74  39650
## 778    4.4    9.1  6.1  7.9     62  46500
## 779    4.5    8.2  6.9  7.6     66  42600
## 780    3.1    7.4  6.2  7.8     75    223
## 781    6.7    7.3  7.8  8.6    254    414
## 782    5.6    7.4  7.7  8.3    289    602
## 783    6.5    7.7  7.3  7.8    258    520
## 784    6.2    7.8  7.4  8.3    170   3420
## 785    5.4    6.7  7.1  8.3    310    682
## 786    6.5    7.4  7.3  8.4    167    288
## 787    6.2    7.2  7.8  8.7    300    521
## 788    6.0    7.5  7.3  7.9    198    593
## 789    6.2    7.6  7.4  7.9    267    541
## 790    5.0    7.5  6.7  8.9     71    810
## 791    4.4    7.5  6.9  8.4     79  50920
## 792    6.0    7.4  6.5  8.7     67   1970
## 793    6.8    7.6  6.6  8.5     66    385
## 794    5.0    7.5  6.7  8.0     71   3572
## 795    3.8    6.2  7.2  8.0    374    819
## 796    6.4    7.6  6.9  9.0     65    137
## 797    4.4    7.2  7.0  8.0     93  59500
## 798    3.5    7.4  6.5  8.1     85  66200
## 799    4.7    7.6  6.8  8.8     67    590
## 800    BDL    7.3  6.1  7.8    129  58970
## 801    4.0    7.0  6.5  8.1     64  55900
## 802    6.2    7.2  6.6  7.7     80    233
## 803    4.3    7.2  6.6  8.2     83   1010
## 804    3.4    7.2  6.6  8.5    127  23800
## 805    6.4    7.4  6.5  7.9     74    997
## 806    6.1    7.3  6.5  7.7     73    277
## 807    6.4    7.4  6.5  7.8     73    176
## 808    3.9    7.2  6.5  7.8     64   1002
## 809    5.4    7.4  6.8  8.5     87  15710
## 810    3.8    7.0  6.5  7.8     47  55780
## 811    4.1    7.1  6.5  8.2     49  54950
## 812    4.0    7.1  6.7  8.0     49  55750
## 813    BDL    6.9  6.5  7.7     51  29790
## 814    4.0    6.9  7.0  7.7     50  58790
## 815    5.8    7.6  6.5  8.5    121    212
## 816    6.0    7.5  6.7  8.5     79    271
## 817    4.3    7.4  6.8  8.4     97  58300
```

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## 818                 6.9             7.4   7.3   8.0              74              288
## 819                 6.4             7.4   6.7   8.0              97             3285
## 820                 6.0             7.4   6.6   7.9              64              958
## 821                 6.3             7.5   6.6   8.0              77              188
## 822                 7.0             7.3   7.2   8.0              82              277
## 823                 5.5             7.0   6.7   8.1              60              397
## 824                 4.0             6.9   6.9   7.8              54            12900
## 825                 5.2             7.0   7.3   7.8              59            10410
## 826                 3.1             8.1   6.9   7.7             105              408
## 827                 6.9             7.9   7.1   7.7             100              516
## 828                 7.3             8.2   7.0   7.8             125             4225
## 829                 3.1             7.1   6.8   7.6             120              445
## 830                 5.3             7.6   6.9   7.8             190              460
## 831                 4.1             7.7   6.3   7.4             110              420
## 832                 3.9             7.8   7.0   7.9              90              482
## 833                 6.7             6.7   7.6   7.6             234              234
## 834                 6.8             8.1   7.0   7.7             130              482
## 835                 7.1             8.3   7.2   7.9              94              411
## 836                 7.0             8.1   7.0   7.6             115              390
## 837                 5.3             7.8   7.1   7.6             150              458
## 838                 6.9             8.1   6.9   7.6              65              407
## 839                 4.4             7.9   7.0   7.7              91              340
## 840                 6.6             7.9   7.1   7.8              65              460
## 841                 6.8             7.6   7.0   7.6             135              452
## 842                 6.4             7.8   7.0   7.5             150              470
## 843                 7.2             8.1   7.1   7.6             150              401
## 844                 7.2             8.2   7.1   7.4             190              476
## 845                 6.3             7.8   7.1   7.8             130              439
## 846                 3.7             6.2   6.0   7.9             270             1410
## 847                 3.8             5.6   6.2   7.9             270             1220
## 848                 4.6             5.9   6.0   7.8             288              643
## 849                 6.8             8.5   7.1   7.5              70              224
## 850                 4.1             6.8   5.8   7.9             160              624
## 851                 4.8             7.8   6.9   7.4             130              516
## 852                 7.1             7.9   7.1   7.8              29              389
## 853                 6.9             7.9   6.9   7.6             170              550
## 854                 7.0             8.3   7.0   7.6             170              305
## 855                 7.2             8.5   7.1   7.9             122              360
## 856                 7.1             8.4   7.0   7.4             127              387
## 857                 7.2             8.3   6.9   7.6             120              420
## 858                 6.8             7.5   7.0   7.8              62              144
## 859                 6.3             7.5   6.8   7.8              71              150
## 860                 7.0             8.0   7.1   7.8              64               87
## 861                 6.3             7.7   7.1   7.5              68              110
## 862                 6.0             7.6   2.7   4.4             190              700
## 863                 5.0             7.2   2.3   3.3            1000             1480
## 864                 7.4             8.0   6.7   7.3             142              430
## 865                 6.1             7.4   6.6   7.1              59               72
## 866                 6.0             7.7   5.0   6.6              40               72
## 867                 7.0             7.7   7.1   7.6              67               94
## 868                 6.8             7.7   6.3   7.4              62               89
## 869                 7.0             7.7   6.9   7.5              72               89
## 870                 6.0             7.6   6.8   7.2              50              130
## 871                 6.4             7.6   6.8   7.3              40               72
```

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## 872            7.0           7.6   6.7   7.3           30           44
## 873            6.9           8.0   7.6   7.9          108          130
## 874            6.5           7.4   7.0   7.3           48           66
## 875            6.6           7.9   6.8   7.5           41           58
## 876            7.0           7.6   7.3   7.8           44           60
## 877            0.8           3.8   6.8   7.6          215          737
## 878            2.5           8.2   6.8   7.5          225          380
## 879            0.5           3.4   7.3   7.9          285          450
## 880            0.8           3.4   6.9   8.1          427          550
## 881            6.4           7.9   6.7   7.2           39           55
## 882            7.0           8.2   7.0   7.6           50           75
## 883            6.9           7.8   6.7   7.3           37           58
## 884            0.5           3.5   6.8   7.6          170          465
## 885            3.0           6.0   6.7   7.3           15          458
## 886            5.4           7.5   6.9   7.4           67           84
## 887            6.0           7.6   6.9   8.0           25           84
## 888            6.6           6.6   7.7   7.7         7190         7190
## 889            7.0           7.0   7.7   7.7         9110         9110
## 890            6.6           6.6   7.5   7.5        12940        12940
## 891            6.3           6.3   7.4   7.4         2940         2940
## 892            4.3           6.9   7.1   8.1          288          630
## 893            1.8           3.8   7.1   8.1          472         1248
## 894            2.7           4.7   7.2   7.8          435          898
## 895            1.8           4.3   7.3   8.0          620         1452
## 896            1.9           4.9   7.1   7.8          417          952
## 897            2.7           4.4   7.3   7.8          328          998
## 898            2.3           4.0   7.2   7.9          532         1200
## 899            2.6           3.6   7.3   7.9          451         1240
## 900            3.1           4.4   7.2   7.8          323          980
## 901            2.2           4.2   7.1   8.0          510         1330
## 902            BDL           5.9   7.5   7.9          394         1410
## 903            BDL           6.5   7.4   7.9          313         1390
## 904            1.6           4.3   7.0   8.1          651         1840
## 905            BDL           3.6   7.0   8.0          750         2040
## 906            BDL           BDL   7.0   8.0          731         1227
## 907              -             -   7.8   8.4          140          570
## 908              -             -   7.4   8.6          300          610
## 909              -             -   7.8   8.7          270         1810
## 910            5.3           6.7   7.3   7.3          920         1389
## 911            6.2           8.0   6.0   7.1           26          307
## 912            6.6           7.6   5.8   6.8           36          692
## 913            4.3           7.4   6.1   7.1           51         1132
## 914            5.9           7.9   6.3   7.4           90          274
## 915            5.0           7.9   5.7   6.8           29          481
## 916            6.4           8.2   5.8   7.0           28          471
## 917            3.0           7.5   6.2   7.7          135         2540
## 918            4.3           7.8   6.5   7.3          255          565
## 919            6.7           8.0   5.8   6.9           32          491
## 920            4.0           7.0   6.3   7.5          160         1044
## 921            2.5           7.4   6.2   6.8           55          184
## 922            2.9           7.1   6.2   7.0           56          253
## 923            6.0           6.0   7.0   7.0          286          286
## 924            6.5           7.9   6.6   7.4          114          189
## 925            6.2           7.6   6.9   7.4          106          177
```

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## 926         6.2        7.5  6.9  7.8         113          174
## 927         5.7        7.5  7.0  7.7         102          177
## 928         6.3        7.6  7.0  7.4         119          193
## 929         6.5        7.9  6.8  7.7         111          167
## 930         6.5        7.9  6.7  7.4         117          181
## 931         6.0        7.4  6.1  7.7         111          191
## 932         5.8        7.7  6.7  7.7         118          212
## 933         6.1        7.9  7.0  7.7         106          183
## 934         6.6        7.7  6.6  7.4         111          169
## 935         6.5        8.0  6.2  7.5         109          162
## 936         6.1        7.6  6.6  7.3         111          163
## 937         5.5        7.8  6.6  7.7         112          189
## 938         6.2        7.6  6.6  7.7         121          233
## 939         6.1        7.9  6.6  7.5         109          174
## 940         6.2        7.9  6.8  7.7         112          198
## 941         6.3        8.1  6.7  7.6         105          175
## 942         5.9        7.8  6.8  7.3         112          173
## 943         6.2        7.3  6.6  7.3         110          172
## 944         6.5        7.9  6.3  7.3         110          179
## 945         6.7        7.7  6.7  7.6         111          188
## 946         6.3        7.6  6.6  7.3         106          175
## 947         6.5        7.9  7.0  7.4         109          167
## 948         6.2        7.8  6.9  7.6         105          177
## 949         5.8        7.8  6.9  7.5         110          179
## 950         Min        Max  Min  Max         Min          Max
## 951         5.0        8.0  7.4  8.4         212          440
## 952         5.8        8.5  6.9  8.3         228          321
## 953         6.0        8.5  7.2  8.3         274          522
## 954         5.3        8.0  7.1  8.7         324          790
## 955         6.0        8.2  6.9  8.2         248          369
## 956         5.6        8.0  7.4  8.3         212          408
## 957         3.7        5.2  7.5  8.1       28400        47930
## 958         5.6        6.8  6.4  7.6          42           92
## 959         5.7        5.7  8.1  8.1         732          732
## 960         5.2        6.6  7.0  8.0          98          130
## 961         5.0        6.8  6.6  7.5          74           96
## 962         5.5        6.4  7.0  7.7          96          127
## 963         5.8        6.7  7.1  7.8          71           98
## 964         5.1        6.8  6.9  7.8         108          205
## 965         6.0        7.5  6.8  7.6         115          141
## 966         5.1        7.8  6.3  7.3         187          297
## 967         4.9        7.6  6.8  7.5          26           61
## 968         5.0        6.5  7.0  7.8          94          230
## 969         6.5        8.8  6.9  7.8         142          180
## 970         0.3        0.3  7.2  7.6         108          176
## 971         4.2        9.4  7.0  7.9          98          119
## 972         5.6        9.8  7.3  8.0         126          150
## 973         5.2        8.0  7.0  7.8         165          196
## 974         5.7        8.8  7.0  8.1         158          180
## 975         5.2        9.8  7.3  7.7          39           69
## 976         4.9        5.9  7.0  7.7          40           79
## 977         5.2        8.8  7.2  7.7          23           82
## 978         5.3        5.8  7.1  7.5          90          125
## 979         6.5        9.8  7.0  7.7          47           96
```

```
## 980                   5.6            9.5   7.1   7.6           46            94
## 981                   5.6            9.4   7.0   7.9           54           133
## 982                   6.6            9.8   7.4   8.0          203           352
## 983                   5.5            8.5   7.5   8.3          169           668
## 984                   1.1            7.5   7.3   7.6          209           771
## 985                   4.8            8.5   7.2   7.9          130           354
## 986                   6.1            7.2   7.3   7.9          145           274
## 987                   4.3            6.3   7.1   7.7          217          7985
## 988                   4.5            4.9   7.3   8.0         7050         28710
## 989                   4.3            6.0   7.1   8.0         1210         32820
## 990                   4.4            6.8   7.2   8.3          228           385
## 991                   5.9            7.3   7.3   8.4          186           336
## 992                   5.1            7.2   7.5   8.3          224           367
## 993                   5.9            7.2   7.5   8.4          168           296
## 994                   3.5            6.1   6.9   8.1          325          4250
## 995                   1.4            5.3   6.8   7.3            -             -
## 996                   4.5            7.9   7.0   7.7          258         58470
## 997                   5.3            7.5   6.7   7.9          359         59130
## 998                   4.0            7.6   6.2   7.5           82         27560
## 999                   4.0            7.3   6.1   7.2          135         47660
## 1000                  6.4            8.0   6.5   7.2           15           101
## 1001                  6.4            8.4   5.8   7.0           44            94
## 1002                  5.1            8.0   5.4   7.8           61           297
## 1003                  6.5            7.6   6.3   7.7           12           163
## 1004                  6.6            7.8   6.3   8.1           46           122
## 1005                  5.7            7.2   5.6   6.9           50           127
## 1006                  6.5            8.0   6.1   7.7           12           155
## 1007                  4.5            7.0   6.3   7.4           40           250
## 1008                  6.6            8.0   6.1   7.6           15           209
## 1009                  4.3            6.5   6.8   7.9        23320         65600
## 1010                  2.0            7.1   6.2   7.3           30           656
## 1011                  6.1            8.5   6.5   7.3           16          7078
## 1012                  5.8            9.3   5.9   7.7           72           938
## 1013                  3.8            7.4   6.3   7.2          196         37180
## 1014                  4.0            7.5   6.4   7.8           83         60000
## 1015                  0.3            5.6   6.6   7.2           89           321
## 1016                  3.8            5.5   6.2   7.4          175         36810
## 1017                  4.5            7.5   6.8   7.7          722         62100
## 1018                  4.7            7.2   6.9   7.7          830         63430
## 1019                  6.8            7.7   6.0   8.4           85           141
## 1020                  6.2            8.1   6.5   8.5           60           110
## 1021                  5.3            7.8   6.7   7.7           87         56140
## 1022                  6.0            7.4   7.0   7.8          536         50290
## 1023                  5.2            6.3   7.2   8.0          469          2612
## 1024                  6.6            7.2   7.0   8.2          160           298
## 1025                  4.8            7.5   4.9   7.9          265          9286
## 1026                  0.3            3.6   7.2   8.2         1176          2380
## 1027                  5.8            7.0   7.5   8.3          858         45790
## 1028                  0.6            7.2   7.3   8.4          642          9787
## 1029                  4.8            7.0   7.1   7.9            5          2296
## 1030                  4.9            7.3   7.1   7.9          519          2086
## 1031                  5.0            7.2   7.1   7.7          387         28630
## 1032                  5.3            7.4   7.2   7.9         1306         52190
## 1033                  0.3            4.1   7.1   7.8          592          1448
```

```
## 1034                0.3                5.2   7.3   8.1              892              2070
## 1035                0.6                5.9   7.2   8.6              590              2163
## 1036                5.0                7.2   7.6   8.4              706             13950
## 1037                0.3                2.5   6.7   8.0              635              1843
## 1038                4.8                8.3   7.6   8.2                5               862
## 1039                7.7                8.1   7.4   8.6              260               260
## 1040                2.1                6.8   7.9   8.8             1356              3800
## 1041                2.1                7.4   7.6   8.7             1468              3450
## 1042                1.8                7.9   6.3   8.1              430              1804
## 1043                6.8                9.2   7.0   8.8              382               938
## 1044                0.9                6.4   8.0   9.1             1318              3830
## 1045                4.2                5.1   7.5   7.8              135               904
## 1046                7.6                8.3   7.8   8.4              398               501
## 1047                3.8                3.8   7.7   7.7             1014              1014
## 1048                3.5                6.5   7.9   8.1              877               970
## 1049                3.2                3.2   8.6   8.6              651               651
## 1050                7.8                9.1   6.6   7.6              409               833
## 1051                7.6                9.2   7.1   7.9              303               564
## 1052                7.7                9.0   7.1   7.9              356               579
## 1053                6.1                9.1   7.1   7.7              303               774
## 1054                7.7                9.0   6.9   7.8              285              3210
## 1055                8.7                9.4   7.2   8.5               76               230
## 1056                8.1                9.0   7.1   8.4               82               263
## 1057                7.2                8.9   7.6   8.0              102               181
## 1058                7.4                9.0   7.5   8.1              115               154
## 1059                6.7                9.6   6.9   7.9              248               453
## 1060                6.7                9.7   6.8   7.9              251               622
## 1061                7.1                8.2   7.0   8.5              279              1862
## 1062                8.5               11.4   6.5   8.2               59               845
## 1063                8.5               10.1   7.3   8.1               65               257
## 1064                7.5               13.8   7.2   8.1               67              1179
## 1065                8.0                9.2   7.9   8.8               60               415
## 1066                7.5                9.1   7.2   8.5              265               565
## 1067                7.8               11.0   7.1   8.1               73               122
## 1068                7.6                9.5   7.2   8.1               59               338
## 1069                6.9                9.4   7.2   7.9               66               368
## 1070                5.8                7.8   6.4   9.0              256               636
## 1071                7.2                9.8   7.9   8.6              377               452
## 1072                8.2               10.1   7.8   8.5              310               375
## 1073                4.8                8.6   7.6   8.4              230               310
## 1074                7.4                7.7   7.2   7.6                -                 -
## 1075                7.0                7.2   7.2   7.4                -                 -
## 1076                6.8                7.2   7.4   7.5              166               202
## 1077                4.2                6.0   7.3   7.7              198               268
## 1078                7.4                7.5   7.4   7.4              202               205
## 1079                2.0                2.0   5.7   7.2                -                 -
## 1080                2.8               10.2   6.5   7.1                -                 -
## 1081                7.2                7.7   6.9   7.4               52               140
## 1082                6.7                7.5   6.7   7.4              122               166
## 1083                6.8                7.6   6.6   7.4              119               168
## 1084                6.9                7.8   6.7   7.3               46               131
## 1085                6.4                7.6   6.7   7.5              122               160
## 1086                5.9                7.4   6.9   7.4              124               156
## 1087                7.2                7.8   7.1   7.7               81               168
```

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## 1088           7.1          7.9  6.9  7.8          63         150
## 1089           7.2          7.9  6.8  7.5          58         103
## 1090           7.6          8.1  6.8  7.9          51         121
## 1091           7.3          7.9  6.7  7.9          46          81
## 1092           7.1          7.7  6.7  7.5          54         119
## 1093           6.4          7.6  7.7  8.7         393         600
## 1094           6.4          7.8  7.7  8.7         338         560
## 1095           1.3          9.7  6.7  8.1          40       32400
## 1096           6.3          8.2  6.4  7.2          28          50
## 1097           6.7          8.6  6.0  7.7          32          83
## 1098           6.9          8.2  6.5  8.1          45       25120
## 1099           6.5          7.2  6.9  8.2         136         169
## 1100           6.4          8.1  6.6  8.2          45          68
## 1101           5.2          8.2  6.3  7.4          41         200
## 1102           0.2          2.5  6.1  7.3         289         618
## 1103           6.0          7.4  6.3  7.5          39          72
## 1104           6.7          8.4  6.0  7.4          38          60
## 1105           6.5          7.7  6.6  8.1          12         104
## 1106           5.9          8.8  6.6  7.8          98         292
## 1107           3.3          6.7  6.1  7.0          58         103
## 1108           5.8          7.2  6.7  7.9         128         154
## 1109           6.1          8.2  6.5  7.4         102         280
## 1110           5.9          6.9  6.4  7.6          66          96
## 1111           6.0          6.9  6.4  8.1         148         179
## 1112           4.7          7.1  6.2  7.4          56         120
## 1113           6.2          7.2  6.7  8.2         137         177
## 1114           3.2          6.3  6.2  6.9          46          92
## 1115           3.9          8.4  6.3  7.7          66         202
## 1116           7.4          8.3  6.5  7.8          22          74
## 1117           6.8          8.0  6.5  7.9          30          65
## 1118           4.5          8.0  6.3  7.9         314       46100
## 1119           5.2          7.9  6.5  8.1          89       55100
## 1120           6.4          8.4  6.1  8.2          52         123
## 1121           5.5          9.5  6.7  7.7          59          85
## 1122           0.7          8.0  5.4  7.2         110        9800
## 1123           4.4          6.8  6.2  7.4          56         130
## 1124           6.1          7.4  6.3  7.4          84         140
## 1125           5.3          6.8  6.1  7.5          71         153
## 1126           6.0          7.0  6.7  8.0        9240        9980
## 1127           6.0          6.9  6.5  8.1         153         186
## 1128           5.5          8.0  5.6  7.3          56         124
## 1129           3.4          8.2  6.0  7.2          96         180
## 1130           5.1          8.0  6.0  7.5          89         170
## 1131           3.0          6.8  4.1  7.6          82       29050
## 1132           5.5          9.6  6.0  7.5          67         190
## 1133           1.9          7.4  6.5  8.0         152       50100
## 1134           5.7          8.0  6.4  7.8         158       43600
## 1135           5.7          7.7  6.2  7.6          51         102
## 1136           5.5          7.7  6.4  7.4          43          91
## 1137           6.5          8.0  6.0  7.9          35          89
## 1138           4.1          5.7  6.3  7.9         409       47300
## 1139           5.2          7.9  6.2  7.8          37         152
## 1140           5.5          7.9  6.1  7.3          45          93
## 1141           5.2          7.9  6.0  7.7          55        7885
```

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## 1142              5.4          8.1   6.2   7.8          52          98
## 1143              4.9          7.5   6.2   7.4         175       60900
## 1144              5.3          8.6   6.5   7.9          57         102
## 1145              5.9          8.2   6.5   7.8          98       58200
## 1146              6.4          8.2   6.8   7.5          70         151
## 1147              6.2          7.9   6.1   7.7          44          98
## 1148              5.2          6.8   7.0   8.0         271        1278
## 1149              6.3          7.9   6.9   8.0          89         317
## 1150              6.1          7.8   6.9   8.1         142         429
## 1151              6.5          8.2   6.1   7.1          34         141
## 1152              4.3          9.0   6.0   8.0          67       26000
## 1153              3.4          8.1   6.2   7.1          45         134
## 1154              6.1          8.2   6.6   7.9          33        8183
## 1155              0.6          7.0   6.0   7.1          90        6064
## 1156              1.5          7.6   6.0   7.2          60         537
## 1157              5.4          7.9   6.6   7.1          90         160
## 1158              4.9          6.9   6.6   7.3          55         149
## 1159              5.4          7.0   6.7   7.9         165         853
## 1160              7.1          8.0   6.7   7.8          45          92
## 1161              6.7          7.3   6.8   7.9         135         181
## 1162              6.7          7.1   6.6   8.1         137         186
## 1163              6.7          8.2   6.3   7.2          35          50
## 1164              5.6          7.2   6.2   7.6          55          80
## 1165              6.0          7.8   6.7   8.0         512       48100
## 1166              6.0          8.3   6.8   7.9          42          79
## 1167              1.9          7.7   6.5   7.6          52         103
## 1168              6.5          7.2   7.3   7.9         168         297
## 1169              6.8          8.0   7.5   8.6         288         652
## 1170              6.8          7.6   7.4   7.9         360         692
## 1171              7.0          7.5   7.0   8.3         246         718
## 1172              6.2          7.8   7.2   8.3         150        1738
## 1173              6.8          7.6   7.2   8.3         170         398
## 1174              1.0          7.6   7.8   8.5         249       50403
## 1175              6.7          7.7   7.6   8.3         240         489
## 1176              6.1          7.8   7.4   8.2         290         572
## 1177              5.6          7.3   7.2   8.3         160         348
## 1178              4.3          7.1   7.2   8.3         160         356
## 1179              3.1          7.5   7.0   8.3         111        3451
## 1180              6.3          7.7   7.1   8.3         129         276
## 1181              6.3          7.3   7.2   8.2          84         376
## 1182              4.9          7.3   6.7   8.1          69        4155
## 1183              6.3          7.6   6.8   8.3          77         192
## 1184              6.3          7.4   6.8   8.2          73         181
## 1185              6.1          7.3   6.8   8.2          70        1443
## 1186              6.1          7.4   7.0   8.2         100         392
## 1187              6.4          7.4   6.8   7.9          45         109
## 1188              0.3          6.8   6.9   7.9         303       49570
## 1189              4.2          6.9   6.7   8.2          80       60060
## 1190              5.4          7.4   7.2   7.8         103       32440
## 1191              6.2          7.7   6.8   8.1          68         195
## 1192              6.2          7.6   7.1   8.0          62         111
## 1193              6.5          7.7   7.0   8.1          62         119
## 1194              5.9          6.0   7.5   8.0         445         663
## 1195              4.3          7.0   6.7   8.1         108       63280
```

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## 1196          6.3        7.7  6.7  8.1        67       179
## 1197          6.0        7.3  7.1  8.1        76       155
## 1198          4.2        7.3  6.7  7.5        71     57950
## 1199          6.0        7.6  6.9  8.2        70      1096
## 1200          6.0        7.3  7.0  8.2        67      4142
## 1201          5.8        7.4  7.0  8.2        68      4163
## 1202          5.8        7.4  6.9  8.1        69     26000
## 1203          6.0        7.4  7.0  8.2       109       178
## 1204          6.2        7.5  7.3  8.1        96       248
## 1205          5.9        7.5  6.9  8.0        90       293
## 1206          6.0        7.6  7.0  8.1        88     23650
## 1207          6.0        7.4  7.1  8.0        89     26810
## 1208          6.2        7.7  6.9  8.1       120       156
## 1209          6.5        7.6  7.2  8.1       134       247
## 1210          6.1        7.5  7.2  8.2       132       305
## 1211          7.0        7.2  7.3  8.2       118       309
## 1212          7.0        7.1  7.4  8.2       162       240
## 1213          6.4        7.2  6.7  7.9        46       162
## 1214          6.4        7.4  7.1  7.9        46       154
## 1215          6.1        7.5  7.1  8.0        70       336
## 1216          7.2        8.1  7.4  7.7       110       336
## 1217          6.5        7.8  7.2  7.9       150       420
## 1218          7.0        7.7  7.2  7.6       110       338
## 1219          3.1        7.2  6.5  7.6       320       624
## 1220          3.3        6.4  6.7  7.3       350       995
## 1221          6.2        7.6  7.2  7.8       125       250
## 1222          6.4        7.5  7.3  7.7       120       336
## 1223          6.8        7.7  7.0  7.5       150       418
## 1224          2.6        7.5  7.1  7.8       150       560
## 1225          6.4        7.7  7.2  7.8       135       365
## 1226          7.1        7.7  7.2  8.0       150       382
## 1227          6.5        7.4  7.1  7.7       170       460
## 1228          6.2        7.5  7.2  7.5       180       530
## 1229          6.3        7.7  7.3  7.7       210       521
## 1230          4.0        6.1  6.5  6.8       220       438
## 1231          7.5        7.8  7.1  7.5        60       263
## 1232          5.1        7.2  6.2  7.3       150       421
## 1233          5.3        6.9  7.1  7.8       120       360
## 1234          0.7        7.4  6.4  7.5       130       441
## 1235          5.3        7.6  6.9  7.6       140       322
## 1236          6.2        7.4  7.2  7.9       120       355
## 1237          6.5        7.5  7.2  7.5       180       325
## 1238          7.0        7.8  7.2  7.6       200       331
## 1239          6.5        7.6  7.2  7.8       195       290
## 1240          6.1        7.5  7.3  7.6       180       460
## 1241          6.4        7.5  7.2  7.6       190       363
## 1242          6.9        7.7  7.2  7.4       160       228
## 1243          6.8        7.8  7.1  7.6       130       380
## 1244          7.1        7.7  7.1  7.6       140       430
## 1245          6.8        7.5  6.9  7.5       140       374
## 1246          6.6        7.8  4.1  7.4        52        79
## 1247          6.8        7.5  2.8  3.9       137       495
## 1248          6.5        7.7  6.7  7.2        44       636
## 1249          7.1        8.1  7.1  7.6        59        85
```

```
## 1250              7.0          7.9  7.1  7.7             62               89
## 1251              6.4          8.1  6.7  7.2             51               69
## 1252              6.9          8.0  6.7  7.1             38               58
## 1253              7.2          8.2  6.9  7.5             43               55
## 1254              6.8          8.1  6.7  7.1             44               65
## 1255              6.9          8.0  6.9  7.3             43               55
## 1256              7.0          7.9  6.7  7.7             35               40
## 1257              7.2          8.2  7.5  7.9             81              130
## 1258              3.0          9.0  6.5  7.3             38              500
## 1259              7.2          8.4  7.1  7.4             47               72
## 1260              2.3          5.5  6.7  7.1            160              385
## 1261              5.0          6.8  7.0  7.4            160              318
## 1262              2.0          5.8  7.1  7.5            240              415
## 1263              2.4          5.6  6.9  7.5            255              518
## 1264              6.8          8.8  6.7  7.2             34               58
## 1265              2.0          4.2  6.7  7.6            165              368
## 1266              4.8          6.8  6.9  7.4            122              284
## 1267              6.7          8.0  6.9  7.4             35               55
## 1268              6.9          7.8  2.3  3.0            650             1430
## 1269              6.8          8.0  6.5  8.1            168              368
## 1270              7.1          8.7  5.0  5.7             55              118
## 1271              7.0          7.8  7.1  7.8             77               97
## 1272              7.1          7.8  6.8  7.6             73              101
## 1273              6.9          8.0  6.9  7.5             58               88
## 1274              7.0          7.9  6.9  7.6             67               78
## 1275              6.8          8.0  6.9  7.4             20               85
## 1276              6.5          6.5  8.1  8.1          20200            20200
## 1277              6.6          6.6  8.0  8.0          29800            29800
## 1278              2.0          2.0  7.4  7.4           2080             2080
## 1279              6.4          6.4  6.9  6.9            186              186
## 1280              4.2          7.3  7.2  8.0            488              680
## 1281              2.0          4.0  7.0  7.8            652             1013
## 1282              2.2          5.3  7.0  7.8            730              989
## 1283              1.9          4.0  7.2  7.8            690             1129
## 1284              1.1          4.9  7.0  7.6            663             1398
## 1285              1.4          5.1  7.2  7.9            597             1093
## 1286              1.2          4.1  7.1  7.7            703             1255
## 1287              1.0          3.4  7.1  7.7            687             1258
## 1288              1.6          5.0  7.1  7.7            607              994
## 1289              1.8          4.2  7.1  7.8            702             1080
## 1290              1.0          5.8  6.8  8.0            589             1218
## 1291              1.4          6.2  7.0  7.9            520             1147
## 1292              1.8          4.2  7.3  7.8            670             1078
## 1293              1.0          3.3  7.3  7.9            792             1182
## 1294              0.3          1.4  7.0  7.9            874             1411
## 1295              3.6          6.1  7.9  8.0            424              789
## 1296              2.8          3.8  7.7  8.0            565             1030
## 1297              4.7          8.2  8.0  9.8            866             1144
## 1298              3.9          6.7  8.0  8.6            190             3600
## 1299              5.2          6.2  7.9  8.6            310              730
## 1300              4.5          6.9  8.0  8.7            320              440
## 1301              4.9          7.1  8.4  8.6            400              560
## 1302              6.1          8.0  5.7  7.6             26              380
## 1303              6.1          7.3  5.7  7.2             39              184
```

```
## 1304                6.1             7.1   6.0   7.1              49              1088
## 1305                6.0             7.6   6.2   7.2              74              1504
## 1306                6.0             7.5   6.0   7.3              34               140
## 1307                6.6             7.4   5.6   7.5              33               138
## 1308                6.0             7.6   5.9   7.1             129               771
## 1309                5.4             6.7   7.4   8.1             321              1100
## 1310                5.3             7.4   6.2   7.3             132              1081
## 1311                7.0             7.5   5.6   7.4              33               492
## 1312                5.3             7.9   6.3   7.3              77               675
## 1313                6.0             7.0   6.0   7.1              55               263
## 1314                5.8             6.8   6.0   7.0              65               414
## 1315                5.8             7.0   6.8   7.9              62               924
## 1316                6.1             6.7   7.0   7.4             124               169
## 1317                5.4             6.3   6.9   7.6             131               187
## 1318                5.0             6.1   6.8   7.6             118               178
## 1319                5.1             6.3   6.8   7.7             125               187
## 1320                5.8             6.9   6.8   7.5             125               179
## 1321                6.1             6.7   6.7   7.7             115               173
## 1322                5.9             6.9   6.7   7.6             119               188
## 1323                6.0             6.8   6.9   7.4             125               179
## 1324                5.9             7.0   7.0   7.7             117               178
## 1325                6.2             7.3   6.4   7.1             117               163
## 1326                5.6             6.8   6.9   7.3             114               171
## 1327                5.0             6.9   6.7   7.4             119               202
## 1328                6.0             6.7   6.9   7.5             127               174
## 1329                5.7             6.9   7.0   7.6              92               167
## 1330                5.5             6.6   6.7   7.3             112               157
## 1331                5.3             6.8   6.5   7.6             117               167
## 1332                5.8             6.6   6.8   7.6             121               181
## 1333                5.2             6.8   6.5   7.0             112               179
## 1334                5.2             6.7   6.7   7.9             131               177
## 1335                5.3             6.7   6.4   7.7             119               175
## 1336                5.0             6.7   6.3   7.5             112               164
## 1337                4.3             6.3   6.4   7.3             111               182
## 1338                5.2             6.8   6.8   7.8             118               180
## 1339                5.3             6.7   6.3   7.6             119               174
## 1340                5.1             6.5   6.7   7.4             118               169
## 1341                5.0             6.2   6.7   7.8             115               161
## 1342                Min             Max   Min   Max             Min               Max
## 1343                5.9             8.2   7.0   8.2             242               400
## 1344                5.2             8.3   6.7   8.5             240               612
## 1345                6.4             8.4   7.1   8.8             243               400
## 1346                6.0             7.5   7.1   8.4             330               648
## 1347                5.0             8.3   6.9   8.5             221               410
## 1348                5.8             8.8   7.0   8.3             228               420
## 1349                6.6             7.9   7.6   8.5             104               251
## 1350                2.7             6.7   6.7   8.3           19214             25108
## 1351                4.8             6.1   6.7   8.0           15824             17943
## 1352                6.4             7.7   7.5   8.6             131               406
## 1353                6.6             7.5   7.4   8.9             112               277
## 1354                4.8             7.4   7.7   8.5             147               295
## 1355                4.3             5.4   7.0   8.1             192              4174
## 1356                4.1             6.1   6.8   8.2            1989              7700
## 1357                1.2             8.9   7.3   8.5             383              9900
```

```
## 1358              6.3              7.3  7.2  8.9           192            391
## 1359              5.0              9.3  6.3  7.0            41           1843
## 1360              5.7              7.5  7.1  8.3           433          55690
## 1361              6.0              7.9  6.2  7.1            48          12430
## 1362              6.1              8.1  6.3  7.3            53            108
## 1363              5.0              8.1  6.2  7.4            11            118
## 1364              4.7              8.2  6.3  7.5            45            172
## 1365              6.0              8.7  6.7  7.7            48            243
## 1366              4.8              8.7  6.4  6.9            37            181
## 1367              5.5              7.5  6.5  7.4            68          38080
## 1368              6.4              8.0  6.9  8.0         16071          57820
## 1369              5.4              7.5  6.7  8.0          5109          57580
## 1370              5.7              7.9  6.5  7.8          4189          54750
## 1371              5.4              7.7  6.3  7.2            67          41300
## 1372              5.9              8.0  7.0  8.0         17240          57360
## 1373              1.6              6.9  6.2  7.2            69           9700
## 1374              0.3              4.6  6.5  7.8            68            263
## 1375              3.4              7.0  6.6  7.5           296          35940
## 1376              4.0              7.5  6.1  7.7         15340          55020
## 1377              4.4              7.5  6.6  7.5            57            124
## 1378              5.4              7.9  6.3  7.9            49             83
## 1379              6.0              7.4  7.0  8.1          5860          57450
## 1380              7.0              8.2  6.2  6.9            47            128
## 1381              4.1              7.3  6.6  7.2           173          31920
## 1382              5.2              6.8  6.9  7.9           791          53380
## 1383              4.7              7.2  6.5  7.8           799          52840
## 1384              4.5              7.6  6.1  7.1            76          14950
## 1385              0.3              6.1  7.2  7.8           678           2093
## 1386              5.2              7.6  6.8  8.0           350          53210
## 1387              0.3              3.7  7.3  7.9           957           1866
## 1388              0.3              5.2  7.2  7.9           694           2003
## 1389              5.0              7.1  7.2  8.4           662          53452
## 1390              0.3              6.2  7.3  8.4          1269           5348
## 1391              1.5              5.9  7.5  8.4          1004           1919
## 1392              7.3              9.0  8.0  8.5           146            540
## 1393              4.8              6.8  7.2  8.0           306          10470
## 1394              6.7              7.2  7.5  8.0           244            340
## 1395              0.3              2.5  7.4  8.2           648           1520
## 1396              5.7              7.2  7.7  8.2           351          51950
## 1397              5.6              6.7  7.4  8.0           376           3102
## 1398              5.3              6.7  7.3  8.0          3131          41450
## 1399              3.6              7.0  7.2  8.2           733           7936
## 1400              5.2              7.2  7.1  8.4           412           3578
## 1401              4.2              6.4  7.4  8.5           570          12886
## 1402              0.3              5.3  7.3  7.9           498           1307
## 1403              4.9              7.4  7.7  8.2           392            568
## 1404              0.3              6.2  7.2  9.1           760           1261
## 1405              5.2              8.1  6.9  8.2           382            575
## 1406              4.2              6.7  7.3  7.8           470           1378
## 1407              5.4              5.9  8.0  8.2          1850           2280
## 1408              5.1              5.9  8.1  8.3          2030           2240
## 1409              5.2              5.8  8.0  8.2          2630           2950
## 1410              4.2              5.6  6.9  7.5           439            905
## 1411              8.1              9.2  6.8  8.4           423            516
```

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## 1412          7.2          9.1  7.2  8.0          218          676
## 1413          7.1          8.8  7.0  8.0          272          626
## 1414          7.2          8.9  7.1  8.1          343          499
## 1415          4.4          8.8  7.3  7.9          300         3935
## 1416          7.1          8.7  7.0  8.1          286          622
## 1417          7.4          7.8  7.1  7.7           61          110
## 1418          7.2          7.8  6.9  7.6           53          117
## 1419          6.9          7.8  6.7  7.6          122          144
## 1420          7.0          7.7  6.8  7.5          126          158
## 1421          7.3          7.9  6.6  7.5          130          172
## 1422          6.6          7.6  6.7  7.4          118          148
## 1423          6.1          7.1  6.1  6.8          158          205
## 1424          5.7          7.4  6.1  7.3          158          201
## 1425          6.2          7.5  6.2  7.3          165          196
## 1426          5.3          7.1  6.7  7.8          149          183
## 1427          6.3          7.9  6.1  7.6           59          100
## 1428          6.5          7.6  6.5  7.8           53          112
## 1429          6.0          6.8  5.4  6.8           89          124
## 1430          6.3          7.7  6.8  7.9          120          454
## 1431          6.4          7.9  6.7  8.1          124          393
## 1432          6.1          8.2  6.4  7.9           38          187
## 1433          6.3          8.2  6.6  7.8           45        37650
## 1434          3.2          8.1  6.4  7.8           40           86
## 1435          7.6          8.2  6.0  8.0           48          106
## 1436          1.2          8.0  5.4  8.3           99         3200
## 1437          6.2          7.5  6.5  7.9          138        37100
## 1438          5.8          6.9  6.4  7.9         9551         9990
## 1439          6.5          7.3  6.3  7.2          180          220
## 1440          1.2          8.2  7.3  7.8           75          123
## 1441          0.5          5.1  6.0  7.6           92         4613
## 1442          1.5          6.8  5.9  7.4           79          152
## 1443          6.0          7.1  6.2  7.9          160          202
## 1444          1.7          8.0  6.8  7.9          367        55200
## 1445          4.7          7.9  7.2  8.4          135          801
## 1446          6.2          7.2  5.4  6.8           60           94
## 1447          0.3          6.5  5.3  7.7          255          420
## 1448          6.9          8.1  6.3  8.2           54          109
## 1449          6.0          8.2  5.5  7.5           47          117
## 1450          5.7          7.5  6.1  7.3           51           96
## 1451          6.2          8.2  5.7  7.1          114          205
## 1452          4.5          7.7  6.3  8.4          644         1116
## 1453          6.0          8.0  6.5  7.6           42           86
## 1454          5.9          7.7  6.2  7.9          133        47200
## 1455          7.5          8.4  6.1  7.4           21           46
## 1456          6.3          8.2  5.9  7.7           36           82
## 1457          6.1          7.6  5.1  6.9          106          121
## 1458          5.2          7.9  6.7  7.7           81          235
## 1459          5.1          7.9  6.9  7.4          120          185
## 1460          6.3          7.7  6.5  7.5           72          158
## 1461          4.3          8.0  6.2  7.8           84          150
## 1462          3.6          8.1  6.1  7.2           38           65
## 1463          4.5          7.8  6.0  7.9           63        54800
## 1464          6.0          8.2  6.1  7.2           51           76
## 1465          4.7          8.2  6.3  7.9           55         3390
```

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## 1466            4.2           7.7   6.4   7.5           82           49200
## 1467            5.9           7.1   5.8   6.9           43              77
## 1468            5.9           7.0   5.6   6.8           63             112
## 1469            6.0           6.9   6.3   7.2          165             201
## 1470            6.2           7.1   6.3   7.5           44              59
## 1471            5.1           6.3   6.4   7.4           62              93
## 1472            6.3           7.5   6.5   7.3           56              83
## 1473            4.8           5.9   6.1   7.1           54              71
## 1474            6.4           7.7   6.9   7.4           43              78
## 1475            6.7           8.2   6.3   8.6           34              47
## 1476            5.7           8.2   6.0   7.9           37             162
## 1477            6.5           8.0   6.2   7.5           39              58
## 1478            5.8           8.2   5.9   7.7           41              72
## 1479            5.9           8.2   6.2   9.4           70           18920
## 1480            5.6           8.2   6.2   7.8           42           14030
## 1481            6.0           8.2   5.9   8.9           37              67
## 1482            3.9           8.0   6.2   7.9           88           11100
## 1483            6.4           8.0   6.5   7.6           37              89
## 1484            5.3           7.8   5.5   7.9           45              80
## 1485            5.8           7.8   5.6   7.8          117             170
## 1486            4.7           7.6   6.2   7.8          239           48700
## 1487            7.3           7.9   6.3   7.9           61              95
## 1488            6.3           7.8   6.5   7.9           56              95
## 1489            2.3           5.4   6.8   7.6           91           11011
## 1490            5.2           8.1   7.3   7.6           64             118
## 1491            4.1           7.9   6.8   7.8           90           50000
## 1492            6.0           7.9   6.6   7.9          225           49800
## 1493            6.1           6.9   5.6   6.9           52             101
## 1494            5.9           7.5   7.0   8.6           71            3072
## 1495            5.8           7.6   7.1   8.0           71             192
## 1496            6.7           7.5   6.7   8.3           80             245
## 1497            6.8           7.4   7.0   8.2           70             194
## 1498            4.2           7.5   7.1   8.0          118             919
## 1499            6.0           6.6   7.6   7.9          503             999
## 1500            4.3           7.5   7.0   8.1          120            9756
## 1501            3.9           7.5   6.8   8.2           65           10850
## 1502            5.9           7.5   6.9   8.9           68             158
## 1503            3.4           7.1   7.3   8.1           72           59470
## 1504            1.0           6.8   6.9   7.8          338           33170
## 1505            6.1           7.4   7.2   8.0           77            8827
## 1506            4.0           7.5   6.8   7.8           54            3326
## 1507            6.4           7.4   6.9   7.9           59             343
## 1508            5.0           7.5   6.9   7.9           54            6578
## 1509            5.0           7.6   6.8   8.1           55            6493
## 1510            6.4           7.5   7.2   8.0           55             500
## 1511            5.1           7.6   6.8   7.8           61            2867
## 1512            6.6           7.6   7.3   8.0           53            1644
## 1513            6.5           7.5   7.1   8.1          110            1221
## 1514            6.3           7.3   6.7   7.8          116           27230
## 1515            5.2           7.3   6.8   8.1          112           30230
## 1516            3.7           7.1   6.4   8.2          140           36250
## 1517            5.3           7.4   6.9   8.2          108             203
## 1518            6.8           7.6   6.8   8.1          109             185
## 1519            6.5           7.3   7.7   8.5           72             246
```

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## 1520     6.8     7.6  6.6  8.1     126     204
## 1521     6.7     7.5  6.8  8.5      96     168
## 1522     6.6     7.5  6.7  8.2     141     189
## 1523     6.8     7.5  7.6  8.5      72     178
## 1524     6.2     7.4  6.6  7.8      45     142
## 1525     6.5     7.3  7.0  7.8      57     111
## 1526     6.3     7.8  6.7  8.1      52     130
## 1527     6.8     7.7  7.3  7.6     190     210
## 1528     7.2     7.3  6.9  7.5     130     320
## 1529     6.1     7.7  7.0  7.5     140     280
## 1530     7.1     7.5  7.2  7.8     115     250
## 1531     5.2     7.4  6.8  7.6     130     330
## 1532     6.8     7.6  7.2  7.6     150     250
## 1533     4.9     7.7  6.5  7.5     190     342
## 1534     6.4     7.5  7.2  7.6     150     310
## 1535     7.4     7.5  7.4  7.6      80     150
## 1536     6.9     7.6  7.3  7.8     140     310
## 1537     3.4     7.4  6.5  7.6     120     830
## 1538     6.4     7.5  7.2  7.5     170     409
## 1539     7.0     7.8  7.3  7.7     160     395
## 1540     5.4     7.4  6.9  7.7     150     460
## 1541     7.0     7.5  7.2  7.4     150     410
## 1542     7.1     7.5  7.2  7.6     130     210
## 1543     6.9     7.5  6.9  7.6     365     480
## 1544     6.7     7.6  6.9  7.4     150     270
## 1545     6.7     7.5  7.2  7.4     190     320
## 1546     7.1     7.7  7.2  7.7     150     250
## 1547     6.3     7.5  7.0  7.4     180     429
## 1548     7.0     7.4  7.0  7.4     120     320
## 1549     3.5     4.9  6.4  7.3     320     880
## 1550     3.2     4.7  6.4  7.3     330     815
## 1551     5.2     6.8  6.6  7.3     140     370
## 1552     5.2     7.4  6.6  7.4     140     450
## 1553     6.9     7.5  7.3  7.7     150     204
## 1554     7.4     8.0  7.4  7.7      80     240
## 1555     6.6     7.7  7.3  7.8     152     260
## 1556     7.2     7.3  7.4  7.5     170     200
## 1557     7.0     7.8  7.3  7.5     200     290
## 1558     6.6    15.0  7.0  7.6     190     369
## 1559     5.4     7.3  5.2  7.6     220     380
## 1560     7.3     7.6  7.5  7.9     140     230
## 1561     6.9     7.5  6.7  7.5      80     280
## 1562     6.6     7.4  7.0  7.4     170     330
## 1563     7.0     7.8  7.1  7.5      68     105
## 1564     7.0     7.8  7.1  7.4      64      92
## 1565     7.1     8.0  7.0  7.4      62      79
## 1566     7.0     7.8  6.7  7.3      50      91
## 1567     7.0     7.6  3.1  3.7     138     421
## 1568     6.8     8.0  5.7  6.4      44      90
## 1569     7.0     8.0  6.7  7.0      38      70
## 1570     6.8     7.5  6.8  7.2      37      68
## 1571     7.0     7.9  6.7  7.1      33      44
## 1572     6.1     7.2  6.7  7.1      50      95
## 1573     7.2     8.2  7.8  8.1      80     121
```

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## 1574              6.8             8.2  6.8  7.1            35           56
## 1575              6.8             8.7  7.0  7.3            40           50
## 1576              6.7             7.9  6.7  7.4            36           52
## 1577              6.5             7.8  6.8  7.3            52           68
## 1578              0.8             4.1  6.8  7.4           210          715
## 1579              0.3             3.7  6.8  7.4           268          503
## 1580              1.0             3.9  6.9  7.5           295          678
## 1581              4.0             6.6  6.8  7.6           192          400
## 1582              0.5             3.8  6.7  7.2           205          432
## 1583              7.0             8.2  6.9  7.5            30           55
## 1584              3.0             6.9  6.7  7.4           135          370
## 1585              6.7             7.6  6.9  7.4            52           83
## 1586              6.9             8.4  7.0  7.4            34           51
## 1587              4.3             8.1  6.7  8.3            98         1113
## 1588              5.1             8.3  6.5  7.9           109          266
## 1589              5.0             7.2  7.1  7.9           116          243
## 1590              6.6             7.5  6.6  7.6            47          190
## 1591              6.5             8.8  6.3  8.6            54          494
## 1592              5.0            11.5  6.1  8.6           117          282
## 1593              4.5             8.6  7.3  8.4           102          378
## 1594              4.7            10.4  6.6  7.8            84          177
## 1595              5.5             7.6  7.2  8.5           132          274
## 1596              4.4             7.6  7.4  9.6           100          266
## 1597              4.5             7.9  7.3  9.4           101          271
## 1598              5.5             7.2  5.7  8.9            22          133
## 1599              5.1             7.7  7.2  8.2           102          291
## 1600              5.2             8.0  7.2  8.1           169         5957
## 1601              6.0             8.4  7.4  8.2           127          365
## 1602              6.0             8.8  7.4  8.4           106          471
## 1603              6.8             7.5  6.8  8.3            74          184
## 1604              6.2             6.8  7.0  8.1           153          497
## 1605              6.7             7.5  7.0  8.3           147          245
## 1606              6.9             7.6  7.4  8.1           123          379
## 1607              6.5            11.0  7.2  8.5           172          792
## 1608              5.0             8.2  7.3  8.3           177        35760
## 1609              6.0             8.5  7.4  8.4           167        12530
## 1610              5.6            11.0  7.4  8.5           185          323
## 1611              5.8            12.0  6.6  8.5           163        44360
## 1612              6.8             7.6  7.3  8.0           133          494
## 1613              6.8             7.4  7.4  8.3           137          416
## 1614              5.1             6.1  7.3  8.0           524          878
## 1615              5.5             5.5  7.9  7.9         23500        23500
## 1616              6.8             6.8  8.0  8.0         24900        24900
## 1617              6.1             6.1  7.9  7.9         20800        20800
## 1618              6.3             6.3  6.9  6.9          8370         8370
## 1619              1.1             3.4  7.3  7.9           597         1252
## 1620              1.3             3.8  7.3  7.9           538          995
## 1621              2.0             4.0  7.0  7.8           491          995
## 1622              2.6             3.4  7.1  7.7           564          910
## 1623              2.3             3.8  7.2  7.8           529          998
## 1624              4.0             6.0  7.3  7.9           426          883
## 1625              1.2             3.4  7.3  7.9           598         1090
## 1626              0.9             5.2  6.9  7.9           477          828
## 1627              4.2             6.8  7.5  7.9           390          728
```

```
## 1628          1.2          3.5   7.1   7.9             568            1128
## 1629          3.7          9.9   7.3   8.1             490            1207
## 1630          2.1          4.6   7.1   7.6             824            1722
## 1631          2.9          4.2   7.2   7.8             461             792
## 1632          2.6          4.2   7.1   7.9             452             855
## 1633          4.0          6.5   7.2   7.9             361             713
## 1634          2.1          3.8   7.0   7.9             502             932
## 1635          1.4          4.0   7.0   7.8             552            1155
## 1636          5.2          7.0   7.0   8.4             653             653
## 1637          6.3          8.2   6.3   8.5             157             601
## 1638          5.4          8.6   6.5   8.0              26              98
## 1639          5.9          8.2   6.4   8.0              49             274
## 1640          5.5          7.6   6.5   8.1             175            1507
## 1641          6.0          9.0   6.3   7.7              37             258
## 1642          6.7          8.1   6.6   7.9             105             974
## 1643          5.3          8.3   6.5   7.7              37             123
## 1644          6.0          8.4   6.4   7.7              33             120
## 1645          5.7          8.5   6.5   8.0              94             436
## 1646          5.0          9.0   7.1   8.3             126             387
## 1647          6.0          8.0   6.1   8.0              83             220
## 1648          5.6          7.6   6.5   7.8              85             270
## 1649          5.7          8.0   6.9   7.9             105             321
## 1650          5.1          6.0   6.7   7.3             135             185
## 1651          5.1          6.3   6.8   7.6             129             199
## 1652          5.0          6.0   7.0   7.5             137             194
## 1653          5.2          5.9   6.9   7.5             129             283
## 1654          5.1          6.7   6.9   7.5             141             183
## 1655          5.1          6.0   6.8   7.4             135             199
## 1656          5.1          6.6   6.6   7.3             127             198
## 1657          5.1          6.9   7.3   7.7             131             189
## 1658          5.1          6.9   7.1   7.6             150             263
## 1659          5.0          5.7   6.8   7.5             141             257
## 1660          5.0          5.9   6.9   7.9             138             248
## 1661          5.1          6.5   6.3   7.3             148             194
## 1662          5.1          6.8   6.5   7.3             124             181
## 1663          5.0          6.5   7.0   7.4             133             196
## 1664          5.1          6.3   6.9   7.4             139             194
## 1665          5.0          5.9   6.8   7.4             134             189
##      BODMin BODMax NitrateMin NitrateMax FecalColiformMin FecalColiformMax
## 1       1.1    2.4       1.26       3.23                7               29
## 2       1.3    2.3       0.45       2.15               11               27
## 3       1.0    5.0       0.20       1.92               10              150
## 4       1.6   24.0       0.12       2.06               49             1600
## 5       1.0   20.0       0.66       2.90              130              710
## 6       2.0   22.0       0.15       5.40               17              540
## 7       1.0    8.0       0.40       4.20               40              920
## 8       1.0    5.0       0.29       2.40               32             1600
## 9       1.0    3.0       0.12       1.60               50              920
## 10      1.0    1.0       0.30       1.81               17             1600
## 11      1.0   12.0       0.05       1.60               21              250
## 12      0.4    5.1       0.02       0.52              200            17000
## 13      0.5    2.3       0.02       0.23               45             7900
## 14      0.6    3.2       0.05       0.74              450             4900
## 15      0.4    2.3       0.07       2.61              230             7900
```

```
## 16    0.4   3.0   0.01   0.23    450    4900
## 17    0.2   4.3   0.01   0.40   2300   24000
## 18    0.5   2.8   0.02   0.33    130    3500
## 19    0.5   2.1   0.02   0.29     78    3500
## 20    0.4   6.8    BDL   0.82     23    1300
## 21    0.1   3.3   0.06   0.52    780    2400
## 22    0.1   2.0   0.02   0.26    330    2400
## 23    0.5   3.9   0.08   1.35    780   17000
## 24    0.6   2.3   0.01   0.22    230    7900
## 25    0.9   5.1   0.01   8.93    790    4900
## 26    0.9   2.8   0.05   0.44   2200  220000
## 27    0.4   3.5   0.03   0.27    450    7900
## 28    0.6   4.8   0.38   3.72   4900   24000
## 29    1.3   3.3   0.05   0.80    200    7900
## 30    1.1   4.2   0.08   0.67    130    1300
## 31    0.5  16.8   0.10   3.06  11000   54000
## 32    1.3   8.4   0.11  43.76    130    1700
## 33    1.2   3.6   0.04   0.88    230   13000
## 34    1.5   3.6   0.10   1.44    130    7900
## 35    1.4   2.5   0.05   0.09      2      58
## 36    1.9   3.1   0.04   0.67     17     130
## 37    0.3   1.3   0.05   0.56      2      34
## 38    1.6   3.4   0.16   0.89      2     130
## 39    4.0  34.0   0.11   0.88    110    1400
## 40    0.9   2.6   0.11   0.34      2      41
## 41    3.2 148.0   0.20   0.40     11      22
## 42    1.2   3.1   0.04   0.13     94     542
## 43    1.2   3.0   0.02   3.92     84     542
## 44    1.1   2.5   0.01   0.52     48     542
## 45    1.5   2.0   0.04   0.10      2     542
## 46    1.2  16.0   0.28   1.05     12      46
## 47    0.2  31.0   0.17   0.82     49     130
## 48    1.9  67.0   0.21   1.46     11      22
## 49    1.1   8.0   0.02   0.24      4       8
## 50    2.5  21.0   0.02   0.86     40     400
## 51    0.3   1.3   0.09   1.08      2      12
## 52   16.0  40.0   <NA>   <NA>   <NA>    <NA>
## 53   20.0  40.2   <NA>   <NA>   <NA>    <NA>
## 54   16.0 290.0   <NA>   <NA>   7000   25300
## 55    3.0   6.0   <NA>   <NA>    210    2100
## 56   20.0  48.0   <NA>   <NA>   <NA>    <NA>
## 57    0.2   0.4   0.29   1.17      8      21
## 58    0.1   0.3   0.22   0.91     11      17
## 59    0.3   3.2   0.22   0.91     11      21
## 60    0.1   0.3   0.30   0.96     12      17
## 61   10.0 160.0   0.14   3.12     12     350
## 62    0.1   0.6   0.20   0.87     10      17
## 63    2.3   6.5   0.04   0.80     35     550
## 64    2.0   4.0   0.40   1.48      8      94
## 65    1.0   4.0   0.11   2.30      8      94
## 66    2.3   3.0   0.02   0.80     25     550
## 67    1.0   3.0   0.09   1.88     17     920
## 68    1.0   3.0   0.44   1.80     17     920
## 69    0.5   4.0   0.08   1.94    600    6300
```

```
## 70      0.8    1.8      0.08       0.55              400          5800
## 71      0.0    2.3      0.01       0.53               14           400
## 72      0.5    1.2      0.04       1.30               30           700
## 73      1.2  104.0      0.10       0.76              110           260
## 74      0.3    1.6      0.07       0.57              500          1800
## 75      0.5    3.0      0.02       1.94              110        700000
## 76      3.7   52.0      0.50       3.00             1420         19500
## 77      0.2    1.3      0.01       2.14               90           370
## 78      1.0    2.1      0.10       1.16              520       1300000
## 79      0.2    2.4      0.03       0.53              800          2000
## 80      0.6    2.2      0.01       0.27               10           700
## 81      0.1    3.3      0.01       1.02              110           580
## 82      1.1    2.0      0.18       1.10              110           210
## 83      0.4    2.5      0.03       0.27               90           200
## 84      0.0    2.0      0.05       0.05              220           800
## 85      1.0    1.4      0.12       0.56              100           180
## 86      0.9    1.0      0.05       0.05               80           240
## 87      1.0    1.6      0.52       0.89              110           190
## 88      0.2    1.8      0.16       0.86              110           490
## 89      0.3    3.0      0.02     168.00               16           255
## 90      0.0    5.0      0.02       0.50               12           260
## 91      0.0    1.0      0.05       0.50                8           480
## 92      0.4    3.0      0.06       1.10               24           940
## 93      0.5    2.2      0.01       0.21               14           188
## 94      0.1    3.0      0.00       0.80               19           184
## 95      0.2    2.5      0.01       0.30               14           212
## 96      0.8    4.6      0.21       5.37              140          5800
## 97      0.5    0.8      0.05       0.05               80           270
## 98      1.1    1.8      0.05       0.05                5           540
## 99      0.6    0.9      0.05       0.05              100           690
## 100     1.2    2.8      0.90       1.40              110           200
## 101     1.0    2.0      0.20       0.96              110           200
## 102     0.3   13.0      0.04       0.50               31           290
## 103     0.6    3.8      0.01       0.52               19           300
## 104     1.1    6.4      0.02       0.54               60           260
## 105     0.6    3.6      0.02       2.00                8           120
## 106     0.3    3.6      0.05       1.40               12          1100
## 107     0.7    4.5      0.07       1.30               40          6000
## 108     0.0    1.4      0.02       0.58               90          4200
## 109     0.2    2.7      0.06       0.87              200           760
## 110     0.7    2.9      0.05       0.72              100           800
## 111     0.1    2.0      0.05       0.80               48           820
## 112     0.2    3.0      0.05       1.05               10           720
## 113     0.1    3.9      0.04       0.84               72           760
## 114     0.3    3.9      0.21       0.74                3           960
## 115     0.3    2.2      0.01       0.30               20           350
## 116     0.1    2.4      0.01       0.54               16           216
## 117     0.0    3.1      0.01       0.50               24           448
## 118     0.3    3.0      0.01       0.20               22           352
## 119     0.2    3.2      0.00       0.50               15           936
## 120     0.5    2.8      0.01       0.50               12           272
## 121     0.3    2.7      0.04       1.56               16           780
## 122     0.4    3.0      0.21       0.52                4           100
## 123     1.1    3.0      0.10       0.73               10           286
```

```
## 124     0.3    6.6        0.21       0.99             40             580
## 125     0.5    2.6        0.08       0.66            400            6300
## 126     0.7    5.1        0.20       2.10            240            7000
## 127     0.6    3.7        0.01       3.37            640            6300
## 128     0.4    2.5        0.02       1.50             80           70000
## 129     1.6    6.4        0.05       1.40            480            6300
## 130     1.2    5.2        0.10       1.40            280            4300
## 131     0.2    2.2        0.13       0.60             14             124
## 132     0.6    2.5        0.13       0.90             36             400
## 133     0.4    3.0        0.18       0.65              6             280
## 134     0.0    1.1        0.03       0.41              2             400
## 135     1.0    1.4        0.22       0.78            100             180
## 136     1.0    1.4        0.28       0.62             80             290
## 137     0.2    2.0        0.04       0.48            100            9200
## 138     0.2    0.9        0.05       0.05             40              82
## 139     0.2    2.9        0.18       2.62              8             920
## 140     3.2   75.0        0.50       7.30             22             170
## 141     3.0    3.4        0.30       2.10              2             110
## 142     3.0    4.0        0.10       1.10              5              46
## 143     3.0    4.0        0.20       1.40              8              32
## 144     3.0    4.0        0.10      12.00             13              94
## 145     3.0    3.6        0.20       1.50              2              27
## 146     3.0    4.0        0.30       1.20             17              46
## 147     3.0    4.0        0.20       1.10              2              79
## 148     2.0    3.4        0.12       1.58              6              33
## 149     6.0  250.0        0.30       4.30            540            1600
## 150     3.2   10.0        0.10       2.70             14             130
## 151     2.0    3.4        0.11       1.08              8             110
## 152     3.0    4.0        0.10       0.70              7              94
## 153     3.0    6.0        0.20       2.60              7              79
## 154     3.0    4.0        0.20       1.10              8              70
## 155     2.8    5.0        <NA>       <NA>              2              11
## 156     5.0   18.0        0.60       2.74             23             110
## 157     2.8    3.6        0.10       0.40             17              79
## 158     2.0    3.0        0.18       1.05              5              26
## 159     3.0   15.0        0.10       7.10             13              94
## 160     3.0    5.0        0.20       1.60              8              26
## 161     3.0    4.0        0.30       1.40              9              27
## 162     3.0    4.0        0.30       1.30             17             110
## 163     3.0    4.0        0.20       1.30              2             274
## 164     3.0    4.0        0.20       1.10              4              33
## 165     2.0    2.8        0.12       1.34             11              79
## 166     2.0    3.2        0.18       1.22             17             120
## 167     2.0    3.4        0.14       1.62             13              94
## 168     2.2    3.2        0.15       1.16              8             120
## 169     3.0    4.0        0.10       4.30              2              22
## 170     3.0    4.0        0.10       4.30              8              27
## 171     3.0    4.0        0.10       4.30              8              33
## 172     3.0    3.4        0.20       1.20              5              23
## 173     3.0    3.2        0.10       1.20              8              22
## 174     2.0    3.2        0.13       1.42              8              49
## 175     2.0    2.4        0.10       1.04              2              21
## 176     3.7    3.9        <NA>       <NA>           <NA>            <NA>
## 177     2.9   12.1        <NA>       <NA>           <NA>            <NA>
```

```
## 178     2.2    2.6       <NA>      <NA>          <NA>          <NA>
## 179     2.6    2.9       <NA>      <NA>          <NA>          <NA>
## 180    13.1   16.2       <NA>      <NA>          <NA>          <NA>
## 181    13.6  120.0       <NA>      <NA>          <NA>          <NA>
## 182     2.1   28.0       <NA>      <NA>          <NA>          <NA>
## 183     6.0    6.4       <NA>      <NA>          <NA>          <NA>
## 184     2.2    2.3       <NA>      <NA>          <NA>          <NA>
## 185     2.6    3.7       <NA>      <NA>          <NA>          <NA>
## 186     1.3    2.7       <NA>      <NA>          <NA>          <NA>
## 187     1.6    3.6       <NA>      <NA>          <NA>          <NA>
## 188     1.0    1.6       <NA>      <NA>          <NA>          <NA>
## 189     1.6    2.0       <NA>      <NA>          <NA>          <NA>
## 190     1.0    1.2       <NA>      <NA>          <NA>          <NA>
## 191     3.6    5.6       <NA>      <NA>          <NA>          <NA>
## 192     1.5    3.6       <NA>      <NA>          <NA>          <NA>
## 193     5.4    9.5       <NA>      <NA>          <NA>          <NA>
## 194     2.4    4.9       <NA>      <NA>          <NA>          <NA>
## 195     1.2    1.4       <NA>      <NA>          <NA>          <NA>
## 196     1.6  127.0       <NA>      <NA>          <NA>          <NA>
## 197     1.2    1.5       <NA>      <NA>          <NA>          <NA>
## 198     1.4    2.9       <NA>      <NA>          <NA>          <NA>
## 199     1.1    1.7       <NA>      <NA>          <NA>          <NA>
## 200     1.0    1.0       <NA>      <NA>          <NA>          <NA>
## 201     0.9    1.0       <NA>      <NA>          <NA>          <NA>
## 202     1.6    2.2       <NA>      <NA>          <NA>          <NA>
## 203     0.9    1.0       <NA>      <NA>          <NA>          <NA>
## 204     1.2    1.4       <NA>      <NA>          <NA>          <NA>
## 205     1.0    3.6       <NA>      <NA>          <NA>          <NA>
## 206     1.5    1.7       <NA>      <NA>          <NA>          <NA>
## 207     1.3    2.3       <NA>      <NA>          <NA>          <NA>
## 208     1.3    2.1       <NA>      <NA>          <NA>          <NA>
## 209     2.4    8.0       0.29      0.88            70           350
## 210     3.2    5.8       0.15      0.26             4          2100
## 211     2.0    5.2       0.23      0.89            27          2200
## 212     1.0    2.3       0.35      1.22            39           320
## 213     1.2    2.3       0.38      0.51            27           380
## 214     1.6    2.6       0.46      1.68             8            32
## 215     1.2    2.5       0.22      0.68             6            35
## 216     1.0    2.5       0.30      0.54             4            36
## 217     1.8    2.6       0.36      1.50            10            46
## 218     1.4    2.7       0.39      0.96             8            40
## 219     1.1    2.2       0.24      0.67             4            25
## 220     1.0    1.7       0.40      3.60             9            39
## 221     1.1    2.5       0.22      1.40             8            35
## 222     1.0    1.7       0.25      0.63             6            38
## 223    10.0   45.0       0.56      4.30          7000         33000
## 224     9.0   28.0       0.91      5.03          3300         18000
## 225     7.5   85.0       0.46      4.88         22000         48000
## 226    18.5   80.0       0.45      4.79         14000         74000
## 227     1.4    2.5       0.25      0.51             6            40
## 228    18.0   95.0       0.33      1.97         14000         39000
## 229     8.8   30.0       0.37      2.37          6000         25000
## 230     1.1    6.2       0.20      0.62            22            79
## 231     3.2    6.0       0.15      0.40             2            15
```

```
## 232     1.7    2.2        0.31        0.51                 13                190
## 233     1.3    2.2        0.18        0.57                  2                 90
## 234     1.4    2.2        0.29        0.52                 10                 60
## 235     1.4    2.4        0.15       54.00                  8                 45
## 236     BDL    BDL        0.09        0.09               <NA>               <NA>
## 237     BDL    BDL        0.08        0.08               <NA>               <NA>
## 238     BDL    BDL        0.15        0.15               <NA>               <NA>
## 239     BDL    BDL        0.45        0.45               <NA>               <NA>
## 240     3.0    8.0        0.05        1.38               1700               5600
## 241     7.0   90.0        0.09        1.60               2000              12000
## 242     5.6   17.0        0.07        1.30               2600               7000
## 243     6.1   56.0        0.05        1.50               2100               4700
## 244     4.0   10.0        0.27        1.10               1400               3400
## 245     4.0   19.0        0.07        1.21               1300               3200
## 246     5.8   23.0        0.05        1.60               1400               3400
## 247     7.0   72.0        0.05        3.60               2700               6100
## 248     5.0   28.0        0.09        2.80               1400               5800
## 249     6.0   48.0        0.18        1.40               1700               9400
## 250     5.0   51.0        0.11        1.20               1500               4900
## 251     4.0   48.0        0.50        1.12               1300               3700
## 252   140.0 1299.0        2.80       18.00              20000             340000
## 253     1.1    1.8        0.98        2.28                  4                 11
## 254     1.0    1.7        0.98        2.62                  3                 11
## 255     1.1    1.7        0.98        2.28                  3                 20
## 256     1.0    3.2        0.02        0.42                 17                 90
## 257     1.0    3.4        0.03        0.26                 11                 70
## 258     1.0    3.3        0.02        0.29                 22                 70
## 259     1.4    2.9        0.01        0.14                 17                 70
## 260     1.0    2.9        0.02        0.22                 11                 40
## 261     1.0    2.8        0.01        0.16                  4                 50
## 262     2.0    3.2        0.14        0.98                  9                700
## 263     1.0    3.6        0.07        0.38                 26                 70
## 264     1.0    3.2        0.02        0.19                  2                 50
## 265     1.9    3.1        0.05        0.19                 30                 70
## 266     1.9    4.0        0.02        0.31                 14                 70
## 267     1.0    3.5        0.03        0.34                  4                 90
## 268     0.1    0.9        0.23        0.67                170                220
## 269     1.0    2.4        0.18        0.66                170                220
## 270     0.4    1.9        0.10        0.70                170                220
## 271     0.7    2.4        0.23        0.77                170                220
## 272     0.3    1.3        0.95        2.83                170                220
## 273     0.8    1.9        0.13        0.69                170                220
## 274     0.7    1.9        0.63        1.73                150                210
## 275     0.1    1.4        0.10        0.64                170                220
## 276     0.2    1.7        0.13        0.62                170                220
## 277     0.5    1.9        0.16        0.63                170                220
## 278     0.5    1.7        0.15        0.53                170                220
## 279     0.9    2.3        0.41        1.04                170                220
## 280     0.3    1.3        0.23        1.08                140                220
## 281     0.5    1.5        0.27        1.00                170                220
## 282     0.5    1.4        0.13        1.33                140                220
## 283     0.7    2.0        0.15        0.52                170                220
## 284     0.4    1.8        0.57        1.57                170                220
## 285     0.3    1.6        0.29        1.16                170                220
```

```
## 286      0.5     1.4        0.20        0.78              170            220
## 287      0.4     1.6        0.11        0.66              140            220
## 288      0.2     1.4        0.12        0.64              170            220
## 289      0.4     1.4        0.13        0.80              170            220
## 290      0.4     1.9        0.11        0.60              170            220
## 291      0.6     2.1        0.16        0.60              170            220
## 292      1.1     2.9        0.34        1.43              170            210
## 293      0.1     1.1        0.15        0.83              170            220
## 294      1.2     1.8        1.26       17.11                7             75
## 295      0.9     2.2        1.27       14.53                9             45
## 296      1.0     4.0        0.10        1.32                2            130
## 297      2.0    28.0        0.16        2.20               26            350
## 298      1.6    38.0        0.18        1.84               26            350
## 299      1.8   108.0        0.15        1.80               33            280
## 300      1.0     6.0        0.10        1.80               34            920
## 301      1.0     6.0        0.15        1.42               29            350
## 302      1.0     5.0        0.12        1.66               34            350
## 303      1.0     4.3        0.10        1.90               27           1200
## 304      1.0    24.0        0.17        2.30               46           1600
## 305      0.9     4.7        0.02        1.64              780          14000
## 306      0.7     3.5         BDL        1.35              450          13000
## 307      BDL     4.6         BDL        0.55              200           2300
## 308      0.5     4.5         BDL        0.45               13           4900
## 309      0.4     2.0         BDL        1.01              450          13000
## 310      0.2     2.1         BDL        0.28             1100          13000
## 311      0.4     2.2         BDL        4.00              200           4900
## 312      BDL     2.4         BDL        0.65               78           4900
## 313      0.5     3.7         BDL        0.04               20           2400
## 314      0.5     2.3         BDL        0.49              130          24000
## 315      BDL     4.2         BDL        0.56              130           4900
## 316      0.6     2.8        0.04        0.73             1300          13000
## 317      BDL     3.5         BDL        0.73              780           4900
## 318      0.5     4.8        0.06        3.23              200           4900
## 319      0.4     6.7         BDL        1.24             3300          24000
## 320      BDL     2.2         BDL        1.46              780          13000
## 321      BDL     5.6        0.15        0.63             3300          24000
## 322      BDL     3.8         BDL        1.38              450           4900
## 323      BDL     5.8         BDL        1.42              130           4900
## 324      0.6     5.8        0.74       20.61            11000          35000
## 325      1.0     5.0        0.22        3.02              450          13000
## 326      BDL     4.2         BDL        2.29              450           4900
## 327      BDL     3.5         BDL       13.13              200           4900
## 328      0.7     4.4         BDL        1.31              450          24000
## 329      0.9     2.0        0.03        0.18                2             22
## 330      1.4     4.3        0.15        0.80              210           1600
## 331      0.4     1.3        0.05        0.44               17             70
## 332      0.9     3.3        0.31        4.53               94            920
## 333      3.1    42.0        0.16        1.48              220           1100
## 334      1.1     3.1        0.14        0.33               22             63
## 335      7.6   221.0        0.20        0.48                2           1600
## 336      1.2     9.0        0.09        0.16                3            120
## 337      1.1     4.0        0.05        3.92                3             94
## 338      0.8     2.0        0.02        0.22                3             84
## 339      0.7     1.9        0.03        0.20                3            212
```

```
## 340     1.2   21.3        0.38        1.16              130             1600
## 341     3.0   42.0        0.09        1.58               94              220
## 342     0.3    7.7        0.03        1.32                2               70
## 343     0.2    4.5        0.04        0.09                2               12
## 344     3.7   42.1        0.42        1.46              400             1600
## 345     0.3    0.5        0.42        0.84                4               14
## 346     1.9    2.5        0.05        0.35                7               12
## 347     0.4    6.8        2.27        2.55               11              280
## 348     4.2   28.0        <NA>        <NA>             <NA>             <NA>
## 349    20.0   36.0        <NA>        <NA>             <NA>             <NA>
## 350    14.0  110.0        <NA>        <NA>             1200             7400
## 351     5.0   16.0        <NA>        <NA>              700             1300
## 352    16.0   32.0        <NA>        <NA>             <NA>             <NA>
## 353     2.6    3.0         BDL        0.92               80              350
## 354     2.4    2.9         BDL        0.45              170              900
## 355     2.0    3.0        0.09        1.70               17              220
## 356     1.0    2.0        0.09        1.42               14              170
## 357     1.3    5.2        0.39        1.26              200             5400
## 358     0.5    1.8        0.12        1.00              310             2600
## 359     0.5    1.9        0.04        0.50               49             2200
## 360     0.3    1.8        0.02        1.20               48             4600
## 361     1.2    1.8        0.44        0.54               49              140
## 362     0.3    0.7        0.03        0.50             1000             2000
## 363     1.0    2.5        0.27        1.30               79             2600
## 364     6.1   58.0        1.20        2.90             1700            25000
## 365     0.2    1.4        0.14        0.56              120              640
## 366     0.5    2.1        0.27        0.88             1200             5400
## 367     0.4    0.7        0.02        0.42              600             2400
## 368     0.2    3.0        0.00        0.20                0              700
## 369     0.4    1.8        0.00        0.89              110              540
## 370     1.2    1.8        0.09        0.96               60              140
## 371     0.2    2.5        0.00        0.20                0              400
## 372     0.9    4.7        0.00        0.50              480             3200
## 373     1.1    1.8        0.46        0.62               70              180
## 374     0.7    1.3        0.00        0.50              200              310
## 375     1.1    1.8        0.76        0.88               91              170
## 376     0.5    1.4        0.00        0.93              120              400
## 377     0.4    3.6        0.20        2.00                6              120
## 378     0.5    1.0        0.00        0.60               10              790
## 379     0.5    1.0        0.00        0.80               40             2700
## 380     0.2    2.2        0.01        0.80              100             1200
## 381     0.5    3.2        0.00        0.58              220              580
## 382     0.5    2.7        0.00        0.56              150              400
## 383     0.5    3.0        0.00        0.40              150              430
## 384     2.0    6.7        0.50        8.60               20             4300
## 385     0.6    5.4        <NA>        <NA>              310              500
## 386     0.8    3.9        <NA>        <NA>              490              920
## 387     0.8    1.5        <NA>        <NA>              100              310
## 388     1.2    1.8        0.72        1.40               17              180
## 389     1.4    1.8        0.48        0.92               60              160
## 390     0.4    3.6        0.01        2.30                0              490
## 391     0.8    2.7        0.06        1.50               40              630
## 392     1.2    3.2        0.14        1.20               10              310
## 393     1.2    3.2        0.00        8.00               10              150
```

```
## 394      0.2    3.6      0.00      5.00            6            120
## 395      0.7    3.5      0.11      4.90         2100          11000
## 396      0.5    2.3      0.00      2.00          100           1800
## 397      0.2    2.5      0.00      1.62           20           2240
## 398      0.1    2.3      0.00      0.54           48           2000
## 399      0.5    2.5      0.00      1.30           40           1100
## 400      0.5    2.7      0.00      1.21           30           1400
## 401      0.3    2.7      0.00      0.33          140            790
## 402      0.1    3.9      0.00      0.95           80           1500
## 403      0.1    2.9      0.00      0.39          220            490
## 404      0.5    2.9      0.00      0.59          170            450
## 405      0.5    2.3      0.00      0.26          250            540
## 406      0.6    2.8      0.00      0.58          200            370
## 407      0.8    3.0      0.00      0.56          220            450
## 408      0.5    2.4      0.00      7.30          270            350
## 409      0.2    2.0      0.00      0.64           39           1700
## 410      0.6    5.1      0.03      4.10            0            360
## 411      0.4    2.9      0.04      1.32            0            480
## 412      0.4    3.6      0.02      1.75            0            700
## 413      0.5    2.4      0.22      1.96          400           3900
## 414      1.5    5.7      0.19      1.86          200           4000
## 415      2.0    3.4      0.19      2.00          540           3400
## 416      0.8    4.8      0.00      1.08           40           2700
## 417      2.7    6.7      0.12      2.00          790           4600
## 418      2.0    6.5      0.10      2.00          200           4300
## 419      0.3    1.2      0.02      0.43            2             33
## 420      0.2    4.4      0.13      0.23            4            100
## 421      0.6    3.5      0.05      8.20            0            640
## 422      0.5    0.9      0.00      1.80          110           1200
## 423      1.1    2.0      0.52      0.86           40            150
## 424      1.1    2.2      0.32      0.56           70            310
## 425      0.2    2.0      0.03      0.90          100           1700
## 426      0.9    2.1      <NA>      <NA>           70            150
## 427      0.5    2.3      0.00      0.42           10            790
## 428      0.2    2.0      0.00      1.51           12          11600
## 429      1.0    4.3      0.00      1.42           22          65000
## 430      3.0    3.0      0.90      0.90           21             21
## 431      3.5    3.5      0.90      0.90           26             26
## 432      1.2    5.6      2.00     35.00         <NA>           <NA>
## 433      0.8    4.3     26.00     35.00         <NA>           <NA>
## 434      0.3    4.3     25.00     40.00         <NA>           <NA>
## 435      2.0    4.1     30.00     45.00         <NA>           <NA>
## 436      3.7   68.7     30.00     40.00         <NA>           <NA>
## 437      0.4   74.9     26.00     35.00         <NA>           <NA>
## 438      0.7    8.2     27.00     40.00         <NA>           <NA>
## 439      0.6    4.3     30.00     40.00         <NA>           <NA>
## 440      3.6    3.6     38.00     38.00         <NA>           <NA>
## 441      2.8    2.8     40.00     40.00         <NA>           <NA>
## 442      3.4    3.4     35.00     35.00         <NA>           <NA>
## 443      1.2    4.1     27.00     45.00         <NA>           <NA>
## 444      0.9    4.9     30.00     46.00         <NA>           <NA>
## 445      1.2    5.3     26.00     55.00         <NA>           <NA>
## 446      2.1    5.4     28.50     50.00         <NA>           <NA>
## 447      0.8   78.1     28.00     48.00         <NA>           <NA>
```

```
## 448     0.8   6.9      25.00      45.00             <NA>             <NA>
## 449     0.1  81.0      30.00      50.00             <NA>             <NA>
## 450     0.6   4.5      27.00      45.00             <NA>             <NA>
## 451     1.0   5.8      26.00      40.00             <NA>             <NA>
## 452     0.6   3.3      28.00      40.00             <NA>             <NA>
## 453     0.6   3.8      30.00      40.00             <NA>             <NA>
## 454     0.1   5.6      30.00      35.00             <NA>             <NA>
## 455     3.1   3.1       <NA>       <NA>             <NA>             <NA>
## 456     0.6   6.2      25.00      40.00             <NA>             <NA>
## 457     1.7   5.7      30.00      45.00                2                2
## 458     0.5   5.9      25.00      50.00             <NA>             <NA>
## 459     0.8   6.8      30.00      50.00             <NA>             <NA>
## 460     5.4   5.4       <NA>       <NA>             <NA>             <NA>
## 461     0.2   5.2      25.00      40.00             <NA>             <NA>
## 462     0.7   5.5      25.00      50.00             <NA>             <NA>
## 463     4.0   5.7       0.35       1.00               39             2100
## 464     3.2   4.3       0.11       0.52                4               12
## 465     1.9   4.8       0.24       0.50              920             2200
## 466     1.0   2.0       0.33       0.53              110              940
## 467     1.0   2.0       0.31       0.48               64              210
## 468     1.4   2.3       0.27       1.75               14               27
## 469     1.2   1.8       0.21       0.60               11               26
## 470     1.2   1.8       0.46       1.02               12               21
## 471     1.8   2.6       0.10       1.35               17               27
## 472     1.2   2.1       0.28       1.15               17               26
## 473     1.4   1.9       0.32       0.94               11               23
## 474     1.0   1.8       0.37       0.51               16               22
## 475     1.3   2.5       0.28       1.03               15               23
## 476     1.0   1.5       0.27       0.97               12               22
## 477    18.0  35.0       0.30       1.75             3100            70000
## 478     9.5  27.0       1.35       7.30             2600            79000
## 479    25.0  46.0       0.29       0.83            35000           120000
## 480     1.5  40.0       0.24       0.74            29000           140000
## 481     1.4   2.4       0.13       0.92               17               36
## 482    24.0  40.0       0.15       1.22            22000            84000
## 483     8.9  22.0       0.54       1.73            12000            49000
## 484     1.0   4.3       0.30       0.56               28               79
## 485     3.5   5.2       0.08       0.40                0                4
## 486     1.3   2.0       0.07       0.57               27               41
## 487     1.2   1.8       0.16       0.32                9               22
## 488     1.2   2.0       0.44       0.54               21               27
## 489     1.2   2.0       0.30       0.51               17               27
## 490     0.6   2.6       0.05       7.75                2             3500
## 491     0.9   3.1       0.12       1.62                2             1700
## 492     0.8   2.8       0.34       1.31              170             3500
## 493     0.5   2.1       0.25       2.79               45             1700
## 494     0.4   1.5       0.24       6.61                2             2400
## 495     0.6   1.6       0.15       0.83              200            35000
## 496     1.0   2.8       0.18       1.83              490            35000
## 497     0.3   1.4       0.13       1.42               20             2400
## 498     0.5   1.5       0.10       4.31               20              700
## 499     0.2   1.6       0.11       1.18               20             2400
## 500     1.0   2.0       0.01       1.33             <NA>             <NA>
## 501    <NA>  <NA>       0.06       0.06             <NA>             <NA>
```

```
## 502     2.0    2.0          0.06         0.06                 <NA>                 <NA>
## 503    20.0   20.0          0.07         0.07                 <NA>                 <NA>
## 504    <NA>   <NA>          0.41         0.41                 <NA>                 <NA>
## 505     6.0   18.0          0.20         1.10                 2100                 4100
## 506    14.0  110.0          0.52         1.80                 3300                13000
## 507    11.0   31.0          0.28         1.80                 3100                 6300
## 508    14.0   58.0          0.21         1.40                 2700                21000
## 509     8.0   35.0          0.25         1.90                 1700                 5800
## 510     8.0   18.0          0.29         1.30                 1400                 2700
## 511    11.0   22.0          0.30         1.40                 1700                 4100
## 512    10.0   50.0          0.49         2.20                 2400                 6300
## 513     8.0   39.0          0.28         1.70                 1700                 4900
## 514    12.0   68.0          0.42         2.10                 2600                11000
## 515     9.0   44.0          0.33         1.30                 1400                 8400
## 516     7.0   40.0          0.31         1.30                 1300                 5800
## 517    95.0  260.0          1.54        12.00               230000              1700000
## 518     1.1    2.8          1.70         3.07                    4                    9
## 519     2.4    2.4          1.76         1.76                   28                   28
## 520     1.8    1.8          2.06         2.06                   20                   20
## 521     0.6    2.5          1.84         3.04                    4                   14
## 522     1.1    1.5          2.46         2.80                    7                   14
## 523     1.1    1.7          1.84         3.07                    4                   20
## 524     2.0   88.2          2.62         3.15                   20                   75
## 525     1.3    5.8          0.08         0.32                    4                   32
## 526     1.0    6.8          0.07         2.94                    6                   70
## 527     1.1    6.0          0.05         2.44                    8                   60
## 528     1.0    6.0          0.07         0.97                   14                   70
## 529     1.0    6.2          0.02         0.49                    6                   40
## 530     1.2    5.8          0.01         0.38                    4                   32
## 531     1.6    8.7          0.12         0.80                   17                   90
## 532     4.4    4.4          1.85         1.85                    2                    2
## 533     1.6    5.2          0.07         0.23                   16                   70
## 534     1.5    6.4          0.01         0.44                    4                   40
## 535     1.0    6.0          0.09         0.92                   14                   60
## 536     1.0    5.5          0.15         3.96                    7                   70
## 537     1.3    7.3          0.21         4.41                   12                   90
## 538     0.1    0.7          0.15         0.46                  110                  170
## 539     0.2    1.8          0.14         0.75                  110                  170
## 540     0.2    1.3          0.16         0.89                  110                  150
## 541     0.2    0.9          0.22         0.60                  130                  350
## 542     0.2    0.6          0.31         1.12                  110                  170
## 543     0.2    0.9          0.17         0.40                  110                  170
## 544     0.3    0.9          0.28         0.80                  120                  170
## 545     0.2    0.9          0.15         0.45                  120                  220
## 546     0.2    0.9          0.20         0.53                  110                  170
## 547     0.3    0.9          0.16         0.51                  110                  170
## 548     0.3    1.1          0.16         0.63                  120                  170
## 549     0.3    1.2          0.30         0.82                  110                  170
## 550     0.3    1.0          0.16         0.55                  110                  220
## 551     0.2    1.1          0.20         0.77                  110                  170
## 552     0.2    0.8          0.17         0.53                  110                  150
## 553     0.3    0.9          0.15         0.50                  110                  170
## 554     0.2    0.7          0.29         0.70                  110                  170
## 555     0.2    1.1          0.22         0.44                  110                  170
```

```
## 556      0.2   1.0      0.15      0.51           110            170
## 557      0.3   0.8      0.20      0.52           110            150
## 558      0.2   0.9      0.15      0.39           110            170
## 559      0.2   0.7      0.13      0.47           110            220
## 560      0.3   1.1      0.15      0.40           130            280
## 561      0.3   1.1      0.15      0.40            94            170
## 562      0.2   1.3      0.28      0.72           110            170
## 563      0.3   1.1      0.16      0.36           110            150
## 564      1.3   2.4      0.70      3.09             4             20
## 565      1.2   2.5      0.23      9.35             7             21
## 566      0.8   2.7      0.24      2.13             4             11
## 567      1.2   2.6      0.96      8.64            15             20
## 568      1.4   2.6      0.16      2.29             7             21
## 569      1.2   2.4      0.38      1.77             7             21
## 570      0.4   1.2      0.09      0.42           BDL              2
## 571      1.2   2.4      0.33      1.07             4             15
## 572      2.2   3.4      0.56      1.40             3              4
## 573      1.4   2.3      0.18      3.26             9             23
## 574      1.7  14.0      0.15      3.30             3              9
## 575      1.3   2.7      0.50      1.60             2           2000
## 576      1.1   2.5      0.60      2.10           300           2100
## 577      2.2   2.8      1.10      1.50             2              2
## 578      1.2   5.2      0.40      3.00             2            730
## 579     16.0  34.0      1.80      3.10          2800          15000
## 580      1.1   2.8      0.60      2.00             2           1500
## 581      1.0   2.9      0.50      2.20             2            360
## 582      1.4   2.8      1.00      4.20           300            910
## 583      1.3   2.3      0.40      2.10           300           2000
## 584      1.5   4.9      0.40      2.50             2            730
## 585      1.3   2.7      0.90      2.60             2           1500
## 586      1.2   2.8      1.00      2.60             2            910
## 587      1.3   2.8      0.60      1.80             2           1100
## 588     18.4  78.0      1.80      4.00           300           2800
## 589      1.2   2.7      0.40      1.80             2            730
## 590      0.4   2.4      0.80      2.10             2           1500
## 591      1.3   3.2      0.20      2.30           300           1100
## 592      1.8   2.8      0.70      1.30           300           1400
## 593      2.0   2.9      0.80      1.80             2            730
## 594      1.8   4.4      1.30      2.40           300           1500
## 595      1.3   3.0      1.30      1.40             2              2
## 596      1.0   2.1      0.70      2.00           720           1500
## 597      1.5   5.0      0.40      2.30             2           1100
## 598      1.1   2.9      0.60      2.00             2           1100
## 599      1.1   2.8      0.30      1.90           300            730
## 600      1.2   2.2      0.50      2.20             2           1500
## 601      1.4  62.0      0.80      3.50          1500           3900
## 602     14.0  34.0      1.90      3.30          2700          24000
## 603      0.4   2.3      0.80      1.90             2            360
## 604      1.4   3.2      0.50      1.30             2            910
## 605      1.1   2.4      1.10      2.40           300            910
## 606      1.0   2.6      0.90      2.40             2           1100
## 607      1.7   5.6      0.11      0.31          1700          28000
## 608      1.7   2.2      0.03      0.45          1100          14000
## 609      1.8   3.1      0.08      0.17           820          35000
```

```
## 610     1.8   3.2       0.06       0.27        830      17000
## 611    19.0  19.0       1.45       1.45       2000       2000
## 612   206.0 206.0       1.81       1.81      20000      20000
## 613    94.0  94.0       1.14       1.14       4000       4000
## 614    21.0  21.0       2.36       2.36       2000       2000
## 615     1.0   1.0       0.02       0.02     350000     350000
## 616     BDL   1.0       0.10       0.40          2          9
## 617     BDL   3.0       0.40       2.50        900       1600
## 618     1.5   3.1       0.70      10.00         23        110
## 619     BDL   2.6       0.20       2.50         21         90
## 620     BDL   2.2       0.10       0.50         34        220
## 621     BDL   1.1       0.10       0.40         21         60
## 622     BDL   BDL       0.10       0.60          8         34
## 623     BDL   3.0       0.10       0.30         11         40
## 624     BDL   2.9       0.10       1.60        240       1600
## 625     BDL   2.1        BDL       0.27        110       1300
## 626     BDL   2.9       0.11       0.91       2300      13000
## 627     BDL   BDL        BDL       0.55          2       2400
## 628     BDL   2.9       0.04       0.23        490       4900
## 629     BDL   4.0       0.03       0.75        450       3300
## 630     BDL   4.2        BDL       0.13         68       1700
## 631     BDL   2.8        BDL       0.17         78       2200
## 632     BDL   2.3       0.01       0.16        170       2300
## 633     BDL   2.7        BDL       0.48        490       2300
## 634     BDL   1.8        BDL       1.41         23       1300
## 635     BDL   2.8       0.02       0.31          5       2300
## 636     BDL   1.1        BDL       1.42         20        790
## 637     BDL   5.0       0.01       0.75       2300      11000
## 638     BDL   3.5        BDL       1.11        490       4900
## 639     BDL   2.8       0.01       0.42         78       3300
## 640     BDL   6.0       0.39      45.00       7900     350000
## 641     BDL   3.2        BDL       1.31        130       2300
## 642     BDL   BDL        BDL       1.27        BDL        790
## 643     BDL   2.7        BDL       1.22         45       2100
## 644     BDL   1.7       0.04       0.82        130       2300
## 645     BDL   2.7        BDL       0.12        130       1700
## 646     BDL   2.1        BDL       0.27        790       3500
## 647     BDL   2.1       0.02       1.24        790       4900
## 648     BDL   3.8       0.03       0.35        460       1700
## 649     BDL   6.4       0.04       1.78        130       2300
## 650     BDL   5.0       0.08       0.45        130       2300
## 651     0.9   1.4       0.04       0.25          6         11
## 652     2.0  49.0       0.19       0.89        220       1400
## 653     2.0  43.0       0.13       0.88         70        140
## 654     0.9   2.9       0.02       0.23          6         33
## 655     2.2 258.6       0.22       0.61         17         49
## 656     0.2   1.8       0.10       0.33          6        170
## 657     0.8   5.3       0.45       0.64         26       1600
## 658     2.7  33.0       0.34       2.16        210       1600
## 659     0.7   0.7       0.03       0.09         23         23
## 660     1.0   1.1       0.02       0.28          4         17
## 661     1.6   2.9       0.19       0.39         94       1600
## 662     1.0  28.0       0.03       0.23          6         27
## 663     0.6  24.0       0.02       0.42         17         58
```

```
## 664     0.7    1.2       0.02       0.19              6                17
## 665     0.8    0.8       0.95       0.95              4                 4
## 666     0.9    2.4       0.04       0.24            BDL                 4
## 667     1.8   38.0       0.42       1.06             96              1800
## 668     0.3    0.7       0.36       0.68              2                12
## 669     2.0   90.0       0.06      34.00           2200            250000
## 670    16.0   60.0          -          -          12500            180000
## 671     7.0   60.0       0.11       1.12          22000            340000
## 672     4.0    7.5       0.05       2.96          14000            940000
## 673    16.0   70.0      22.00      22.00           9600            198000
## 674     0.1    0.1          -          -             21                26
## 675     0.1    0.1          -          -             11                27
## 676     0.1    1.8       0.11       0.45              4                26
## 677     0.1    0.2       0.07       1.00              2                20
## 678     0.1    0.3       0.13       1.12              2                37
## 679     0.3    1.0       0.10       1.16             12                22
## 680     0.4    1.7       0.02       0.89             11                33
## 681     0.6    1.8       0.01       0.75             17                43
## 682     0.4    1.6       0.05       1.41             13                26
## 683     0.6   16.0       0.07       2.12             39              1700
## 684     0.5    2.1       0.05       1.32             14                27
## 685     0.1    0.3       0.13       0.72              2                 4
## 686     0.1    0.3       0.18       0.97              2                 6
## 687     0.1    0.2          -          -             13                40
## 688       -      -          -          -              -                 -
## 689       -      -       0.01       0.01              -                 -
## 690     0.2    0.2          -          -              -                 -
## 691     0.6    3.0          -          -              2               140
## 692     3.4    4.0          -          -            200               230
## 693     3.6    4.0          -          -            200               230
## 694     2.1    2.5          -          -              -                 -
## 695     3.0    3.6          -          -              -                 -
## 696     2.8    8.0          -          -              2                 2
## 697     0.4    0.9          -          -              2                 2
## 698     2.6    3.0          -          -            140               200
## 699     2.0    2.8       0.10       0.52            170               350
## 700     2.0    2.6       0.13       0.55            110               300
## 701     2.6   26.0       0.02       0.21             35               350
## 702     2.3    2.6       0.02       0.18             17               900
## 703     2.1    2.3       0.10       0.29             25               250
## 704     2.0    2.0       1.00       1.10             14               500
## 705     2.0    6.0       0.10       1.47             17               110
## 706     2.0    2.0       0.88       1.12             22               170
## 707     2.0    2.0       1.04       1.12             34               140
## 708     1.6    2.4       0.60       0.82             70               280
## 709     1.6    2.6       0.56       0.84            100               320
## 710     1.6    2.8       0.62       0.86            130               480
## 711     1.6    2.4       0.54       0.76            130               410
## 712     0.2    2.5       0.01       0.30             20               150
## 713     0.1    2.1       0.01       0.32             20               170
## 714     1.0    5.5       0.01       0.10            100               310
## 715     0.8    2.9       0.03       2.00              2               260
## 716     1.1    2.6       0.10       7.80              2              1200
## 717     0.3    2.6       0.01       1.63             79              2400
```

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## 718      0.1    1.7        0.01        0.88              100              5600
## 719      0.1    1.5        0.08        0.90               60              4600
## 720      0.1    1.9        0.01        0.83              150              4900
## 721      0.3    2.8        0.01        0.30               17               280
## 722      0.4    2.8        0.16        7.38              170              6300
## 723      0.1    2.4        0.03        2.65              200              4600
## 724      1.2    2.1        0.62        0.98               70               210
## 725      1.4    2.1        1.00        1.60               91               280
## 726      0.8    3.4        0.01        0.80                4                70
## 727      0.6    2.1        0.02        0.85                4                40
## 728      1.2    3.6        0.10        1.80              200            100000
## 729      0.4    4.4        0.03        0.83              120              6300
## 730      1.2    2.1        0.48        0.66               82               280
## 731      0.2    4.6        0.04        1.69              200             12800
## 732      1.2    3.0        0.19       12.04               10              1000
## 733      0.1    2.0        0.12        0.16                2                56
## 734      0.3    1.8        0.01        0.50               16               220
## 735      2.9   10.2        1.00        2.60             3100            190000
## 736      1.1    4.3        0.01        0.10               79               500
## 737      0.8    2.9        0.01        0.32               60               480
## 738      0.3    2.1        0.01        0.25               10               180
## 739      0.9    2.8        0.01        0.34              100               480
## 740      0.7    3.0        0.29        5.84                2               400
## 741      0.3    2.8        0.01        0.30               10               120
## 742      0.2    2.9        0.01        0.31               10               130
## 743      0.1    1.5        0.01        0.60               50              1400
## 744      0.1    2.4        0.01        0.49              180              3400
## 745      0.5    4.6        0.01        0.06              100               910
## 746      0.4    3.0        0.01        0.31               50               610
## 747      0.3    2.4        0.05        0.24              100               790
## 748      0.2    2.8        0.10        0.21                2                84
## 749      1.0    2.9        0.01        0.60                4               220
## 750      0.2    0.9        0.06        0.80              310              2800
## 751      0.5    2.1        0.01        0.21               31               430
## 752      0.2    0.8        0.11        0.48             1100              2700
## 753      0.4    2.9        0.03        0.60               32               390
## 754      0.6    2.7        0.01        0.21               26               240
## 755      0.1    3.9        0.01        0.22              100               600
## 756      0.4    6.5        0.01        0.30              100               480
## 757      1.2    2.2        0.52        0.76              100               280
## 758      0.8    2.5        0.15        0.54              110               380
## 759      0.5    3.9        0.26        0.41              140               460
## 760      0.2    1.7        0.22        1.14              210             42500
## 761      0.8    3.9        0.27        2.25              520             32500
## 762      0.3    1.5        0.14        0.59              170               630
## 763      0.3    2.8        0.07        1.58              170             12000
## 764      0.5    2.6        0.01        1.19              170              3800
## 765      0.4    2.1        0.01        2.63              580              7000
## 766      0.1    1.6        0.01        0.59              240              3500
## 767      0.2    2.9        0.01        2.62              400              4700
## 768      0.3    2.4        0.01        0.52              350              4600
## 769      0.1    2.8        0.05        1.12               40              2700
## 770      0.3    2.7        0.01        0.97               10              3500
## 771      0.2    2.6        0.05        0.50               20               210
```

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## 772      1.0    3.8        0.01        0.57                 26              380
## 773      1.0    2.6        0.01        1.42                 55              400
## 774      0.3    2.4        0.01        0.23                 10              150
## 775      0.1    2.8        0.01        0.32                 19               80
## 776      0.3    2.1        0.01        0.35                 10              150
## 777      0.8    3.2        0.24        1.90                  8               48
## 778      0.1    3.3        0.01        0.66                 32              490
## 779      0.7    2.7        0.01        0.51                  5              170
## 780      0.4    6.3        0.01        0.30                100              940
## 781      0.8    1.5        0.39        0.93                  2                2
## 782      0.8    1.4        0.52        1.64                  2                2
## 783      1.8    2.0        0.61        0.90                  2                6
## 784      1.6    6.0        0.34        1.60                  2              140
## 785      1.5    2.3        0.13        1.52                  2               18
## 786      0.5    1.2        0.01        0.44                  2                2
## 787      0.5    1.4        0.69        1.03                  2                2
## 788      1.8    2.4        0.14        1.99                  2               32
## 789      0.7    1.4        0.14        0.96                  2               18
## 790      3.0    4.9        0.10        3.05                  2              170
## 791      3.0   10.0        0.10        3.23                  2              210
## 792      3.0    4.0        0.10        3.30                 11              220
## 793      3.0    4.0        0.10        1.50                  2              220
## 794      3.0    7.0        0.10        1.30                  2              540
## 795      3.0    6.5        2.30       14.10                  2              350
## 796      3.0    4.0        0.10        0.80                  2              350
## 797      3.0    9.0        0.30        2.80                  6              540
## 798      3.0   15.0        0.30        1.50                  2               79
## 799      3.0    5.4        0.10        8.70                  2              350
## 800      3.0   50.0        0.10        2.40                 13             3500
## 801      2.0   12.0        0.02        0.91                  2              920
## 802      3.0    4.0        0.20        1.70                  2              220
## 803      3.0    5.8        0.20        1.80                  9              350
## 804      3.0   11.0        0.40        2.70                 17               34
## 805      3.0    4.0        0.20        6.82                  8              220
## 806      3.0    4.0        0.20        1.70                  9              240
## 807      3.0    4.0        0.20        1.70                  2              540
## 808      3.0    6.6        0.20        1.70                 14              110
## 809      3.0   64.0        0.20       22.10                  2              170
## 810      1.8   13.0        0.16        0.70                  6             1600
## 811      2.0   11.0        0.13        1.58                  4              110
## 812      2.0   12.0        0.05        1.00                  2              540
## 813      2.0   50.0        0.22        1.40                  5              920
## 814      2.0   12.0        0.22        1.50                  7              920
## 815      3.0    8.0         BDL        1.00                  2              280
## 816      3.0    4.0         BDL        0.90                  2              170
## 817      3.0   11.0         BDL        1.60                  2              280
## 818      3.0    4.0        0.10        1.20                  4              350
## 819      3.0    4.0        0.30        1.70                  2              110
## 820      3.0    4.0        0.10        2.10                 11               79
## 821      3.0    4.0        0.10        1.80                  4              110
## 822      3.0    4.0        0.20        1.40                 23              240
## 823      1.8    2.6        0.06        0.64                  2                8
## 824      1.8    4.0        0.05        1.08                  2               12
## 825      1.8    2.8        0.03        0.94                  2                9
```

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## 826     1.4    6.9         0.02        0.03              2              75
## 827     2.4    4.3         0.02        0.03              2              45
## 828     2.7    4.3         0.03        0.03              2              35
## 829     2.0    4.0         0.03        0.03              2              30
## 830     2.0    4.5         0.02        0.04              2              45
## 831     2.1    4.9         0.03        0.03              2             135
## 832     2.0    3.2         0.03        0.03              2              65
## 833     2.5    2.5         0.03        0.03              -               -
## 834     2.7    3.9         0.02        0.17              2              25
## 835     2.7    3.8         0.03        0.03              2              50
## 836     2.0    3.8         0.03        0.03              2              20
## 837     2.3    3.8         0.03        0.03              2              45
## 838     2.7    4.4         0.02        0.03              2              55
## 839     1.8    3.8         0.03        0.03              2              10
## 840     2.6    4.2         0.02        0.03             55             152
## 841     2.8    4.4         <NA>        <NA>              2              30
## 842     2.6    4.7         0.03        0.03              2              40
## 843     2.9    3.9         0.02        0.03              2              45
## 844     2.6    4.1         0.03        0.03              2              55
## 845     2.1    4.0         0.02        0.03              2              35
## 846     5.2    6.0         0.03        0.04              2             180
## 847     5.1    6.2         0.03        0.03              2             205
## 848     2.0    5.6         0.03        0.03              2              90
## 849     2.7    4.0         0.02        0.03              2               5
## 850     3.1    4.8         0.02        0.03              2              85
## 851     1.8    4.5         0.03        0.03              2              65
## 852     2.7    3.8         0.03        0.03              2              60
## 853     2.9    4.4         0.03        0.04              2              60
## 854     2.6    3.7         <NA>        <NA>              2              10
## 855     2.7    4.9         0.03        0.03              2              20
## 856     2.2    3.8         0.02        0.03              2              75
## 857     2.6    4.4         0.02        0.04              2              55
## 858     1.5    2.3         0.29        0.51              8              32
## 859     1.5    7.1         0.25        0.52             12              38
## 860     1.0    1.8         0.40        0.57            170            1400
## 861     1.1    2.0         0.31        0.47             79            1100
## 862     3.2    5.5         0.20        0.30              2              14
## 863     3.3    5.5         0.20        0.36              2               2
## 864     1.2    1.8         0.42        0.85             13              49
## 865     3.2    6.5         0.46        0.65            210            2400
## 866     1.2    1.9         0.28        0.47             11              26
## 867     1.3    1.8         0.32        0.54            110             410
## 868     1.0    1.7         0.45        0.56             17              94
## 869     1.1    1.9         0.04        0.44              2             140
## 870     1.2    2.2         0.37        1.52             14              32
## 871     1.6    2.4         0.33        0.84             11              31
## 872     1.5    1.8         0.50        1.10             12              26
## 873     1.0    1.5         0.35        0.69              2              27
## 874     1.6    7.4         1.00        1.70             17              36
## 875     1.1    1.9         0.35        0.47             12              32
## 876     1.4    2.2         0.54        1.00              6              24
## 877    21.0   50.0         0.36        6.24          21000          110000
## 878    10.5   40.0         0.64        6.45           8400          110000
## 879    24.0   56.0         0.28        1.68          23000          210000
```

```
## 880    26.0   40.0        0.27        0.74            27000             230000
## 881     1.2    2.7        0.23        0.96               10                 27
## 882     1.0    1.7        0.28        0.56                2                 26
## 883     1.2    2.8        0.40        0.64               11                 34
## 884    24.0   44.0        0.33        1.00            22000             130000
## 885    13.0   31.0        0.45        2.27             9100              79000
## 886     3.3    5.8        0.40        1.10              120                700
## 887     1.4    5.4        0.31        0.84               38                120
## 888     BDL    BDL        0.37        0.37                -                  -
## 889     BDL    BDL        0.34        0.34                -                  -
## 890     0.1    0.1        0.34        0.34                -                  -
## 891     BDL    BDL        0.24        0.24                -                  -
## 892     4.0   17.0        0.69        4.63             1700               4300
## 893    10.0   46.0        0.70        1.61             2100               7000
## 894     5.0   50.0        0.78        1.94             2100               9200
## 895    10.0   42.0        0.60        0.98             2100               7000
## 896    11.0   28.0        0.72        1.13             2200               7000
## 897     4.0   21.0        0.58        0.91             1400               6300
## 898    10.0   26.0        0.74        1.30             1700               6800
## 899     9.0   25.0        0.72        1.32             1700               5800
## 900     8.0   21.0        0.62        0.93             1400               3400
## 901    12.0   35.0        0.69        1.29             2300               5800
## 902     8.0   64.0        0.51        1.02             1700               8400
## 903     6.0   60.0        0.32        0.93             1500               4100
## 904    11.0   59.0        0.75        1.21             1700               6300
## 905    14.0   66.0        0.66        1.49             3100               9200
## 906    30.0  210.0        0.98        2.51            49000             210000
## 907       -      -        1.54        2.10                7                 93
## 908       -      -        1.54        2.36                7                 75
## 909       -      -        1.54        2.20                7                 75
## 910     2.0    2.0        0.54        1.05              BDL                 18
## 911     BDL    3.3        0.01        1.06                2                 18
## 912     BDL    5.2        0.01        1.58                2                 41
## 913     BDL    5.5        0.06        1.64                4                 63
## 914     BDL    6.4        0.02        2.44                4                 50
## 915     BDL    4.2        0.02        1.16                2                 17
## 916     BDL    3.5        0.05        0.98                2                 17
## 917     BDL    5.5        0.06        1.08                2                 70
## 918     2.4    5.8        0.08        1.40               20                 84
## 919     BDL    4.0        0.02        1.01                2                 13
## 920     2.3    6.4        0.01        9.13               12                 70
## 921     BDL    3.0        0.02        1.66                7                 23
## 922     BDL    6.0        0.02        2.36                5                 70
## 923     2.2    2.2        0.02        0.02               84                 84
## 924     1.1    2.7        0.26        2.73               11                170
## 925     1.2    2.5        0.21        1.61               58                120
## 926     0.7    2.5        0.17        2.46               46                110
## 927     0.5    2.6        0.20        1.35               31                130
## 928     1.1    2.6        0.21        1.10               46                120
## 929     0.9    2.8        0.25        1.34               43                150
## 930     0.8    2.0        0.30      111.28               63                120
## 931     0.6    2.8        0.28        1.09               94                150
## 932     0.6    2.7        0.17        1.10               70                150
## 933     0.6    1.9        0.25        2.63               63                170
```

```
## 934     0.4    1.9       0.26       2.41                46              150
## 935     0.4    1.9       0.28       1.72                31              140
## 936     0.6    2.9       0.35       1.67                63              170
## 937     0.5    2.5       0.23       0.83                79              150
## 938     1.1    3.8       0.31       2.52               150              350
## 939     0.4    2.3       0.29       3.34                70              170
## 940     0.5    2.4       0.27       1.94                58              170
## 941     0.7    2.1       0.28       1.61                40              170
## 942     0.4    2.1       0.25       2.26                58              170
## 943     0.3    2.5       0.27       2.07                70              170
## 944     0.3    2.3       0.28       1.98                70              210
## 945     0.7    2.2       0.31       2.00                63              170
## 946     0.7    2.2       0.23       2.30                94              170
## 947     0.9    1.9       0.23       1.84                70              130
## 948     1.8    2.9       0.29       2.54                31              130
## 949     1.4    2.9       0.28       2.85                48              130
## 950     Min    Max        Min        Max               Min              Max
## 951     1.2    2.7       0.15       2.05                 4               15
## 952     1.1    3.0       0.10       3.93                 7               21
## 953     1.0    2.7       0.25       1.72                 7               21
## 954     1.7    4.5       0.25       9.50                 9               23
## 955     1.2    2.6       0.07       3.65                 7               21
## 956     1.0    2.8       0.34       3.09                 7               21
## 957     2.2    2.8       0.66       1.30                 3                3
## 958     0.5    1.0       0.06       0.43                 2              100
## 959     2.2    2.2       0.48       0.48                69               69
## 960     1.2    2.5       0.40       1.00               300              700
## 961     1.3    2.1       0.40       1.20               300              730
## 962     1.3    2.3       0.50       1.00               300              730
## 963     1.2    2.2       0.40       1.40               300             1100
## 964     1.4    2.1       0.50       1.80                 2              360
## 965     0.9    2.0       0.40       1.80               300              360
## 966     0.7    2.2       0.40       1.60                 2              360
## 967     1.9    2.3       0.30       0.90                 2              300
## 968     1.1    2.2       0.60       2.60               300              600
## 969     1.6    2.3       0.60       1.60               300             1500
## 970     1.3    1.7       0.70       0.80                 2                2
## 971     2.2    2.7       0.70       1.40               300              730
## 972     1.4    2.3       0.80       1.80               300              610
## 973     1.2    2.1       0.60       1.40               300              730
## 974     1.3    2.1       0.30       1.20               300              910
## 975     1.2    2.3       0.40       1.70               300              730
## 976     1.6    2.2       0.50       1.10               300              730
## 977     1.2    2.2       0.60       1.40               300             1100
## 978     1.3    2.2       0.40       0.80               300             1400
## 979     1.4    2.2       0.60       1.10               300             1500
## 980     1.1    2.5       0.70       1.00               300             1100
## 981     1.4    2.8       0.60       1.10               300              910
## 982     1.3    2.3       0.05       0.74               780           160000
## 983     1.9    3.8       0.05       0.54              2100           160000
## 984     2.5    4.0       0.19       0.57              4000           160000
## 985     1.1    2.0       0.15       0.33              1100           160000
## 986     1.0    1.0       0.10       0.60                 7               17
## 987     1.0    4.0       0.30       3.00               500             1600
```

```
## 988    1.9   3.0   1.00   2.50      90     130
## 989    1.0   3.0   0.10   3.00      33     170
## 990    1.0   2.0   0.10   0.50      21     280
## 991    1.0   1.0   0.10   3.60      11      40
## 992    1.0   1.0   0.10   1.80       7      40
## 993    1.0   1.0   0.10   1.80       7      22
## 994    1.0   2.8   0.10   3.40      40    1600
## 995    5.5   6.4   9.89  24.98       -       -
## 996    1.0   2.9   0.11   0.72    1300    4900
## 997    1.0   1.9   0.11   1.09      70     130
## 998    1.0   2.3   0.16   0.82      78    2200
## 999    1.0   1.7   0.11   0.78     680    1300
## 1000   1.0   1.0   0.06   0.62     230    2300
## 1001   1.0   2.0   0.11   0.32    1300    2200
## 1002   1.0   2.3   0.11   0.32     220    1700
## 1003   1.0   2.5   0.11   0.38     110    1400
## 1004   1.0   1.2   0.11   0.32     330    2300
## 1005   1.0   2.2   0.11   0.32     270    1700
## 1006   1.0   2.5   0.11   0.32     110    1700
## 1007   1.0   2.5   0.11   0.66     780    4900
## 1008   1.0   1.7   0.11   0.32     780    2300
## 1009   1.0   1.0   0.11   1.50    1100    3300
## 1010   1.0   5.0   0.11   0.74    1300    7900
## 1011   1.0   1.8   0.11   0.54    1300    4900
## 1012   1.0   2.8   0.11   0.69    3100    7900
## 1013   1.0   2.7   0.11   1.13     130    1700
## 1014   1.0   3.0   0.11   0.91     680    2300
## 1015   1.0   6.0   0.11   2.45    4900   13000
## 1016   1.0   2.3   0.11   4.11    1100    2200
## 1017   1.0   2.0   0.11   1.67     330   23000
## 1018   1.0   2.1   0.10   1.46     450    2700
## 1019   1.0   2.2   0.11  10.62      13     330
## 1020   1.0   1.4   0.09   0.71      22    1300
## 1021   1.0   2.0   0.11   1.05      82     330
## 1022   0.2   1.1   0.03   1.12       2      18
## 1023   1.0   2.9   0.21   0.45      90    1600
## 1024   0.5   1.9   0.09   0.43       9      41
## 1025   0.9   2.8   0.06   0.64      11    1600
## 1026   2.1  24.0   0.13   0.57     140     330
## 1027   0.8   2.2   0.22   0.70      12      80
## 1028   2.9 238.0   0.14   1.10       2      20
## 1029   0.8   8.0   0.06   0.16       2     540
## 1030   0.4   1.8   0.06   1.30       6     350
## 1031   0.5   1.5   0.04   0.14       2      46
## 1032   0.3   1.4   0.04   1.33       2      18
## 1033   0.9  19.0   0.14   1.03      25    1600
## 1034   1.7  18.0   0.09   0.53      94     170
## 1035   1.0  20.6   0.08   1.11       2      25
## 1036   1.7   2.9   0.03   0.80       2       2
## 1037   4.7  26.0   0.20   1.48      31    1600
## 1038   0.5   1.3   0.08   0.54       4      25
## 1039   3.0   3.1   0.83   0.86       -       -
## 1040  16.0  54.0   8.00  26.00   48000  210000
## 1041  18.0  52.0  10.00  34.00   64000  250000
```

```
## 1042    4.5   58.0         0.03         1.14              2100              49000
## 1043    2.6    6.8         0.28         0.91               200              34000
## 1044   22.0   64.0         6.00        18.00             11000             170000
## 1045    5.3   83.0         0.53         7.31              2000            1300000
## 1046    1.0    2.9         1.41         2.83               400               6800
## 1047   16.0   16.0         3.24         3.24               830                830
## 1048    5.8    7.9         0.51         2.19               170                450
## 1049    7.1    7.1         0.83         0.83             17000              17000
## 1050    0.3    1.0         0.07         1.01                 2                 31
## 1051    0.5    1.6         0.07         0.91                11                 79
## 1052    0.7    2.0         0.01         0.89                12                 84
## 1053    0.4    2.0         0.02         0.89                 9                 58
## 1054    0.4    2.4         0.06         0.86                10                 94
## 1055    0.1    9.4         0.14         1.13                 2                  2
## 1056    0.1    1.0         0.08         1.06                 2                  2
## 1057    0.1    1.0         0.08         1.70                 2                  2
## 1058    0.1    1.0         0.08         0.49                 2                  2
## 1059    0.3    1.7         0.02         0.90                 6                 22
## 1060    0.3    2.0         0.03         0.85                 9                 32
## 1061    0.1    1.6            -            -                 3                 13
## 1062    0.1    1.0         0.02         0.84                 2                 58
## 1063    0.1    1.0         0.25         0.80                13                 40
## 1064    0.2    1.0         0.26         2.06                 9                 34
## 1065    0.1    1.0         0.56         4.95                17                 49
## 1066    0.1    1.0         0.31         0.62                13                 38
## 1067    0.1    1.0         0.07         1.40                 2                  2
## 1068    0.1    1.0         0.06         1.53                 2                  2
## 1069    0.1    1.0         0.15         0.28                 2                  2
## 1070    0.1    2.4            -            -                 2                 21
## 1071    1.0    5.0         0.21         0.64                45              54000
## 1072    1.0    5.7         1.22         1.71                78               2200
## 1073    2.4    2.6            -            -                 -                  -
## 1074    2.3    2.9            -            -                 -                  -
## 1075    2.1    4.0            -            -                 -                  -
## 1076    1.0    1.6         1.44         1.66                 -                  -
## 1077    3.6    7.0         1.14         1.36                 -                  -
## 1078    0.8    1.0            -            -                 -                  -
## 1079    3.2   30.0            -            -               200                230
## 1080    3.4   29.0            -            -               200                200
## 1081    2.4    2.9         0.03         0.06                63                137
## 1082    2.0    2.0         0.50         1.38                 2               1600
## 1083    2.0    2.0         0.62         1.29                 2               1600
## 1084    2.2    2.6         0.02         0.04                58                122
## 1085    2.0    2.0         0.61         1.17                 2               1600
## 1086    2.0    3.0         0.47         1.38                 2               1600
## 1087    2.3    2.6         0.03         0.52                 4                 21
## 1088    2.1    2.6         0.09         0.32                 5                 25
## 1089    2.1    2.6         0.09         0.43                 9                 17
## 1090    2.1    2.5         0.01         0.47                 7                 26
## 1091    2.1    2.3         0.11         0.25                 4                 21
## 1092    2.1    2.6         0.12         0.69                 2                 33
## 1093    2.0    3.0         0.10         2.64                94               1100
## 1094    2.0    3.0         0.10         0.80               170                700
## 1095    0.2    7.6         0.04         1.91                27               3500
```

```
## 1096    0.2   1.8      0.01      0.96               130             3100
## 1097    0.2   1.0      0.04      0.70               110             6300
## 1098    0.1   1.0      0.01      0.53                32             7000
## 1099    1.4   2.0      0.68      0.78                79              140
## 1100    0.3   1.0      0.01      0.38               490             2500
## 1101    0.1   1.9      0.01      0.94                14             1800
## 1102    1.9   9.0      0.79      1.90              1800             5800
## 1103    0.3   1.0      0.01      0.61                70              270
## 1104    0.3   3.0      0.04      0.66               220            40000
## 1105    0.2   1.0      0.01      0.49               400             2100
## 1106    1.2   3.2      0.01      0.31               100              910
## 1107    0.5   2.1      0.01      0.68                40              240
## 1108    1.6   2.6      0.68      0.87                94              180
## 1109    0.9   2.6      0.01      0.27               100              790
## 1110    1.2   3.1      0.01      0.01               100              200
## 1111    1.7   2.5      0.66      0.92                79              200
## 1112    0.4   2.6      0.01      0.01               100              200
## 1113    1.3   1.8      0.58      0.70                60              110
## 1114    0.7   2.1      0.01      0.55                70              490
## 1115    1.0   5.8      0.03      0.80                 8               70
## 1116    0.1   1.0      0.01      0.40                91             2200
## 1117    0.3   1.9      0.02      0.45               150            10000
## 1118    0.3   1.8      0.01      0.37                40              180
## 1119    1.4   2.5      0.01      6.50                70              130
## 1120    0.4   2.3      0.04      0.75                12               81
## 1121    0.5   2.3      0.03      0.41                56               94
## 1122    0.8   3.5      0.04      6.60                24             4700
## 1123    0.1   1.7      0.01      0.01               100              200
## 1124    0.3   2.9      0.01      0.01               100              310
## 1125    1.0   2.1      0.01      0.01               100              210
## 1126    1.3   2.0      0.96      1.30               100              170
## 1127    1.5   2.7      0.68      0.80                60              180
## 1128    0.9   2.3      0.01      0.42               100             1100
## 1129    1.0   2.6      0.01      0.75               100              200
## 1130    0.7   2.4      0.01      2.30               100              580
## 1131    0.3   2.8      0.30      1.86                12               84
## 1132    0.3   5.4      0.01      0.45                10               79
## 1133    0.4   3.6      0.10      0.98               460            41000
## 1134    0.3   1.0      0.01      0.68                91             3100
## 1135    0.1   1.5      0.01      0.20                31              120
## 1136    0.3   1.9      0.01      0.05                40              170
## 1137    0.2   2.9      0.01      0.04                39              170
## 1138    0.5   1.9      0.01      0.19                40              200
## 1139    0.2   2.8      0.01      0.18                40              150
## 1140    0.4   2.7      0.01      0.16                40              340
## 1141    1.2   2.3      0.01      0.37                49              100
## 1142    1.0   2.5      0.01      0.43                24               94
## 1143    1.0   2.5      0.01      0.72                48              100
## 1144    1.1   2.5      0.01      0.26                40               79
## 1145    1.0   2.7      0.01      0.89                48              100
## 1146    1.0   1.9      0.01      0.41                32               84
## 1147    0.1   1.4      0.01      0.10                20              140
## 1148    1.0   2.8      0.18     11.90                 2              810
## 1149    1.0   1.8      0.02      6.30                20             3800
```

```
## 1150    1.0    1.9        0.23        2.41                60                900
## 1151    0.1    2.9        0.01        0.52               100               1700
## 1152    0.2    2.5        0.01        3.97                24              70000
## 1153    0.2    2.6        0.06        0.45               310               3800
## 1154    0.3    2.8        0.01        0.58                79               1400
## 1155    1.0    4.0        0.01        3.06                12               5800
## 1156    1.2    3.3        0.01        0.66               340               3500
## 1157    0.3    1.8        0.01        0.11                 4                 70
## 1158    0.3    1.5        0.01        0.10                 2                 84
## 1159    1.2    2.9        0.18        3.69                40               1200
## 1160    0.4    1.0        0.02        0.49               240               7000
## 1161    1.3    2.9        0.68        0.80                79                180
## 1162    1.5    3.6        0.68        0.74                91                170
## 1163    0.2    2.5        0.01        0.96                34               1000
## 1164    0.8    1.6        0.01        0.01               100                200
## 1165    0.3    2.4        0.01        0.33                40                120
## 1166    0.4    1.8        0.01        1.10               140               5400
## 1167    0.5    4.1        0.01        1.50               200              18000
## 1168    0.5    1.6        0.01        0.13                 2                  2
## 1169    0.7    2.0        0.10        0.33                 2                 20
## 1170    1.5    2.0        0.09        1.69                 2                  6
## 1171    1.2    2.0        0.10        1.00                 2                  6
## 1172    1.4    3.8        0.12        1.38                 2                350
## 1173    0.8    1.8        0.06        1.30                 2                  2
## 1174    0.6    1.2        0.51        1.71                 2                  2
## 1175    0.7    1.2        0.61        3.37                 2                  2
## 1176    0.9    1.4        0.63        1.95                 2                  2
## 1177    0.7    1.8        0.19        1.42                 2                 10
## 1178    0.7    1.8        0.21        1.52                 2                 11
## 1179    3.0   20.0        0.30        1.90                 2                170
## 1180    2.6    4.0        0.30        0.80                 2                170
## 1181    2.8    4.2        0.30        0.80                 2                 40
## 1182    2.4    6.0        0.30       10.40                 8                110
## 1183    2.6    4.8        0.30        1.10                 2                 33
## 1184    2.8    3.4        0.30        0.70                 5                130
## 1185    2.4    4.0        0.30        1.50                 2                170
## 1186    2.8    4.2        0.30        5.30                 2                 70
## 1187    1.5    2.0        0.30        1.00                 4                 13
## 1188    3.0   54.0        0.30        5.30               350              92000
## 1189    2.8   12.0        0.30        4.20                 2                 21
## 1190    1.6    2.8        0.30        2.90                 6                 17
## 1191    2.4    4.0        0.30        1.60                 2                110
## 1192    3.0    4.0        0.30        0.50                 2                 17
## 1193    2.8    3.8        0.30        0.50                 2                 33
## 1194    2.8    3.2        0.90        4.27                11                 14
## 1195    3.4   12.0        0.30        2.70                 2                240
## 1196    2.6    4.4        0.30        1.80                 2                 40
## 1197    1.4    2.0        0.30        0.60                 4                  9
## 1198    2.8   12.0        0.30       10.00                 2                110
## 1199    2.6    4.2        0.30        1.30                 2                110
## 1200    2.4    4.8        0.30        1.10                 2                140
## 1201    2.8    5.0        0.30        1.40                 2                540
## 1202    2.8    4.4        0.30        1.60                 2                220
## 1203    2.8    4.0        0.30        0.50                 2                 21
```

```
## 1204    1.6   2.0       0.30       0.70              4              14
## 1205    1.6   2.0       0.30       0.78              5              17
## 1206    1.6   2.4       0.30       3.00              6              21
## 1207    1.6   2.8       0.30       1.44              6              17
## 1208    2.8   4.0       0.30       0.90              2              21
## 1209    2.8   4.0       0.30       1.70              2              21
## 1210    2.8   4.2       0.30       1.70              2              23
## 1211    2.8   4.0       0.40       1.80             11              17
## 1212    2.6   4.0       0.30       1.20              8              27
## 1213    1.5   2.0       0.30       1.22              4              17
## 1214    1.5   1.8       0.30       1.08              4              12
## 1215    2.8   3.6          -          -              5              50
## 1216    2.7   3.2          -          -             25              60
## 1217    2.5   3.8          -          -             10              55
## 1218    2.6   4.0          -          -             35              75
## 1219    2.8   6.5          -          -             95             200
## 1220    3.2   6.8          -          -            130             235
## 1221    2.7   3.7          -          -             25              55
## 1222    2.7   3.7          -          -             30              55
## 1223    2.8   3.7          -          -             15              75
## 1224    2.7   3.7          -          -             55             135
## 1225    3.0   3.9          -          -             15              65
## 1226    2.6   3.9          -          -             35              60
## 1227    2.6   3.6          -          -             20              40
## 1228    2.6   3.7          -          -             25              50
## 1229    2.0   3.9          -          -             20              65
## 1230    3.9   5.8          -          -            120             320
## 1231    2.5   3.4          -          -              2               2
## 1232    2.7   4.6          -          -             69             155
## 1233    3.6   4.6          -          -             30              45
## 1234    3.0   5.5          -          -             35             289
## 1235    2.5   3.9          -          -              5              45
## 1236    2.3   3.8          -          -             30              55
## 1237    2.7   3.5          -          -              5              30
## 1238    2.7   3.6          -          -              5              15
## 1239    2.4   3.7          -          -              5              15
## 1240    3.1   3.8          -          -             40              75
## 1241    2.7   3.7          -          -             30              55
## 1242    2.7   3.5          -          -              2               5
## 1243    2.5   3.7          -          -             10              25
## 1244    2.8   3.4          -          -             30              55
## 1245    2.8   3.6          -          -             30              55
## 1246    2.2   3.7       0.28       2.51             27             280
## 1247    2.2   3.5       0.11       0.38              2               2
## 1248    2.3   3.4       0.35       0.61            130             340
## 1249    1.2   1.8       0.38       0.79            130             220
## 1250    1.4   1.8       0.34       0.53             63             140
## 1251    1.5   5.0       0.72       1.60             11              23
## 1252    1.2   1.9       0.21       0.40              6              14
## 1253    1.0   1.8       0.34       0.75              2              12
## 1254    1.3   1.9       0.62       0.92             12              33
## 1255    1.2   2.0       0.31       0.52             12              27
## 1256    1.4   4.0       0.58       1.23             14              27
## 1257    1.0   8.2       0.48       0.64              2               6
```

```
## 1258    1.1   30.0        0.31        0.45             6            28000
## 1259    1.0    5.0        0.30        0.39             2                4
## 1260    7.2   35.0        0.59        6.40          3800            25000
## 1261    5.0   17.6        0.80        8.41          3100            12000
## 1262    8.0   38.5        0.70        3.70          5800            38000
## 1263    8.5   32.0        0.46        3.21          4100            31000
## 1264    1.0    1.9        0.28        0.68             2               17
## 1265   13.0   35.0        0.31        0.86          7000            27000
## 1266    6.0   18.0        0.70        5.43          2700            13000
## 1267    1.2    2.5        0.29        2.55            27              230
## 1268    2.2    3.5        0.15        0.35             2                2
## 1269    1.4    1.8        0.31        0.65             2               14
## 1270    1.3    2.0        0.38        0.61             7               24
## 1271    1.2    2.1        0.30        0.56             8               31
## 1272    1.4    2.0        0.31        0.59             2               24
## 1273    1.1    1.9        0.32        0.58            17               27
## 1274    1.3    1.8        0.31        0.56            34               79
## 1275    1.2    2.0        0.26        0.48             2               24
## 1276    1.0    1.0        0.38        0.38             -                -
## 1277    1.0    1.0        2.50        2.50             -                -
## 1278    1.0    1.0        1.29        1.29             -                -
## 1279    1.0    1.0           -           -             -                -
## 1280    5.0   18.0        1.02        3.14          1400             4000
## 1281   12.0   27.0        0.80        1.50          2100             4900
## 1282   17.0   44.0        0.80        2.11          2600             5800
## 1283   13.0   37.0        1.00        1.70          2500             5800
## 1284    8.0   53.0        0.70        2.00          1700             6300
## 1285    5.0   34.0        0.72        1.90          1700             4300
## 1286    7.0   43.0        0.90        2.40          2100             5800
## 1287   10.0   32.0        0.90        3.20          2000             7000
## 1288    8.0   28.0        0.50        1.60          1700             4300
## 1289   11.0   28.0        0.60        1.80          1700             6300
## 1290    9.0   42.0        0.60        2.10          2000             4700
## 1291    7.0   37.0        0.50        1.90          1700             3800
## 1292   12.0   35.0        0.80        1.50          2200             4700
## 1293   18.0   42.0        0.70        1.90          2700             5800
## 1294   40.0  111.0        1.70        4.10         94000           210000
## 1295    3.0   42.0        0.56        2.56          2200            38000
## 1296    9.0   21.0        0.23        2.17          3800           130000
## 1297    5.0   14.0        1.24        1.95             2             1100
## 1298    0.7    2.9        0.84        2.37            20              120
## 1299    1.0    1.6        1.02        2.24            93               93
## 1300    1.1    2.8        0.85        1.84            23               75
## 1301    1.4    3.1        0.58        2.29            39               75
## 1302    1.0   13.0        0.02        0.40             2               12
## 1303    1.0   24.0        0.02        0.56             4               22
## 1304    2.0    3.0        0.02        1.79            11              110
## 1305    1.0    3.3        0.02        0.52            17              150
## 1306    1.0    3.0        0.02        0.46             2               17
## 1307    1.0    3.0        0.02        0.86             2               17
## 1308    2.4    5.1        0.02        0.85            41              220
## 1309    2.0    3.0        0.32        1.11             2               45
## 1310    2.2    5.1        0.04        0.91            34              140
## 1311    1.0    3.0        0.02        0.41             2               22
```

```
## 1312    1.0    4.0       0.02       0.63              25              110
## 1313    2.2    3.0       0.02       1.82              14               94
## 1314    2.4    3.0       0.02       0.51              21              120
## 1315    2.0    3.1       0.02       0.54              20              110
## 1316    1.0    1.7       0.51       1.16              26               70
## 1317    1.0    2.2       0.52       0.99              38               70
## 1318    1.0    1.7       0.35       1.53              17               49
## 1319    1.2    2.6       1.15       3.25              58              170
## 1320    1.0    1.3       0.79       1.78              21               94
## 1321    0.6    1.4       0.52       1.91              17               58
## 1322    1.0    1.5       0.41       1.19              15               63
## 1323    1.0    1.5       0.90       2.85              22               63
## 1324    0.8    1.3       0.48       1.57              26               48
## 1325    0.6    1.4       0.51       1.27              21               63
## 1326    0.5    1.2       0.54       1.79              15               40
## 1327    0.7    1.7       0.97       3.15              21               79
## 1328    0.9    1.5       1.01       3.01              25               94
## 1329    0.3    1.3       0.55       1.61              17               58
## 1330    0.9    1.3       0.66       1.27              17               47
## 1331    0.9    1.7       0.43       2.19              22               47
## 1332    1.0    1.6       0.52       2.51              22               58
## 1333    0.7    1.3       0.46       1.25              15               32
## 1334    1.0    1.8       1.05       2.29              25               63
## 1335    1.0    1.9       1.19       2.79              17               58
## 1336    0.8    1.8       1.02       2.22              21               63
## 1337    0.7    1.8       0.87       1.97              21               58
## 1338    1.0    1.6       0.47       1.84              17               58
## 1339    0.7    1.3       0.62       1.09              25               48
## 1340    0.6    1.8       0.68       1.87              17               58
## 1341    0.5    1.4       0.57       1.78              21               63
## 1342    Min    Max        Min        Max             Min              Max
## 1343    1.4    2.0       0.72       1.66               7               15
## 1344    1.2    2.5       0.92       3.02              11               21
## 1345    1.2    2.0       0.54       3.60               7               15
## 1346    1.4    2.3       0.33       4.02              11               15
## 1347    1.5    2.2       0.42       2.46               9               21
## 1348    1.5    2.2       0.42       3.05               7               15
## 1349    1.0    1.0       0.30       0.30               5                9
## 1350    1.0    7.1       0.50       0.90              21               53
## 1351    2.6    6.1       0.30       0.50              36              110
## 1352    1.0    1.0       0.30       0.30              35               41
## 1353    1.0    1.0       0.30       0.50              12               18
## 1354    1.0   14.3       0.40       4.00              71              214
## 1355    1.0   14.8       0.90       2.10             340             1600
## 1356    2.3   12.2       0.40       1.10             460             1600
## 1357    1.8    9.1       0.32      33.44             920            17000
## 1358    1.0    1.0       0.30       0.50               4               18
## 1359    1.0    1.9       0.32       0.42            2300             7900
## 1360    1.3    2.1       0.32       0.52             230             2200
## 1361    1.0    1.9       0.32       0.33             230             1700
## 1362    1.0    1.5       0.32       0.32             230             2300
## 1363    1.0    1.9       0.32       0.32             230             1300
## 1364    1.0    1.9       0.32       0.32             220              790
## 1365    1.0    1.9       0.32       1.13             490             1700
```

##	1366	1.0	1.6	0.32	0.35	110	1700
##	1367	1.0	1.9	0.32	0.43	130	1700
##	1368	1.2	2.0	0.32	0.80	8	230
##	1369	1.0	1.9	0.32	1.02	78	460
##	1370	1.2	1.9	0.32	0.98	110	330
##	1371	1.0	2.0	0.32	0.41	330	1400
##	1372	1.0	1.9	0.32	1.46	78	210
##	1373	1.3	3.6	0.32	0.73	130	4900
##	1374	1.3	6.0	0.32	3.82	2300	35000
##	1375	1.0	3.9	0.32	1.73	45	1700
##	1376	1.0	2.5	0.32	1.02	490	2200
##	1377	1.0	3.3	0.32	0.42	330	2700
##	1378	1.0	1.9	0.32	0.32	5	490
##	1379	1.1	1.9	0.32	0.52	170	1100
##	1380	1.0	1.9	0.32	0.33	230	2400
##	1381	1.0	1.9	0.32	0.57	130	3300
##	1382	1.0	2.0	0.32	3.62	2200	3300
##	1383	1.0	2.4	0.32	0.53	490	2200
##	1384	1.0	1.9	0.32	0.36	230	1700
##	1385	1.0	22.0	0.02	1.28	33	1600
##	1386	1.0	2.1	0.05	1.09	10	38
##	1387	1.0	20.0	0.30	0.83	79	1600
##	1388	1.0	23.0	0.30	1.32	70	1600
##	1389	1.3	2.7	0.30	1.01	15	920
##	1390	1.0	22.0	0.32	0.34	11	220
##	1391	1.4	6.0	0.32	0.90	2	47
##	1392	1.0	3.0	0.30	2.21	12	13000
##	1393	1.0	2.2	0.30	0.64	38	1600
##	1394	1.0	1.0	0.30	0.52	8	28
##	1395	1.9	33.0	0.32	1.67	1600	1600
##	1396	1.0	2.4	0.05	1.07	10	27
##	1397	1.0	1.5	0.32	0.43	33	920
##	1398	1.0	1.5	0.33	0.66	10	27
##	1399	1.6	2.9	0.01	0.90	220	920
##	1400	1.0	2.2	0.04	0.90	94	430
##	1401	1.8	2.3	0.30	1.00	2	2
##	1402	3.0	40.0	1.04	3.59	1300	4900
##	1403	2.8	5.4	0.30	0.88	200	9400
##	1404	2.8	42.0	0.10	0.30	800	41000
##	1405	1.3	13.0	1.13	2.82	2800	130000
##	1406	4.9	11.0	1.99	4.98	78	110000
##	1407	26.0	30.0	-	-	94000	210000
##	1408	38.0	42.0	-	-	90000	220000
##	1409	30.0	39.0	-	-	72000	280000
##	1410	3.0	29.0	0.32	1.22	13	3300000
##	1411	1.0	3.8	0.32	1.13	23	130000
##	1412	1.0	2.6	0.32	2.96	17	32
##	1413	1.1	2.4	0.32	1.02	22	47
##	1414	1.0	4.0	0.32	0.83	22	49
##	1415	1.1	3.2	0.32	1.22	21	40
##	1416	1.0	2.9	0.32	1.02	22	40
##	1417	2.4	2.8	0.02	1.82	33	64
##	1418	2.2	2.6	0.02	0.32	26	48
##	1419	2.0	2.0	0.80	4.10	40	1600

```
## 1420    2.0    2.0    1.40    4.90      17     1600
## 1421    2.0    3.0    1.10    3.90      33     1600
## 1422    2.0    2.0    0.60    4.10      21     1600
## 1423    1.0    2.2    0.30    0.70      84      120
## 1424    1.0    2.3    0.30    0.80      84      110
## 1425    1.0    2.2    0.30    0.80      79      150
## 1426    1.0    2.3    0.30    0.70     100      940
## 1427    1.0    1.8    0.30    0.30      31      120
## 1428    1.0    1.4    0.30    0.30      31      180
## 1429    1.0    1.9    0.30    0.90     200      310
## 1430    1.0    2.6    0.30    2.30     200     2000
## 1431    1.0    2.1    0.30    2.70       2      400
## 1432    1.0    3.3    0.30    0.30      17     4800
## 1433    1.0    1.9    0.30    0.31     100     7000
## 1434    1.0    1.0    0.30    0.38     100     7000
## 1435    1.0    1.0    0.30    0.30     600     3400
## 1436    1.0    3.2    0.30    3.90    1100     4800
## 1437    1.0    1.9    0.30    0.60     400     5800
## 1438    1.2    2.4    0.30    1.10      70      210
## 1439    1.0    2.1    0.30    0.60      79      140
## 1440    1.0    3.3    0.30    0.73      27       94
## 1441    2.0    4.0    0.30    0.70     270     2800
## 1442    1.0    3.6    0.30    0.60     200     4000
## 1443    1.6    2.6    0.30    0.70      94      140
## 1444    1.0    3.3    0.30    0.80    1000    70000
## 1445    1.0    3.3    0.30    3.70       2      920
## 1446    1.0    1.6    0.30    0.30     100      200
## 1447    4.1    8.2    1.10    1.50    4000     4900
## 1448    1.0    1.7    0.30    0.30      32      110
## 1449    1.0    2.1    0.30    1.00     200     1000
## 1450    1.0    2.1    0.30    0.30      20      100
## 1451    1.1    2.4    0.30    0.80     200      490
## 1452    1.0    3.5    0.30    3.30       2      400
## 1453    1.0    1.5    0.30    0.30      20       84
## 1454    1.0    2.2    0.30    0.40      20      120
## 1455    1.0    1.6    0.30    0.30      84     2500
## 1456    1.0    1.8    0.30    0.30     100    17000
## 1457    1.0    2.5    0.30    0.30     200      400
## 1458    1.0    2.4    0.30    0.30       2     2200
## 1459    1.0    3.1    0.30    0.30       2     1200
## 1460    1.0    1.8    0.30    0.40       2       70
## 1461    1.0    2.0    0.30    0.30      17      150
## 1462    1.0    1.0    0.30    2.02     100     1100
## 1463    1.0    2.9    0.30    0.70      27      250
## 1464    1.0    1.3    0.30    1.00       2     1500
## 1465    1.0    2.3    0.30    0.40      39      120
## 1466    1.0    2.1    0.30    0.60      58      150
## 1467    1.0    2.3    0.30    0.30     100      200
## 1468    1.0    2.5    0.30    0.30     100      310
## 1469    1.8    2.2    0.30    0.80     100      140
## 1470    1.0    1.0    0.30    0.70     100      170
## 1471    1.0    1.5    0.30    1.20      61      170
## 1472    1.0    1.0    0.30    0.42     110      680
## 1473    1.0    1.7    0.30    0.90      91      210
```

```
## 1474   1.0   1.0    0.30    0.30     80    270
## 1475   1.0   1.6    0.30    0.34    220   2000
## 1476   1.0   3.6    0.30    0.30    200   4800
## 1477   1.0   2.3    0.30    0.30     63   3400
## 1478   1.0   2.9    0.30    0.30    310   1400
## 1479   1.0   1.7    0.30    1.30    310   6300
## 1480   1.0   3.9    0.30    0.40     70   1300
## 1481   1.0   2.7    0.30    0.30    340   7000
## 1482   1.0   3.3    0.30    2.60     94   4000
## 1483   1.0   2.1    0.30    0.30     20     84
## 1484   1.0   1.8    0.30    0.31     24    120
## 1485   1.0   2.2    0.30    0.60    310   1500
## 1486   1.0   2.1    0.30    0.40     40     84
## 1487   1.0   1.7    0.30    0.30     27     94
## 1488   1.0   2.0    0.30    0.30     31    100
## 1489   1.0   2.4    0.30    1.20     36     79
## 1490   1.0   2.9    0.30    0.40     40     79
## 1491   1.0   2.4    0.30    0.60     48    210
## 1492   1.0   2.1    0.30    0.30     20     94
## 1493   1.0   2.0    0.30    0.30    100    310
## 1494   3.0   4.0    0.30    0.40      2    110
## 1495   3.0   4.0    0.30    0.51      2     23
## 1496   3.0   4.0    0.30    0.60      5     27
## 1497   3.0   4.0    0.30    0.51      2     21
## 1498   3.0   8.0    0.30    1.60      2     26
## 1499   2.4   3.2    0.90    4.27      4     11
## 1500   3.0   9.0    0.30    3.10      2     79
## 1501   3.0  12.0    0.30    1.20      2     33
## 1502   3.2   4.0    0.30    0.89      2     49
## 1503   3.6  17.0    0.30    2.40      2    170
## 1504   3.2  45.0    0.30   15.90      5  17000
## 1505   1.4   1.8    0.30    0.99      4      6
## 1506   3.0  10.0    0.30    9.20      2     48
## 1507   3.0   3.8    0.30    2.30      5    140
## 1508   3.2   7.4    0.30    5.90      2     33
## 1509   3.0   7.4    0.30    6.20      2    140
## 1510   3.2   3.8    0.30    0.60      2    240
## 1511   3.0   7.4    0.30    3.50      5     79
## 1512   3.2   3.8    0.30    0.30      2     70
## 1513   3.0   4.0    0.30    1.12      2     22
## 1514   1.6   2.0    0.30    2.35      5     14
## 1515   1.4   2.8    0.30    4.20      2     17
## 1516   1.4   3.8    0.30    4.72      6     14
## 1517   1.4   2.2    0.30    2.27      2      6
## 1518   1.4   2.0    0.30    1.26      2      6
## 1519   3.2   3.8    0.30    0.55      5     27
## 1520   3.0   3.8    0.30    1.00      5     33
## 1521   3.0   3.8    0.30    1.20      2    110
## 1522   3.0   4.0    0.30    0.79      5     94
## 1523   3.2   3.8    0.30    0.51      5     17
## 1524   1.6   1.8    0.30    2.25      4      5
## 1525   1.2   1.8    0.30    0.80      4      6
## 1526   1.4   1.8    0.30    2.19      4      5
## 1527   2.9   3.3    <NA>    <NA>      5     20
```

```
## 1528   2.9   3.3    0.32    0.32          50         95
## 1529   3.0   3.5       -       -          40         85
## 1530   2.8   3.3       -       -          35         60
## 1531   3.1   5.1       -       -          10        180
## 1532   3.0   3.5       -       -          55         90
## 1533   3.0   4.9       -       -          50        195
## 1534   3.0   3.4       -       -          35         95
## 1535   2.9   3.0       -       -           5          5
## 1536   2.8   3.2       -       -          25         45
## 1537   3.0   5.3       -       -          60        285
## 1538   3.0   3.6       -       -          50         95
## 1539   2.9   3.4       -       -          35         60
## 1540   3.0   4.5       -       -          40         80
## 1541   3.0   3.4       -       -          45         80
## 1542   2.8   3.5       -       -           2         25
## 1543   3.1   3.5       -       -          15        200
## 1544   2.0   3.5       -       -          30         70
## 1545   2.8   3.4       -       -          10         35
## 1546   3.0   3.3       -       -          50         80
## 1547   3.0   3.7       -       -          50         85
## 1548   3.2   3.6       -       -          50         90
## 1549   3.9   6.2       -       -         215        295
## 1550   3.8   5.9       -       -         200        295
## 1551   3.3   4.7       -       -          80        165
## 1552   3.3   4.8    0.30    0.30          95        190
## 1553   3.0   3.8       -       -          40         75
## 1554   2.8   3.0       -       -           5         25
## 1555   2.7   3.4       -       -          15         35
## 1556   3.0   3.1       -       -          20         30
## 1557   3.0   3.5       -       -          15         30
## 1558   3.1   3.3       -       -          40         65
## 1559   2.8   4.1       -       -          25        175
## 1560   2.9   3.0       -       -          10         30
## 1561   2.9   3.6       -       -          40         65
## 1562   3.1   3.2       -       -          45         85
## 1563   1.4   1.8    0.42    0.52          21         36
## 1564   1.4   1.8    0.32    0.56          31         43
## 1565   1.3   1.7    0.37    0.52         130        170
## 1566   1.4   1.8    0.44    0.55          23         49
## 1567   1.8   2.6    0.32    0.32           2          2
## 1568   1.3   1.6    0.37    0.55          20         31
## 1569   1.0   1.6    0.32    0.36          27         38
## 1570   2.1   2.9    0.32    0.62         300        430
## 1571   1.2   1.8    0.32    1.22          17         27
## 1572   1.3   2.0    0.34    1.22          31         63
## 1573   1.0   1.7    0.32    1.32           2          4
## 1574   1.3   2.0    0.32    0.82          13         31
## 1575   1.0   1.7    0.37    0.72           6         17
## 1576   1.1   1.7    0.32    0.36           2          8
## 1577   1.5   2.2    2.02    3.42          17         34
## 1578  14.0  35.0    0.39    4.16        6300      17000
## 1579  15.6  45.0    0.33    5.00       14000      32000
## 1580  15.1  40.0    0.40    1.90       13000      30000
## 1581   6.2  14.2    1.12    5.16        4200      11000
```

```
## 1582   16.0  39.0        0.32        2.60            13000           27000
## 1583    1.4   1.8        0.32        0.52                2              17
## 1584    6.0  24.0        0.32        5.57             4100            8400
## 1585    2.3   2.7        0.32        0.52              210             380
## 1586    1.0   1.7        0.32        0.47               43              63
## 1587    1.0   2.3        0.02        0.12                3            1100
## 1588    1.0   1.7        0.02        0.11                2             240
## 1589    1.1   2.4        0.02        0.10                -               -
## 1590    1.0   2.4        0.02        0.02                3              42
## 1591    1.0   1.7        0.02        0.04                2              95
## 1592    1.0   2.4        0.02        0.21               10            1100
## 1593    1.0   2.0        0.02        0.10                3            1100
## 1594    1.0   1.8        0.02        0.02                -               -
## 1595    1.0   2.6        0.02        0.06                3            1100
## 1596    1.0   1.9        0.02        0.05                -               -
## 1597    1.0   2.2        0.02       25.20                -               -
## 1598    1.0   1.6        0.02        0.02                -               -
## 1599    1.0   2.1        0.02        0.05                3            1100
## 1600    1.0   2.5        0.37        2.02              330            2300
## 1601    1.0   2.2        0.32        1.02               78            1700
## 1602    1.0   2.1        0.32        3.39              330            2300
## 1603    1.0   1.3        0.32        1.02               20            1700
## 1604    1.0   1.9        0.32        1.22               78            2200
## 1605    1.0   1.5        0.32        1.52               78            1400
## 1606    1.0   1.6        0.32        1.22               20            1300
## 1607    1.0   2.0        0.32        1.32              130            2200
## 1608    1.0   2.1        0.32        1.45                2             490
## 1609    1.0   2.6        0.32        1.09               45            2200
## 1610    1.0   1.8        0.32        1.22              130            2200
## 1611    1.0   1.8        0.32        1.52              130            2400
## 1612    1.0   1.2        0.32        1.02              130            1700
## 1613    1.0   1.3        0.32        1.42               20            1300
## 1614    1.0   1.3        0.32        0.92                2             300
## 1615   20.0  20.0        0.32        0.32                -               -
## 1616   25.0  25.0        0.32        0.32                -               -
## 1617    2.0   2.0        0.32        0.32                -               -
## 1618    1.0   1.0        0.32        0.32                -               -
## 1619   14.0  47.0        1.10        3.80             3900            4900
## 1620   11.0  37.0        1.00        2.50             2700            4600
## 1621   13.0  43.0        1.00        1.60             3200            6300
## 1622   14.0  27.0        1.10        1.40             3400            6300
## 1623   14.0  38.0        1.10        1.50             3400            4900
## 1624    9.0  23.0        1.00        2.70             2400            3400
## 1625   14.0  41.0        1.20        3.10             3900            6300
## 1626    6.0  25.0        0.32        1.88             2100         1700000
## 1627    7.0  24.0        0.90        1.70             1700            4100
## 1628   12.0  42.0        1.00        2.90             3200            4900
## 1629    4.0  16.0        2.91        3.64               78            2600
## 1630    5.0  25.0        0.32        0.66             4900           49000
## 1631   10.0  22.0        1.00        1.20             2600            4000
## 1632   11.0  33.0        1.00        1.40             2600            4700
## 1633    6.0  19.0        0.30        2.50             1700            2700
## 1634   13.0  40.0        1.00        1.40             2600            6300
## 1635   12.0  43.0        1.00        2.90             3300            4700
```

```
## 1636    1.0    4.0       0.32       0.62                 2                460
## 1637    2.0    7.0       0.32       1.42                31                110
## 1638    1.0    3.0       0.19       0.45                 2                  2
## 1639    1.0    3.0       0.18       0.66                 2                 20
## 1640    2.0    7.5       0.32       6.42                26                130
## 1641    1.0    3.0       0.32       0.90                 2                 17
## 1642    2.0    3.0       0.32       0.56                17                 70
## 1643    1.0    2.6       0.32       0.82                 2                 13
## 1644    1.0    3.0       0.32       0.69                 2                  8
## 1645    2.0    3.0       0.17       0.57                11                 94
## 1646    2.0    3.0       0.32       0.84                21                 84
## 1647    2.0    3.0       0.19       0.45                12                 70
## 1648    2.0    3.2       0.32       5.15                 4                 63
## 1649    2.0    3.0       0.32       0.80                17                110
## 1650    1.0    2.3       0.92       2.90                17                 63
## 1651    1.1    1.9       0.80       2.40                21                 63
## 1652    1.2    2.1       0.88       2.59                33                 94
## 1653    1.5    2.9       0.68       6.76                47                120
## 1654    1.3    2.2       1.30       3.20                33                 84
## 1655    1.5    2.4       1.08       3.40                41                 94
## 1656    1.1    2.1       0.68       2.34                26                 63
## 1657    1.0    1.8       0.58       2.50                38                 84
## 1658    1.6    2.8       0.85       4.30                58                 94
## 1659    1.5    3.2       2.10       4.40                63                110
## 1660    1.2    2.5       0.65       3.82                15                 63
## 1661    1.4    2.8       1.80       4.40                33                 63
## 1662    1.2    2.1       0.81       2.48                26                 58
## 1663    1.1    2.2       0.92       3.90                31                 63
## 1664    1.1    2.2       0.80       3.10                25                 63
## 1665    1.0    1.9       0.90       3.00                27                 63
##      TotalColiformMin TotalColiformMax year
## 1                 150              640 2017
## 2                 120              460 2017
## 3                  17              540 2017
## 4                 110             1600 2017
## 5                 240             1600 2017
## 6                  33             1600 2017
## 7                  70             1600 2017
## 8                 110             1600 2017
## 9                 120             1600 2017
## 10                 33             1600 2017
## 11                 63             1600 2017
## 12                450            28000 2017
## 13                 78           132000 2017
## 14                780             7900 2017
## 15                330            13000 2017
## 16                780             7900 2017
## 17               4600            54000 2017
## 18                230             5400 2017
## 19                110             9200 2017
## 20                 46             9200 2017
## 21               1300             9200 2017
## 22                460             5400 2017
## 23               1300            24000 2017
```

```
## 24                 490             17000 2017
## 25                1100              9400 2017
## 26                2700             92000 2017
## 27                 780             13000 2017
## 28                7900             35000 2017
## 29                 330             17000 2017
## 30                 170              1700 2017
## 31               17000             92000 2017
## 32                 170              3300 2017
## 33                 310             22000 2017
## 34                 170             11000 2017
## 35                   2               177 2017
## 36                  94              1600 2017
## 37                   2               210 2017
## 38                   2               540 2017
## 39                 700             17000 2017
## 40                  13               140 2017
## 41                 110               240 2017
## 42                 276               542 2017
## 43                 212               542 2017
## 44                 175               542 2017
## 45                   2               542 2017
## 46                   3               210 2017
## 47                 170               700 2017
## 48                  50               110 2017
## 49                  14                22 2017
## 50                 240              2400 2017
## 51                  11                47 2017
## 52                <NA>              <NA> 2017
## 53                <NA>              <NA> 2017
## 54               27800             54200 2017
## 55                1090              9400 2017
## 56                <NA>              <NA> 2017
## 57                  24                39 2017
## 58                  21                32 2017
## 59                  26                79 2017
## 60                  24                34 2017
## 61                  46               920 2017
## 62                  25                33 2017
## 63                 140              1600 2017
## 64                  27               540 2017
## 65                  79               920 2017
## 66                 130              1800 2017
## 67                  79              1600 2017
## 68                  94              1600 2017
## 69                1380              7900 2017
## 70                1160             17000 2017
## 71                  20              1280 2017
## 72                  40              1680 2017
## 73                 310               500 2017
## 74                1200              4000 2017
## 75                 140            790000 2017
## 76               38200             41000 2017
## 77                 240               480 2017
```

```
## 78                   600           1400000 2017
## 79                  1800              3800 2017
## 80                    72               460 2017
## 81                   260               840 2017
## 82                   260               560 2017
## 83                   180               320 2017
## 84                   620              1750 2017
## 85                   140               460 2017
## 86                   550               880 2017
## 87                   320               400 2017
## 88                   250               680 2017
## 89                    32               480 2017
## 90                    20               400 2017
## 91                    18              1400 2017
## 92                    49              3000 2017
## 93                    91              1180 2017
## 94                    34              1230 2017
## 95                    84               990 2017
## 96                   220              7900 2017
## 97                   200               400 2017
## 98                  1380              1600 2017
## 99                  1000              1330 2017
## 100                  360               480 2017
## 101                  320               420 2017
## 102                  100               700 2017
## 103                  210               700 2017
## 104                  190               750 2017
## 105                   12               240 2017
## 106                   24              2400 2017
## 107                   70             14000 2017
## 108                  100              4800 2017
## 109                  380              2800 2017
## 110                  350              1740 2017
## 111                  330              1020 2017
## 112                  140              1700 2017
## 113                  130              1720 2017
## 114                  120              2600 2017
## 115                   89              1200 2017
## 116                   51              1120 2017
## 117                   66              1520 2017
## 118                   62             12000 2017
## 119                   48              1760 2017
## 120                   72              1240 2017
## 121                  480              1280 2017
## 122                   20               200 2017
## 123                   40               320 2017
## 124                   60               980 2017
## 125                  700              7900 2017
## 126                  430              7900 2017
## 127                 1060              7900 2017
## 128                  120             79000 2017
## 129                  780             10000 2017
## 130                  350              9400 2017
## 131                   40               180 2017
```

```
## 132                 82                 800  2017
## 133                 12                 540  2017
## 134                  4                 580  2017
## 135                200                 300  2017
## 136                260                 630  2017
## 137                200               14000  2017
## 138                 90                 140  2017
## 139                 20                1430  2017
## 140                110                 540  2017
## 141                  5                 540  2017
## 142                 17                 220  2017
## 143                 24                 170  2017
## 144                 52                 140  2017
## 145                  8                 130  2017
## 146                 33                 140  2017
## 147                  5                 210  2017
## 148                 70                  94  2017
## 149                920                1600  2017
## 150                 43                 280  2017
## 151                 31                 430  2017
## 152                 15                 220  2017
## 153                 23                 140  2017
## 154                 23                 170  2017
## 155                110                 170  2017
## 156                 70                 280  2017
## 157                 46                 280  2017
## 158                 46                 170  2017
## 159                 79                 240  2017
## 160                 22                 110  2017
## 161                 34                 130  2017
## 162                 49                 280  2017
## 163                  8                 540  2017
## 164                  9                 110  2017
## 165                 58                 280  2017
## 166                 94                 430  2017
## 167                 63                 350  2017
## 168                 43                 540  2017
## 169                  6                  70  2017
## 170                 22                  79  2017
## 171                 20                 140  2017
## 172                 25                  94  2017
## 173                 21                  79  2017
## 174                 33                 150  2017
## 175                 26                 140  2017
## 176                175                 190  2017
## 177                 60                  80  2017
## 178                150                 170  2017
## 179                120                 130  2017
## 180                250                9500  2017
## 181               3700                7200  2017
## 182                115                 250  2017
## 183                120                 270  2017
## 184                 50                  82  2017
## 185                 80                  93  2017
```

```
## 186            85           145 2017
## 187            75           130 2017
## 188            40            60 2017
## 189            70            75 2017
## 190            80            87 2017
## 191             3           220 2017
## 192           120           130 2017
## 193           120           350 2017
## 194            75           350 2017
## 195            69            80 2017
## 196            70            73 2017
## 197            40            59 2017
## 198            30            87 2017
## 199            30            39 2017
## 200            29            36 2017
## 201            10            25 2017
## 202           130           230 2017
## 203            11            25 2017
## 204            80           190 2017
## 205            35           120 2017
## 206            45           110 2017
## 207            80           150 2017
## 208            60           130 2017
## 209           220           740 2017
## 210            17          3800 2017
## 211            59          3500 2017
## 212           210           590 2017
## 213           110           670 2017
## 214            40            94 2017
## 215            39            79 2017
## 216            38            74 2017
## 217            33           110 2017
## 218            47            79 2017
## 219            27            70 2017
## 220            35            94 2017
## 221            31            79 2017
## 222            25            79 2017
## 223         22000         54000 2017
## 224          7900         54000 2017
## 225         54000         95000 2017
## 226         49000        123000 2017
## 227            31           120 2017
## 228         33000         93000 2017
## 229         14000         52000 2017
## 230            50           240 2017
## 231             2            50 2017
## 232            94           350 2017
## 233            19          1200 2017
## 234            30           123 2017
## 235            24           110 2017
## 236          <NA>          <NA> 2017
## 237          <NA>          <NA> 2017
## 238          <NA>          <NA> 2017
## 239          <NA>          <NA> 2017
```

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## 240                    11000                28000 2017
## 241                    15000                70000 2017
## 242                    17000                35000 2017
## 243                    14000                28000 2017
## 244                    14000                24000 2017
## 245                    11000                22000 2017
## 246                    13000                24000 2017
## 247                    17000                33000 2017
## 248                    14000                28000 2017
## 249                    14000                35000 2017
## 250                    13000                28000 2017
## 251                    11000                26000 2017
## 252                    38000               470000 2017
## 253                        7                   28 2017
## 254                        7                   28 2017
## 255                        7                   75 2017
## 256                       40                  280 2017
## 257                       34                  170 2017
## 258                       50                  220 2017
## 259                       50                  220 2017
## 260                       33                  140 2017
## 261                       17                  170 2017
## 262                       26                  280 2017
## 263                       50                  220 2017
## 264                       12                  130 2017
## 265                       70                  220 2017
## 266                       34                  220 2017
## 267                       17                  280 2017
## 268                      280                  350 2017
## 269                      280                  350 2017
## 270                      280                  350 2017
## 271                      430                  540 2017
## 272                      350                  350 2017
## 273                      280                  350 2017
## 274                      280                  350 2017
## 275                      280                  350 2017
## 276                      280                  350 2017
## 277                      280                  350 2017
## 278                      280                  350 2017
## 279                      280                  350 2017
## 280                      280                  350 2017
## 281                      280                  400 2017
## 282                      280                  350 2017
## 283                      280                  350 2017
## 284                      280                  350 2017
## 285                      280                  350 2017
## 286                      280                  350 2017
## 287                      220                  350 2017
## 288                      280                  350 2017
## 289                      280                  350 2017
## 290                      280                  350 2017
## 291                      280                  350 2017
## 292                      280                  350 2017
## 293                      280                  350 2017
```

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## 294                 210             2400 2018
## 295                 120             1100 2018
## 296                  15              920 2018
## 297                 120             1600 2018
## 298                  58             1600 2018
## 299                  84             1600 2018
## 300                 220             1600 2018
## 301                  63             1600 2018
## 302                  70              920 2018
## 303                  63              540 2018
## 304                 170             1600 2018
## 305                1300            17000 2018
## 306                 780            24000 2018
## 307                 450             4900 2018
## 308                  23             7900 2018
## 309                 780            24000 2018
## 310                1300            17000 2018
## 311                 450             7000 2018
## 312                 230             7900 2018
## 313                  45             5400 2018
## 314                 170            54000 2018
## 315                 220             7000 2018
## 316                2300            24000 2018
## 317                1100             7900 2018
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## 319                4900            54000 2018
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## 325                 780            22000 2018
## 326                 780             7900 2018
## 327                 450             7900 2018
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## 330                1600             1600 2018
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## 335                   4             1600 2018
## 336                  84              348 2018
## 337                  83              542 2018
## 338                  20              212 2018
## 339                  10              426 2018
## 340                 540             1600 2018
## 341                 390             1100 2018
## 342                   4              500 2018
## 343                   2               33 2018
## 344                1600             2200 2018
## 345                  21               49 2018
## 346                  14               14 2018
## 347                  21              350 2018
```

```
## 348              <NA>              <NA> 2018
## 349              <NA>              <NA> 2018
## 350              4300             25300 2018
## 351              2700              4000 2018
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## 354               550              1800 2018
## 355               170               900 2018
## 356               240               900 2018
## 357               400              7400 2018
## 358               790              5800 2018
## 359                79              5600 2018
## 360               120              8500 2018
## 361               120               410 2018
## 362              2200              4300 2018
## 363               200              7000 2018
## 364              5400             47000 2018
## 365               280               890 2018
## 366              2000              7900 2018
## 367              1400              4100 2018
## 368                 0              1400 2018
## 369               200               840 2018
## 370               140               410 2018
## 371                20               800 2018
## 372              2000              9400 2018
## 373               160               430 2018
## 374               700               840 2018
## 375               180               410 2018
## 376               220               700 2018
## 377                12               240 2018
## 378                49              1300 2018
## 379               115              4300 2018
## 380               170              1600 2018
## 381               910              2000 2018
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## 383               790              1600 2018
## 384                40              7000 2018
## 385               400               800 2018
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## 390               200               900 2018
## 391               130              1000 2018
## 392                40               630 2018
## 393                40               300 2018
## 394                20               240 2018
## 395              4900             17000 2018
## 396               130              4700 2018
## 397               120              2860 2018
## 398               120              2580 2018
## 399               170              2000 2018
## 400               100              1600 2018
## 401               170              1100 2018
```

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## 402          180    2000 2018
## 403          920    2000 2018
## 404          890    1530 2018
## 405         1060    2180 2018
## 406          840    1500 2018
## 407          980    1820 2018
## 408         1030    1700 2018
## 409           40    2800 2018
## 410           40     800 2018
## 411          100    1220 2018
## 412          100    1000 2018
## 413          790    7000 2018
## 414          700    7000 2018
## 415         1700   24000 2018
## 416          270    7000 2018
## 417         1300    7900 2018
## 418         1000    7000 2018
## 419           10     190 2018
## 420           30     322 2018
## 421          100    1200 2018
## 422          150    1600 2018
## 423          120     380 2018
## 424          150     630 2018
## 425          400    5800 2018
## 426          100     200 2018
## 427           20    1200 2018
## 428           36   20000 2018
## 429           48   78750 2018
## 430           47      47 2018
## 431           94      94 2018
## 432           52     345 2018
## 433           60     200 2018
## 434           80     280 2018
## 435           85     125 2018
## 436           12    1450 2018
## 437           95    1115 2018
## 438           45     330 2018
## 439            5     450 2018
## 440            0       0 2018
## 441            0       0 2018
## 442            0       0 2018
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## 444          135     450 2018
## 445          145     495 2018
## 446          150     210 2018
## 447          150     350 2018
## 448           20      50 2018
## 449          145     425 2018
## 450           95     410 2018
## 451           75     200 2018
## 452           75     140 2018
## 453           40     100 2018
## 454            5     420 2018
## 455          680     680 2018
```

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## 456                 65              180 2018
## 457                 95              235 2018
## 458                 95              465 2018
## 459                 30              255 2018
## 460                 75               75 2018
## 461                 30              215 2018
## 462                 40              160 2018
## 463                220             3500 2018
## 464                 10               49 2018
## 465               2700             4600 2018
## 466                580             1500 2018
## 467                350             2200 2018
## 468                110              170 2018
## 469                110              150 2018
## 470                 94              170 2018
## 471                110              210 2018
## 472                 79              150 2018
## 473                 94              220 2018
## 474                110              210 2018
## 475                 84              170 2018
## 476                 70              150 2018
## 477              39000           140000 2018
## 478              58000           170000 2018
## 479              84000           350000 2018
## 480              28000           410000 2018
## 481                110              220 2018
## 482              52000           200000 2018
## 483              35000           130000 2018
## 484                120              540 2018
## 485                  0               11 2018
## 486                140              350 2018
## 487                 58              110 2018
## 488                110              220 2018
## 489                 52              120 2018
## 490                  2             4300 2018
## 491                  2             3500 2018
## 492                700            16000 2018
## 493                170             3500 2018
## 494                 68             3500 2018
## 495                680            54000 2018
## 496               1700            54000 2018
## 497                 78             3500 2018
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## 499                 20             3500 2018
## 500               <NA>             <NA> 2018
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## 506              24000            54000 2018
## 507              22000            35000 2018
## 508              21000            63000 2018
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## 510                 12000                 22000 2018
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## 518                     7                    28 2018
## 519                   150                   150 2018
## 520                    75                    75 2018
## 521                    28                    28 2018
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## 523                    28                    28 2018
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## 525                     6                    90 2018
## 526                    16                   132 2018
## 527                    17                   170 2018
## 528                    36                   220 2018
## 529                    17                   120 2018
## 530                     9                    90 2018
## 531                    36                   280 2018
## 532                   230                   230 2018
## 533                    40                   220 2018
## 534                    12                   120 2018
## 535                    28                   170 2018
## 536                    17                   220 2018
## 537                    17                   280 2018
## 538                   220                   350 2018
## 539                   220                   350 2018
## 540                   220                   280 2018
## 541                   210                   430 2018
## 542                   220                   350 2018
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## 544                   210                   350 2018
## 545                   220                   350 2018
## 546                   220                   350 2018
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## 560                   220                   350 2018
## 561                   170                   350 2018
## 562                   220                   350 2018
## 563                   220                   280 2018
```

```
## 564                  93                 210 2019
## 565                  75                2400 2019
## 566                  69                 120 2019
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## 568                  93                 460 2019
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## 570                   2                 300 2019
## 571                  28                 150 2019
## 572                 210                1600 2019
## 573                 120                 390 2019
## 574                  69                1300 2019
## 575                 720                4200 2019
## 576                 720                4400 2019
## 577                   -                   - 2019
## 578                 300                2900 2019
## 579                3600              110000 2019
## 580                 300                3500 2019
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## 583                 730                3500 2019
## 584                 360                4300 2019
## 585                 360                2800 2019
## 586                 300                1500 2019
## 587                 360                2700 2019
## 588                 730               21000 2019
## 589                 360                2000 2019
## 590                 360                3500 2019
## 591                1100                3500 2019
## 592                1400                3500 2019
## 593                 360                2100 2019
## 594                 720                3500 2019
## 595                   -                   - 2019
## 596                1400                3600 2019
## 597                 720                2800 2019
## 598                 360                2800 2019
## 599                 300                2000 2019
## 600                 300                3500 2019
## 601                3500               15000 2019
## 602                3500              110000 2019
## 603                 300                 930 2019
## 604                 300                2800 2019
## 605                 720                2000 2019
## 606                 600                2300 2019
## 607               17000               92000 2019
## 608                7000               92000 2019
## 609                1400              160000 2019
## 610                1200               28000 2019
## 611                2000                2000 2019
## 612               68000               68000 2019
## 613                4000                4000 2019
## 614                2000                2000 2019
## 615             1600000             1600000 2019
## 616                  10                 170 2019
## 617                 920                1600 2019
```

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## 618          40       350 2019
## 619          58       280 2019
## 620         110       540 2019
## 621          58       150 2019
## 622          26        84 2019
## 623          25        94 2019
## 624         430      1600 2019
## 625         220      2400 2019
## 626        4900     17000 2019
## 627           5      5400 2019
## 628         790      7900 2019
## 629         780      4900 2019
## 630         170      3300 2019
## 631         220      3300 2019
## 632         330      4900 2019
## 633        1300      3300 2019
## 634          33      3500 2019
## 635           8      4900 2019
## 636          45      2400 2019
## 637        3300     22000 2019
## 638        1100      7000 2019
## 639         220      7000 2019
## 640       13000    540000 2019
## 641         220      3500 2019
## 642           2      1100 2019
## 643          78      5400 2019
## 644         310      3500 2019
## 645         170      9200 2019
## 646        2200      5400 2019
## 647        1700      7900 2019
## 648         700      3300 2019
## 649         230      4900 2019
## 650         220      4900 2019
## 651          21        63 2019
## 652        1100      4000 2019
## 653         170       460 2019
## 654          41       239 2019
## 655         110       170 2019
## 656          18       540 2019
## 657         140      1600 2019
## 658         520      1600 2019
## 659          70        79 2019
## 660          26        94 2019
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## 662          53       143 2019
## 663          24       350 2019
## 664           9        94 2019
## 665          12        12 2019
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## 668          21        63 2019
## 669       27800    820000 2019
## 670      160000    520000 2019
## 671      141000   5420000 2019
```

```
## 672              148000             3450000 2019
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## 675                  79                 210 2019
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## 678                  46                 170 2019
## 679                  31                  79 2019
## 680                  26                 140 2019
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## 682                  27                  94 2019
## 683                 280                4300 2019
## 684                  40                 110 2019
## 685                  70                  94 2019
## 686                  46                 110 2019
## 687                 150                 280 2019
## 688                   -                   - 2019
## 689                   -                   - 2019
## 690                   -                   - 2019
## 691                 750                 750 2019
## 692                1200                1200 2019
## 693                1200                1200 2019
## 694                   -                   - 2019
## 695                   -                   - 2019
## 696                   -                   - 2019
## 697                   -                   - 2019
## 698                 750                1200 2019
## 699                 900                1600 2019
## 700                 540                 920 2019
## 701                  95                1600 2019
## 702                  70                1800 2019
## 703                  40                1800 2019
## 704                  90                 900 2019
## 705                  90                 350 2019
## 706                  90                 900 2019
## 707                 220                 900 2019
## 708                 170                 480 2019
## 709                 220                 540 2019
## 710                 310                 630 2019
## 711                 260                 630 2019
## 712                 100                 560 2019
## 713                 120                 650 2019
## 714                 310                1200 2019
## 715                  31                 840 2019
## 716                  31                1300 2019
## 717                 340                4700 2019
## 718                 140                6300 2019
## 719                  81                7000 2019
## 720                 260                6300 2019
## 721                  92                1200 2019
## 722                 840               17000 2019
## 723                 400                5000 2019
## 724                 170                 410 2019
## 725                 260                 490 2019
```

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## 726                    8               81  2019
## 727                   20               61  2019
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## 729                  340             7900  2019
## 730                  210              470  2019
## 731                  400            28000  2019
## 732                  110             2200  2019
## 733                   15              112  2019
## 734                   65              840  2019
## 735                 8100           410000  2019
## 736                  180              600  2019
## 737                  100              610  2019
## 738                   50              810  2019
## 739                  200              790  2019
## 740                   40              920  2019
## 741                   49              790  2019
## 742                   80              610  2019
## 743                   70             1700  2019
## 744                  460             7000  2019
## 745                  200             2500  2019
## 746                  100              920  2019
## 747                  200             1200  2019
## 748                   17              170  2019
## 749                   40              940  2019
## 750                  700             4900  2019
## 751                  150             1720  2019
## 752                 2200             4900  2019
## 753                  230             1400  2019
## 754                  120              940  2019
## 755                  400             1500  2019
## 756                  200              920  2019
## 757                  260              480  2019
## 758                  220              540  2019
## 759                  270              660  2019
## 760                  430            78000  2019
## 761                  710            57000  2019
## 762                  380              840  2019
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## 766                 1100             5400  2019
## 767                 1400            26000  2019
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## 772                  140             1850  2019
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## 774                  100              500  2019
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## 777                   17               63  2019
## 778                  110             1980  2019
## 779                   31              750  2019
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## 780                       400                2600  2019
## 781                        40                  48  2019
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## 784                        39                 540  2019
## 785                        34                  94  2019
## 786                         3                  25  2019
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## 789                        26                  46  2019
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## 791                        24                1600  2019
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## 793                        27                 920  2019
## 794                        23                1600  2019
## 795                       220                1800  2019
## 796                        26                1600  2019
## 797                        33                1600  2019
## 798                        23                 350  2019
## 799                        39                1600  2019
## 800                        46                9200  2019
## 801                        21                 920  2019
## 802                        40                 540  2019
## 803                        34                1600  2019
## 804                        47                 280  2019
## 805                        23                 540  2019
## 806                        39                 920  2019
## 807                        39                1600  2019
## 808                        33                 920  2019
## 809                        33              110000  2019
## 810                        49                1600  2019
## 811                        39                 210  2019
## 812                        31                 920  2019
## 813                        46                1600  2019
## 814                        43                 920  2019
## 815                         2                 920  2019
## 816                         2                1600  2019
## 817                         2                1600  2019
## 818                        11                1600  2019
## 819                        12                 540  2019
## 820                        33                 920  2019
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## 822                        49                1600  2019
## 823                        21                  79  2019
## 824                        24                  84  2019
## 825                        17                  70  2019
## 826                       115                 500  2019
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## 830                        80                 395  2019
## 831                        55                 395  2019
## 832                        30                 290  2019
## 833                        30                  30  2019
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## 834            120          380 2019
## 835            105          370 2019
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## 845             50          200 2019
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## 849             30           85 2019
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## 851             50          250 2019
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## 855             75          180 2019
## 856            150          400 2019
## 857            100          305 2019
## 858             84          280 2019
## 859             70          170 2019
## 860            410         2200 2019
## 861            130         2100 2019
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## 863              2           12 2019
## 864            110          280 2019
## 865            700         4900 2019
## 866             63          170 2019
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## 869            120          430 2019
## 870            170          320 2019
## 871            140          240 2019
## 872            120          280 2019
## 873             94          350 2019
## 874            140          350 2019
## 875             70          210 2019
## 876            110          280 2019
## 877          46000       240000 2019
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## 881            130          280 2019
## 882            110          210 2019
## 883             94          170 2019
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## 886            630         3300 2019
## 887            220          840 2019
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## 888                  -                   - 2019
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## 901              22000               35000 2019
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## 940                130                 220 2019
## 941                120                 280 2019
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## 942                   150                   240 2019
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## 970                     2                     2 2020
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## 974                   720                  2100 2020
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## 976                   360                  1500 2020
## 977                   610                  2100 2020
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## 982                  1700                160000 2020
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## 991                    63                    94 2020
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## 993                    39                   120 2020
## 994                   130                  1600 2020
## 995                     -                     - 2020
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## 996               2300             7900 2020
## 997                120              280 2020
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## 1005               340             2400 2020
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## 1013               220             2700 2020
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## 1018               790             3400 2020
## 1019                23              920 2020
## 1020                33             3500 2020
## 1021               170              490 2020
## 1022                 2               77 2020
## 1023               920             1600 2020
## 1024                32              210 2020
## 1025                84             1600 2020
## 1026               920             1700 2020
## 1027                43              430 2020
## 1028                 2              120 2020
## 1029                26             1600 2020
## 1030                41             1600 2020
## 1031                 2              350 2020
## 1032                18               63 2020
## 1033               170             1600 2020
## 1034               210              330 2020
## 1035                 2              120 2020
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## 1039                 -                - 2020
## 1040            150000           320000 2020
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## 1044             72000           390000 2020
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## 1047              4700             4700 2020
## 1048              3300             4900 2020
## 1049             46000            46000 2020
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## 1050                31                 140 2020
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## 1054                33                 220 2020
## 1055                21                  47 2020
## 1056                24                  47 2020
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## 1058                24                  46 2020
## 1059                26                  70 2020
## 1060                32                 110 2020
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## 1062                12                 240 2020
## 1063                70                 170 2020
## 1064                84                 540 2020
## 1065               110                 220 2020
## 1066                94                 170 2020
## 1067                17                  33 2020
## 1068                11                  38 2020
## 1069                17                  33 2020
## 1070                10                  68 2020
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## 1072              1100               54000 2020
## 1073                 -                   - 2020
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## 1076                 -                   - 2020
## 1077                 -                   - 2020
## 1078                 -                   - 2020
## 1079              1200                1600 2020
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## 1085                 2                1600 2020
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## 1087                14                  70 2020
## 1088                20                  76 2020
## 1089                32                  63 2020
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## 1091                11                  67 2020
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## 1095               400                7900 2020
## 1096               630                6300 2020
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## 1100               840                4300 2020
## 1101               130                2600 2020
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## 1103               280                 920 2020
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## 1104                  400               63000  2020
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## 1127                  180                 390  2020
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## 1157                   20                 170  2020
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## 1158                12                180 2020
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## 1167               610              20000 2020
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## 1180                23                540 2020
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## 1187                11                 48 2020
## 1188               920             160000 2020
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## 1190                21                140 2020
## 1191                21                540 2020
## 1192                17                540 2020
## 1193                17                540 2020
## 1194                79                140 2020
## 1195                 2                350 2020
## 1196                22                540 2020
## 1197                12                 48 2020
## 1198                 2                430 2020
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## 1200                17                920 2020
## 1201                17               1600 2020
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## 1203                12                540 2020
## 1204                12                 94 2020
## 1205                17                 94 2020
## 1206                20                170 2020
## 1207                17                150 2020
## 1208                 2                240 2020
## 1209                 2                220 2020
## 1210                 2                 79 2020
## 1211                23                 39 2020
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## 1212            33            140  2020
## 1213            12             58  2020
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## 1216            85            195  2020
## 1217            75            180  2020
## 1218            80            225  2020
## 1219           470           1135  2020
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## 1221           120            190  2020
## 1222           105            185  2020
## 1223           130            175  2020
## 1224           145            335  2020
## 1225            85            155  2020
## 1226            95            210  2020
## 1227            60            170  2020
## 1228           145            235  2020
## 1229            65            260  2020
## 1230           335           1015  2020
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## 1232           235            360  2020
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## 1245           130            165  2020
## 1246           790           1300  2020
## 1247             2             17  2020
## 1248           410            930  2020
## 1249           210            430  2020
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## 1251           140            430  2020
## 1252            58             94  2020
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## 1254           220            410  2020
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## 1256           230            350  2020
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## 1258           120          92000  2020
## 1259            31             94  2020
## 1260          9200          70000  2020
## 1261          7900          38000  2020
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## 1264            49            140  2020
## 1265         25000          79000  2020
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## 1266            5800           39000  2020
## 1267             240             840  2020
## 1268               2               6  2020
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## 1271              84             210  2020
## 1272              70             240  2020
## 1273             210             230  2020
## 1274             140             330  2020
## 1275             110             330  2020
## 1276               -               -  2020
## 1277               -               -  2020
## 1278               -               -  2020
## 1279               -               -  2020
## 1280           11000           28000  2020
## 1281           17000           35000  2020
## 1282           22000           35000  2020
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## 1285           12000           28000  2020
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## 1288           17000           28000  2020
## 1289           17000           43000  2020
## 1290           17000           35000  2020
## 1291           14000           28000  2020
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## 1295           24000         9200000  2020
## 1296          160000          240000  2020
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## 1308             110             430  2020
## 1309               2            1200  2020
## 1310              94             350  2020
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## 1314              58             350  2020
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## 1317             130             280  2020
## 1318              94             240  2020
## 1319             170             430  2020
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## 1320                  58                 240 2020
## 1321                  58                 210 2020
## 1322                  58                 210 2020
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## 1325                  70                 170 2020
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## 1328                  70                 170 2020
## 1329                  63                 170 2020
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## 1331                  63                 150 2020
## 1332                  63                 240 2020
## 1333                  40                 210 2020
## 1334                  63                 240 2020
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## 1337                  84                 240 2020
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## 1341                  63                 210 2020
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## 1343                  93                 150 2021
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## 1373                 330                9400 2021
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## 1395          1600          1600 2021
## 1396            34            63 2021
## 1397            84          1600 2021
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## 1404           300        148000 2021
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## 1426           390          2500 2021
## 1427           140           580 2021
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## 1428                 130                 490  2021
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## 1478                 700                4900  2021
## 1479                 790                7000  2021
## 1480                 120                2500  2021
## 1481                 840               40000  2021
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## 1482                 540              7000 2021
## 1483                 170               430 2021
## 1484                 120               600 2021
## 1485                 700              3100 2021
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## 1487                 100               630 2021
## 1488                 170               380 2021
## 1489                  70               170 2021
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## 1495                  22               130 2021
## 1496                  22               220 2021
## 1497                  17                94 2021
## 1498                  21               110 2021
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## 1501                  11               220 2021
## 1502                  17               540 2021
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## 1504                  27             92000 2021
## 1505                  11                25 2021
## 1506                  17               920 2021
## 1507                  22              1600 2021
## 1508                  11               280 2021
## 1509                  22               540 2021
## 1510                  17              1600 2021
## 1511                  17               540 2021
## 1512                  17               540 2021
## 1513                  11               140 2021
## 1514                  17                47 2021
## 1515                   2                49 2021
## 1516                  24                48 2021
## 1517                   2                39 2021
## 1518                   2                40 2021
## 1519                  17                79 2021
## 1520                  22               170 2021
## 1521                  17               220 2021
## 1522                  17               210 2021
## 1523                  17                70 2021
## 1524                  12                27 2021
## 1525                  13                39 2021
## 1526                  11                25 2021
## 1527                  40                50 2021
## 1528                 160               250 2021
## 1529                 140               270 2021
## 1530                  85               180 2021
## 1531                  25               945 2021
## 1532                 140               275 2021
## 1533                 130               450 2021
## 1534                 100               210 2021
## 1535                  30                45 2021
```

```
## 1536                    60                 95 2021
## 1537                   120                990 2021
## 1538                   130                215 2021
## 1539                    85                140 2021
## 1540                   125                195 2021
## 1541                   170                250 2021
## 1542                     5                 50 2021
## 1543                   240                515 2021
## 1544                   100                195 2021
## 1545                    50                 75 2021
## 1546                   125                190 2021
## 1547                   165                210 2021
## 1548                   145                230 2021
## 1549                   775               1115 2021
## 1550                   735               1015 2021
## 1551                   160                295 2021
## 1552                   215                885 2021
## 1553                    75                180 2021
## 1554                    15                 70 2021
## 1555                    35                270 2021
## 1556                    65                100 2021
## 1557                    20                 75 2021
## 1558                   155                195 2021
## 1559                    60                300 2021
## 1560                    60                 80 2021
## 1561                   115                170 2021
## 1562                   130                215 2021
## 1563                   280                470 2021
## 1564                   230                350 2021
## 1565                   340                460 2021
## 1566                   280                440 2021
## 1567                     2                 24 2021
## 1568                   140                170 2021
## 1569                   280                440 2021
## 1570                   920               1700 2021
## 1571                   310                430 2021
## 1572                   350                700 2021
## 1573                     8                 94 2021
## 1574                   240                540 2021
## 1575                    79                140 2021
## 1576                    84                140 2021
## 1577                   310                630 2021
## 1578                 21000              43000 2021
## 1579                 49000             110000 2021
## 1580                 46000              94000 2021
## 1581                 12000              24000 2021
## 1582                 48000              94000 2021
## 1583                    49                120 2021
## 1584                  9400              17000 2021
## 1585                  1300               2300 2021
## 1586                   410                700 2021
## 1587                   120               2400 2021
## 1588                    75               1100 2021
## 1589                     -                  - 2021
```

```
## 1590                93               1100 2021
## 1591               210               1100 2021
## 1592               120               2400 2021
## 1593                53               2400 2021
## 1594                 -                  - 2021
## 1595                20               2400 2021
## 1596                 -                  - 2021
## 1597                 -                  - 2021
## 1598                 -                  - 2021
## 1599                20               2400 2021
## 1600              1700               4900 2021
## 1601               330               3500 2021
## 1602               940               4900 2021
## 1603                78               3500 2021
## 1604               330               4700 2021
## 1605               220               3500 2021
## 1606               110               3500 2021
## 1607              1100               3500 2021
## 1608                 2               3500 2021
## 1609               230               4000 2021
## 1610               790               4900 2021
## 1611               790               4700 2021
## 1612               460               4000 2021
## 1613                45               3500 2021
## 1614               280               1600 2021
## 1615                 -                  - 2021
## 1616                 -                  - 2021
## 1617                 -                  - 2021
## 1618                 -                  - 2021
## 1619             24000              35000 2021
## 1620             21000              28000 2021
## 1621             22000              35000 2021
## 1622             22000              35000 2021
## 1623             24000              35000 2021
## 1624             17000              24000 2021
## 1625             21000              35000 2021
## 1626             16000           17000000 2021
## 1627             15000              28000 2021
## 1628             22000              35000 2021
## 1629               130              26000 2021
## 1630              7900             350000 2021
## 1631             21000              28000 2021
## 1632             21000              28000 2021
## 1633             14000              17000 2021
## 1634             21000              35000 2021
## 1635             22000              35000 2021
## 1636                 2               1400 2021
## 1637               110                430 2021
## 1638                 2                 12 2021
## 1639                 6                 62 2021
## 1640                94                350 2021
## 1641                 2                 58 2021
## 1642                70                220 2021
## 1643                 3                 43 2021
```

```
## 1644                 2                24 2021
## 1645                40               280 2021
## 1646                63               280 2021
## 1647                47               220 2021
## 1648                25               210 2021
## 1649                58               350 2021
## 1650                94               240 2021
## 1651               110               240 2021
## 1652               140               350 2021
## 1653               210               430 2021
## 1654               150               280 2021
## 1655               150               280 2021
## 1656                98               240 2021
## 1657               150               280 2021
## 1658               280               350 2021
## 1659               350               540 2021
## 1660               150               430 2021
## 1661               210               350 2021
## 1662               110               280 2021
## 1663               150               280 2021
## 1664                94               240 2021
## 1665               110               240 2021
```

```
View(AirQualityDataset)

AirQualityDataset$State=toupper(AirQualityDataset$State)
AirQualityDataset$City=toupper(AirQualityDataset$City)

AirQualityDataset$NO2=as.numeric(AirQualityDataset$NO2)
AirQualityDataset$PM10=as.numeric(AirQualityDataset$PM10)
AirQualityDataset$SO2=as.numeric(AirQualityDataset$SO2)
AirQualityDataset$PM2.5=as.numeric(AirQualityDataset$PM2.5)


AirQualityDataset$year=as.integer(AirQualityDataset$year)

finalDataset = merge(WaterQualityData, AirQualityDataset, by = c("State","City","year"), all.x = TRUE)



grouped_df1 = aggregate(cbind(NO2, PM10,PM2.5,SO2) ~ State + year, data = AirQualityDataset, mean)

grouped_df2 = aggregate(cbind(NO2, PM10,PM2.5,SO2) ~ State, data = AirQualityDataset, mean)



finalDataset = merge(finalDataset, grouped_df1, by = c("State","year"), all.x = TRUE)

finalDataset = merge(finalDataset, grouped_df2, by = c("State"), all.x = TRUE)

fd=finalDataset

finalDataset = subset(fd, select = -c(21, 22, 23, 24, 25, 26, 27, 28))
```

```r
finalDataset[finalDataset == "-"] = NA


finalDataset = subset(finalDataset, select = -StateCode)

colSums(is.na(finalDataset))
```

```
##           State             year             City   TemperatureMin
##               0                0                0               42
##    TemperatureMax   DissolvedO2Min   DissolvedO2Max            pHMin
##              37               10               10                0
##           pHMax  ConductivityMin  ConductivityMax           BODMin
##               0               10               10                7
##          BODMax       NitrateMin       NitrateMax FecalColiformMin
##               7              143              143              109
## FecalColiformMax TotalColiformMin TotalColiformMax              NO2
##             109               49               49              116
##            PM10            PM2.5              SO2
##             116              116              116
```

```r
waterQuality_2017=finalDataset[finalDataset$year == 2017,]

waterQuality_2017$TemperatureMin     =as.numeric(waterQuality_2017$TemperatureMin)
waterQuality_2017$TemperatureMax     =as.numeric(waterQuality_2017$TemperatureMin)
waterQuality_2017$DissolvedO2Min     =as.numeric(waterQuality_2017$DissolvedO2Min)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2017$DissolvedO2Max     =as.numeric(waterQuality_2017$DissolvedO2Max)
waterQuality_2017$pHMin              =as.numeric(waterQuality_2017$pHMin)
waterQuality_2017$pHMax              =as.numeric(waterQuality_2017$pHMax)
waterQuality_2017$ConductivityMin    =as.numeric(waterQuality_2017$ConductivityMin)
waterQuality_2017$ConductivityMax    =as.numeric(waterQuality_2017$ConductivityMax)
waterQuality_2017$BODMin             =as.numeric(waterQuality_2017$BODMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2017$BODMax             =as.numeric(waterQuality_2017$BODMax)
```

```
## Warning: NAs introduced by coercion
```

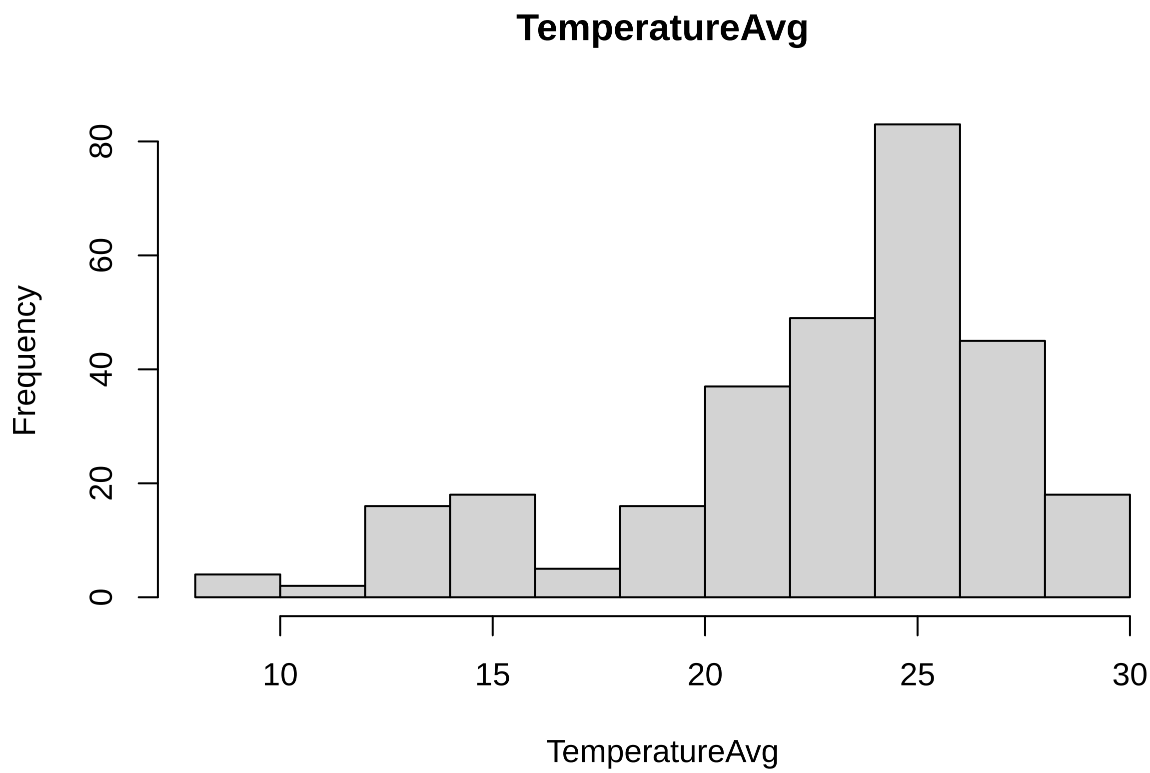
```r
waterQuality_2017$NitrateMin         =as.numeric(waterQuality_2017$NitrateMin)
```

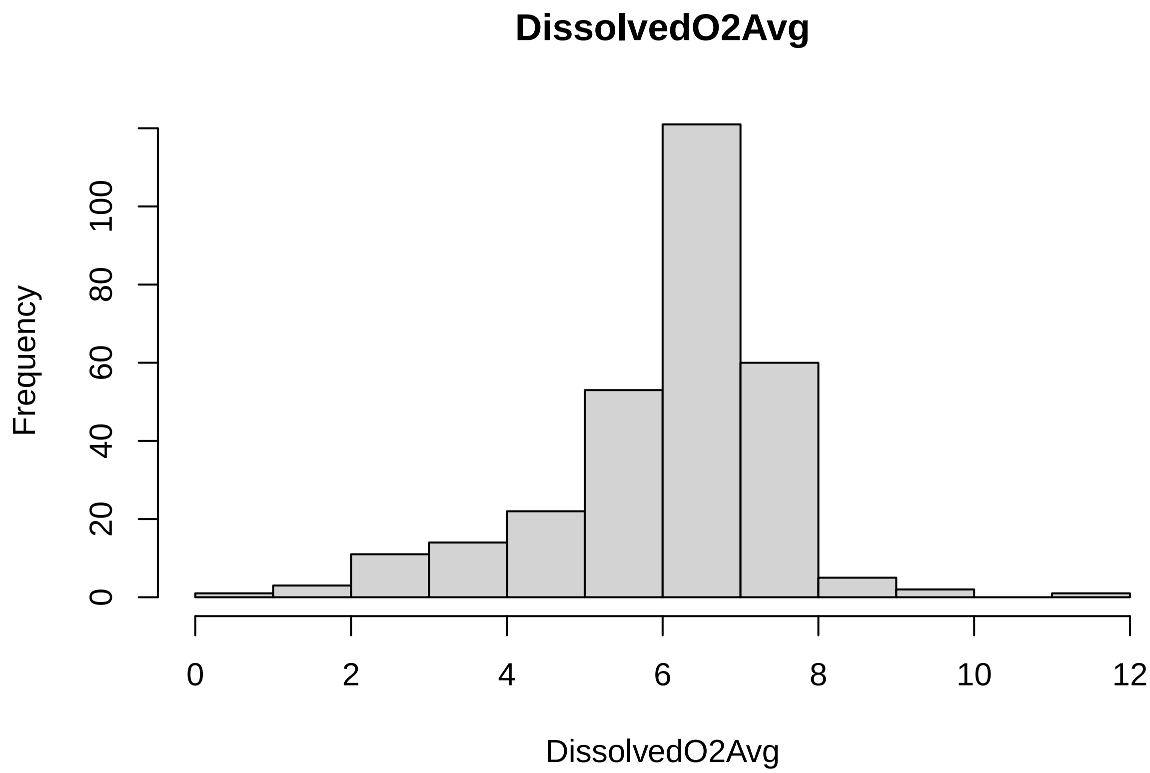
```
## Warning: NAs introduced by coercion
```

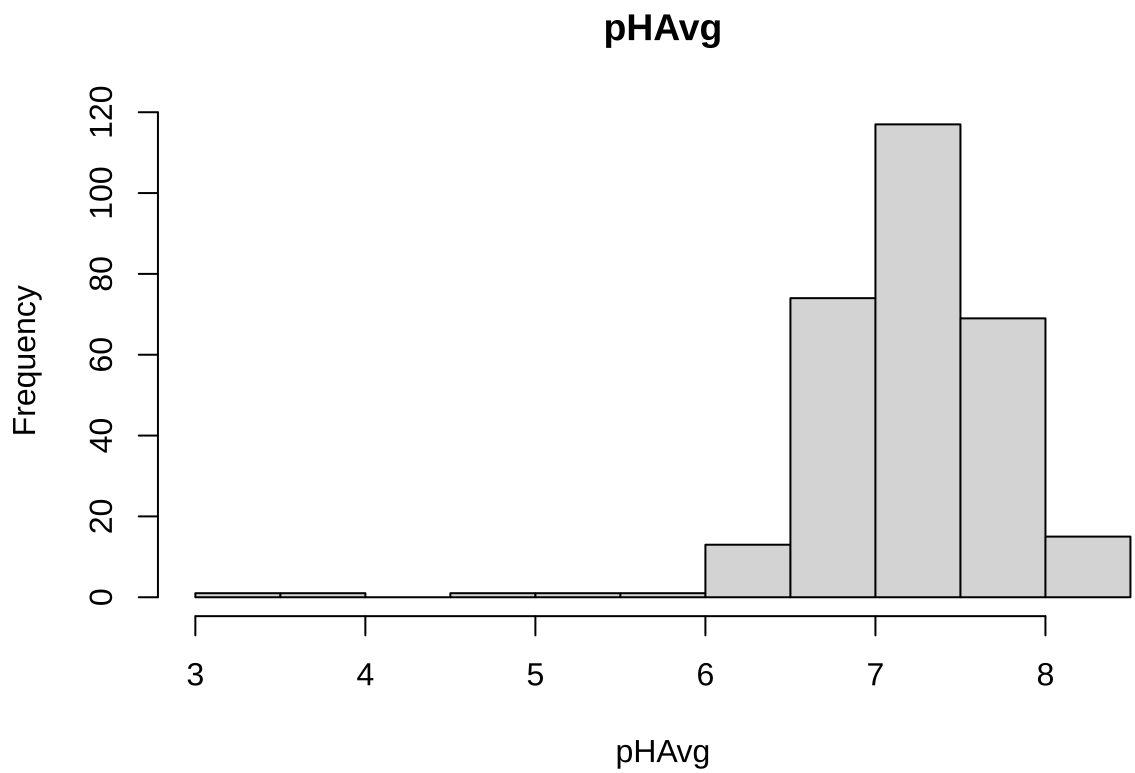
```r
waterQuality_2017$NitrateMax         =as.numeric(waterQuality_2017$NitrateMax)
waterQuality_2017$FecalColiformMin   =as.numeric(waterQuality_2017$FecalColiformMin)
waterQuality_2017$FecalColiformMax   =as.numeric(waterQuality_2017$FecalColiformMax)
waterQuality_2017$TotalColiformMin   =as.numeric(waterQuality_2017$TotalColiformMin)
```

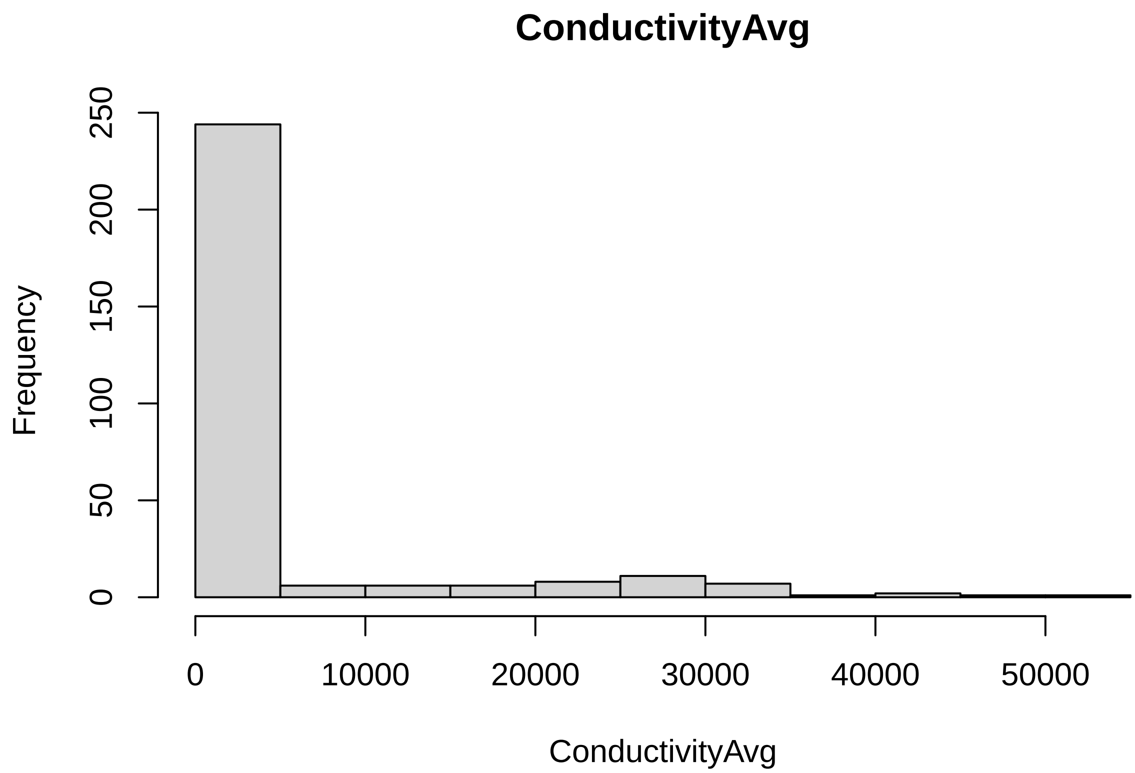
```
waterQuality_2017$TotalColiformMax   =as.numeric(waterQuality_2017$TotalColiformMax)
waterQuality_2017$NO2                =as.numeric(waterQuality_2017$NO2)
waterQuality_2017$PM10               =as.numeric(waterQuality_2017$PM10)

cols=c("TemperatureMin"
,"TemperatureMax"
,"DissolvedO2Min"
,"DissolvedO2Max"
,"pHMin"
,"pHMax"
,"ConductivityMin"
,"ConductivityMax"
,"BODMin"
,"BODMax"
,"NitrateMin"
,"NitrateMax"
,"FecalColiformMin"
,"FecalColiformMax"
,"TotalColiformMin"
,"TotalColiformMax"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

waterQuality_2017_Avg=waterQuality_2017


# Calculate the average values for each variable
waterQuality_2017_Avg$TemperatureAvg = (waterQuality_2017_Avg$TemperatureMin + waterQuality_2017_Avg$Te
waterQuality_2017_Avg$DissolvedO2Avg = (waterQuality_2017_Avg$DissolvedO2Min + waterQuality_2017_Avg$Di
waterQuality_2017_Avg$pHAvg = (waterQuality_2017_Avg$pHMin + waterQuality_2017_Avg$pHMax) / 2
waterQuality_2017_Avg$ConductivityAvg = (waterQuality_2017_Avg$ConductivityMin + waterQuality_2017_Avg$
waterQuality_2017_Avg$FecalColiformAvg = (waterQuality_2017_Avg$FecalColiformMin + waterQuality_2017_Av
waterQuality_2017_Avg$BODAvg = (waterQuality_2017_Avg$BODMin + waterQuality_2017_Avg$BODMax) / 2
waterQuality_2017_Avg$NitrateAvg = (waterQuality_2017_Avg$NitrateMin + waterQuality_2017_Avg$NitrateMax

waterQuality_2017_Avg$TotalColiformAvg = (waterQuality_2017_Avg$TotalColiformMin + waterQuality_2017_Av

waterQuality_2017_Avg = subset(waterQuality_2017_Avg,select=-c(TemperatureMin
,TemperatureMax
,DissolvedO2Min
,DissolvedO2Max
,pHMin
,pHMax
,ConductivityMin
,ConductivityMax
,BODMin
,BODMax
,NitrateMin
,NitrateMax
,FecalColiformMin
,FecalColiformMax
```

```
,TotalColiformMin
,TotalColiformMax))

numCols=c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"FecalColiformAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

for (col in colnames(waterQuality_2017_Avg)) {
  # Check if column has any NAs
  if (sum(is.na(waterQuality_2017_Avg[, col])) > 0) {
    # Replace NAs with mean value of the column
    waterQuality_2017_Avg[is.na(waterQuality_2017_Avg[, col]), col] = mean(waterQuality_2017_Avg[, col]
  }
}


for (col in numCols) {
  # Create the histogram plot
  hist(waterQuality_2017_Avg[[col]], main = col, xlab = col)
}
```

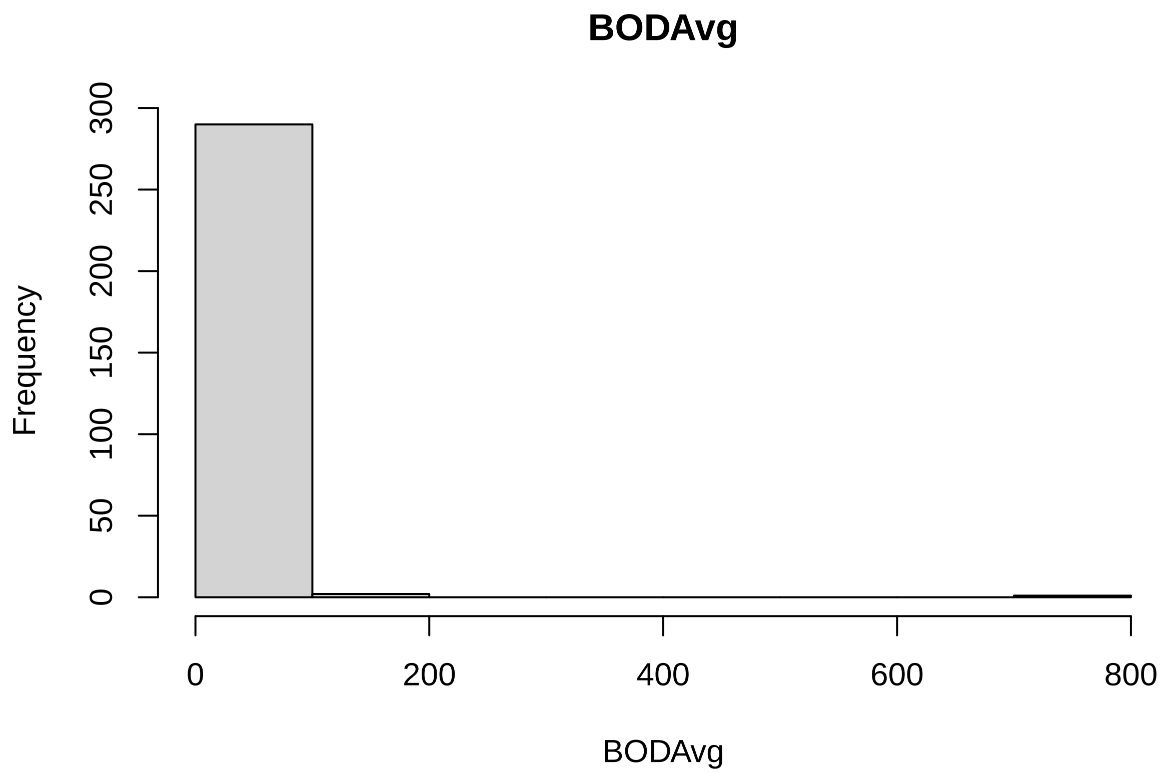

TemperatureAvg
Frequency
0
20
40
60
80
10
15
20
25
30
TemperatureAvg

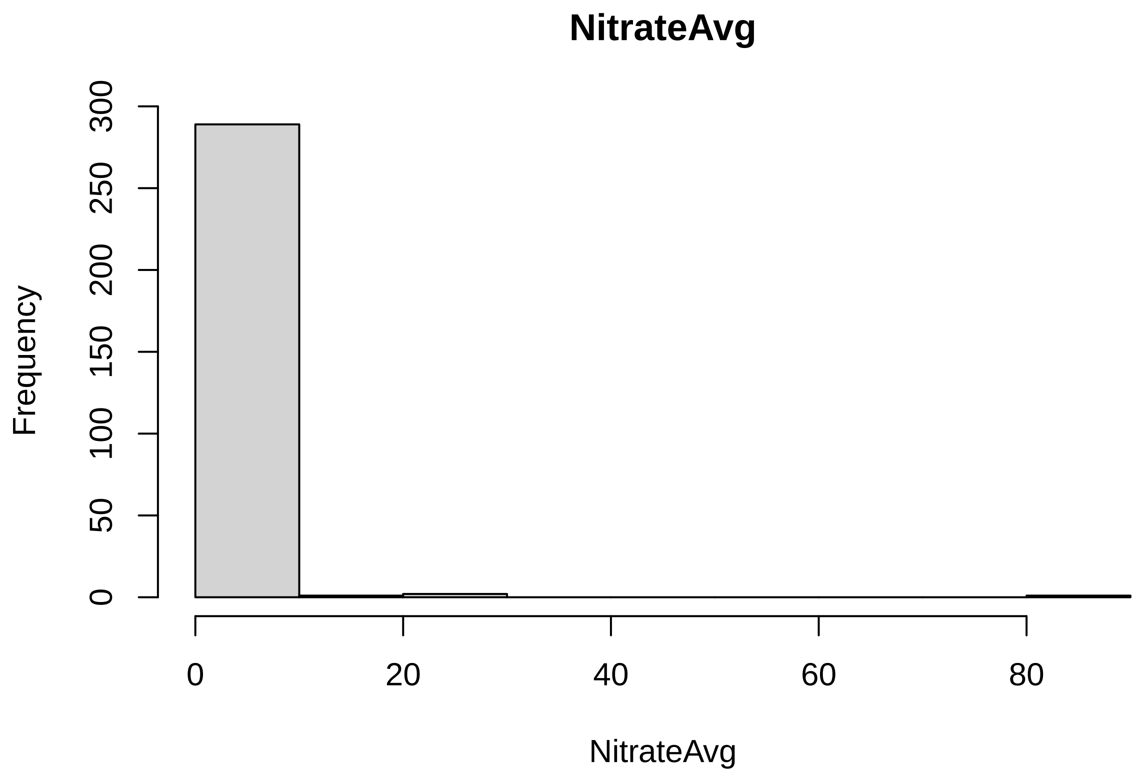

DissolvedO2Avg
Frequency
0
20
40
60
80
100
0
2
4
6
8
10
12
DissolvedO2Avg


pHAvg
Frequency
0
20
40
60
80
100
120
3
4
5
6
7
8
pHAvg

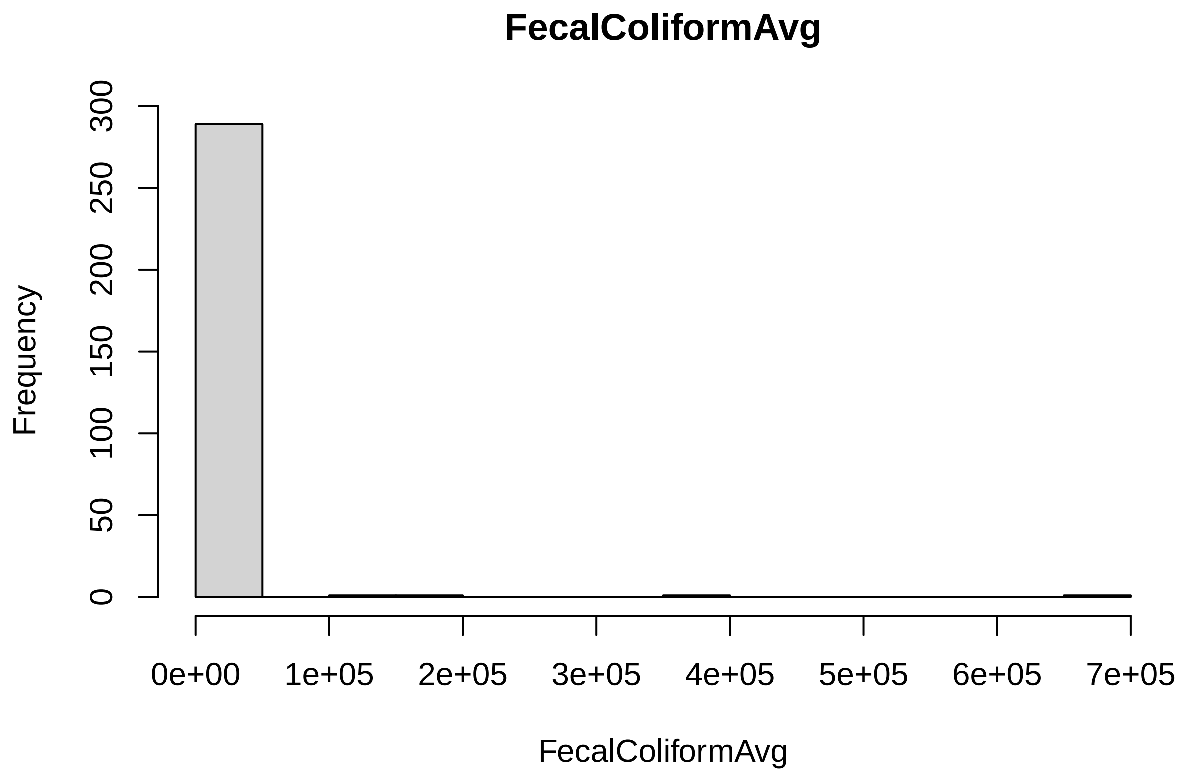


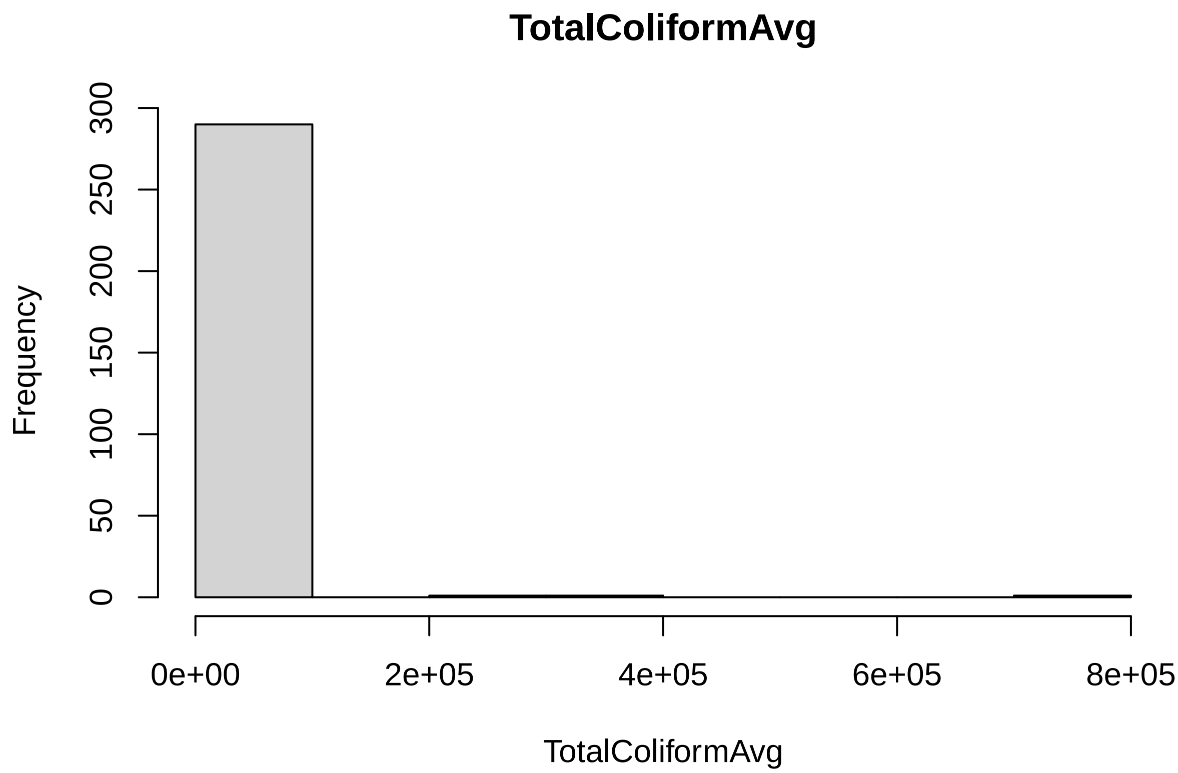
ConductivityAvg
Frequency
0
50
100
150
200
250
0
10000
20000
30000
40000
50000
ConductivityAvg

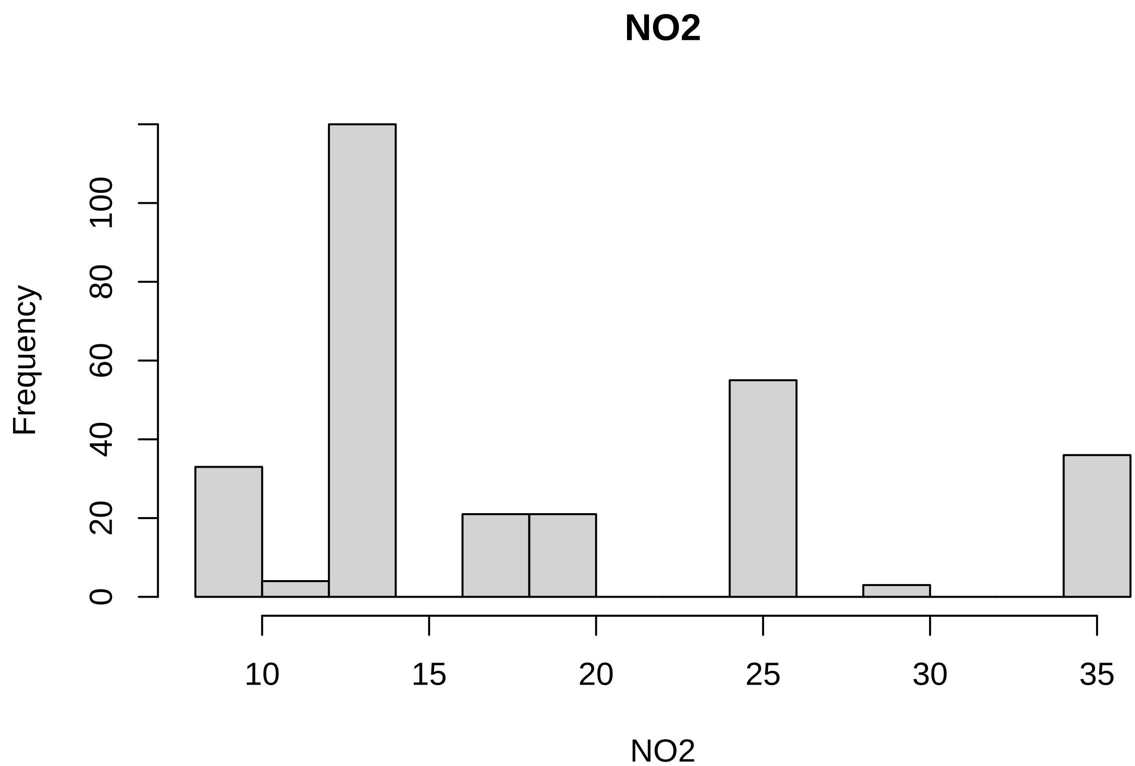

BODAvg
Frequency
0
50
100
150
200
250
300
0
200
400
600
800
BODAvg

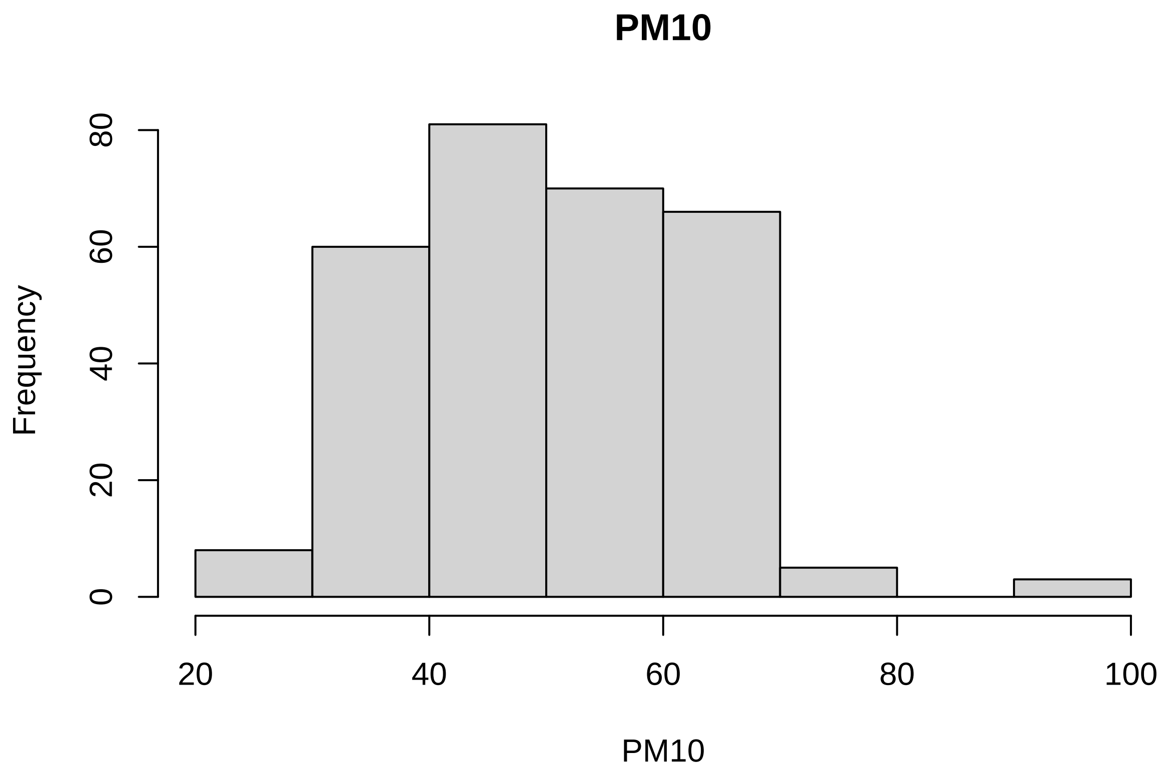


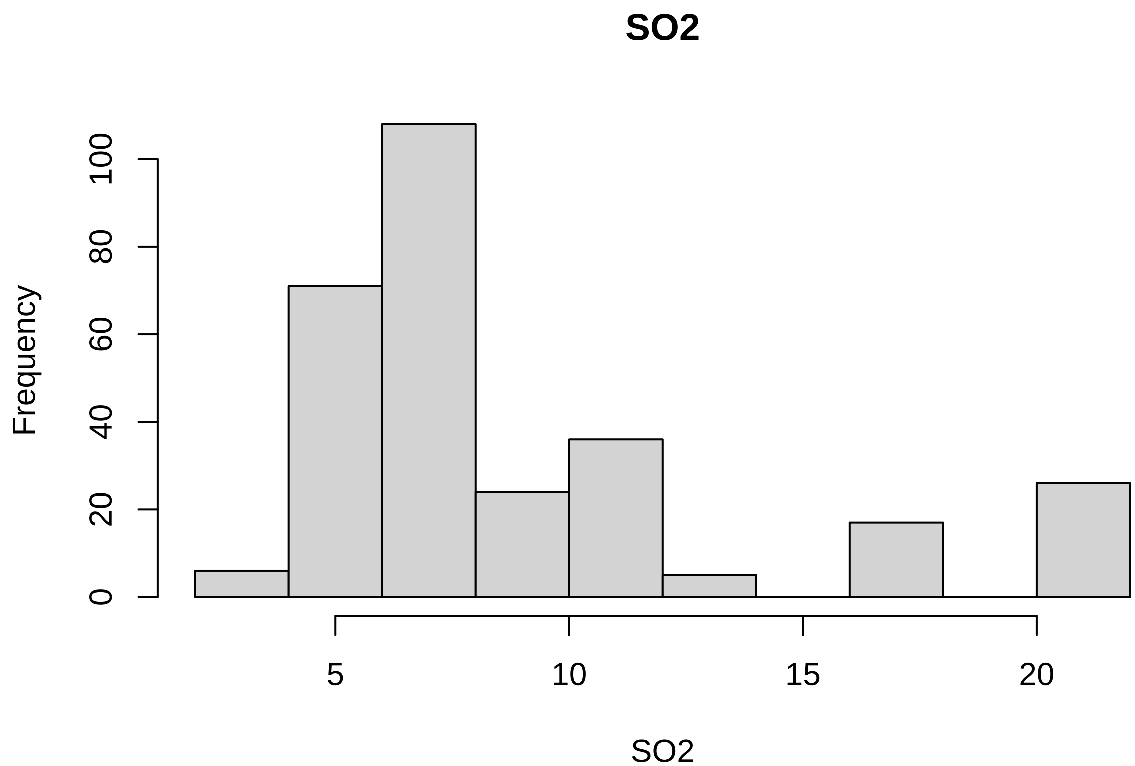
NitrateAvg
Frequency
0
50
100
150
200
250
300
0
20
40
60
80
NitrateAvg

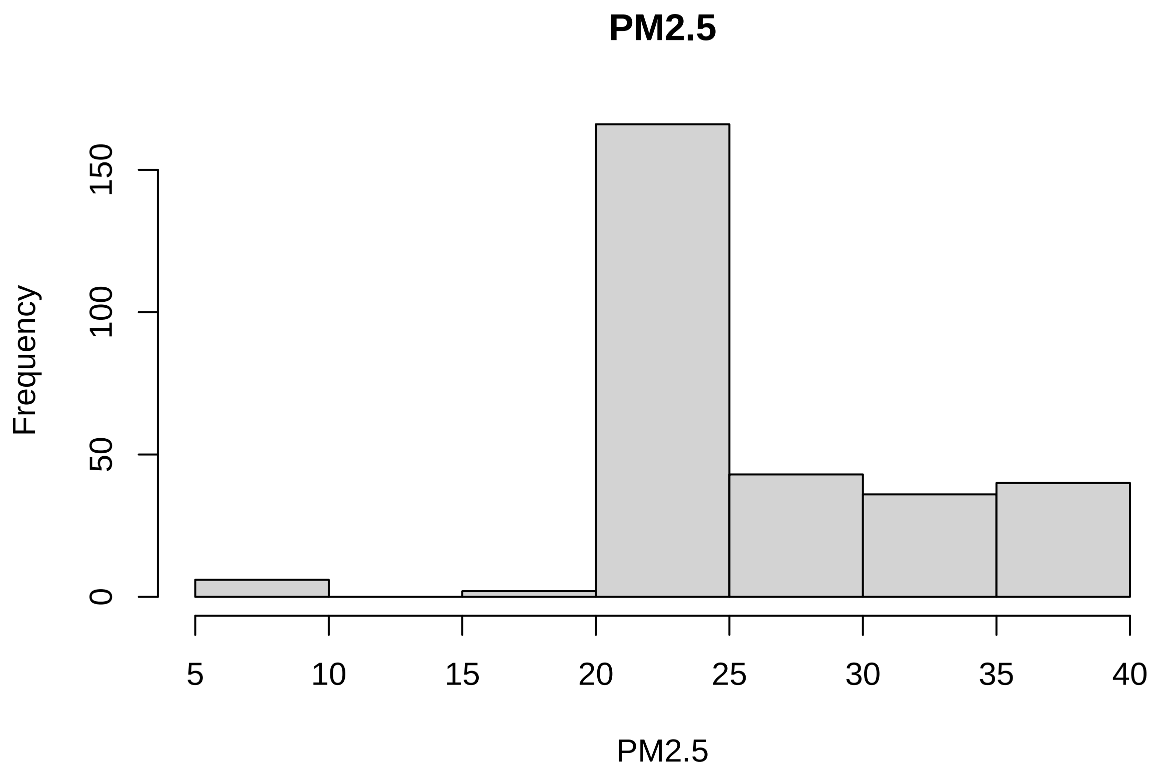

FecalColiformAvg
Frequency
0
50
100
150
200
250
300
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
6e+05
7e+05
FecalColiformAvg


TotalColiformAvg
Frequency
0
50
100
150
200
250
300
0e+00
2e+05
4e+05
6e+05
8e+05
TotalColiformAvg


NO2
Frequency
0
20
40
60
80
100
10
15
20
25
30
35
NO2


PM10
Frequency
0
20
40
60
80
20
40
60
80
100
PM10

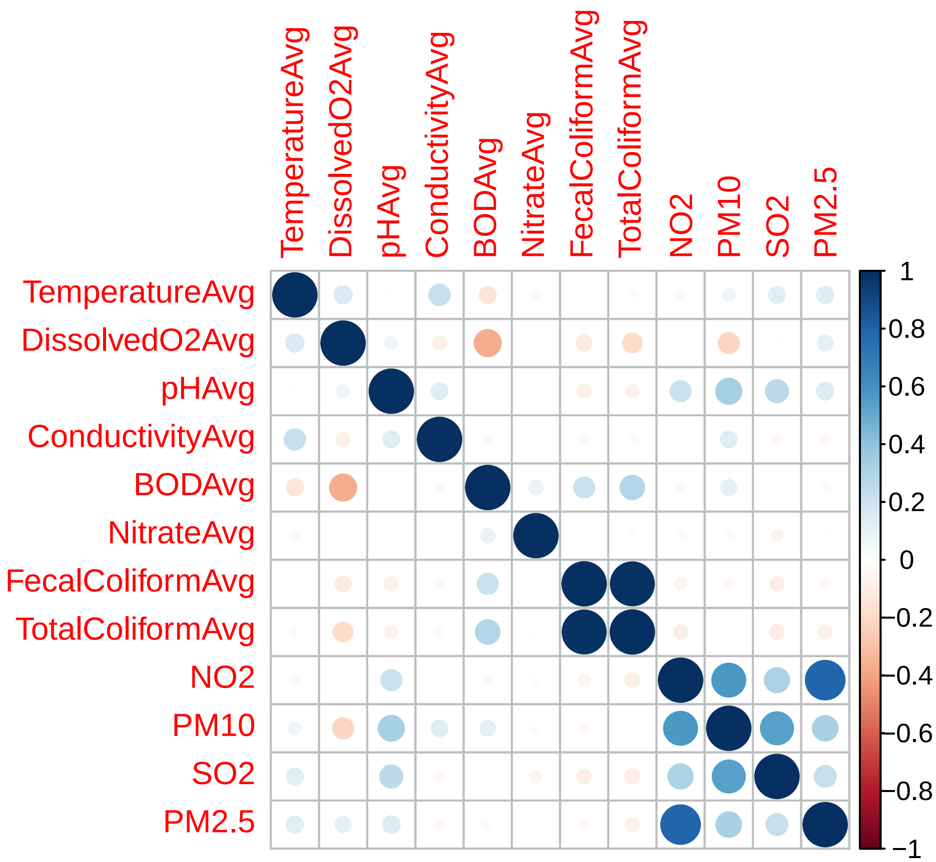

SO2
Frequency
0
20
40
60
80
100
5
10
15
20
SO2




```
cov_mat = cov(waterQuality_2017_Avg[, numCols])

corr_matrix = cor(waterQuality_2017_Avg[, numCols])



library(corrplot)
```

```
## corrplot 0.92 loaded
```

```
corrplot(corr_matrix)
```




```r
waterQuality_2017_Avg = aggregate(cbind(TemperatureAvg,
                          DissolvedO2Avg,
                          pHAvg,
                          ConductivityAvg,
                          BODAvg,
                          NitrateAvg,
                          FecalColiformAvg,
                          TotalColiformAvg,
                          NO2,
                          PM10,
                          SO2,
                          PM2.5) ~ State,
                     data = waterQuality_2017_Avg,
                     mean)
```

```r
WaterQualityAlone = waterQuality_2017_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
)]

# Center and scale the data
```

```
WaterQualityAlone_scaled = scale(WaterQualityAlone)

# Perform PCA
pca_result = princomp(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3     Comp.4     Comp.5
## Standard deviation     1.8146658 1.1892782 1.1439859 0.85904559 0.57131965
## Proportion of Variance 0.4390683 0.1885843 0.1744938 0.09839458 0.04352082
## Cumulative Proportion  0.4390683 0.6276526 0.8021465 0.90054104 0.94406186
##                            Comp.6    Comp.7      Comp.8
## Standard deviation     0.50050392 0.3601625 0.198279855
## Proportion of Variance 0.03340056 0.0172956 0.005241987
## Cumulative Proportion  0.97746241 0.9947580 1.000000000
```

```
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

```
##      Comp.1      Comp.2      Comp.3      Comp.4      Comp.5      Comp.6
## 0.439068273 0.188584344 0.174493843 0.098394577 0.043520818 0.033400556
##      Comp.7      Comp.8
## 0.017295602 0.005241987
```

```
pc.comp = pca_result$scores

#87%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5= -1*pc.comp[,5]
pc.comp6 = -1*pc.comp[,6]

library(factoextra)
```

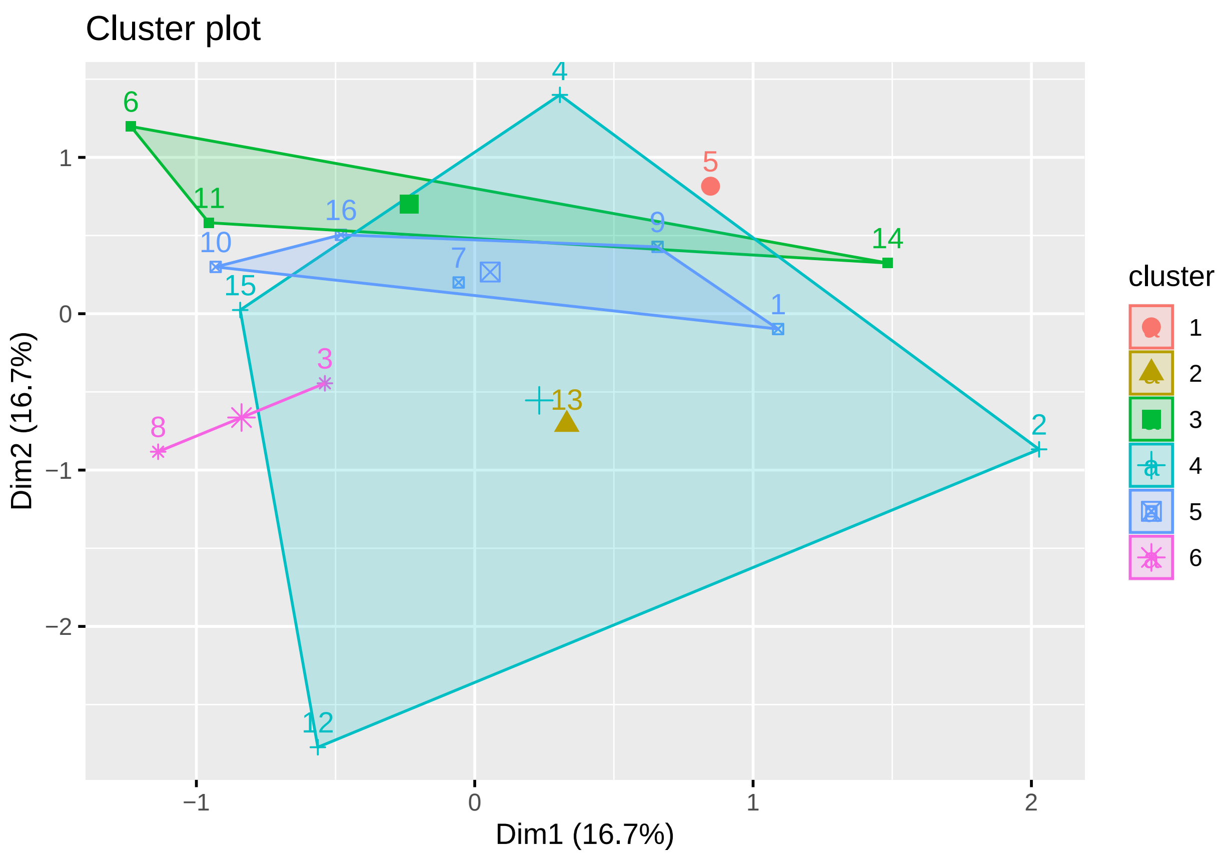
```
## Loading required package: ggplot2
```

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5,pc.comp6)

X
```

```
##         pc.comp1    pc.comp2   pc.comp3    pc.comp4    pc.comp5    pc.comp6
##  [1,] -1.0094213  0.53611506 -1.3197288  0.03375428  0.19437300 -1.09453633
##  [2,] -1.3967625 -1.44339630  0.7873702  1.80466323  0.13753972 -0.41329506
##  [3,]  0.2119474 -2.46856150 -1.4411109  0.82752166 -0.32684075  0.55999324
##  [4,] -0.8599363 -0.55025993  1.3263095  0.29844103 -1.32036263  0.38128402
##  [5,]  2.1681169  0.01821827  0.4830776 -0.59348019 -0.85976354 -0.70485271
##  [6,] -0.3673538  1.72746067  0.3008697 -0.02546562 -0.10007942  0.95061585
##  [7,] -1.3562605  0.38691127 -0.3104345 -0.92898550 -0.15596234 -0.47337758
##  [8,]  1.3112576 -1.32662550 -1.8332806 -0.43162172  0.30978745  0.19410837
##  [9,] -0.8866027  0.22844910 -0.1826866  0.34741078 -0.25500835 -0.31679893
## [10,] -0.1162755  0.65408640 -1.1798106 -0.49762819  0.10355544  0.15743170
## [11,]  1.2231685  1.28116053 -1.7366682  0.36100005  0.31473338  0.45105874
## [12,] -1.5791522 -1.59707793  1.5659784 -1.00096738  1.32932737  0.10180988
## [13,]  5.5614610 -0.25919816  1.4968510 -0.26850722  0.28659847 -0.08506035
## [14,]  0.1591854  1.94111648  0.9180136  1.81301040  0.60059920 -0.07377380
## [15,] -1.7582087  0.23377406  0.9812632 -0.84348270 -0.01108269  0.40588091
## [16,] -1.3051633  0.63782748  0.1439869 -0.89566293 -0.24741432 -0.04048797
```

```
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2017_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2017_Avg$State,waterQuality_2017_Avg$cluster)
```

```
##
##                                              1 2 3 4 5 6
##   ANDHRA PRADESH                             0 0 0 0 1 0
##   DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI   0 0 0 1 0 0
##   GOA                                        0 0 0 0 0 1
##   GUJARAT                                    0 0 0 1 0 0
##   HARYANA                                    1 0 0 0 0 0
##   HIMACHAL PRADESH                           0 0 1 0 0 0
##   KARNATAKA                                  0 0 0 0 1 0
##   KERALA                                     0 0 0 0 0 1
##   MAHARASHTRA                                0 0 0 0 1 0
##   MANIPUR                                    0 0 0 0 1 0
##   MEGHALAYA                                  0 0 1 0 0 0
##   PUDUCHERRY                                 0 0 0 1 0 0
##   PUNJAB                                     0 1 0 0 0 0
##   RAJASTHAN                                  0 0 1 0 0 0
##   TAMIL NADU                                 0 0 0 1 0 0
##   TRIPURA                                    0 0 0 0 1 0
```

```
WaterQualityAlone
```

```
##    TemperatureAvg DissolvedO2Avg    pHAvg ConductivityAvg    BODAvg
## 1        26.00000       7.100000 7.200000        462.5000  1.775000
## 2        26.11111       6.816667 8.005556      13533.6667  6.144444
## 3        26.75217       6.458696 7.071739      15039.6739  2.486957
## 4        24.58824       5.114706 7.644118       9336.4118 11.038235
## 5        22.98681       4.440000 7.320000       1469.9000 49.920000
## 6        14.00000       6.441667 7.350000        843.8333 14.633333
## 7        27.00000       6.808333 7.283333        137.5000  2.758333
## 8        25.71690       5.888732 6.950000       4915.1761  2.775352
## 9        23.50000       6.504492 7.416667       4500.4583  8.186111
## 10       21.25758       6.572727 7.050000        328.5303  7.139394
## 11       14.51852       6.214815 6.907407        198.8148  9.918519
## 12       29.50000       7.900000 8.075000       5908.5000  9.338235
## 13       14.92308       3.208143 7.688462        887.0769 75.826923
## 14       13.00000       5.216667 8.033333        566.6667  1.400000
## 15       24.41667       6.862500 7.629167       2651.2500  2.262500
## 16       24.78846       6.461538 7.369231        135.3462  1.109615
##    FecalColiformAvg NitrateAvg TotalColiformAvg
## 1         18.500000  1.7725000        342.50000
## 2        480.888889  1.4544444        785.33333
## 3      10291.000000  1.6443968      14351.82609
## 4        149.794118  0.4597059        812.94118
## 5       7606.787747  1.3161265      14633.61503
## 6         42.250000  0.7758333        108.58333
## 7        269.833333  0.8466667        717.41667
## 8      15450.626761  1.6994366      17967.12676
## 9         69.041667  1.2793368        165.95833
## 10      6909.646245  1.3161265        410.19697
## 11      5736.814815  1.9396296      12302.44444
## 12      6909.646245  0.1925000       8974.35839
## 13     17319.230769  1.6226923      40500.00000
## 14         8.666667  1.6866667         25.33333
## 15        66.958333  0.1800000        124.29167
## 16       192.500000  0.5936538        322.69231
```

```
Result_2017_water= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_gro


Result_2017_water$Rank=c("A", "B", "C", "D", "E","F")




Water2017 = merge(waterQuality_2017_Avg, Result_2017_water[,c("cluster","Rank")], by = "cluster", all.x
```

```
pca_data = waterQuality_2017_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
```

```r
,"PM10"
,"SO2"
,"PM2.5")]

# Center and scale the data
pca_data_scaled = scale(pca_data)

# Perform PCA
pca_result = princomp(pca_data_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(pca_data_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```r
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3     Comp.4     Comp.5
## Standard deviation     1.8552403 1.6513287 1.2364663 1.03617229 0.91758906
## Proportion of Variance 0.3059481 0.2423899 0.1358977 0.09543582 0.07484175
## Cumulative Proportion  0.3059481 0.5483380 0.6842357 0.77967154 0.85451329
##                           Comp.6    Comp.7     Comp.8     Comp.9     Comp.10
## Standard deviation     0.8732970 0.6062998 0.48530935 0.39403716 0.246568352
## Proportion of Variance 0.0677909 0.0326755 0.02093557 0.01380136 0.005404085
## Cumulative Proportion  0.9223042 0.9549797 0.97591526 0.98971662 0.995120706
##                            Comp.11     Comp.12
## Standard deviation     0.175338638 0.155397616
## Proportion of Variance 0.002732768 0.002146526
## Cumulative Proportion  0.997853474 1.000000000
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

```
##      Comp.1      Comp.2      Comp.3      Comp.4      Comp.5      Comp.6
## 0.305948142 0.242389907 0.135897671 0.095435823 0.074841750 0.067790896
##      Comp.7      Comp.8      Comp.9     Comp.10     Comp.11     Comp.12
## 0.032675504 0.020935570 0.013801358 0.005404085 0.002732768 0.002146526
```

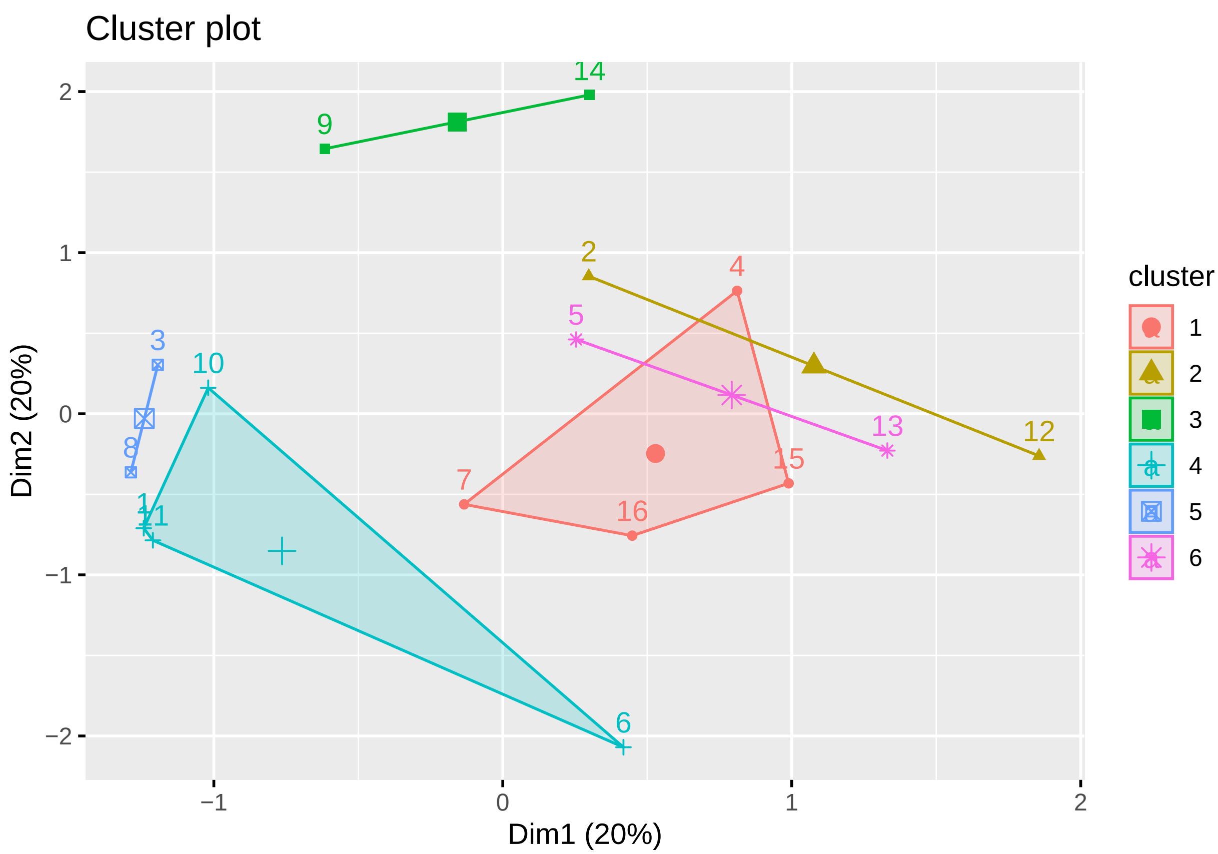
```r
pc.comp = pca_result$scores

#84%
```

```r
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5= -1*pc.comp[,5]
```

```r
library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5)

X
```

```
##         pc.comp1    pc.comp2   pc.comp3   pc.comp4    pc.comp5
##  [1,] -1.0257589 -1.88775530  0.8945993 -0.7289317 -0.21517961
##  [2,] -1.3735625  0.49327406 -1.2983128 -0.3173637  1.32496235
##  [3,]  0.3541202 -1.25390009 -2.0651711 -1.3932519 -0.02341779
##  [4,] -0.9429651  2.24432940 -0.3488594  0.3798702 -0.71510228
##  [5,]  2.2114628  1.59151657  0.1276494  0.0633817 -1.07439800
##  [6,] -0.1115279 -2.81421913  1.9585091  1.5311612  1.00785382
##  [7,] -1.3395268 -0.64183608  0.4082663  0.2172671 -0.43592197
##  [8,]  1.2842255 -1.93655785 -1.3502824 -1.0665042 -0.44572403
##  [9,] -0.9524811  2.13950433  0.3410365 -1.4174892 -0.06782937
## [10,] -0.2978967 -0.43485477  0.4723653 -1.0005260 -0.22597948
## [11,]  1.1962888 -2.06530411  1.1393566 -0.6626610  0.08179564
## [12,] -1.8012698  0.08999583 -2.4315783  1.6873941  0.91426213
## [13,]  5.6054007  0.64569241 -0.5430013  1.3281224  0.14374165
## [14,]  0.4856780  2.94672095  1.8246916 -0.7558295  1.78884303
## [15,] -1.7541699  0.25653933  0.1243600  1.1571537  0.05792929
## [16,] -1.5380176  0.62685444  0.7463713  0.9782068 -2.11583538
```

```r
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2017_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2017_Avg$State,waterQuality_2017_Avg$cluster)
```

```
##
##                                             1 2 3 4 5 6
##   ANDHRA PRADESH                            0 0 0 1 0 0
##   DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI  0 1 0 0 0 0
##   GOA                                       0 0 0 0 1 0
##   GUJARAT                                   1 0 0 0 0 0
##   HARYANA                                   0 0 0 0 0 1
##   HIMACHAL PRADESH                          0 0 0 1 0 0
##   KARNATAKA                                 1 0 0 0 0 0
##   KERALA                                    0 0 0 0 1 0
##   MAHARASHTRA                               0 0 1 0 0 0
##   MANIPUR                                   0 0 0 1 0 0
##   MEGHALAYA                                 0 0 0 1 0 0
##   PUDUCHERRY                                0 1 0 0 0 0
##   PUNJAB                                    0 0 0 0 0 1
##   RAJASTHAN                                 0 0 1 0 0 0
##   TAMIL NADU                                1 0 0 0 0 0
##   TRIPURA                                   1 0 0 0 0 0
```

```
waterQuality_2017_Avg
```

```
##                                  State TemperatureAvg DissolvedO2Avg
## 1                       ANDHRA PRADESH       26.00000       7.100000
## 2  DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI       26.11111       6.816667
## 3                                  GOA       26.75217       6.458696
## 4                              GUJARAT       24.58824       5.114706
## 5                              HARYANA       22.98681       4.440000
## 6                     HIMACHAL PRADESH       14.00000       6.441667
## 7                            KARNATAKA       27.00000       6.808333
## 8                               KERALA       25.71690       5.888732
## 9                          MAHARASHTRA       23.50000       6.504492
## 10                             MANIPUR       21.25758       6.572727
## 11                           MEGHALAYA       14.51852       6.214815
## 12                          PUDUCHERRY       29.50000       7.900000
## 13                              PUNJAB       14.92308       3.208143
## 14                           RAJASTHAN       13.00000       5.216667
## 15                          TAMIL NADU       24.41667       6.862500
## 16                             TRIPURA       24.78846       6.461538
##       pHAvg ConductivityAvg    BODAvg NitrateAvg FecalColiformAvg
## 1  7.200000        462.5000  1.775000  1.7725000        18.500000
## 2  8.005556      13533.6667  6.144444  1.4544444       480.888889
## 3  7.071739      15039.6739  2.486957  1.6443968     10291.000000
## 4  7.644118       9336.4118 11.038235  0.4597059       149.794118
## 5  7.320000       1469.9000 49.920000  1.3161265      7606.787747
## 6  7.350000        843.8333 14.633333  0.7758333        42.250000
## 7  7.283333        137.5000  2.758333  0.8466667       269.833333
## 8  6.950000       4915.1761  2.775352  1.6994366     15450.626761
## 9  7.416667       4500.4583  8.186111  1.2793368        69.041667
## 10 7.050000        328.5303  7.139394  1.3161265      6909.646245
## 11 6.907407        198.8148  9.918519  1.9396296      5736.814815
## 12 8.075000       5908.5000  9.338235  0.1925000      6909.646245
## 13 7.688462        887.0769 75.826923  1.6226923     17319.230769
## 14 8.033333        566.6667  1.400000  1.6866667         8.666667
## 15 7.629167       2651.2500  2.262500  0.1800000        66.958333
## 16 7.369231        135.3462  1.109615  0.5936538       192.500000
##    TotalColiformAvg       NO2     PM10       SO2     PM2.5 cluster
## 1         342.50000 17.562500 28.25000  7.125000 17.562500       4
## 2         785.33333 18.269553 51.77669  9.068159 26.843819       2
## 3       14351.82609 13.411765 59.06424  7.021524 21.260108       5
## 4         812.94118 24.562963 67.99259 16.120823 29.083951       1
## 5       14633.61503 24.576923 78.03846 12.346154 26.329325       6
## 6         108.58333  8.454545 28.45455  2.272727  8.454545       4
## 7         717.41667 17.102624 47.58049  7.824026 24.676111       1
## 8       17967.12676 12.891386 43.55600  4.900582 24.997756       5
## 9         165.95833 34.694938 67.94619 11.944126 35.157701       3
## 10        410.19697 24.231229 38.50000  7.254072 32.640613       4
## 11      12302.44444  9.928571 39.37500  6.562912 23.854899       4
## 12       8974.35839 11.500000 41.83333  6.500000 39.281226       2
## 13      40500.00000 17.832208 67.48132  7.546342 23.521703       6
## 14         25.33333 28.032680 99.91756  9.937908 32.468740       3
## 15        124.29167 18.269553 51.77669  9.068159 26.843819       1
## 16        322.69231 13.000000 55.75000 21.000000 24.250000       1
```

```
Result_2017= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_group$Di
```

```r
Result_2017$Rank=c("A", "B", "C", "D", "E","F")

class(Result_2017$cluster)
```

```
## [1] "integer"
```

```r
class(waterQuality_2017_Avg$cluster)
```

```
## [1] "integer"
```

```r
WaterAir2017 = merge(waterQuality_2017_Avg, Result_2017[,c("cluster","Rank")], by = "cluster", all.x = T
```

```r
library(factoextra)
library(tidyr)
library(ggplot2)

waterQuality_2017_Avg_clust = waterQuality_2017_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")]

selected_cols = c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

data_selected = waterQuality_2017_Avg[, selected_cols]

scaled_df = waterQuality_2017_Avg
scaled_df = subset(waterQuality_2017_Avg, select = c(State,TemperatureAvg
,DissolvedO2Avg
,pHAvg
,ConductivityAvg
,BODAvg
,FecalColiformAvg
```

```r
,NitrateAvg
,TotalColiformAvg
,NO2
,PM10
,SO2
,PM2.5))


rownames(scaled_df)=scaled_df$State


k =6
kmeans_model = kmeans(scaled_df[,-1], centers = k,nstart=1)

# Print cluster centers
print(kmeans_model$centers)
```

```
##   TemperatureAvg DissolvedO2Avg    pHAvg ConductivityAvg    BODAvg
## 1       26.23454       6.173714 7.010870       9977.4250  2.631154
## 2       22.33511       6.184938 7.434136       2525.7383 23.058918
## 3       21.81502       6.485028 7.468819       1328.2221  4.589270
## 4       21.25758       6.572727 7.050000        328.5303  7.139394
## 5       14.92308       3.208143 7.688462        887.0769 75.826923
## 6       25.34967       5.965686 7.824837      11435.0392  8.591340
##   FecalColiformAvg NitrateAvg TotalColiformAvg      NO2     PM10       SO2
## 1      12870.81338  1.6719167       16159.4764 13.15158 51.31012  5.961053
## 2       6751.08294  1.1494187       11970.1393 15.33516 53.08226  8.469689
## 3         95.39286  1.0192368         258.1108 19.58812 54.23935  9.881707
## 4       6909.64625  1.3161265         410.1970 24.23123 38.50000  7.254072
## 5      17319.23077  1.6226923       40500.0000 17.83221 67.48132  7.546342
## 6        315.34150  0.9570752         799.1373 21.41626 59.88464 12.594491
##      PM2.5
## 1 23.12893
## 2 29.82182
## 3 24.20192
## 4 32.64061
## 5 23.52170
## 6 27.96389
```

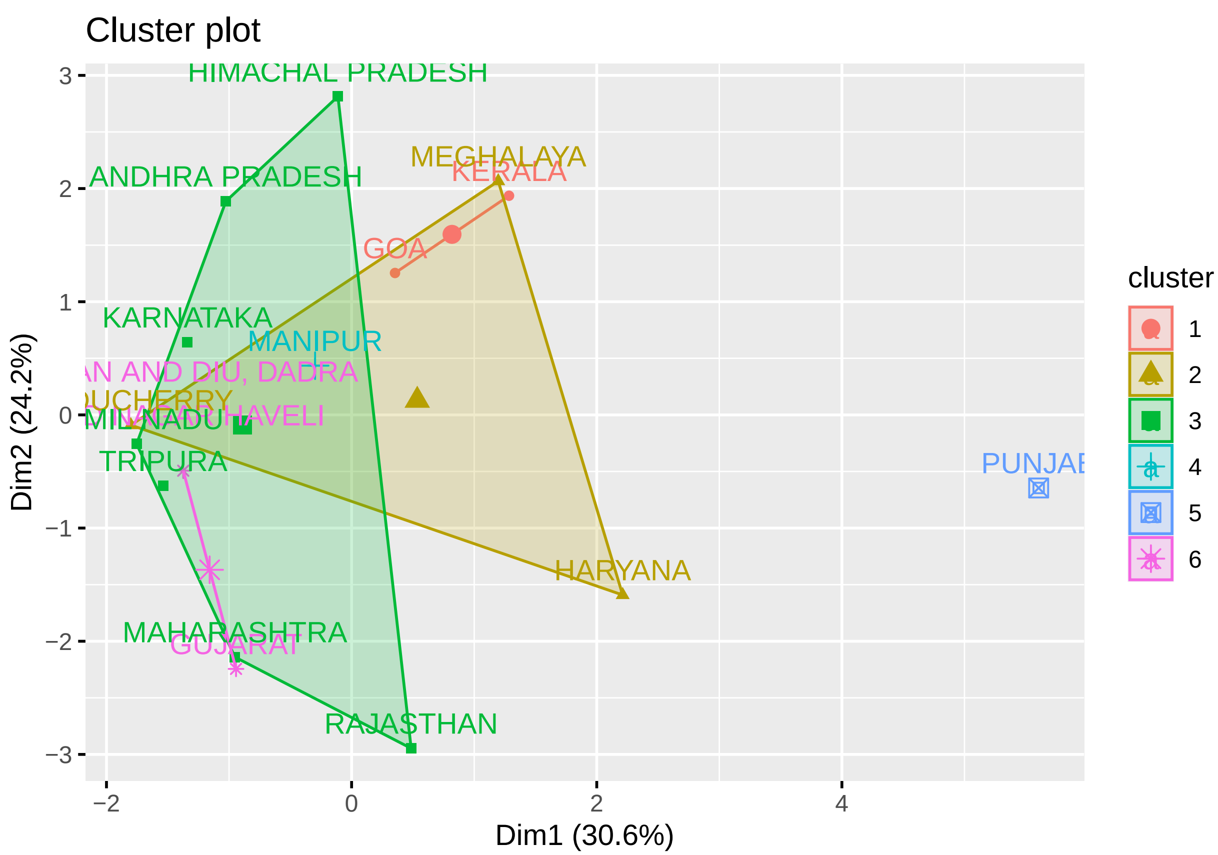
```r
# Print cluster membership for each observation
waterQuality_2017_Avg$cluster=kmeans_model$cluster

# create a new column to store the classification


# view the updated dataset with the new classification column
head(waterQuality_2017_Avg)
```

```
##                                      State TemperatureAvg DissolvedO2Avg
## 1                           ANDHRA PRADESH       26.00000       7.100000
## 2 DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI       26.11111       6.816667
## 3                                      GOA       26.75217       6.458696
## 4                                  GUJARAT       24.58824       5.114706
```

```
## 5                                   HARYANA       22.98681       4.440000
## 6                          HIMACHAL PRADESH       14.00000       6.441667
##       pHAvg ConductivityAvg    BODAvg NitrateAvg FecalColiformAvg
## 1 7.200000        462.5000  1.775000  1.7725000          18.5000
## 2 8.005556      13533.6667  6.144444  1.4544444         480.8889
## 3 7.071739      15039.6739  2.486957  1.6443968       10291.0000
## 4 7.644118       9336.4118 11.038235  0.4597059         149.7941
## 5 7.320000       1469.9000 49.920000  1.3161265        7606.7877
## 6 7.350000        843.8333 14.633333  0.7758333          42.2500
##   TotalColiformAvg       NO2      PM10       SO2     PM2.5 cluster
## 1         342.5000 17.562500 28.25000  7.125000 17.562500       3
## 2         785.3333 18.269553 51.77669  9.068159 26.843819       6
## 3       14351.8261 13.411765 59.06424  7.021524 21.260108       1
## 4         812.9412 24.562963 67.99259 16.120823 29.083951       6
## 5       14633.6150 24.576923 78.03846 12.346154 26.329325       2
## 6         108.5833  8.454545 28.45455  2.272727  8.454545       3
```

```
fviz_cluster(kmeans_model, data = scaled_df[,-1])
```

```
## Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
## font width unknown for character 0xd
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,FecalColif

table(waterQuality_2017_Avg$State,waterQuality_2017_Avg$cluster)
```

```
##
##                                          1 2 3 4 5 6
##   ANDHRA PRADESH                         0 0 1 0 0 0
##   DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI 0 0 0 0 0 1
##   GOA                                    1 0 0 0 0 0
##   GUJARAT                                0 0 0 0 0 1
##   HARYANA                                0 1 0 0 0 0
##   HIMACHAL PRADESH                       0 0 1 0 0 0
##   KARNATAKA                              0 0 1 0 0 0
##   KERALA                                 1 0 0 0 0 0
##   MAHARASHTRA                            0 0 1 0 0 0
##   MANIPUR                                0 0 0 1 0 0
##   MEGHALAYA                              0 1 0 0 0 0
##   PUDUCHERRY                             0 1 0 0 0 0
##   PUNJAB                                 0 0 0 0 1 0
##   RAJASTHAN                              0 0 1 0 0 0
##   TAMIL NADU                             0 0 1 0 0 0
##   TRIPURA                                0 0 1 0 0 0
```

```
waterQuality_2017_Avg
```

```
##                                       State TemperatureAvg DissolvedO2Avg
## 1                            ANDHRA PRADESH       26.00000       7.100000
## 2  DAMAN AND DIU, DADRA\r\nAND NAGAR HAVELI       26.11111       6.816667
## 3                                       GOA       26.75217       6.458696
## 4                                   GUJARAT       24.58824       5.114706
## 5                                   HARYANA       22.98681       4.440000
## 6                          HIMACHAL PRADESH       14.00000       6.441667
## 7                                 KARNATAKA       27.00000       6.808333
## 8                                    KERALA       25.71690       5.888732
## 9                               MAHARASHTRA       23.50000       6.504492
## 10                                  MANIPUR       21.25758       6.572727
## 11                                MEGHALAYA       14.51852       6.214815
## 12                               PUDUCHERRY       29.50000       7.900000
## 13                                   PUNJAB       14.92308       3.208143
## 14                                RAJASTHAN       13.00000       5.216667
## 15                               TAMIL NADU       24.41667       6.862500
## 16                                  TRIPURA       24.78846       6.461538
##       pHAvg ConductivityAvg    BODAvg NitrateAvg FecalColiformAvg
## 1  7.200000        462.5000  1.775000  1.7725000        18.500000
## 2  8.005556      13533.6667  6.144444  1.4544444       480.888889
## 3  7.071739      15039.6739  2.486957  1.6443968     10291.000000
## 4  7.644118       9336.4118 11.038235  0.4597059       149.794118
## 5  7.320000       1469.9000 49.920000  1.3161265      7606.787747
## 6  7.350000        843.8333 14.633333  0.7758333        42.250000
## 7  7.283333        137.5000  2.758333  0.8466667       269.833333
## 8  6.950000       4915.1761  2.775352  1.6994366     15450.626761
## 9  7.416667       4500.4583  8.186111  1.2793368        69.041667
## 10 7.050000        328.5303  7.139394  1.3161265      6909.646245
## 11 6.907407        198.8148  9.918519  1.9396296      5736.814815
## 12 8.075000       5908.5000  9.338235  0.1925000      6909.646245
## 13 7.688462        887.0769 75.826923  1.6226923     17319.230769
## 14 8.033333        566.6667  1.400000  1.6866667         8.666667
## 15 7.629167       2651.2500  2.262500  0.1800000        66.958333
```

```
## 16 7.369231        135.3462  1.109615  0.5936538       192.500000
##    TotalColiformAvg       NO2     PM10       SO2     PM2.5 cluster
## 1         342.50000 17.562500 28.25000  7.125000 17.562500       3
## 2         785.33333 18.269553 51.77669  9.068159 26.843819       6
## 3       14351.82609 13.411765 59.06424  7.021524 21.260108       1
## 4         812.94118 24.562963 67.99259 16.120823 29.083951       6
## 5       14633.61503 24.576923 78.03846 12.346154 26.329325       2
## 6         108.58333  8.454545 28.45455  2.272727  8.454545       3
## 7         717.41667 17.102624 47.58049  7.824026 24.676111       3
## 8       17967.12676 12.891386 43.55600  4.900582 24.997756       1
## 9         165.95833 34.694938 67.94619 11.944126 35.157701       3
## 10        410.19697 24.231229 38.50000  7.254072 32.640613       4
## 11      12302.44444  9.928571 39.37500  6.562912 23.854899       2
## 12       8974.35839 11.500000 41.83333  6.500000 39.281226       2
## 13      40500.00000 17.832208 67.48132  7.546342 23.521703       5
## 14         25.33333 28.032680 99.91756  9.937908 32.468740       3
## 15        124.29167 18.269553 51.77669  9.068159 26.843819       3
## 16        322.69231 13.000000 55.75000 21.000000 24.250000       3
```

```
Result_2017= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_group$Di


Result_2017$Rank=c("A", "B", "C", "D", "E","F")

class(Result_2017$cluster)
```

```
## [1] "integer"
```

```
class(waterQuality_2017_Avg$cluster)
```

```
## [1] "integer"
```

```
WaterAir2017 = merge(waterQuality_2017_Avg, Result_2017[,c("cluster","Rank")], by = "cluster", all.x =
```

```
waterQuality_2018=finalDataset[finalDataset$year == 2018,]
waterQuality_2018$TemperatureMin     =as.numeric(waterQuality_2018$TemperatureMin)
waterQuality_2018$TemperatureMax     =as.numeric(waterQuality_2018$TemperatureMin)
waterQuality_2018$DissolvedO2Min     =as.numeric(waterQuality_2018$DissolvedO2Min)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2018$DissolvedO2Max     =as.numeric(waterQuality_2018$DissolvedO2Max)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2018$pHMin              =as.numeric(waterQuality_2018$pHMin)
waterQuality_2018$pHMax              =as.numeric(waterQuality_2018$pHMax)
waterQuality_2018$ConductivityMin    =as.numeric(waterQuality_2018$ConductivityMin)
waterQuality_2018$ConductivityMax    =as.numeric(waterQuality_2018$ConductivityMax)
waterQuality_2018$BODMin             =as.numeric(waterQuality_2018$BODMin)
```

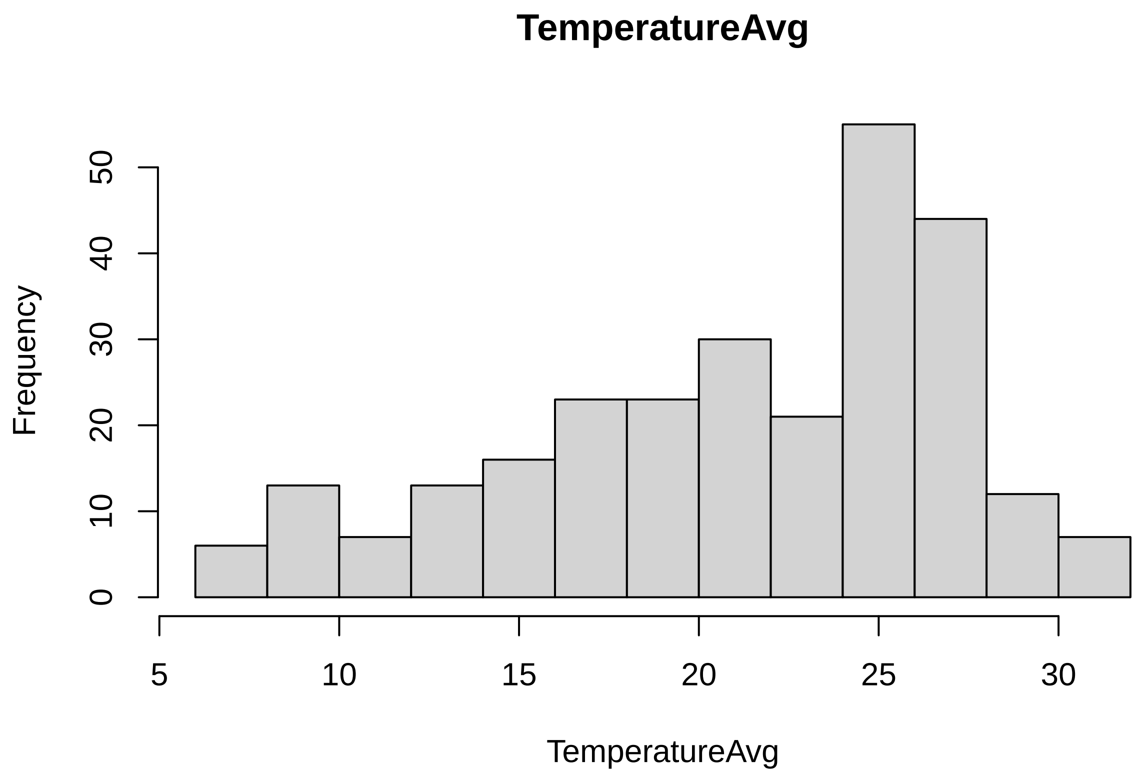
```
## Warning: NAs introduced by coercion
```

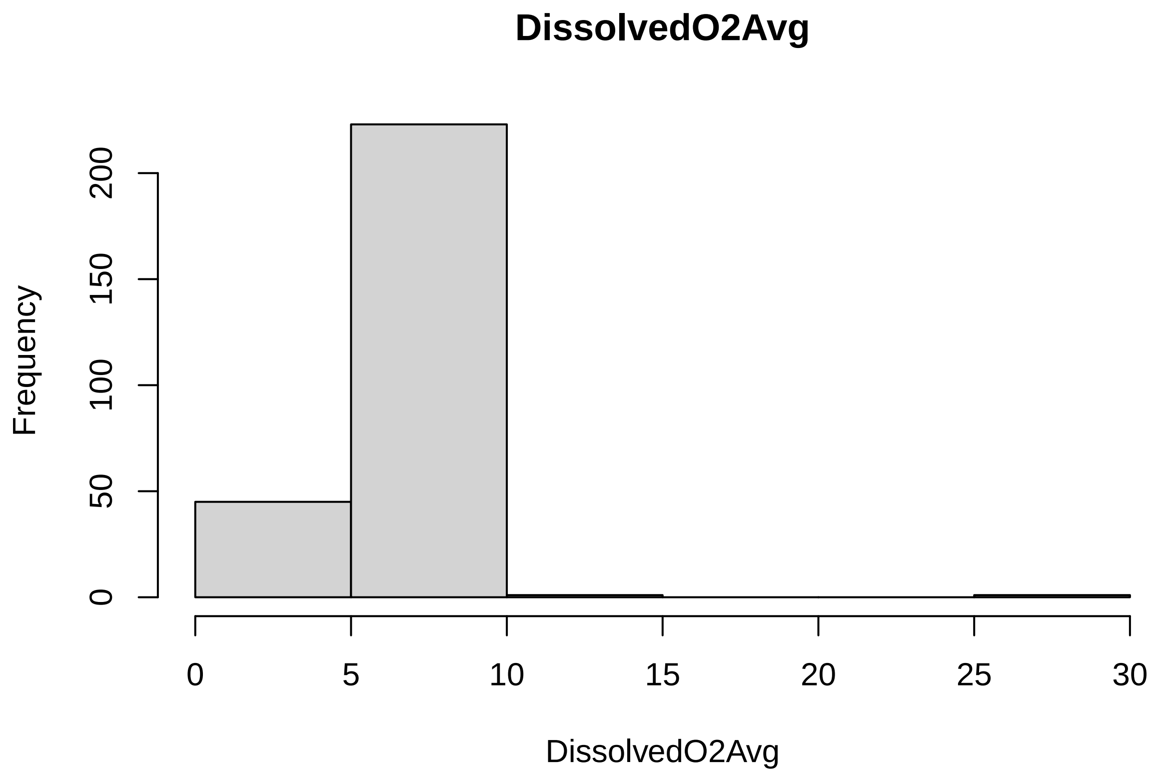
```
waterQuality_2018$BODMax             =as.numeric(waterQuality_2018$BODMax)
waterQuality_2018$NitrateMin         =as.numeric(waterQuality_2018$NitrateMin)
```

```
## Warning: NAs introduced by coercion
```

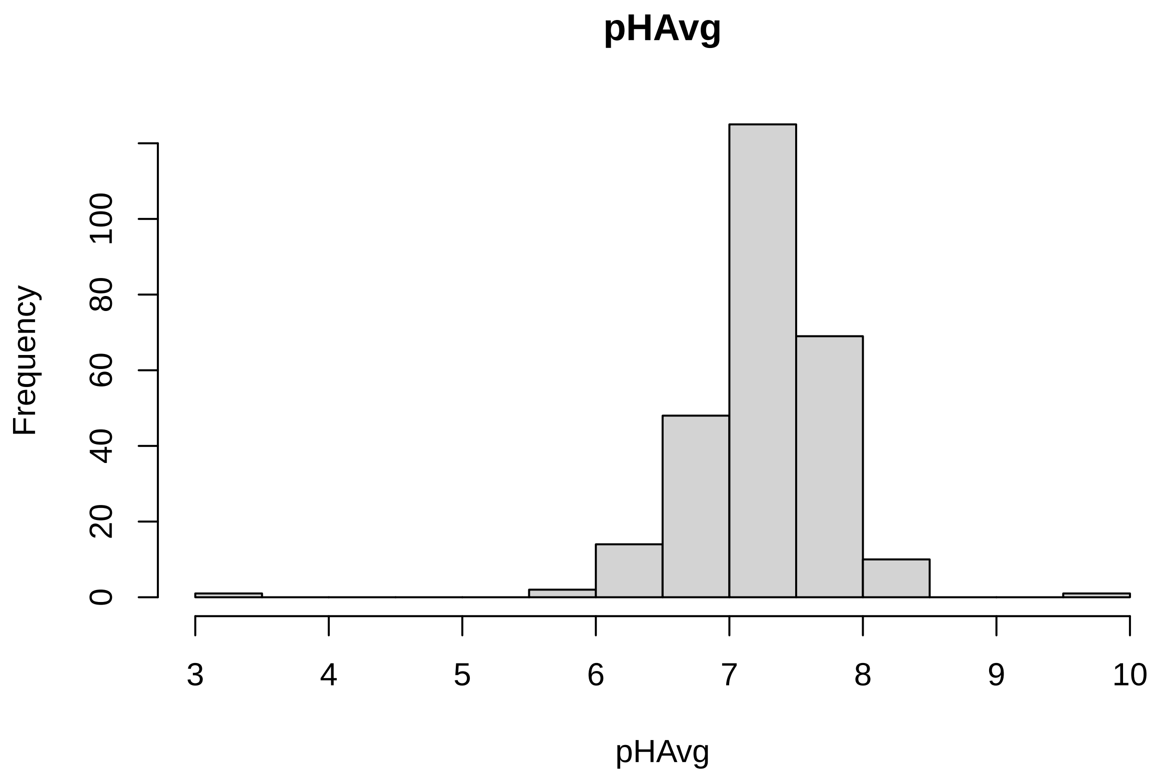
```
waterQuality_2018$NitrateMax         =as.numeric(waterQuality_2018$NitrateMax)
waterQuality_2018$FecalColiformMin   =as.numeric(waterQuality_2018$FecalColiformMin)
waterQuality_2018$FecalColiformMax   =as.numeric(waterQuality_2018$FecalColiformMax)
waterQuality_2018$TotalColiformMin   =as.numeric(waterQuality_2018$TotalColiformMin)
waterQuality_2018$TotalColiformMax   =as.numeric(waterQuality_2018$TotalColiformMax)
waterQuality_2018$NO2                =as.numeric(waterQuality_2018$NO2)
waterQuality_2018$PM10               =as.numeric(waterQuality_2018$PM10)

cols=c("TemperatureMin"
,"TemperatureMax"
,"DissolvedO2Min"
,"DissolvedO2Max"
,"pHMin"
,"pHMax"
,"ConductivityMin"
,"ConductivityMax"
,"BODMin"
,"BODMax"
,"NitrateMin"
,"NitrateMax"
,"FecalColiformMin"
,"FecalColiformMax"
,"TotalColiformMin"
,"TotalColiformMax"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

waterQuality_2018_Avg=waterQuality_2018


# Calculate the average values for each variable
waterQuality_2018_Avg$TemperatureAvg = (waterQuality_2018_Avg$TemperatureMin + waterQuality_2018_Avg$Te
waterQuality_2018_Avg$DissolvedO2Avg = (waterQuality_2018_Avg$DissolvedO2Min + waterQuality_2018_Avg$Di
waterQuality_2018_Avg$pHAvg = (waterQuality_2018_Avg$pHMin + waterQuality_2018_Avg$pHMax) / 2
waterQuality_2018_Avg$ConductivityAvg = (waterQuality_2018_Avg$ConductivityMin + waterQuality_2018_Avg$
waterQuality_2018_Avg$FecalColiformAvg = (waterQuality_2018_Avg$FecalColiformMin + waterQuality_2018_Av
waterQuality_2018_Avg$BODAvg = (waterQuality_2018_Avg$BODMin + waterQuality_2018_Avg$BODMax) / 2
waterQuality_2018_Avg$NitrateAvg = (waterQuality_2018_Avg$NitrateMin + waterQuality_2018_Avg$NitrateMax

waterQuality_2018_Avg$TotalColiformAvg = (waterQuality_2018_Avg$TotalColiformMin + waterQuality_2018_Av

waterQuality_2018_Avg = subset(waterQuality_2018_Avg,select=-c(TemperatureMin
,TemperatureMax
,DissolvedO2Min
```

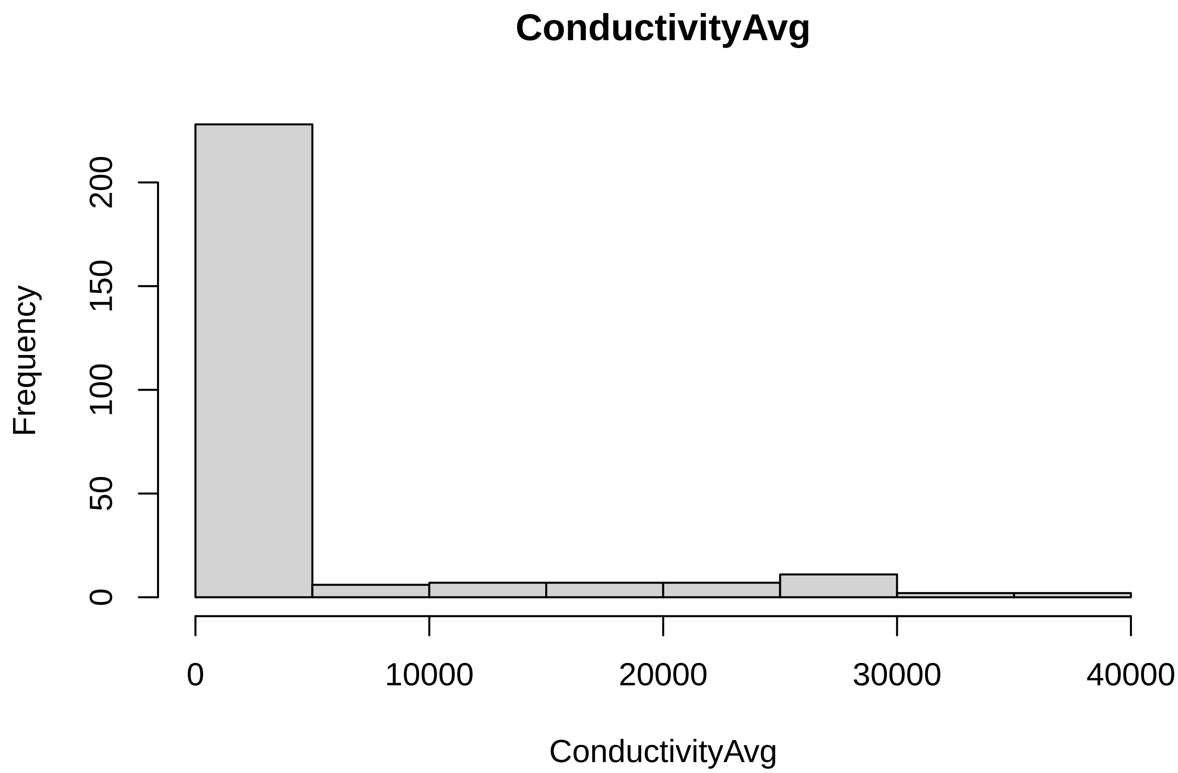
```
,DissolvedO2Max
,pHMin
,pHMax
,ConductivityMin
,ConductivityMax
,BODMin
,BODMax
,NitrateMin
,NitrateMax
,FecalColiformMin
,FecalColiformMax
,TotalColiformMin
,TotalColiformMax))

numCols=c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

for (col in colnames(waterQuality_2018_Avg)) {
  # Check if column has any NAs
  if (sum(is.na(waterQuality_2018_Avg[, col])) > 0) {
    # Replace NAs with mean value of the column
    waterQuality_2018_Avg[is.na(waterQuality_2018_Avg[, col]), col] = mean(waterQuality_2018_Avg[, col]
  }
}


for (col in numCols) {
  # Create the histogram plot
  hist(waterQuality_2018_Avg[[col]], main = col, xlab = col)
}
```


TemperatureAvg
Frequency
0
10
20
30
40
50
5
10
15
20
25
30
TemperatureAvg

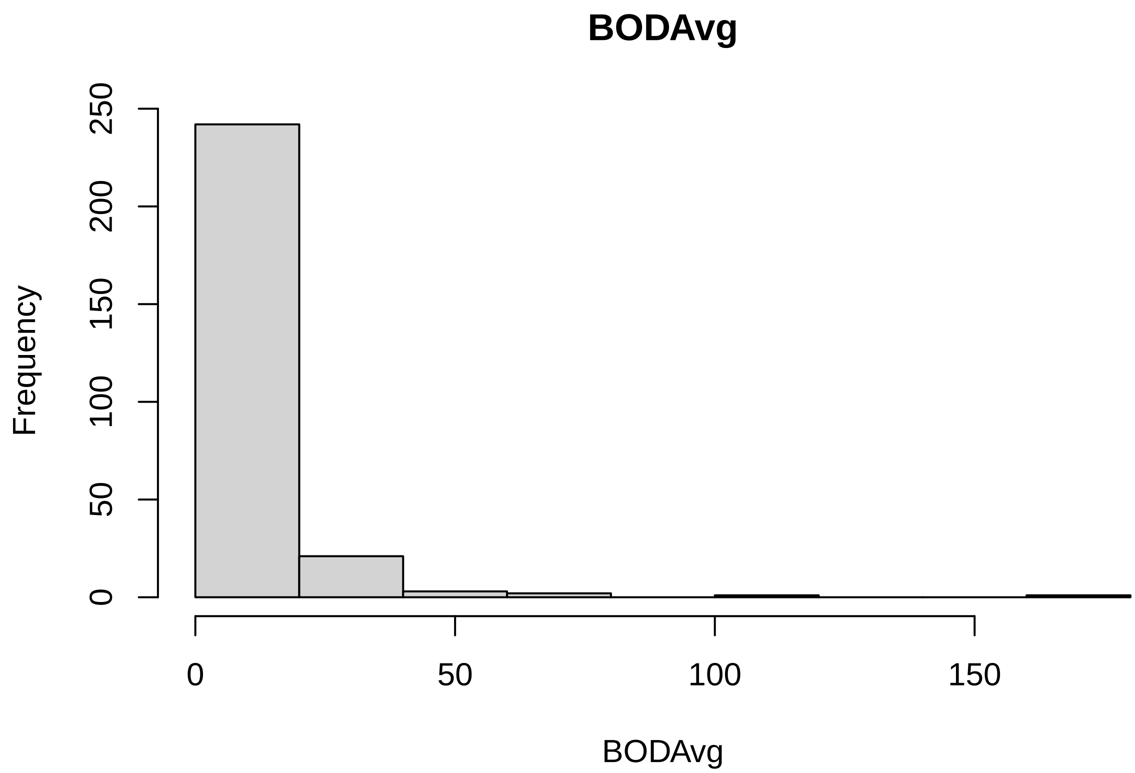


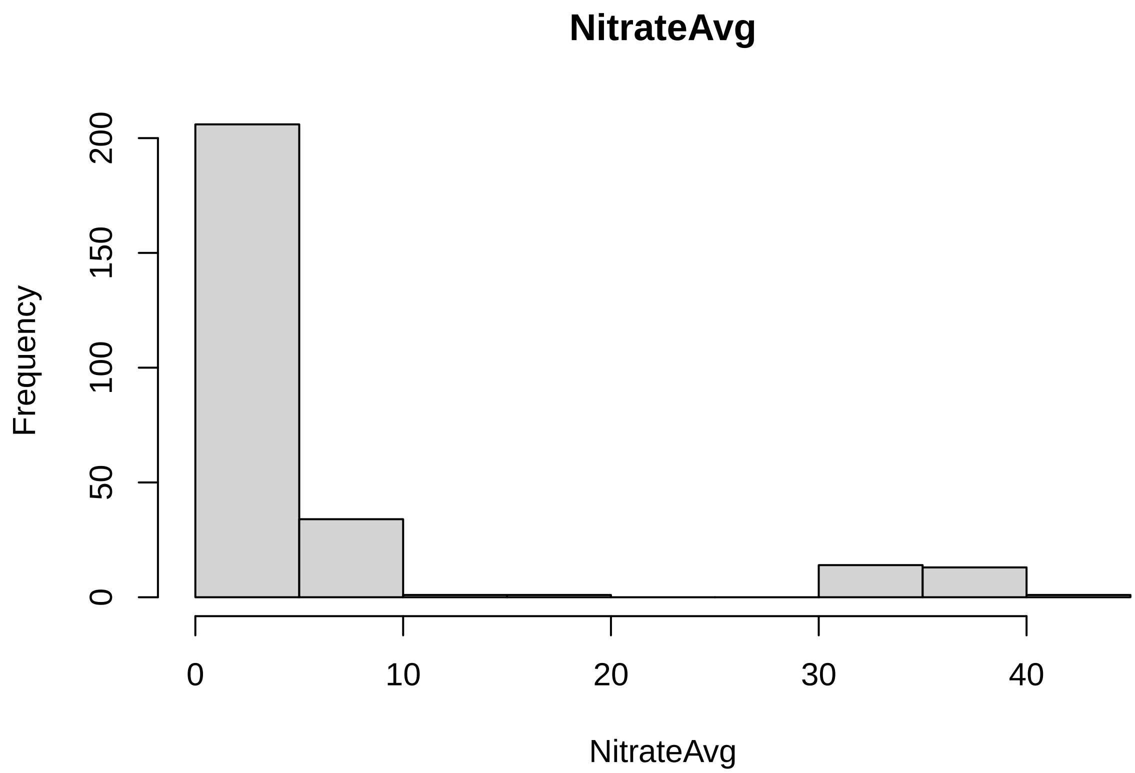
DissolvedO2Avg
Frequency
0
50
100
150
200
0
5
10
15
20
25
30
DissolvedO2Avg

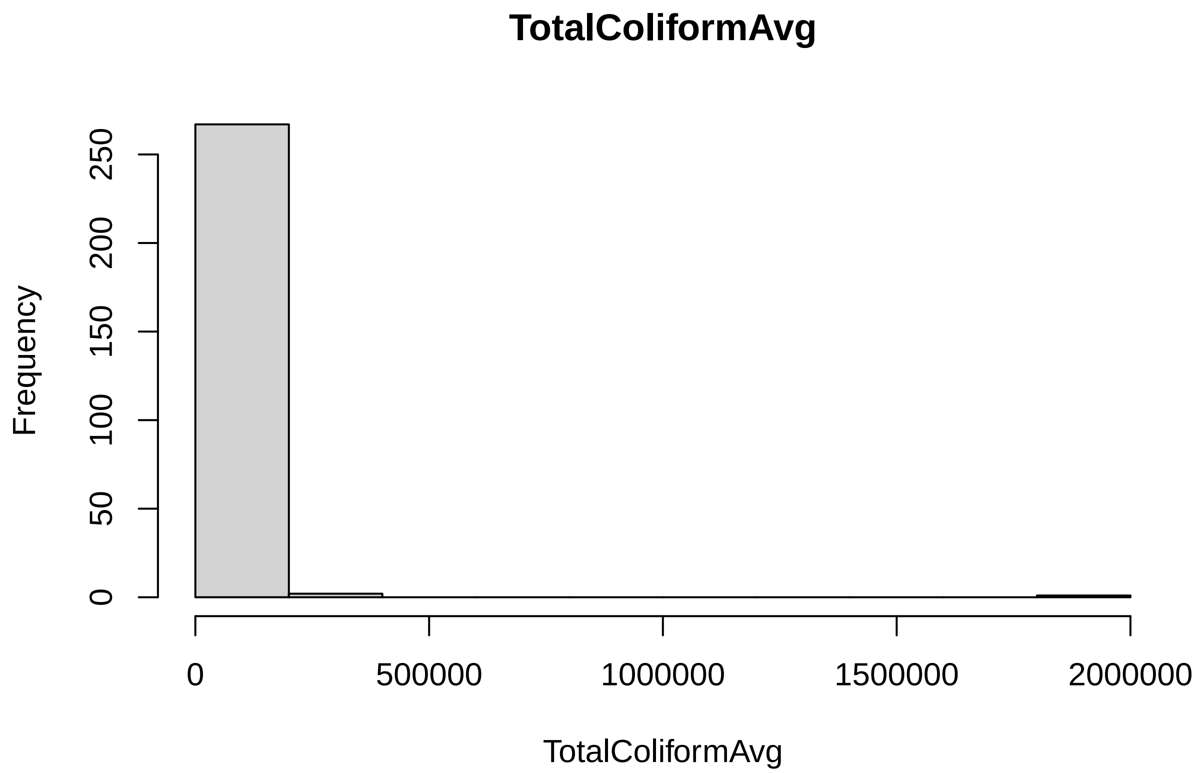

pHAvg
Frequency
0
20
40
60
80
100
3
4
5
6
7
8
9
10
pHAvg

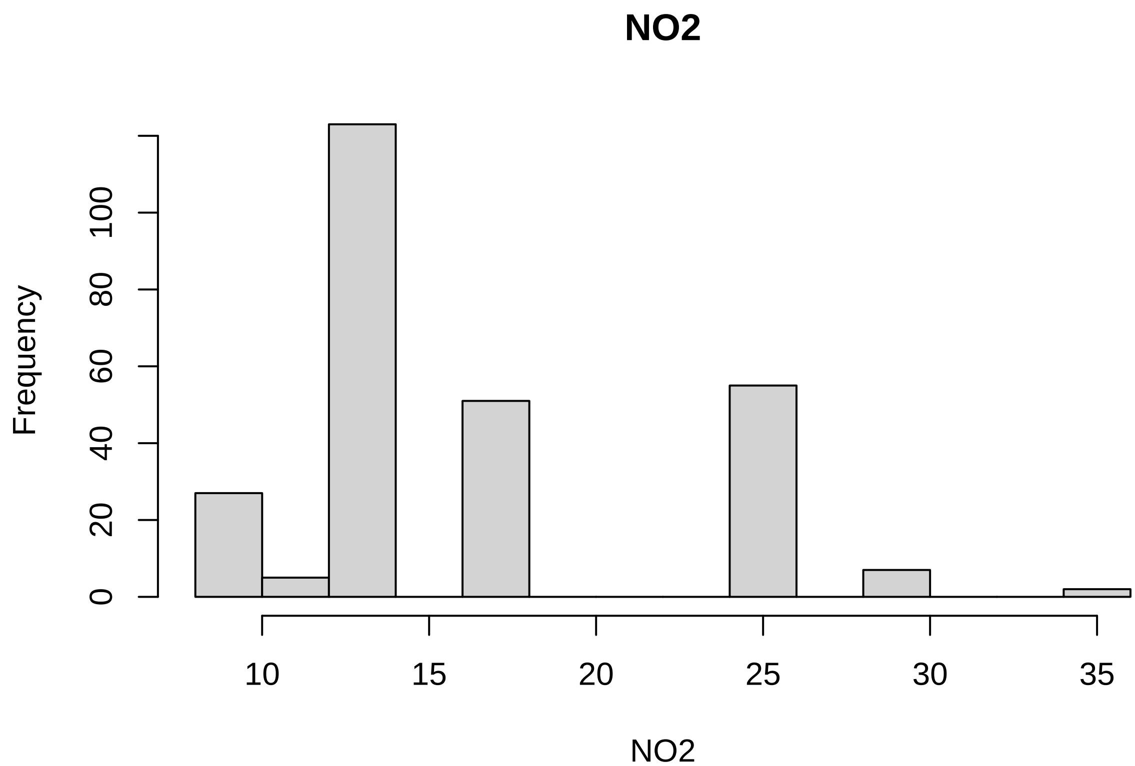


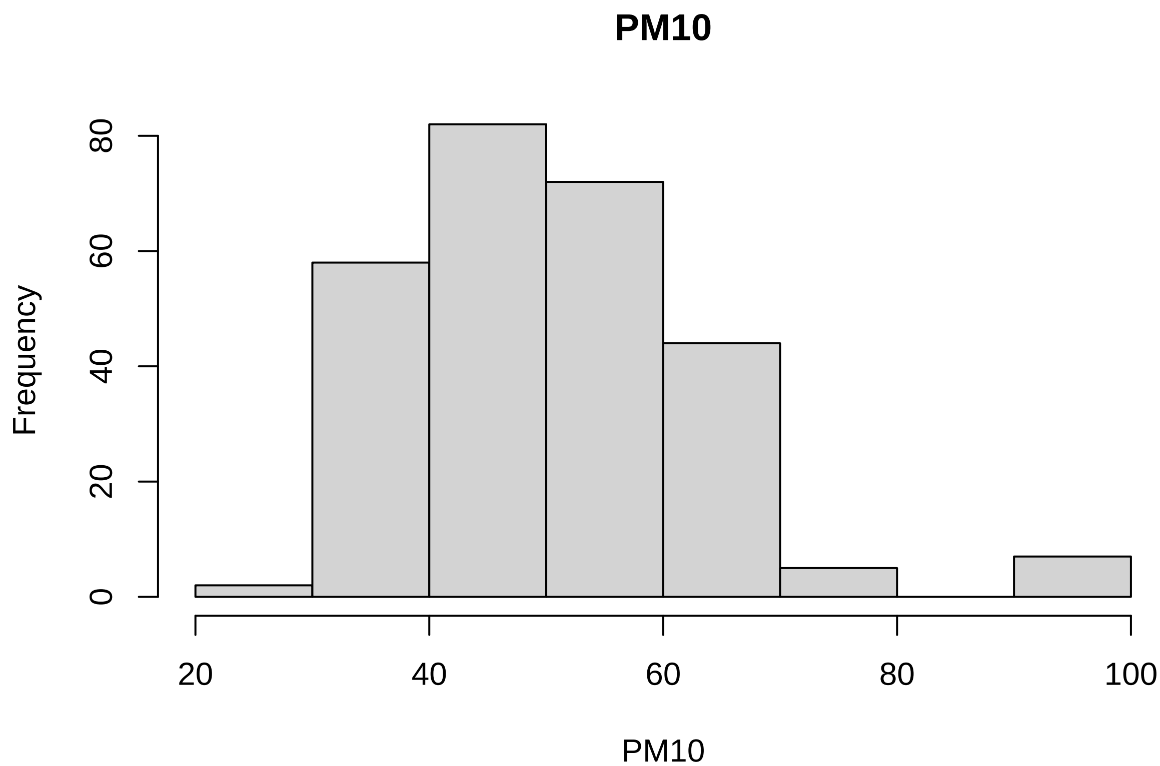
ConductivityAvg
Frequency
0
50
100
150
200
0
10000
20000
30000
40000
ConductivityAvg

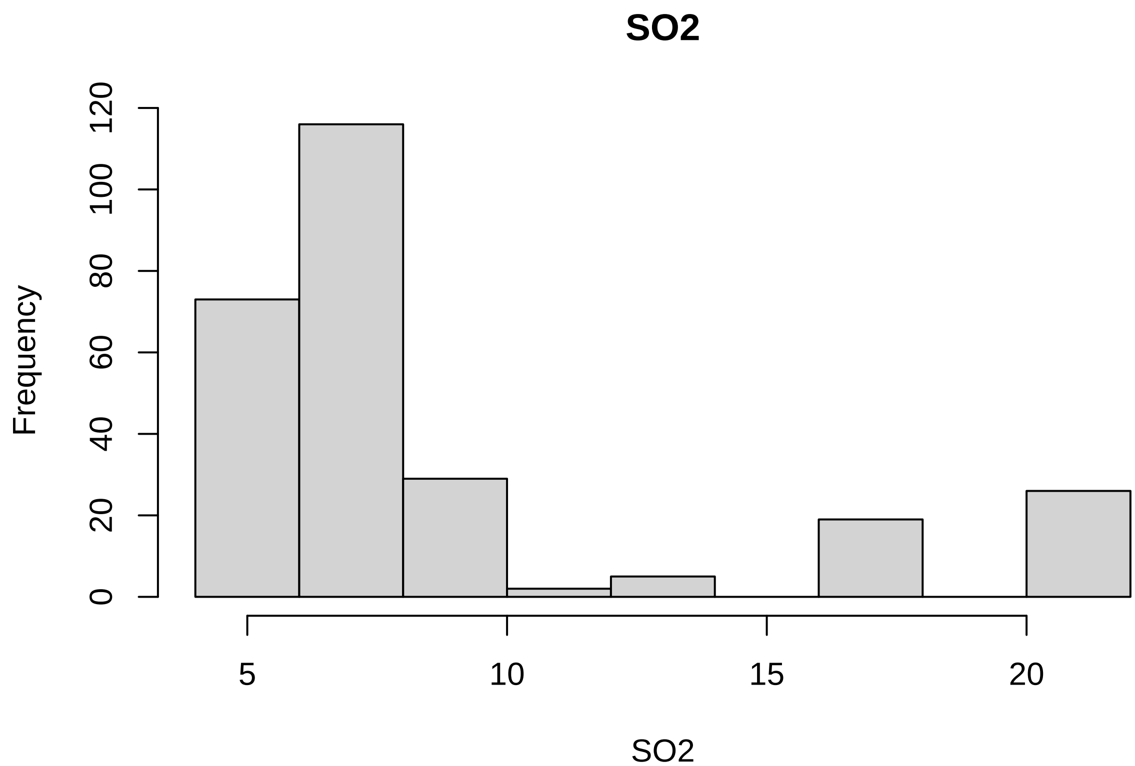

BODAvg
Frequency
0
50
100
150
200
250
0
50
100
150
BODAvg

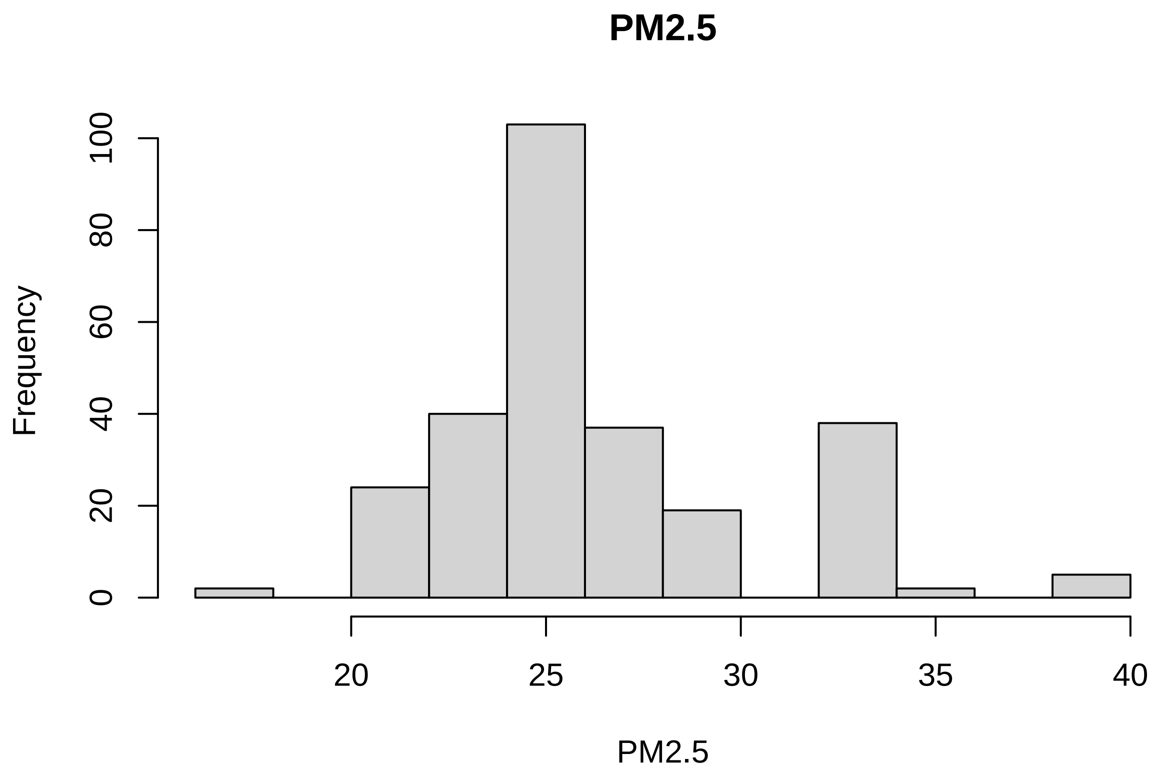

NitrateAvg
Frequency
0
50
100
150
200
0
10
20
30
40
NitrateAvg


TotalColiformAvg
Frequency
0
50
100
150
200
250
0
500000
1000000
1500000
2000000
TotalColiformAvg

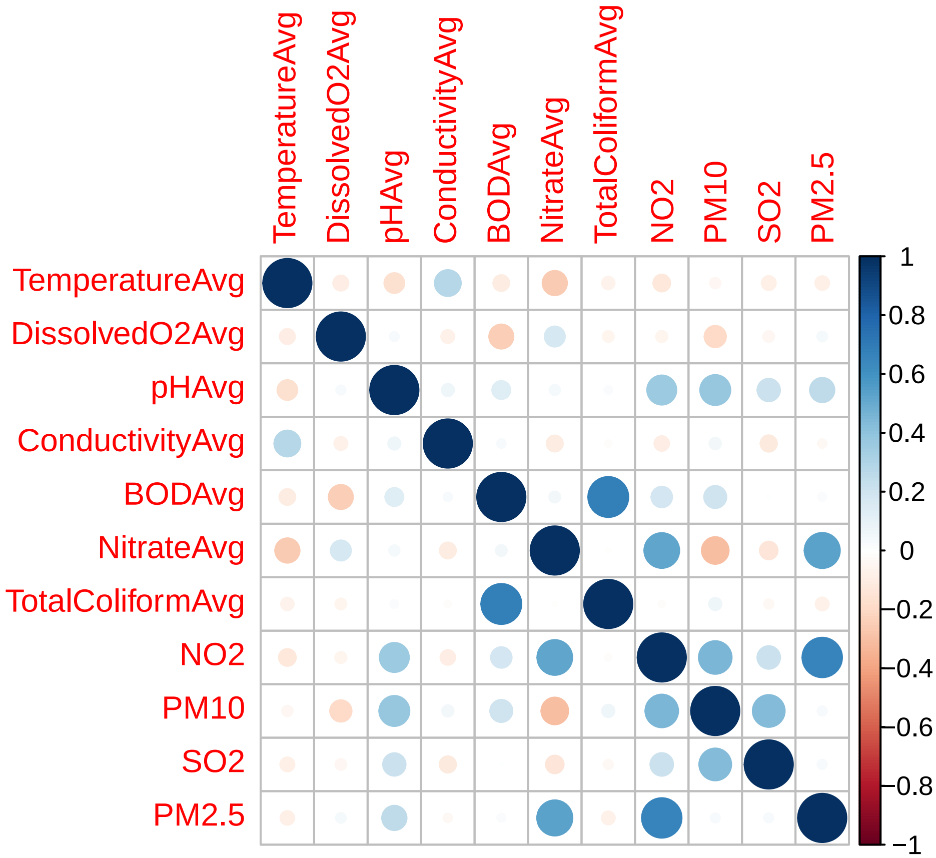

NO2
Frequency
0
20
40
60
80
100
10
15
20
25
30
35
NO2


PM10
Frequency
0
20
40
60
80
20
40
60
80
100
PM10


SO2
Frequency
0
20
40
60
80
100
120
5
10
15
20
SO2




```
cov_mat = cov(waterQuality_2018_Avg[, numCols])

corr_matrix = cor(waterQuality_2018_Avg[, numCols])

library(corrplot)

corrplot(corr_matrix)
```




```
waterQuality_2018_Avg = aggregate(cbind(TemperatureAvg,
                         DissolvedO2Avg,
                         pHAvg,
                         ConductivityAvg,
                         BODAvg,
                         NitrateAvg,
                         FecalColiformAvg,
                         TotalColiformAvg,
                         NO2,
                         PM10,
                         SO2,
                         PM2.5) ~ State,
                    data = waterQuality_2018_Avg,
                    mean)

pca_data = waterQuality_2018_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"FecalColiformAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
```

```r
,"PM2.5")]

# Center and scale the data
pca_data_scaled = scale(pca_data)

# Perform PCA
pca_result = princomp(pca_data_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(pca_data_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```r
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                          Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.795372 1.6209385 1.2898093 1.1508861 0.84983365
## Proportion of Variance 0.286521 0.2335504 0.1478763 0.1177368 0.06419709
## Cumulative Proportion  0.286521 0.5200714 0.6679477 0.7856844 0.84988152
##                            Comp.6     Comp.7    Comp.8     Comp.9     Comp.10
## Standard deviation     0.78797250 0.70555331 0.5053609 0.45984654 0.281318668
## Proportion of Variance 0.05519117 0.04424937 0.0227013 0.01879634 0.007034684
## Cumulative Proportion  0.90507269 0.94932207 0.9720234 0.99081971 0.997854392
##                            Comp.11      Comp.12
## Standard deviation     0.154473980 1.660946e-02
## Proportion of Variance 0.002121085 2.452215e-05
## Cumulative Proportion  0.999975478 1.000000e+00
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print("Before")
```

```
## [1] "Before"
```

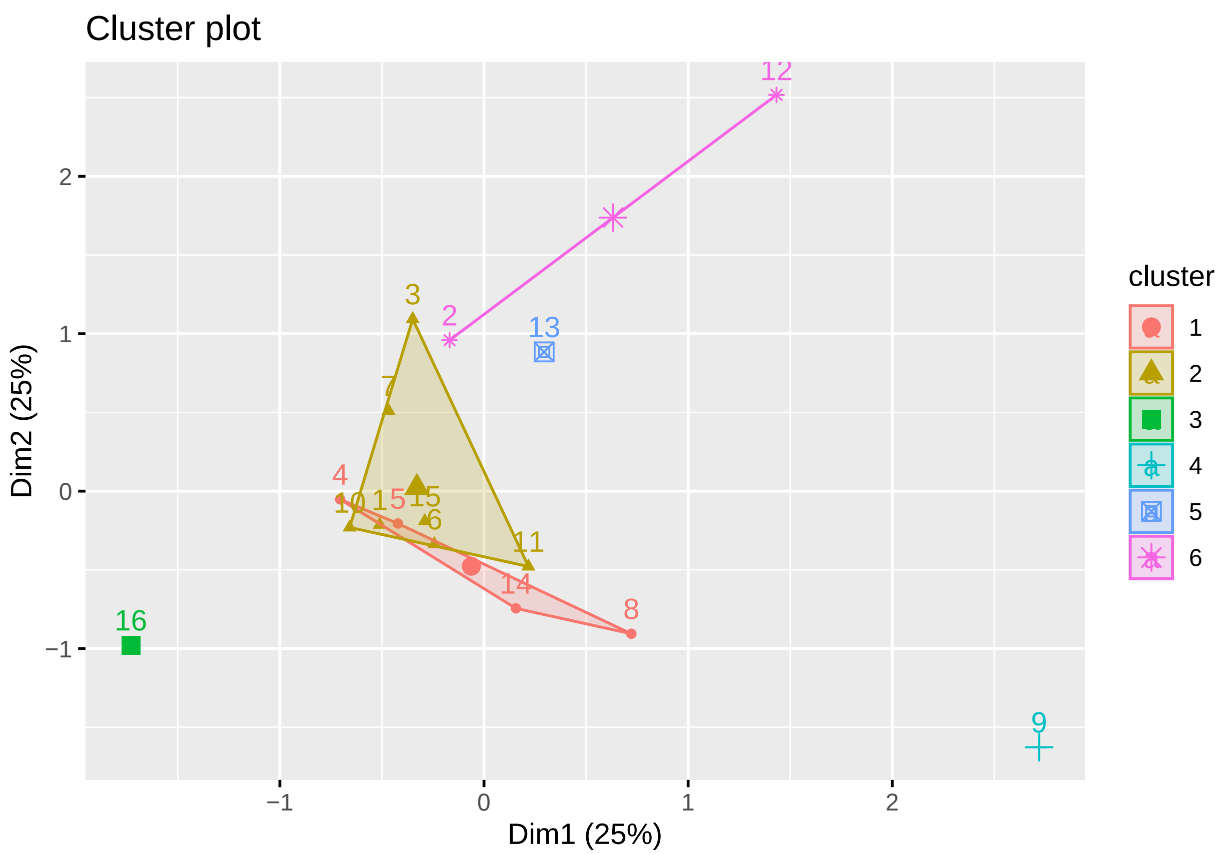
```r
print(var_explained)
```

```
##       Comp.1       Comp.2       Comp.3       Comp.4       Comp.5       Comp.6
## 2.865210e-01 2.335504e-01 1.478763e-01 1.177368e-01 6.419709e-02 5.519117e-02
##       Comp.7       Comp.8       Comp.9      Comp.10      Comp.11      Comp.12
## 4.424937e-02 2.270130e-02 1.879634e-02 7.034684e-03 2.121085e-03 2.452215e-05
```

```r
pc.comp = pca_result$scores

#86%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]



library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4)

X
```

```
##          pc.comp1   pc.comp2   pc.comp3   pc.comp4
##  [1,] -1.8979617  0.9787115  0.3890051  0.6192182
##  [2,] -0.1017835 -0.7234323 -1.4084539  0.1405186
##  [3,] -1.2430553  0.5481157 -1.4245127  0.3465032
##  [4,]  1.2785995 -2.0569369 -0.2674963  0.8396035
##  [5,]  2.7997885 -1.4014173  0.0513338  0.5135111
##  [6,] -1.6751929  0.5227284  0.5111217  0.3094810
##  [7,] -1.9359276  0.8591319 -0.6030710  0.5237516
##  [8,]  0.1228824 -2.0967510  0.9813471 -0.8006504
##  [9,] -1.0335265  0.5769160  2.4711766 -3.1266757
## [10,] -0.5638875  2.1482111  0.5660710  0.7952671
## [11,] -0.2201336  0.2388891  0.6956469 -0.2286696
## [12,] -1.0843620 -0.8343389 -3.4160246 -1.8574002
## [13,]  4.5184202  4.1093009 -0.5978607 -0.4048123
## [14,]  2.5024650 -2.4437442  0.6746147 -0.1393086
## [15,] -0.6653201 -0.1618106  0.2140996  0.3556425
## [16,] -0.8010048 -0.2635735  1.1630027  2.1140198
```

```r
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2018_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2018_Avg$State,waterQuality_2018_Avg$cluster)
```

```
##
##                                   1 2 3 4 5 6
##   ANDHRA PRADESH                  0 1 0 0 0 0
##   DAMAN, DIU, DADRA\r\nNAGAR HAVELI 0 0 0 0 0 1
##   GOA                             0 1 0 0 0 0
##   GUJARAT                         1 0 0 0 0 0
##   HARYANA                         1 0 0 0 0 0
##   KARNATAKA                       0 1 0 0 0 0
##   KERALA                          0 1 0 0 0 0
##   MAHARASHTRA                     1 0 0 0 0 0
##   MANIPUR                         0 0 0 1 0 0
##   MEGHALAYA                       0 1 0 0 0 0
##   ODISHA                          0 1 0 0 0 0
##   PUDUCHERRY                      0 0 0 0 0 1
##   PUNJAB                          0 0 0 0 1 0
##   RAJASTHAN                       1 0 0 0 0 0
##   TAMIL NADU                      0 1 0 0 0 0
##   TRIPURA                         0 0 1 0 0 0
```

```
waterQuality_2018_Avg
```

```
##                                  State TemperatureAvg DissolvedO2Avg    pHAvg
## 1                       ANDHRA PRADESH       25.00000       6.175000 7.225000
## 2  DAMAN, DIU, DADRA\r\nNAGAR HAVELI       28.06667       5.738889 7.755556
## 3                                  GOA       26.13333       6.264583 7.204167
## 4                              GUJARAT       23.87576       4.634211 7.671053
## 5                              HARYANA       21.60656       4.200000 7.880000
## 6                            KARNATAKA       25.75000       7.125000 7.150000
## 7                               KERALA       26.00000       6.039726 6.928082
## 8                          MAHARASHTRA       27.50000       6.750000 7.450000
## 9                              MANIPUR       17.17419       7.280645 7.322581
## 10                           MEGHALAYA       12.07778       6.175926 7.135185
## 11                              ODISHA       14.80000       7.195000 7.620000
## 12                          PUDUCHERRY       30.40000       6.480000 7.690000
## 13                              PUNJAB       14.15385       6.073771 7.561538
## 14                           RAJASTHAN       15.91429       4.728571 7.950000
## 15                          TAMIL NADU       23.45385       6.580769 7.588462
## 16                             TRIPURA       20.28846       6.688462 7.226923
##    ConductivityAvg     BODAvg NitrateAvg FecalColiformAvg TotalColiformAvg
## 1        2348.2500  1.5250000  8.5425000         34.00000         957.5000
## 2        7339.8333 13.0388889  0.9705556        321.50000         713.5000
## 3       12217.9792  4.1847707  4.5083412       6313.35417       13139.5417
## 4        5579.0263 11.8815789  0.7110526        287.42105         647.7632
## 5        1580.0000 28.1200000  5.1475105       5395.43707       12308.3760
## 6         108.2500  2.3625000  2.9862552        240.12500         863.7500
## 7        4282.7260  2.1691781  1.0863704       1509.34932        2773.3630
## 8         242.5000  3.2500000  0.9000000         23.50000          70.5000
## 9         628.5000  7.7290323 33.2595168       6992.70495         207.9677
## 10        231.2037  7.1685185  0.7035185      12092.51852       31783.9074
## 11       2132.1500  1.3400000  1.5660000       4463.55000        7547.0000
## 12      17812.4000  7.4693798  0.2540000       7225.72845       14463.9599
## 13       1073.6154 38.6923077  1.4123077      78800.00000      175400.0000
## 14       2189.2857  7.9285714  2.3735714         19.07143          67.0000
## 15        253.2308  3.8115385  0.8826923         32.30769         108.5769
## 16        122.4423  0.6115385  0.3880769        147.96154         276.9231
##          NO2     PM10       SO2    PM2.5 cluster
## 1  17.562500 28.25000  7.125000 17.56250       2
## 2  16.294960 51.56409  8.801921 26.26899       6
## 3  13.411765 59.06424  7.021524 21.26011       2
## 4  24.562963 67.99259 16.120823 29.08395       1
## 5  24.576923 78.03846 12.346154 26.32933       1
## 6  17.102624 47.58049  7.824026 24.67611       2
## 7  12.891386 43.55600  4.900582 24.99776       2
## 8  34.694938 67.94619 11.944126 35.15770       1
## 9  24.231229 38.50000  7.254072 32.64061       4
## 10  9.928571 39.37500  6.562912 23.85490       2
## 11 17.290323 63.40261  7.091398 27.53333       2
## 12 11.500000 41.83333  6.500000 39.28123       6
## 13 17.832208 67.48132  7.546342 23.52170       5
## 14 28.032680 99.91756  9.937908 32.46874       1
## 15 16.294960 51.56409  8.801921 26.26899       2
## 16 13.000000 55.75000 21.000000 24.25000       3
```

```r
Result_2018= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_group$Di
```

```r
Result_2018$Rank=c("A", "B", "C", "D", "E","F")

class(Result_2018$cluster)
```

```
## [1] "integer"
```

```r
class(waterQuality_2018_Avg$cluster)
```

```
## [1] "integer"
```

```r
WaterAir2018 = merge(waterQuality_2018_Avg, Result_2018[,c("cluster","Rank")], by = "cluster", all.x = T

WaterQualityAlone = waterQuality_2018_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
)]

# Center and scale the data
WaterQualityAlone_scaled = scale(WaterQualityAlone)

# Perform PCA
pca_result = princomp(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```r
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.7022634 1.3441246 1.0773239 0.9073936 0.66410055
## Proportion of Variance 0.3863601 0.2408895 0.1547502 0.1097817 0.05880394
## Cumulative Proportion  0.3863601 0.6272495 0.7819998 0.8917815 0.95058546
##                            Comp.6      Comp.7       Comp.8
## Standard deviation     0.57368627 0.202426610 2.272925e-02
## Proportion of Variance 0.04388212 0.005463538 6.888253e-05
## Cumulative Proportion  0.99446758 0.999931117 1.000000e+00
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)
print("After")
```

```
## [1] "After"
```

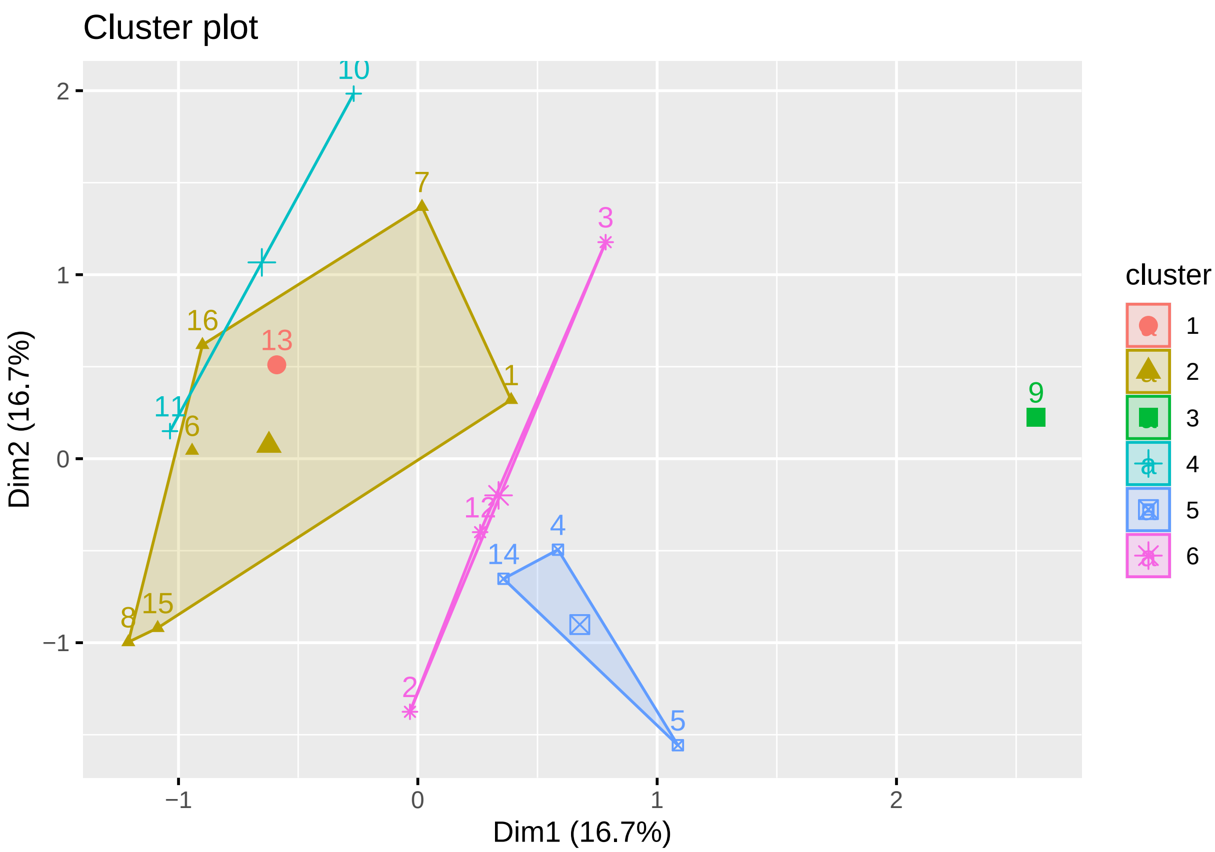
```r
print(var_explained)
```

```
##       Comp.1       Comp.2       Comp.3       Comp.4       Comp.5       Comp.6
## 3.863601e-01 2.408895e-01 1.547502e-01 1.097817e-01 5.880394e-02 4.388212e-02
##       Comp.7       Comp.8
## 5.463538e-03 6.888253e-05
```

```r
pc.comp = pca_result$scores

#86%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5= -1*pc.comp[,5]
pc.comp6 = -1*pc.comp[,6]

library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5,pc.comp6)

X
```

```
##          pc.comp1    pc.comp2    pc.comp3    pc.comp4    pc.comp5    pc.comp6
##  [1,] -1.08440520  0.54357031 -0.02785999 -0.15234880 -0.65409629 -0.04198959
##  [2,] -0.31493332 -1.70297492 -0.13844562 -0.36220550  0.11031889 -0.52426251
##  [3,] -0.93635006 -0.43789029 -1.51468621 -0.57132265 -0.23341311  0.82893934
##  [4,]  0.07102067 -1.76438229  0.70155024  0.08847368 -0.49331280  0.31181732
##  [5,]  1.57784224 -1.85925455  1.72304365 -0.42166877 -0.85117490 -0.27330121
##  [6,] -1.24019860  1.08060776 -0.52113444  0.54452799 -0.29846523 -0.69831086
##  [7,] -1.22207214  0.38385853 -0.88646172  0.66044466 -1.19120550  0.42156637
##  [8,] -1.02854966  0.15432140 -0.18182365  0.51982091  0.02593051 -1.09801080
##  [9,] -0.40248614  2.70949254  1.05073326 -2.72557547 -0.04193558  0.01417763
## [10,]  0.65737064  1.41512599  0.35336142  1.14367368 -0.03028694  1.10174786
## [11,] -0.21339445  0.89349144  0.45962986  0.51887168  1.63241117  0.18235004
## [12,] -0.80040834 -2.08058276 -2.03981520 -1.08205093  0.91038568  0.24292782
## [13,]  5.90497553  0.83450638 -1.40882229  0.05358687 -0.03210360 -0.29653687
## [14,]  0.54866250 -1.22348226  1.99628722  0.26534724  0.59597581  0.55053427
## [15,] -0.64364806  0.08451558  0.35682748  0.53827538  0.47691957 -0.74906869
## [16,] -0.87342563  0.96907715  0.07761600  0.98215003  0.07405233  0.02741988
```

```
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2018_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2018_Avg$State,waterQuality_2018_Avg$cluster)
```

```
##
##                                  1 2 3 4 5 6
##    ANDHRA PRADESH                0 1 0 0 0 0
##    DAMAN, DIU, DADRA\r\nNAGAR HAVELI 0 0 0 0 0 1
##    GOA                           0 0 0 0 0 1
##    GUJARAT                       0 0 0 0 1 0
##    HARYANA                       0 0 0 0 1 0
##    KARNATAKA                     0 1 0 0 0 0
##    KERALA                        0 1 0 0 0 0
##    MAHARASHTRA                   0 1 0 0 0 0
##    MANIPUR                       0 0 1 0 0 0
##    MEGHALAYA                     0 0 0 1 0 0
```

```
##   ODISHA                           0 0 0 1 0 0
##   PUDUCHERRY                       0 0 0 0 0 1
##   PUNJAB                           1 0 0 0 0 0
##   RAJASTHAN                        0 0 0 0 1 0
##   TAMIL NADU                       0 1 0 0 0 0
##   TRIPURA                          0 1 0 0 0 0
```

```
WaterQualityAlone
```

```
##    TemperatureAvg DissolvedO2Avg    pHAvg ConductivityAvg     BODAvg
## 1        25.00000       6.175000 7.225000       2348.2500  1.5250000
## 2        28.06667       5.738889 7.755556       7339.8333 13.0388889
## 3        26.13333       6.264583 7.204167      12217.9792  4.1847707
## 4        23.87576       4.634211 7.671053       5579.0263 11.8815789
## 5        21.60656       4.200000 7.880000       1580.0000 28.1200000
## 6        25.75000       7.125000 7.150000        108.2500  2.3625000
## 7        26.00000       6.039726 6.928082       4282.7260  2.1691781
## 8        27.50000       6.750000 7.450000        242.5000  3.2500000
## 9        17.17419       7.280645 7.322581        628.5000  7.7290323
## 10       12.07778       6.175926 7.135185        231.2037  7.1685185
## 11       14.80000       7.195000 7.620000       2132.1500  1.3400000
## 12       30.40000       6.480000 7.690000      17812.4000  7.4693798
## 13       14.15385       6.073771 7.561538       1073.6154 38.6923077
## 14       15.91429       4.728571 7.950000       2189.2857  7.9285714
## 15       23.45385       6.580769 7.588462        253.2308  3.8115385
## 16       20.28846       6.688462 7.226923        122.4423  0.6115385
##    FecalColiformAvg NitrateAvg TotalColiformAvg
## 1          34.00000  8.5425000         957.5000
## 2         321.50000  0.9705556         713.5000
## 3        6313.35417  4.5083412       13139.5417
## 4         287.42105  0.7110526         647.7632
## 5        5395.43707  5.1475105       12308.3760
## 6         240.12500  2.9862552         863.7500
## 7        1509.34932  1.0863704        2773.3630
## 8          23.50000  0.9000000          70.5000
## 9        6992.70495 33.2595168         207.9677
## 10      12092.51852  0.7035185       31783.9074
## 11       4463.55000  1.5660000        7547.0000
## 12       7225.72845  0.2540000       14463.9599
## 13      78800.00000  1.4123077      175400.0000
## 14         19.07143  2.3735714          67.0000
## 15         32.30769  0.8826923         108.5769
## 16        147.96154  0.3880769         276.9231
```

```
Result_2018_water= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_gr


Result_2018_water$Rank=c("A", "B", "C", "D", "E","F")

class(waterQuality_2018_Avg$cluster)
```

```
## [1] "integer"
```

```
class(waterQuality_2018_Avg$cluster)
```

```
## [1] "integer"
```

```
Water2018 = merge(waterQuality_2018_Avg, Result_2018_water[,c("cluster","Rank")], by = "cluster", all.x
```

```
waterQuality_2019=finalDataset[finalDataset$year == 2019,]
waterQuality_2019$TemperatureMin     =as.numeric(waterQuality_2019$TemperatureMin)
waterQuality_2019$TemperatureMax     =as.numeric(waterQuality_2019$TemperatureMin)
waterQuality_2019$DissolvedO2Min     =as.numeric(waterQuality_2019$DissolvedO2Min)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2019$DissolvedO2Max     =as.numeric(waterQuality_2019$DissolvedO2Max)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2019$pHMin              =as.numeric(waterQuality_2019$pHMin)
waterQuality_2019$pHMax              =as.numeric(waterQuality_2019$pHMax)
waterQuality_2019$ConductivityMin    =as.numeric(waterQuality_2019$ConductivityMin)
waterQuality_2019$ConductivityMax    =as.numeric(waterQuality_2019$ConductivityMax)
waterQuality_2019$BODMin             =as.numeric(waterQuality_2019$BODMin)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2019$BODMax             =as.numeric(waterQuality_2019$BODMax)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2019$NitrateMin         =as.numeric(waterQuality_2019$NitrateMin)
```

```
## Warning: NAs introduced by coercion
```

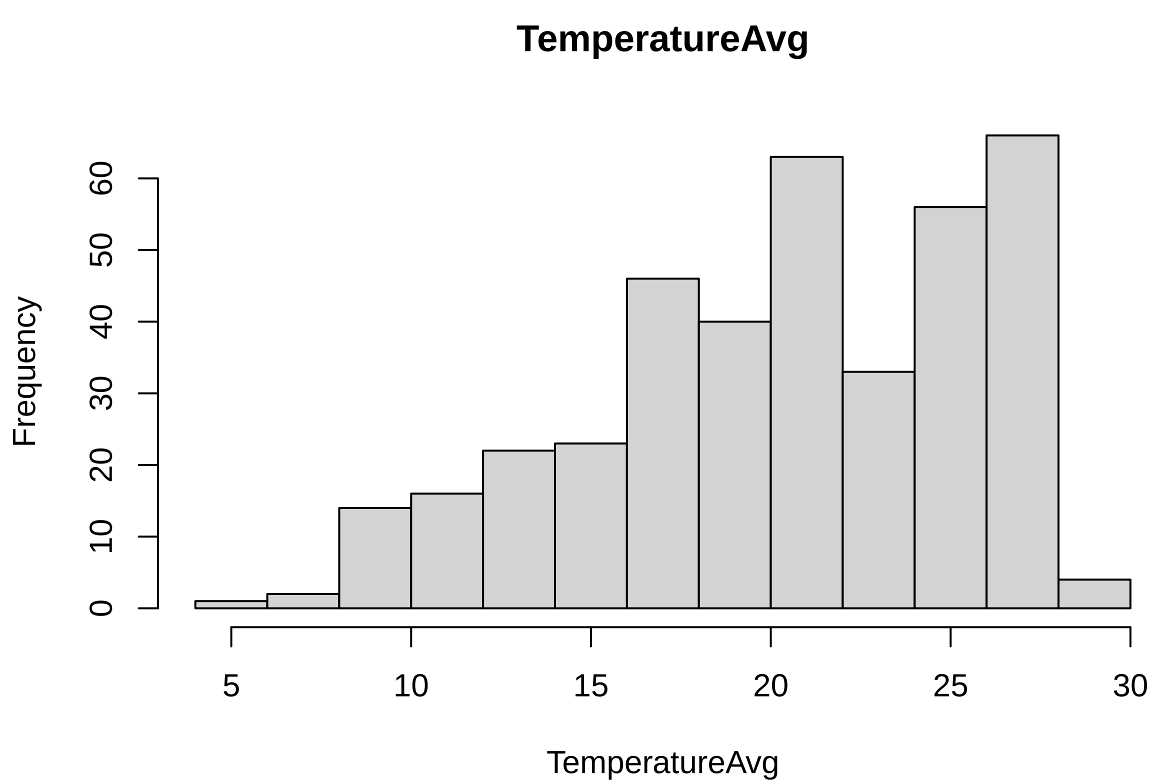
```
waterQuality_2019$NitrateMax         =as.numeric(waterQuality_2019$NitrateMax)
waterQuality_2019$FecalColiformMin   =as.numeric(waterQuality_2019$FecalColiformMin)
```

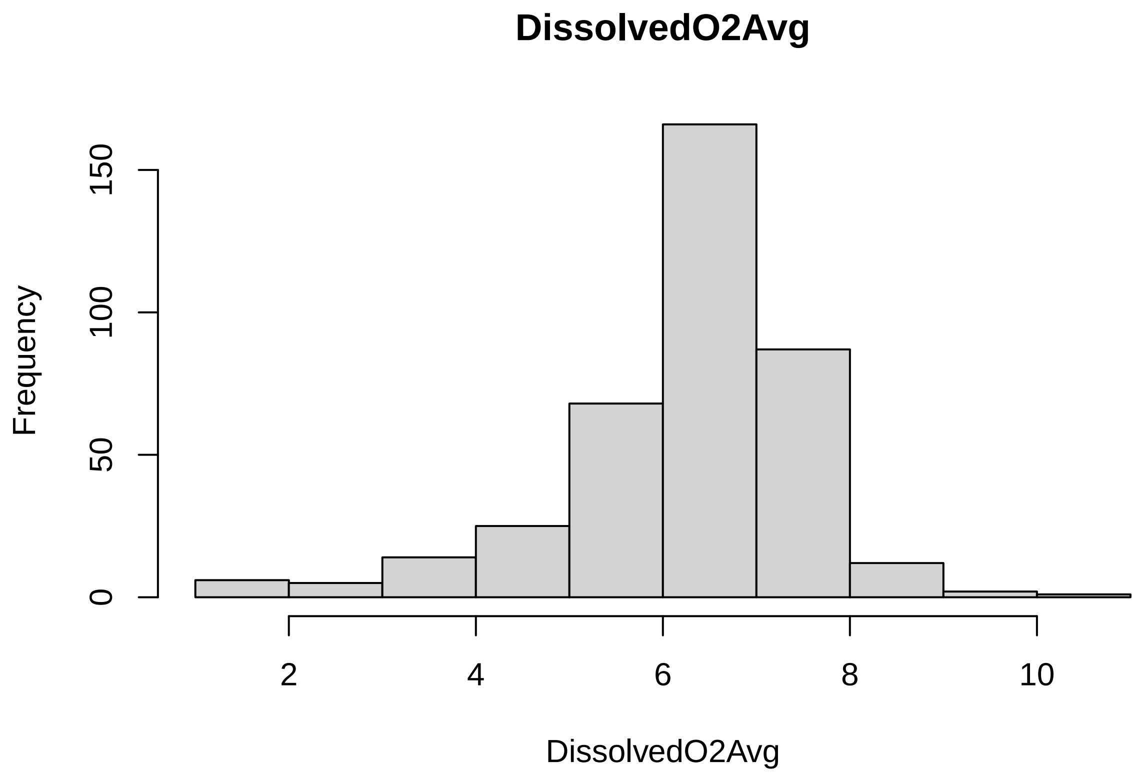
```
## Warning: NAs introduced by coercion
```

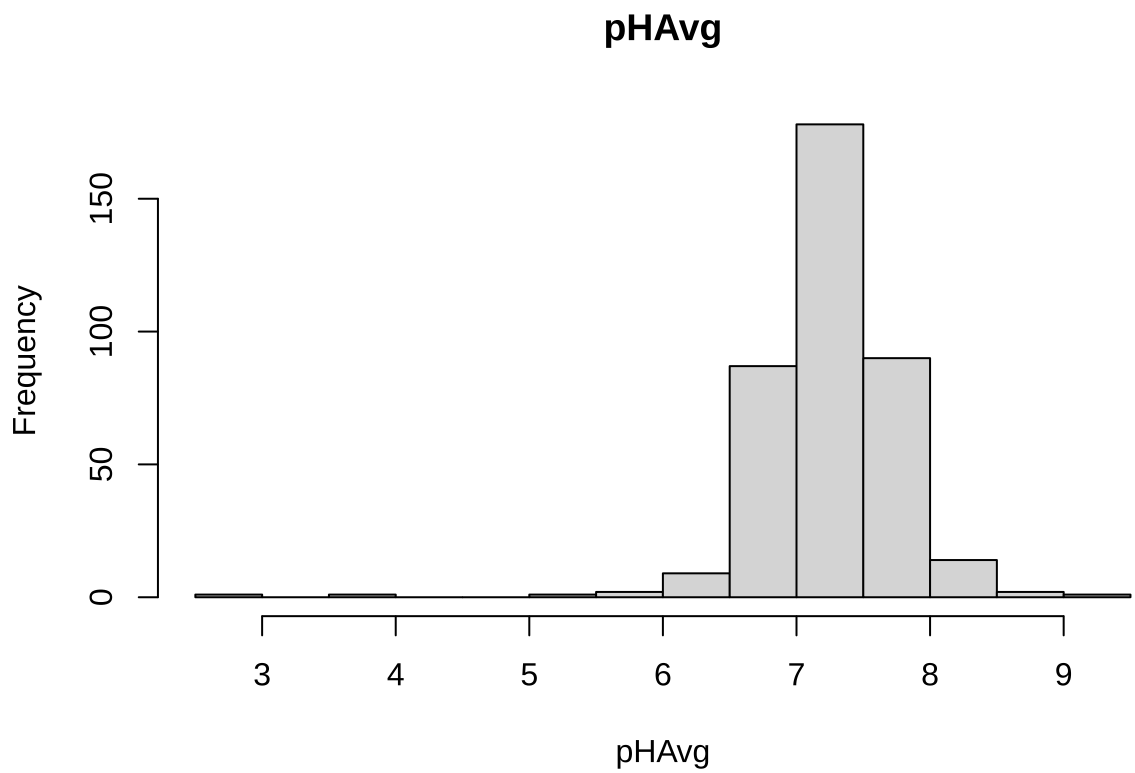
```
waterQuality_2019$FecalColiformMax   =as.numeric(waterQuality_2019$FecalColiformMax)
waterQuality_2019$TotalColiformMin   =as.numeric(waterQuality_2019$TotalColiformMin)
waterQuality_2019$TotalColiformMax   =as.numeric(waterQuality_2019$TotalColiformMax)
waterQuality_2019$NO2                =as.numeric(waterQuality_2019$NO2)
waterQuality_2019$PM10               =as.numeric(waterQuality_2019$PM10)

cols=c("TemperatureMin"
,"TemperatureMax"
,"DissolvedO2Min"
```

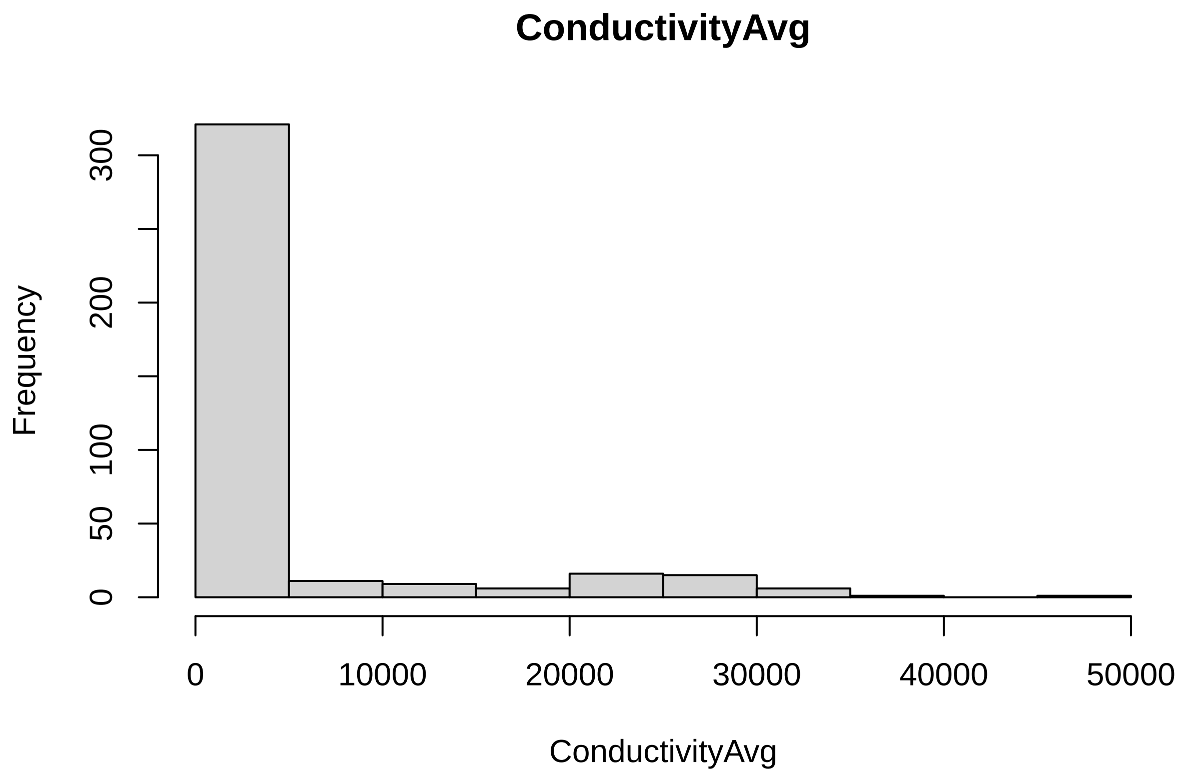
```
,"DissolvedO2Max"
,"pHMin"
,"pHMax"
,"ConductivityMin"
,"ConductivityMax"
,"BODMin"
,"BODMax"
,"NitrateMin"
,"NitrateMax"
,"FecalColiformMin"
,"FecalColiformMax"
,"TotalColiformMin"
,"TotalColiformMax"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

waterQuality_2019_Avg=waterQuality_2019


# Calculate the average values for each variable
waterQuality_2019_Avg$TemperatureAvg = (waterQuality_2019_Avg$TemperatureMin + waterQuality_2019_Avg$Te
waterQuality_2019_Avg$DissolvedO2Avg = (waterQuality_2019_Avg$DissolvedO2Min + waterQuality_2019_Avg$Di
waterQuality_2019_Avg$pHAvg = (waterQuality_2019_Avg$pHMin + waterQuality_2019_Avg$pHMax) / 2
waterQuality_2019_Avg$ConductivityAvg = (waterQuality_2019_Avg$ConductivityMin + waterQuality_2019_Avg$
waterQuality_2019_Avg$FecalColiformAvg = (waterQuality_2019_Avg$FecalColiformMin + waterQuality_2019_Av
waterQuality_2019_Avg$BODAvg = (waterQuality_2019_Avg$BODMin + waterQuality_2019_Avg$BODMax) / 2
waterQuality_2019_Avg$NitrateAvg = (waterQuality_2019_Avg$NitrateMin + waterQuality_2019_Avg$NitrateMax

waterQuality_2019_Avg$TotalColiformAvg = (waterQuality_2019_Avg$TotalColiformMin + waterQuality_2019_Av

waterQuality_2019_Avg = subset(waterQuality_2019_Avg,select=-c(TemperatureMin
,TemperatureMax
,DissolvedO2Min
,DissolvedO2Max
,pHMin
,pHMax
,ConductivityMin
,ConductivityMax
,BODMin
,BODMax
,NitrateMin
,NitrateMax
,FecalColiformMin
,FecalColiformMax
,TotalColiformMin
,TotalColiformMax))

numCols=c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
```

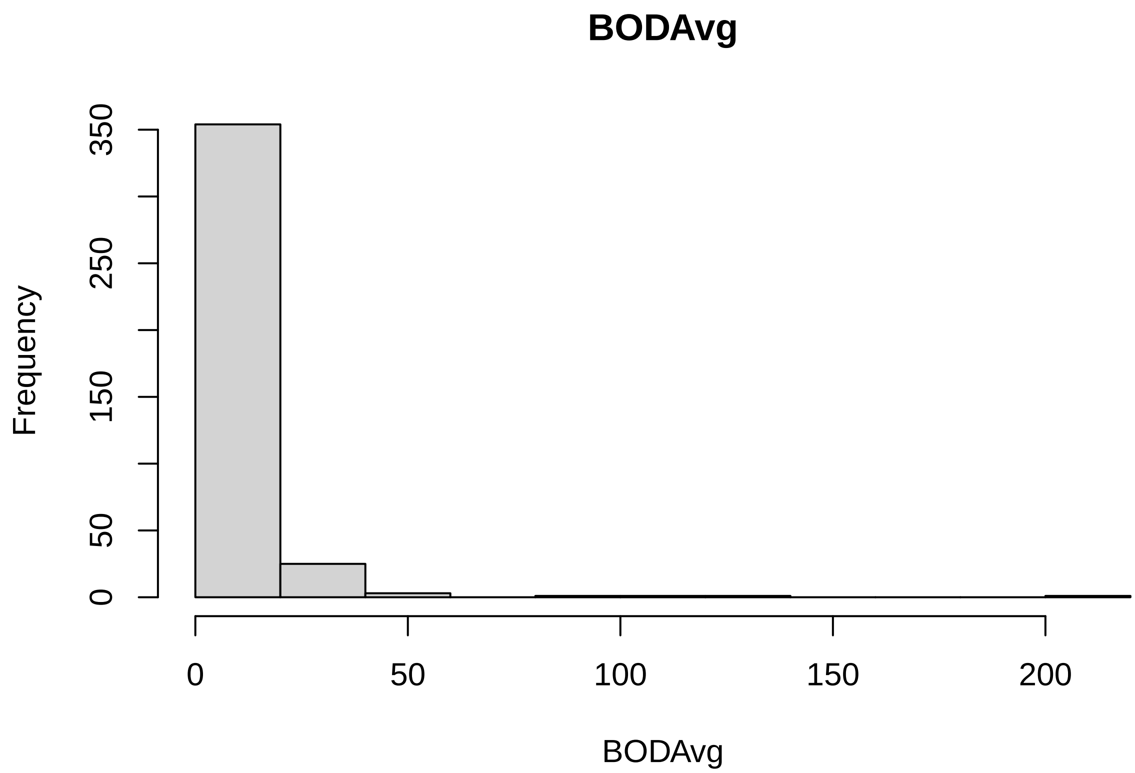
```
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

for (col in colnames(waterQuality_2019_Avg)) {
  # Check if column has any NAs
  if (sum(is.na(waterQuality_2019_Avg[, col])) > 0) {
    # Replace NAs with mean value of the column
    waterQuality_2019_Avg[is.na(waterQuality_2019_Avg[, col]), col] = mean(waterQuality_2019_Avg[, col]
  }
}


for (col in numCols) {
  # Create the histogram plot
  hist(waterQuality_2019_Avg[[col]], main = col, xlab = col)
}
```



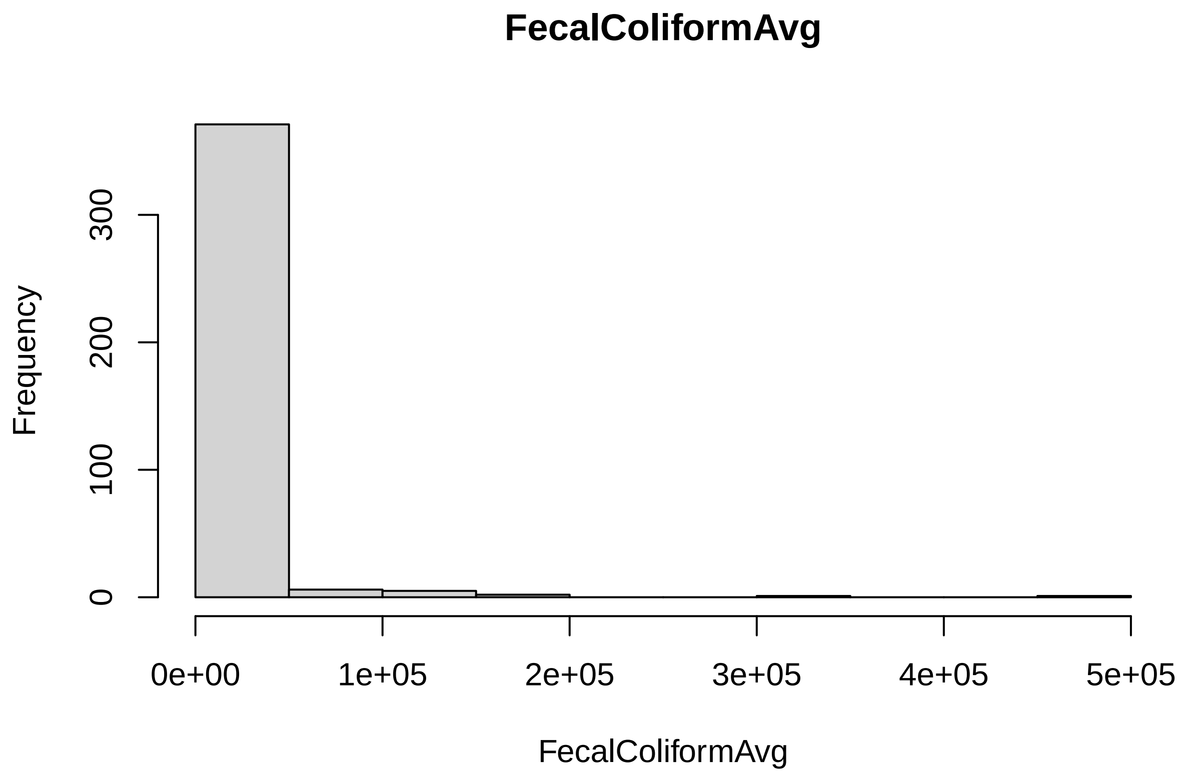

DissolvedO2Avg
Frequency
0
50
100
150
2
4
6
8
10
DissolvedO2Avg


pHAvg
Frequency
0
50
100
150
3
4
5
6
7
8
9
pHAvg

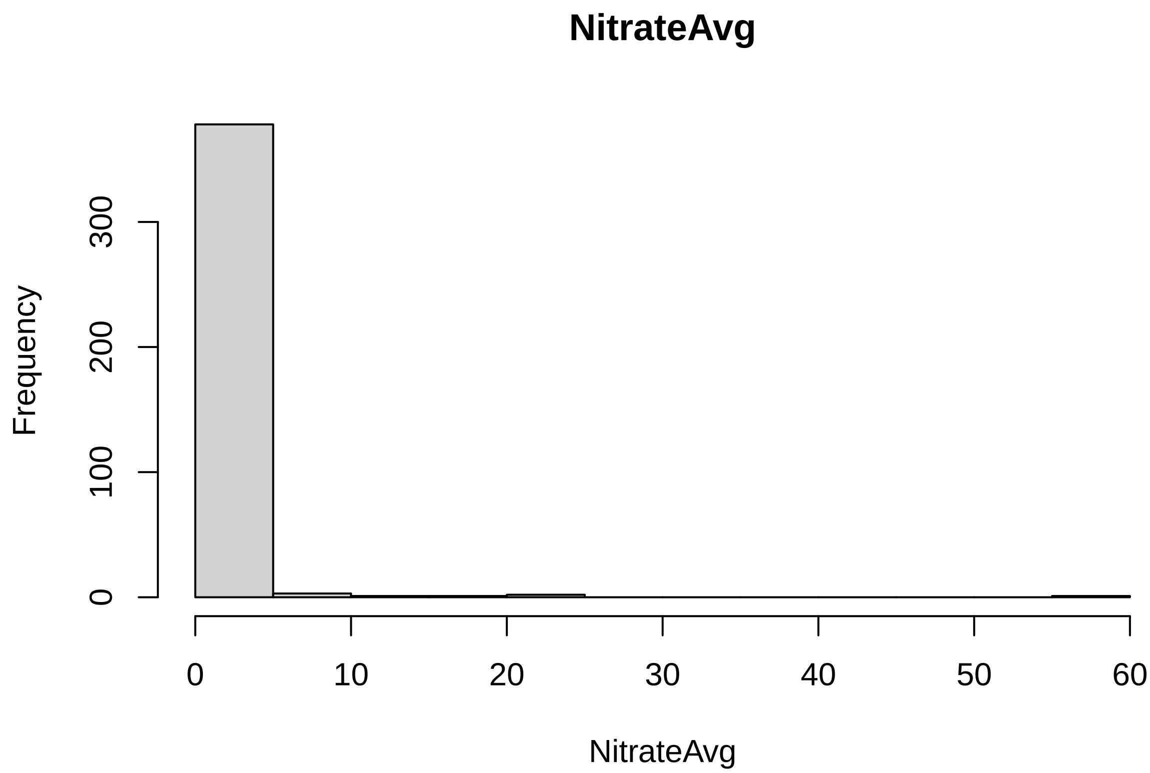

ConductivityAvg
Frequency
0
50
100
200
300
0
10000
20000
30000
40000
50000
ConductivityAvg

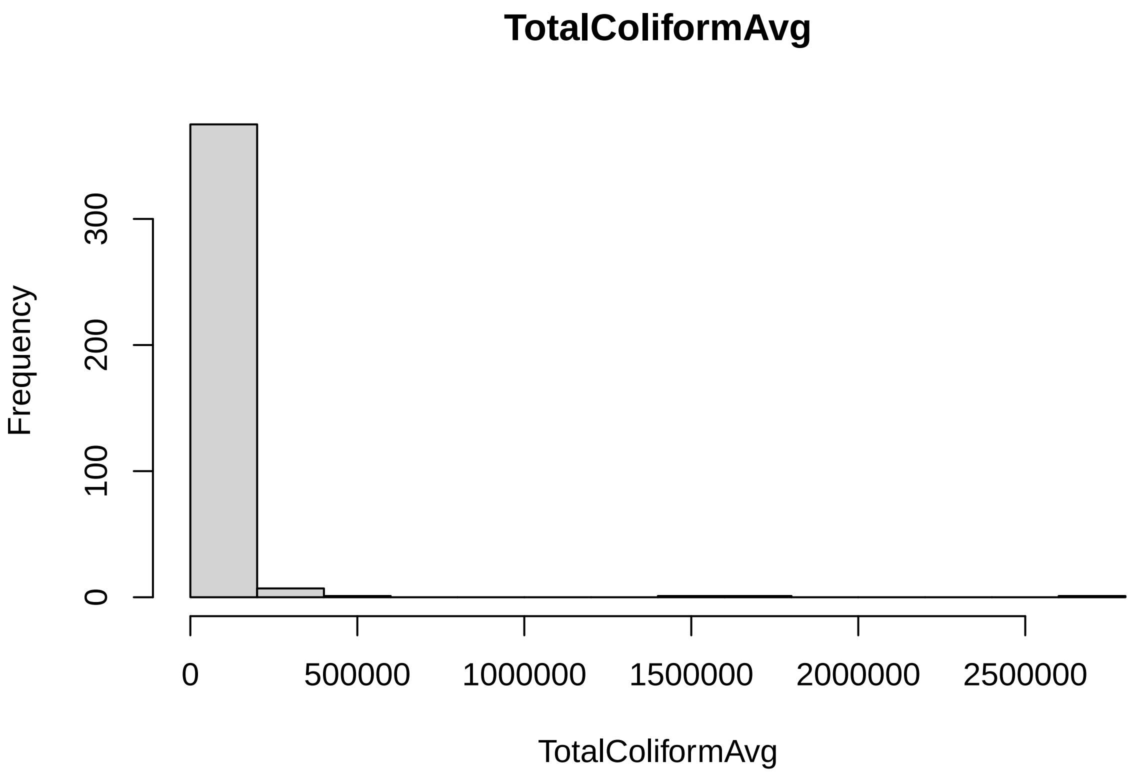


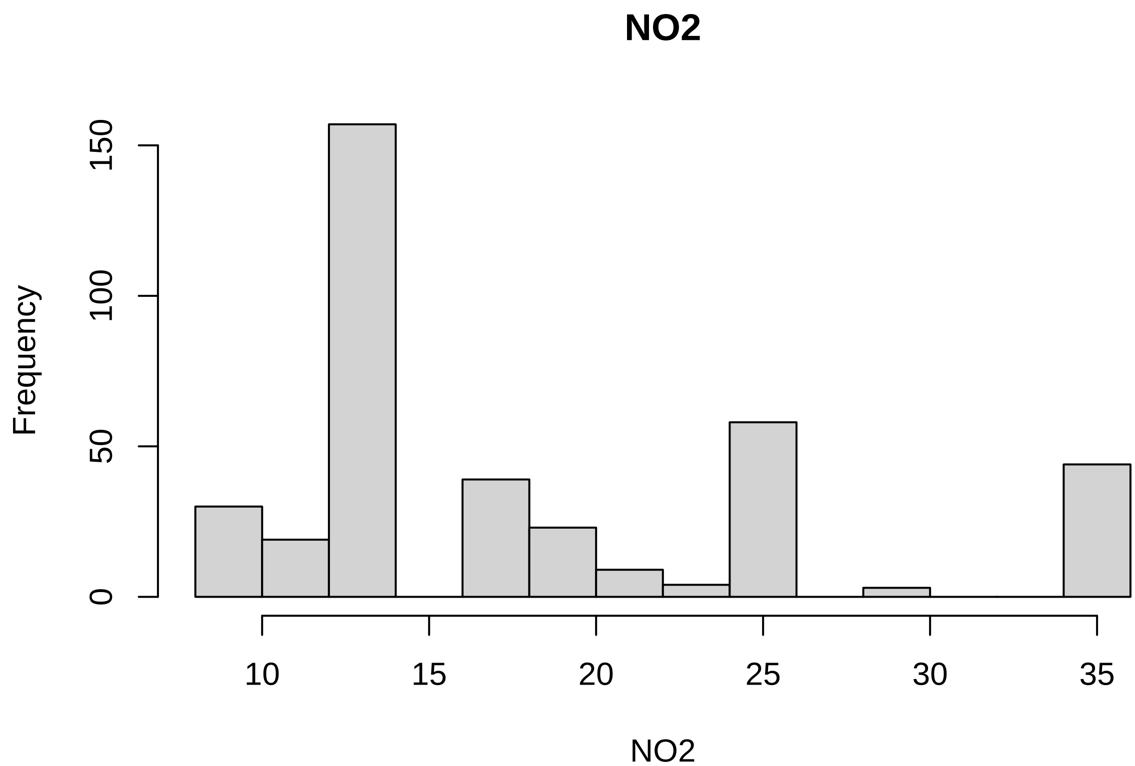
BODAvg
Frequency
0
50
150
250
350
0
50
100
150
200
BODAvg

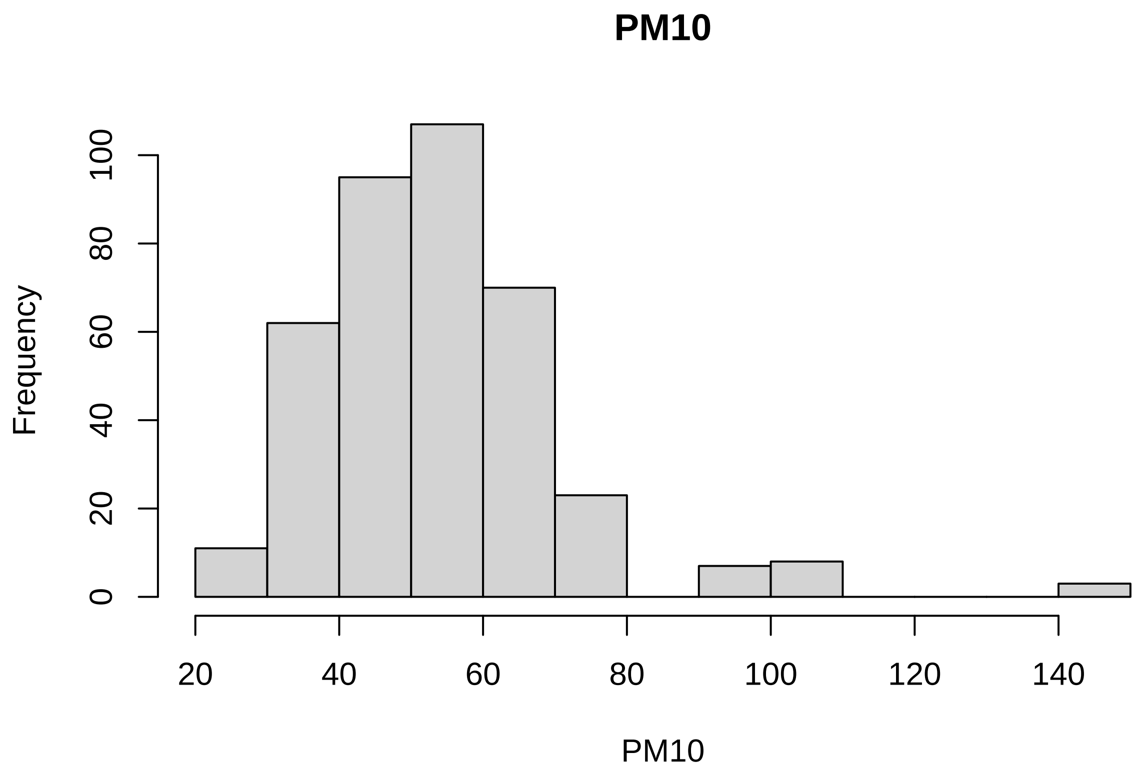


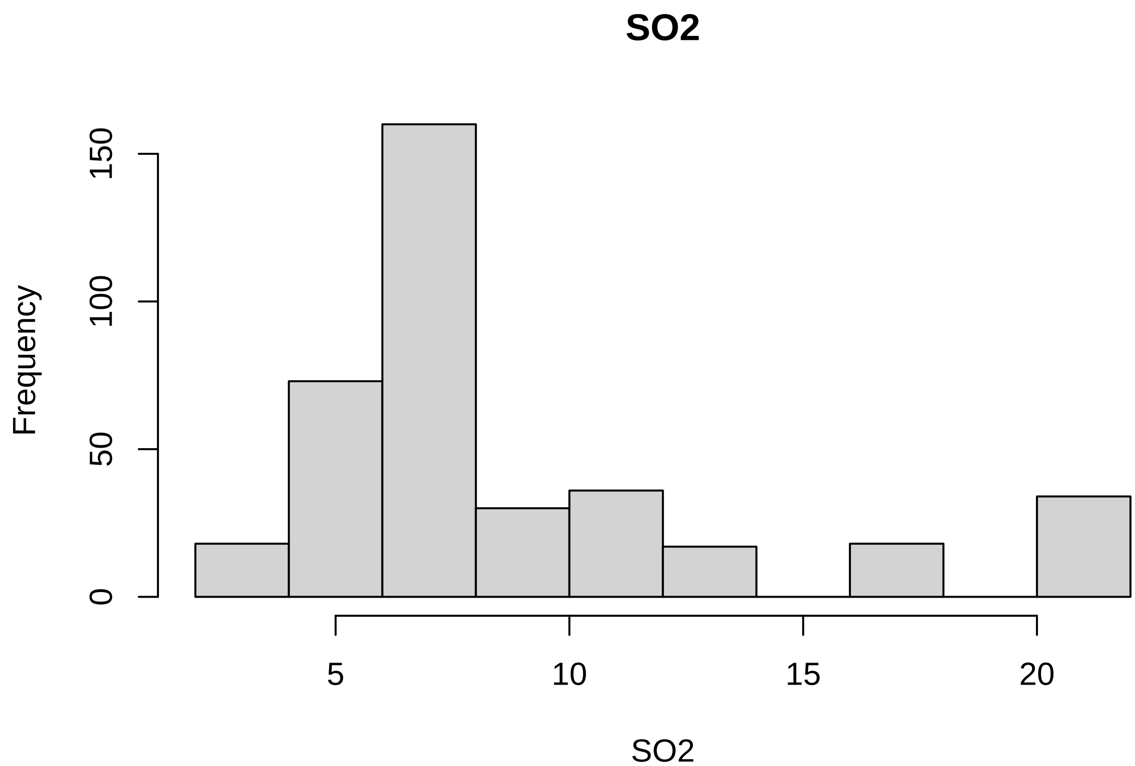
FecalColiformAvg
Frequency
0
100
200
300
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
FecalColiformAvg

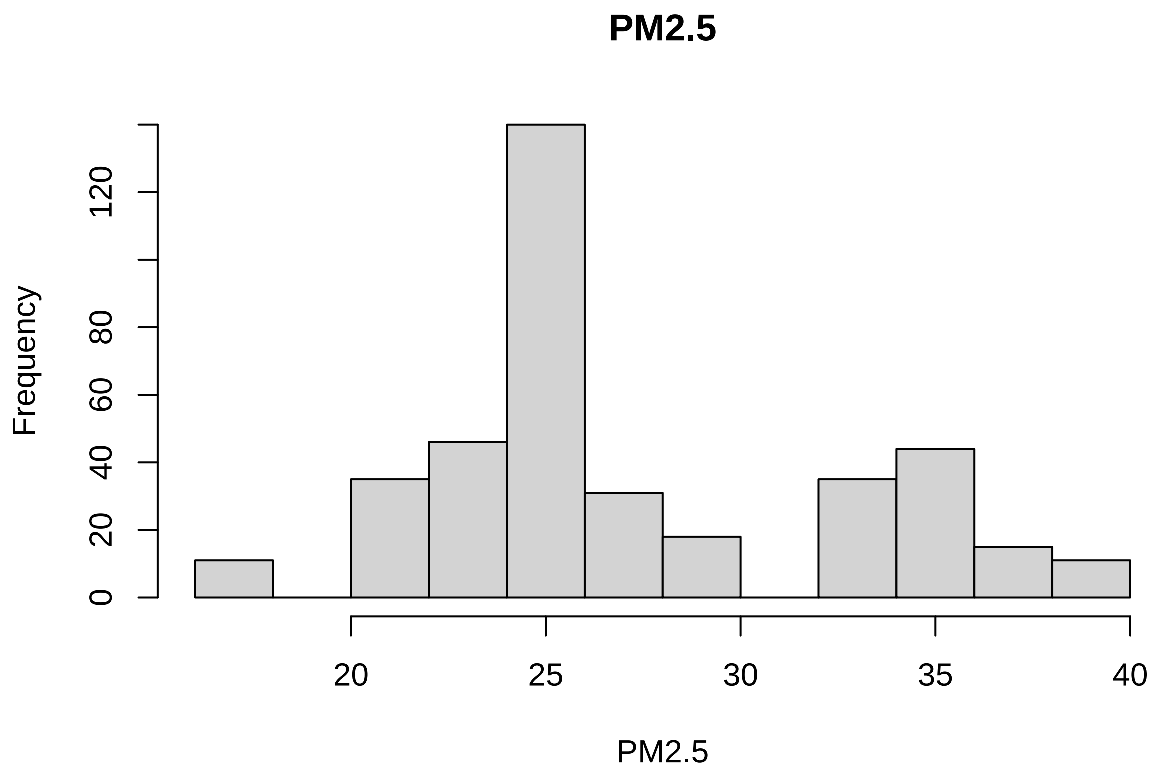

NitrateAvg
Frequency
0
100
200
300
0
10
20
30
40
50
60
NitrateAvg


TotalColiformAvg
Frequency
0
100
200
300
0
500000
1000000
1500000
2000000
2500000
TotalColiformAvg

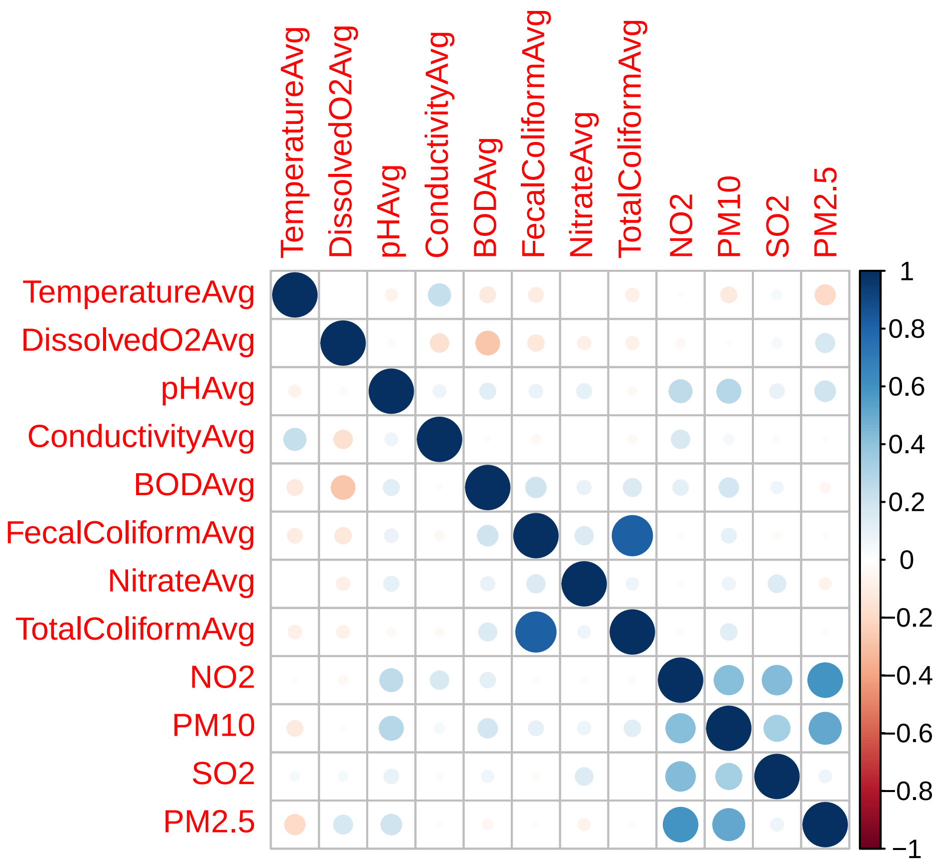

NO2
Frequency
0
50
100
150
10
15
20
25
30
35
NO2


PM10
Frequency
0
20
40
60
80
100
20
40
60
80
100
120
140
PM10


SO2
Frequency
0
50
100
150
5
10
15
20
SO2




```r
cov_mat = cov(waterQuality_2019_Avg[, numCols])

corr_matrix = cor(waterQuality_2019_Avg[, numCols])

library(corrplot)

corrplot(corr_matrix)
```




```
waterQuality_2019_Avg = aggregate(cbind(TemperatureAvg,
                          DissolvedO2Avg,
                          pHAvg,
                          ConductivityAvg,
                          BODAvg,
                          NitrateAvg,
                          TotalColiformAvg,
                          FecalColiformAvg,
                          NO2,
                          PM10,
                          SO2,
                          PM2.5) ~ State,
                    data = waterQuality_2019_Avg,
                    mean)

pca_data = waterQuality_2019_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"FecalColiformAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
```

```
,"PM2.5")]

# Center and scale the data
pca_data_scaled = scale(pca_data)

# Perform PCA
pca_result = princomp(pca_data_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(pca_data_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.9591177 1.5337974 1.2415924 1.1499651 0.85667074
## Proportion of Variance 0.3358374 0.2058468 0.1348858 0.1157117 0.06421492
## Cumulative Proportion  0.3358374 0.5416842 0.6765700 0.7922817 0.85649661
##                           Comp.6     Comp.7     Comp.8     Comp.9    Comp.10
## Standard deviation     0.7757489 0.59234968 0.53782571 0.47204624 0.35988834
## Proportion of Variance 0.0526563 0.03070184 0.02530994 0.01949742 0.01133297
## Cumulative Proportion  0.9091529 0.93985475 0.96516469 0.98466211 0.99599508
##                            Comp.11      Comp.12
## Standard deviation     0.211363704 3.310426e-02
## Proportion of Variance 0.003909029 9.589053e-05
## Cumulative Proportion  0.999904109 1.000000e+00
```

```
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

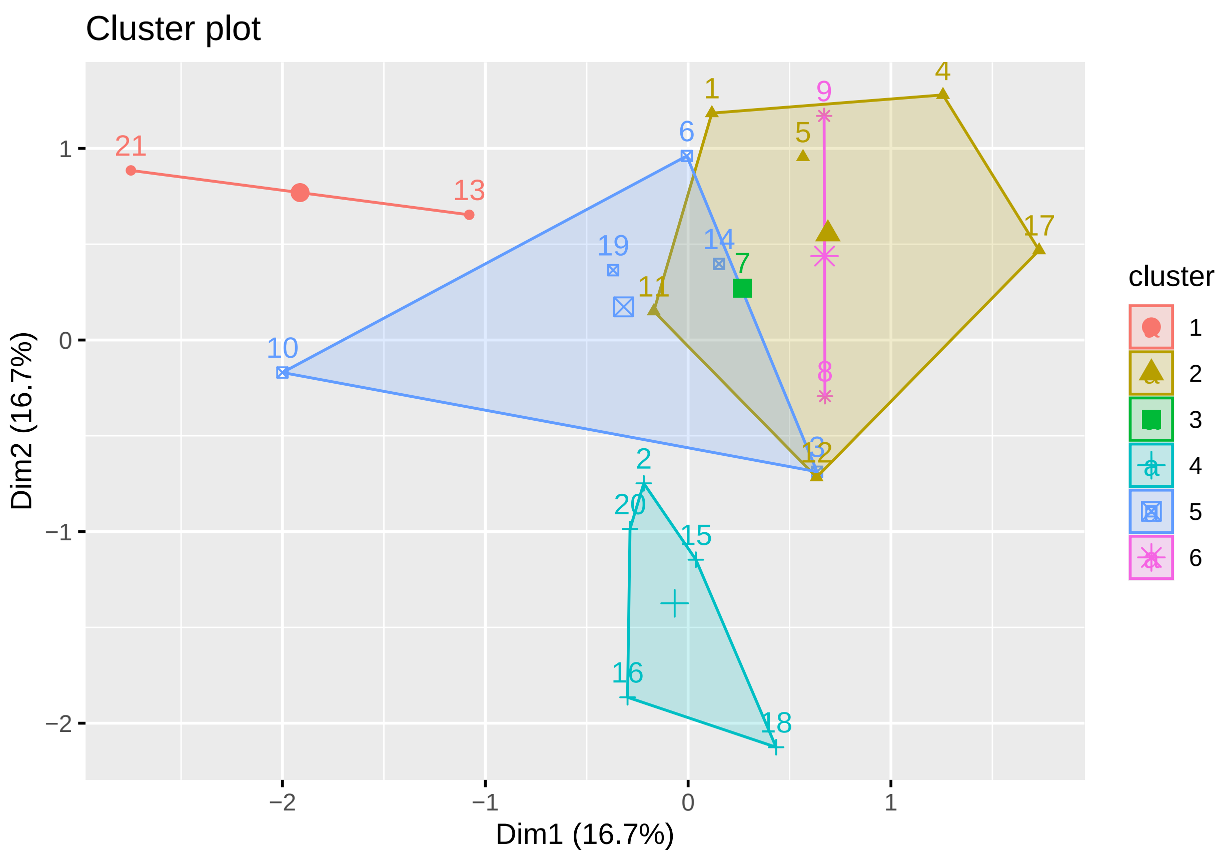
```
##       Comp.1       Comp.2       Comp.3       Comp.4       Comp.5       Comp.6
## 3.358374e-01 2.058468e-01 1.348858e-01 1.157117e-01 6.421492e-02 5.265630e-02
##       Comp.7       Comp.8       Comp.9      Comp.10      Comp.11      Comp.12
## 3.070184e-02 2.530994e-02 1.949742e-02 1.133297e-02 3.909029e-03 9.589053e-05
```

```
pc.comp = pca_result$scores

#88%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
```

```r
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5 = -1*pc.comp[,5]
pc.comp6 = -1*pc.comp[,6]

library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5,pc.comp6)

X
```

```
##          pc.comp1   pc.comp2    pc.comp3    pc.comp4    pc.comp5    pc.comp6
##  [1,] -0.42338677 -2.0254335 -0.57491156 -0.68866706  0.03373105  1.43162119
##  [2,] -0.37888806 -0.4746289  1.24046204  0.42583132  0.18335981  0.32185762
##  [3,] -0.34830087  1.8838367  0.08043478 -0.24484545  0.70502055 -0.70459974
##  [4,] -0.21798982 -1.3713559 -1.80033482 -1.53654833  0.62198003  0.34688459
##  [5,] -0.49460567 -2.2683292 -0.67350613 -0.94766986 -0.72837022 -0.34574849
##  [6,] -0.13382215 -0.1608466 -2.12270416 -0.02504963  0.25803396  0.02736947
##  [7,]  8.32240889 -0.2690643  0.32592711 -0.57922610 -0.66375870 -0.34073053
##  [8,] -0.83514275  1.7277293  2.24655363 -1.29845216 -0.70457648 -0.03909843
##  [9,] -0.79274782  3.6194762  0.50428580 -1.96831427 -0.83958331  0.50778820
## [10,] -0.01582507  2.4515910 -1.59968553  2.45858596 -0.34923191 -0.65323218
## [11,] -1.18225105 -0.7038423  0.42648292 -0.04523364 -0.40429086  0.25452729
## [12,] -1.08095855 -1.7533223  0.72723998 -0.20698773  0.16173433 -0.71202859
## [13,] -0.67864363 -0.3550360 -0.20032171  0.67392268 -0.09655650  1.60823225
## [14,]  0.03427609  0.6324116 -2.29854471  0.25074422  0.53846200 -0.82234761
## [15,] -1.15968825  0.4783996  0.62491103  0.61244026  0.59162588 -0.56796810
## [16,] -0.44031845 -0.9899853  2.40470688  1.00929472  0.21299758 -0.31398245
## [17,] -1.11213660 -0.5464175 -0.32296986 -1.94962905 -0.14655997 -1.06411691
## [18,]  1.59862214 -0.3123051  1.23966726  0.87277496  2.44775668  0.53628133
## [19,]  0.34047593  2.2236797 -0.51635803  0.13773215  0.62845047  1.12655113
## [20,] -0.87605482 -1.0740455  0.43837398  0.94644462 -0.26648514 -1.25311543
## [21,] -0.12502271 -0.7125117 -0.14970890  2.10285240 -2.18373925  0.65585541
```

```r
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2019_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2019_Avg$State,waterQuality_2019_Avg$cluster)
```

```
##
##                                                 1 2 3 4 5 6
##    ANDHRA PRADESH                               0 1 0 0 0 0
##    ASSAM                                        0 0 0 1 0 0
##    BIHAR                                        0 0 0 0 1 0
##    DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI  0 1 0 0 0 0
##    GOA                                          0 1 0 0 0 0
##    GUJARAT                                      0 0 0 0 1 0
##    HARYANA                                      0 0 1 0 0 0
##    HIMACHAL\r\nPRADESH                          0 0 0 0 0 1
##    JAMMU &\r\nKASHMIR                           0 0 0 0 0 1
##    JHARKHAND                                    0 0 0 0 1 0
##    KARNATAKA                                    0 1 0 0 0 0
##    KERALA                                       0 1 0 0 0 0
##    MADHYA PRADESH                               1 0 0 0 0 0
##    MAHARASHTRA                                  0 0 0 0 1 0
##    MANIPUR                                      0 0 0 1 0 0
##    MEGHALAYA                                    0 0 0 1 0 0
##    PUDUCHERRY                                   0 1 0 0 0 0
##    PUNJAB                                       0 0 0 1 0 0
##    RAJASTHAN                                    0 0 0 0 1 0
```

```
##   TAMIL NADU                                      0 0 0 1 0 0
##   TRIPURA                                         1 0 0 0 0 0
```

```
waterQuality_2019_Avg
```

```
##                                            State TemperatureAvg DissolvedO2Avg
## 1                                 ANDHRA PRADESH       23.09091       6.513636
## 2                                          ASSAM       18.37500       6.076481
## 3                                          BIHAR       19.25000       6.025000
## 4  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI       27.94444       5.627778
## 5                                            GOA       27.03846       6.627379
## 6                                        GUJARAT       25.11111       6.273393
## 7                                        HARYANA       19.53381       4.565461
## 8                         HIMACHAL\r\nPRADESH       13.15694       8.060000
## 9                           JAMMU &\r\nKASHMIR       19.66667       8.166667
## 10                                     JHARKHAND       14.31250       6.795231
## 11                                     KARNATAKA       25.00000       6.988889
## 12                                        KERALA       24.36986       6.021918
## 13                                MADHYA PRADESH       21.24444       6.772222
## 14                                   MAHARASHTRA       22.05556       6.221491
## 15                                       MANIPUR       17.18750       6.806250
## 16                                     MEGHALAYA       13.31667       6.276667
## 17                                    PUDUCHERRY       27.25000       6.625000
## 18                                        PUNJAB       13.11588       4.181086
## 19                                     RAJASTHAN       16.83333       6.311846
## 20                                    TAMIL NADU       24.50000       6.200000
## 21                                       TRIPURA       21.00000       6.975000
##       pHAvg ConductivityAvg    BODAvg NitrateAvg TotalColiformAvg
## 1  7.722727      10041.3182  2.386364  1.8500000        430.09091
## 2  7.325000        183.4531  5.896875  1.5500000       7532.58286
## 3  7.650000        484.3750  2.637500  0.1850000      49825.00000
## 4  7.838889      12905.2778  6.438789  1.1500000        363.61111
## 5  7.044231      12424.5000  6.956138  1.6460675      13856.75000
## 6  7.655556       9185.3889 14.330556  0.3913889        450.86111
## 7  7.850000       4463.2500 60.656250  5.8456515     723425.00000
## 8  7.700000        955.2000  1.103333  0.6720424     106913.13333
## 9  8.150000        141.0000  4.704092  0.8134746      28351.32574
## 10 7.193750       2555.8704  2.968750  1.2152119      14691.28787
## 11 7.377778        213.8889  3.738889  0.5527778        716.94444
## 12 6.959589       4114.8630  1.734247  0.6756849       6551.45890
## 13 7.850000        544.1111  1.644444  0.7766667         83.16667
## 14 7.420833       9562.8611  6.719444  1.6025177       2167.48611
## 15 7.278125        373.2656  3.468750  0.1050132        233.26562
## 16 6.900000        188.1000  8.253333  0.7841667      38921.58333
## 17 7.575000       8045.0000  5.242103  0.3225000      28351.32574
## 18 7.571875        890.3125 30.125000  1.1868750      42156.25000
## 19 8.116667        616.6667  6.956138  1.8800000         75.33333
## 20 6.675000        438.1429  5.872241  0.9825000         73.07143
## 21 7.111538        146.0962  1.598077  3.2169231        209.23077
##    FecalColiformAvg       NO2      PM10      SO2    PM2.5 cluster
## 1         653.05743 17.562500  28.25000 7.125000 17.56250       2
## 2        1346.43750 13.429487  58.08731 7.089744 25.67907       4
## 3       12306.25000 22.136364  94.04545 8.818922 39.12783       5
## 4         279.05556 18.052259  55.41188 8.969022 27.37201       2
```

```
## 5       8883.42814 13.411765  59.06424  7.021524 21.26011       2
## 6        653.14621 24.562963  67.99259 16.120823 29.08395       5
## 7     126268.75000 24.576923  78.03846 12.346154 26.32933       3
## 8      23406.66667 11.119048  71.55952  2.226190 36.89954       6
## 9       7069.63172 18.000000 148.66667  4.000000 39.28123       6
## 10      1851.78293 34.255556 104.85260 21.177778 35.46457       5
## 11       195.22222 17.102624  47.58049  7.824026 24.67611       2
## 12      3381.01370 12.891386  43.55600  4.900582 24.99776       2
## 13        13.33333 20.947368  40.36842 13.243725 20.94737       1
## 14       211.97222 34.694938  67.94619 11.944126 35.15770       5
## 15       252.44162 24.231229  38.50000  7.254072 32.64061       4
## 16     16453.51667  9.928571  39.37500  6.562912 23.85490       4
## 17      7069.63172 11.500000  41.83333  6.500000 39.28123       2
## 18     11884.37500 17.832208  67.48132  7.546342 23.52170       4
## 19        44.00000 28.032680  99.91756  9.937908 32.46874       5
## 20       532.40227 18.052259  55.41188  8.969022 27.37201       4
## 21       109.73077 13.000000  55.75000 21.000000 24.25000       1
```

```
Result_2019= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_group$Di


Result_2019$Rank=c("A", "B", "C", "D", "E","F")

class(Result_2019$cluster)
```

```
## [1] "integer"
```

```
class(waterQuality_2019_Avg$cluster)
```

```
## [1] "integer"
```

```
WaterAir2019 = merge(waterQuality_2019_Avg, Result_2019[,c("cluster","Rank")], by = "cluster", all.x = 

WaterQualityAlone = waterQuality_2019_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
)]

# Center and scale the data
WaterQualityAlone_scaled = scale(WaterQualityAlone)

# Perform PCA
pca_result = princomp(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```r
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.9314039 1.2660204 0.9991275 0.8088802 0.54596668
## Proportion of Variance 0.4896046 0.2103685 0.1310211 0.0858752 0.03912295
## Cumulative Proportion  0.4896046 0.6999731 0.8309942 0.9168694 0.95599235
##                            Comp.6      Comp.7       Comp.8
## Standard deviation     0.52287086 0.243055773 0.0531629572
## Proportion of Variance 0.03588295 0.007753739 0.0003709519
## Cumulative Proportion  0.99187531 0.999629048 1.0000000000
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

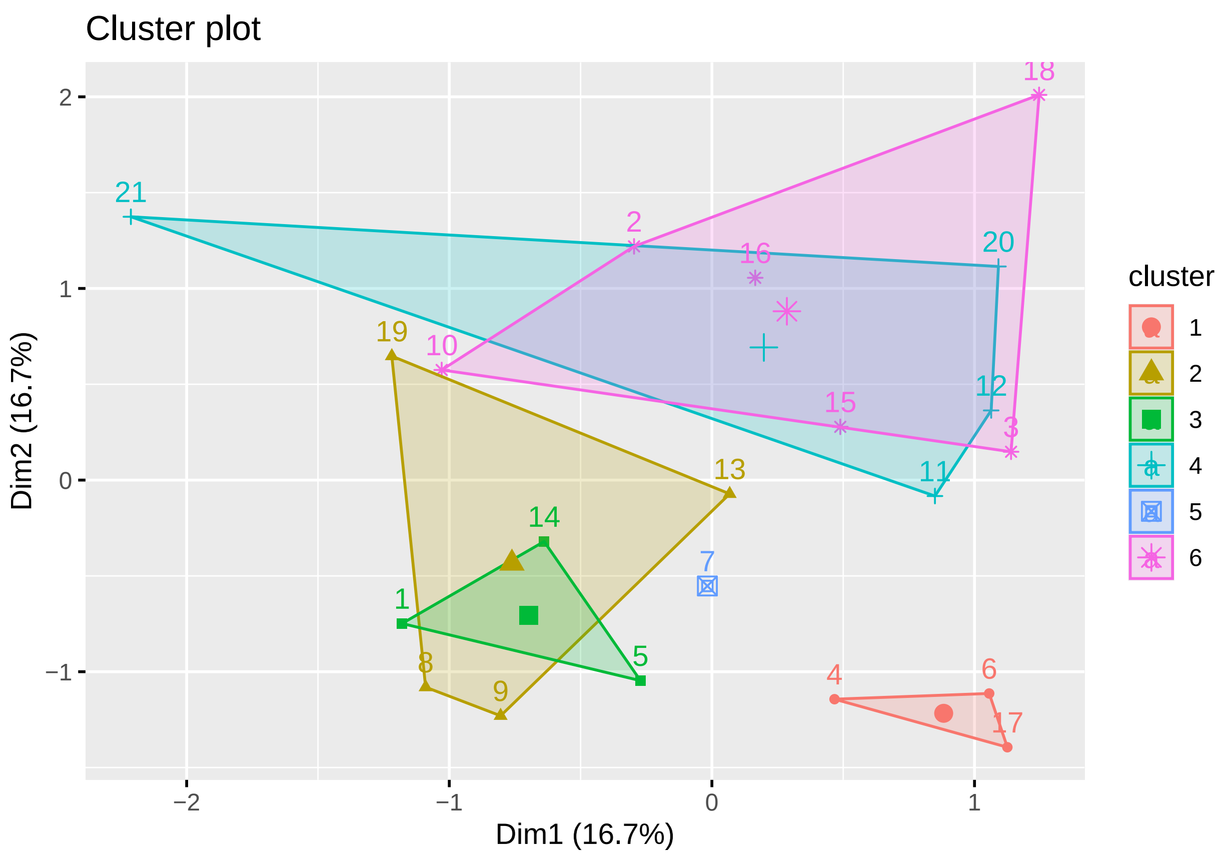
```
##       Comp.1       Comp.2       Comp.3       Comp.4       Comp.5       Comp.6
## 0.4896046178 0.2103685117 0.1310210803 0.0858751954 0.0391229493 0.0358829543
##       Comp.7       Comp.8
## 0.0077537393 0.0003709519
```

```r
pc.comp = pca_result$scores

#86%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5= -1*pc.comp[,5]
pc.comp6 = -1*pc.comp[,6]

library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5,pc.comp6)

X
```

```
##          pc.comp1    pc.comp2     pc.comp3    pc.comp4    pc.comp5    pc.comp6
##   [1,] -0.34728680 -1.34440233 -0.746219355  0.05835626  0.81772745 -0.20617820
##   [2,] -0.23833725  0.77806745  0.602221042  0.20380588  0.08273259 -0.52722422
```

```
##  [3,] -0.38408005  0.69535336 -0.176143796  0.67910553 -0.65856585  0.19116206
##  [4,] -0.16817015 -2.62096089 -0.644227553  0.89215648  0.13338708 -0.08649049
##  [5,] -0.37335127 -2.24751562  0.622741193 -0.86382861  0.54465596  0.38123481
##  [6,] -0.38599110 -1.50357715 -0.425181030  0.60665793 -0.24799552  0.45321485
##  [7,]  8.27905361 -0.14137056 -0.217875137 -0.76360684 -0.27470566  0.08706358
##  [8,] -0.48311166  1.88937315 -1.316522857 -0.85623520  0.42701263  0.99556716
##  [9,] -0.84392272  1.04694015 -2.283833009 -0.56606728 -0.36281708 -0.05268209
## [10,] -0.63312135  1.14403389  0.484222036 -0.19518746  0.86599264  0.34219530
## [11,] -1.10200837  0.03292164 -0.007927365 -0.55060409 -1.02166839 -0.27885714
## [12,] -0.82656392 -0.65937084  1.285415761 -0.22122216 -0.44330243  0.07580659
## [13,] -0.81745709  0.48148115 -0.943163037  0.21336838 -0.49919327 -0.41895092
## [14,] -0.25757361 -1.17738510  0.099152089  0.15675990  0.77344026  0.06011281
## [15,] -1.09926888  1.11099797  0.329715777  0.03072848 -0.18452860  0.47677292
## [16,] -0.16739889  1.59739337  1.425584053 -0.05577068  0.36983753  0.70668287
## [17,] -0.72616325 -1.53527188 -0.477006451 -0.08982932 -0.60512831  0.40627864
## [18,]  1.62709870  1.08876628  1.071241360  2.49495318  0.10177291 -0.06117025
## [19,]  0.06375282  0.96955388 -1.250357839  0.85589813  0.34494006 -0.90269613
## [20,] -0.81851282 -0.10756720  1.943317942 -0.70009862 -0.74045197 -0.27935766
## [21,] -0.29758594  0.50253930  0.624846179 -1.32933988  0.57685797 -1.36248448
```

```r
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2019_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2019_Avg$State,waterQuality_2019_Avg$cluster)
```

```
##
##                                                 1 2 3 4 5 6
##    ANDHRA PRADESH                               0 0 1 0 0 0
##    ASSAM                                        0 0 0 0 0 1
##    BIHAR                                        0 0 0 0 0 1
##    DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI  1 0 0 0 0 0
##    GOA                                          0 0 1 0 0 0
##    GUJARAT                                      1 0 0 0 0 0
##    HARYANA                                      0 0 0 0 1 0
##    HIMACHAL\r\nPRADESH                          0 1 0 0 0 0
##    JAMMU &\r\nKASHMIR                           0 1 0 0 0 0
##    JHARKHAND                                    0 0 0 0 0 1
##    KARNATAKA                                    0 0 0 1 0 0
##    KERALA                                       0 0 0 1 0 0
##    MADHYA PRADESH                               0 1 0 0 0 0
##    MAHARASHTRA                                  0 0 1 0 0 0
##    MANIPUR                                      0 0 0 0 0 1
##    MEGHALAYA                                    0 0 0 0 0 1
##    PUDUCHERRY                                   1 0 0 0 0 0
##    PUNJAB                                       0 0 0 0 0 1
##    RAJASTHAN                                    0 1 0 0 0 0
```

```
##   TAMIL NADU                                          0 0 0 1 0 0
##   TRIPURA                                             0 0 0 1 0 0
```

```
WaterQualityAlone
```

```
##    TemperatureAvg DissolvedO2Avg    pHAvg ConductivityAvg    BODAvg
## 1        23.09091       6.513636 7.722727      10041.3182  2.386364
## 2        18.37500       6.076481 7.325000        183.4531  5.896875
## 3        19.25000       6.025000 7.650000        484.3750  2.637500
## 4        27.94444       5.627778 7.838889      12905.2778  6.438789
## 5        27.03846       6.627379 7.044231      12424.5000  6.956138
## 6        25.11111       6.273393 7.655556       9185.3889 14.330556
## 7        19.53381       4.565461 7.850000       4463.2500 60.656250
## 8        13.15694       8.060000 7.700000        955.2000  1.103333
## 9        19.66667       8.166667 8.150000        141.0000  4.704092
## 10       14.31250       6.795231 7.193750       2555.8704  2.968750
## 11       25.00000       6.988889 7.377778        213.8889  3.738889
## 12       24.36986       6.021918 6.959589       4114.8630  1.734247
## 13       21.24444       6.772222 7.850000        544.1111  1.644444
## 14       22.05556       6.221491 7.420833       9562.8611  6.719444
## 15       17.18750       6.806250 7.278125        373.2656  3.468750
## 16       13.31667       6.276667 6.900000        188.1000  8.253333
## 17       27.25000       6.625000 7.575000       8045.0000  5.242103
## 18       13.11588       4.181086 7.571875        890.3125 30.125000
## 19       16.83333       6.311846 8.116667        616.6667  6.956138
## 20       24.50000       6.200000 6.675000        438.1429  5.872241
## 21       21.00000       6.975000 7.111538        146.0962  1.598077
##    FecalColiformAvg NitrateAvg TotalColiformAvg
## 1         653.05743  1.8500000        430.09091
## 2        1346.43750  1.5500000       7532.58286
## 3       12306.25000  0.1850000      49825.00000
## 4         279.05556  1.1500000        363.61111
## 5        8883.42814  1.6460675      13856.75000
## 6         653.14621  0.3913889        450.86111
## 7      126268.75000  5.8456515     723425.00000
## 8       23406.66667  0.6720424     106913.13333
## 9        7069.63172  0.8134746      28351.32574
## 10       1851.78293  1.2152119      14691.28787
## 11        195.22222  0.5527778        716.94444
## 12       3381.01370  0.6756849       6551.45890
## 13         13.33333  0.7766667         83.16667
## 14        211.97222  1.6025177       2167.48611
## 15        252.44162  0.1050132        233.26562
## 16      16453.51667  0.7841667      38921.58333
## 17       7069.63172  0.3225000      28351.32574
## 18      11884.37500  1.1868750      42156.25000
## 19         44.00000  1.8800000         75.33333
## 20        532.40227  0.9825000         73.07143
## 21        109.73077  3.2169231        209.23077
```

```
Result_2019_water= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_gro
```

```r
Result_2019_water$Rank=c("A", "B", "C", "D", "E","F")

class(waterQuality_2019_Avg$cluster)
```

```
## [1] "integer"
```

```r
class(waterQuality_2019_Avg$cluster)
```

```
## [1] "integer"
```

```r
Water2019 = merge(waterQuality_2019_Avg, Result_2019_water[,c("cluster","Rank")], by = "cluster", all.x
```

```r
waterQuality_2020=finalDataset[finalDataset$year == 2020,]
waterQuality_2020$TemperatureMin     =as.numeric(waterQuality_2020$TemperatureMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$TemperatureMax     =as.numeric(waterQuality_2020$TemperatureMin)
waterQuality_2020$DissolvedO2Min     =as.numeric(waterQuality_2020$DissolvedO2Min)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$DissolvedO2Max     =as.numeric(waterQuality_2020$DissolvedO2Max)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$pHMin              =as.numeric(waterQuality_2020$pHMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$pHMax              =as.numeric(waterQuality_2020$pHMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$ConductivityMin    =as.numeric(waterQuality_2020$ConductivityMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$ConductivityMax    =as.numeric(waterQuality_2020$ConductivityMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$BODMin             =as.numeric(waterQuality_2020$BODMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$BODMax              =as.numeric(waterQuality_2020$BODMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$NitrateMin          =as.numeric(waterQuality_2020$NitrateMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$NitrateMax          =as.numeric(waterQuality_2020$NitrateMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$FecalColiformMin   =as.numeric(waterQuality_2020$FecalColiformMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$FecalColiformMax   =as.numeric(waterQuality_2020$FecalColiformMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2020$TotalColiformMin   =as.numeric(waterQuality_2020$TotalColiformMin)
```

```
## Warning: NAs introduced by coercion
```

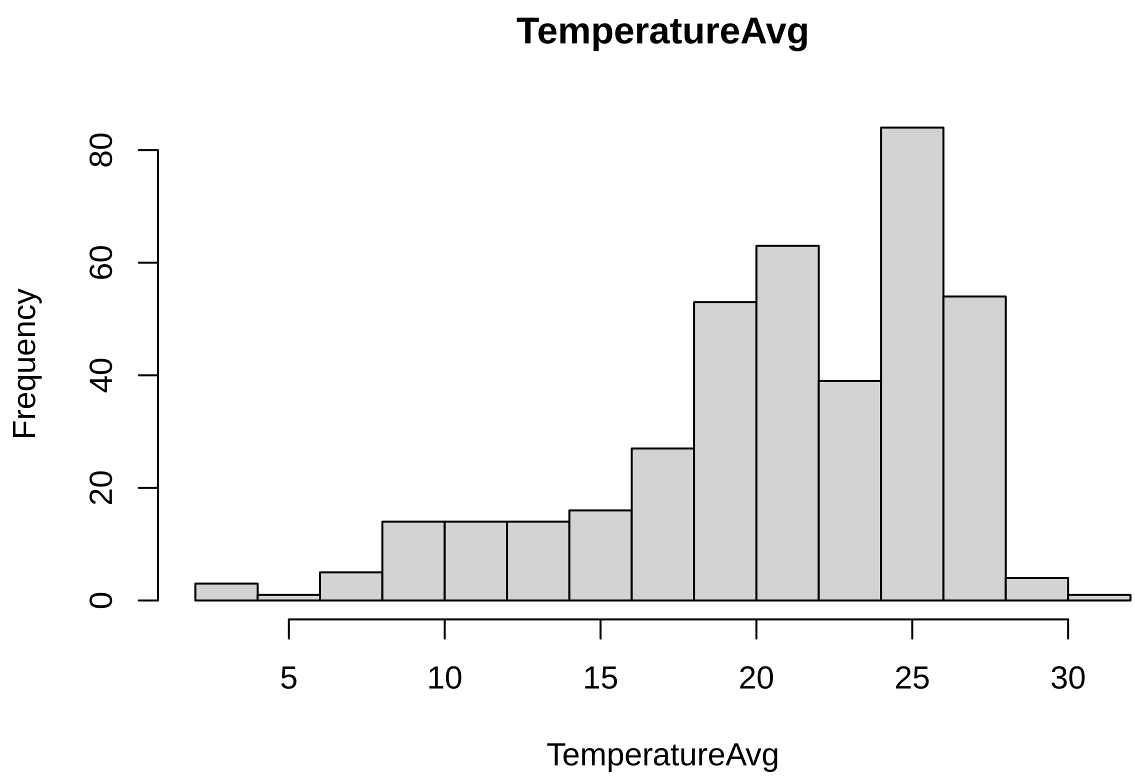
```r
waterQuality_2020$TotalColiformMax   =as.numeric(waterQuality_2020$TotalColiformMax)
```

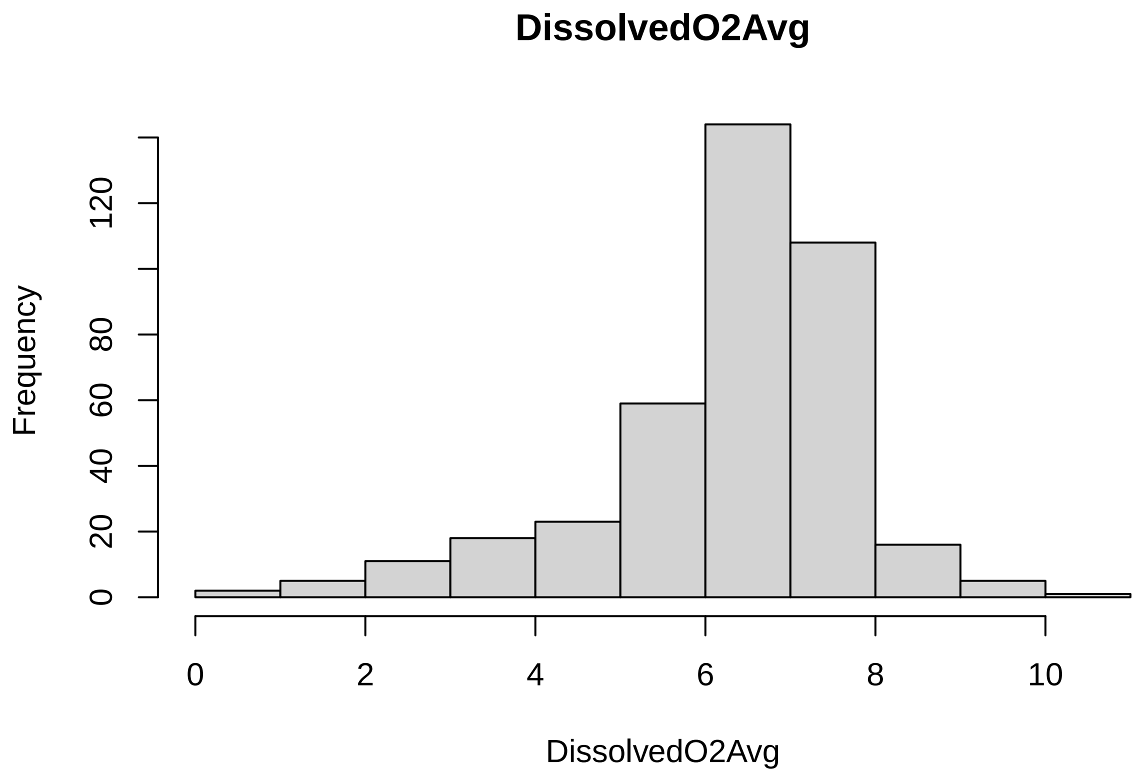
```
## Warning: NAs introduced by coercion
```

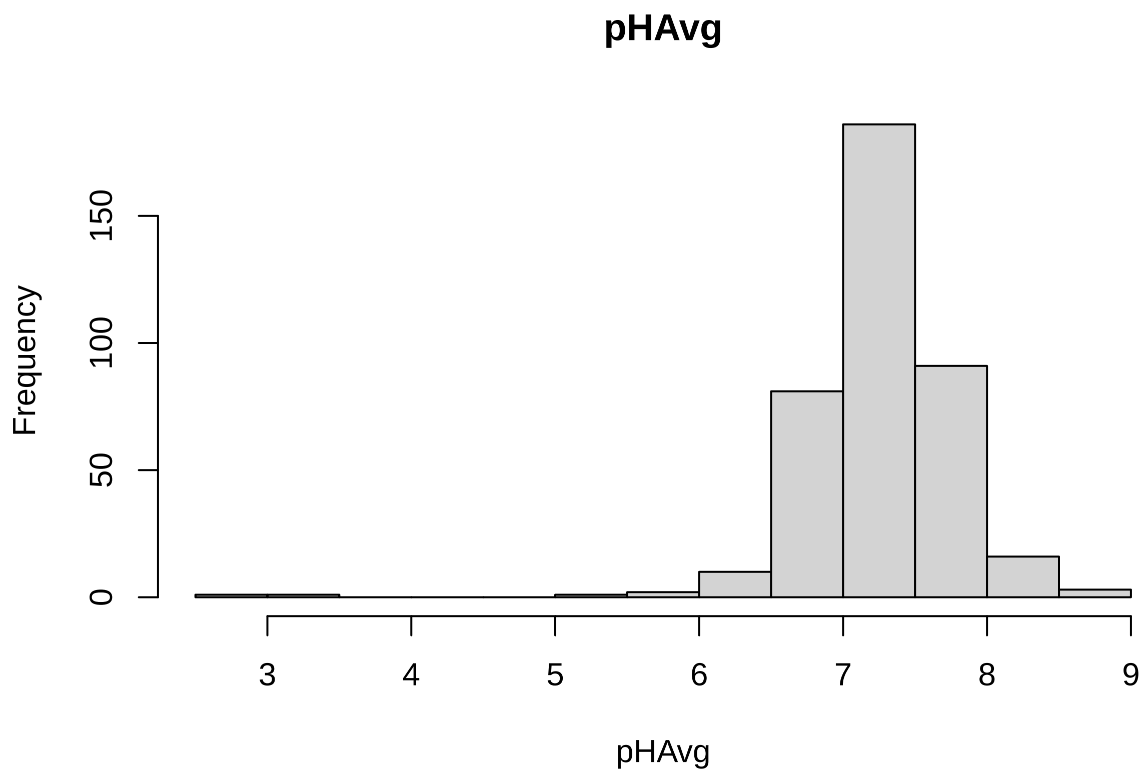
```r
waterQuality_2020$NO2                 =as.numeric(waterQuality_2020$NO2)
waterQuality_2020$PM10                =as.numeric(waterQuality_2020$PM10)

cols=c("TemperatureMin"
,"TemperatureMax"
,"DissolvedO2Min"
,"DissolvedO2Max"
,"pHMin"
,"pHMax"
,"ConductivityMin"
,"ConductivityMax"
,"BODMin"
,"BODMax"
,"NitrateMin"
,"NitrateMax"
,"FecalColiformMin"
,"FecalColiformMax"
,"TotalColiformMin"
,"TotalColiformMax"
,"NO2"
```

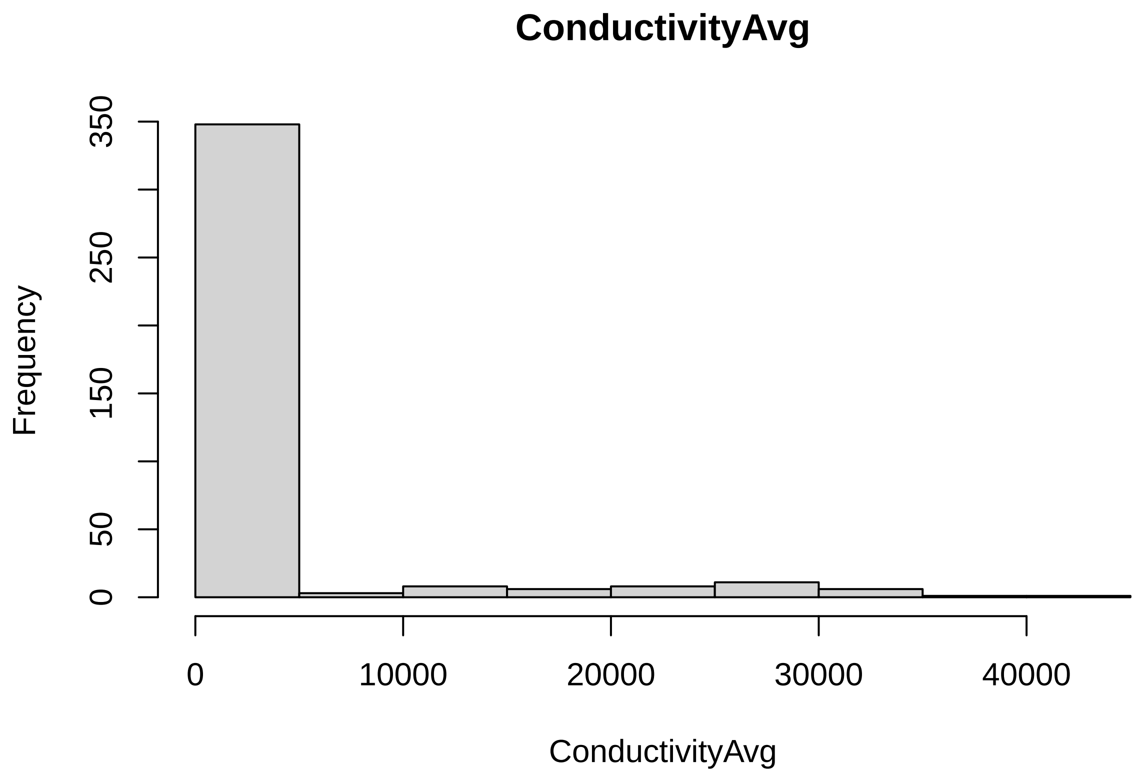
```
,"PM10"
,"SO2"
,"PM2.5")

waterQuality_2020_Avg=waterQuality_2020


# Calculate the average values for each variable
waterQuality_2020_Avg$TemperatureAvg = (waterQuality_2020_Avg$TemperatureMin + waterQuality_2020_Avg$Te
waterQuality_2020_Avg$DissolvedO2Avg = (waterQuality_2020_Avg$DissolvedO2Min + waterQuality_2020_Avg$Di
waterQuality_2020_Avg$pHAvg = (waterQuality_2020_Avg$pHMin + waterQuality_2020_Avg$pHMax) / 2
waterQuality_2020_Avg$ConductivityAvg = (waterQuality_2020_Avg$ConductivityMin + waterQuality_2020_Avg$
waterQuality_2020_Avg$FecalColiformAvg = (waterQuality_2020_Avg$FecalColiformMin + waterQuality_2020_Av
waterQuality_2020_Avg$BODAvg = (waterQuality_2020_Avg$BODMin + waterQuality_2020_Avg$BODMax) / 2
waterQuality_2020_Avg$NitrateAvg = (waterQuality_2020_Avg$NitrateMin + waterQuality_2020_Avg$NitrateMax

waterQuality_2020_Avg$TotalColiformAvg = (waterQuality_2020_Avg$TotalColiformMin + waterQuality_2020_Av

waterQuality_2020_Avg = subset(waterQuality_2020_Avg,select=-c(TemperatureMin
,TemperatureMax
,DissolvedO2Min
,DissolvedO2Max
,pHMin
,pHMax
,ConductivityMin
,ConductivityMax
,BODMin
,BODMax
,NitrateMin
,NitrateMax
,FecalColiformMin
,FecalColiformMax
,TotalColiformMin
,TotalColiformMax))

numCols=c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

for (col in colnames(waterQuality_2020_Avg)) {
  # Check if column has any NAs
  if (sum(is.na(waterQuality_2020_Avg[, col])) > 0) {
    # Replace NAs with mean value of the column
    waterQuality_2020_Avg[is.na(waterQuality_2020_Avg[, col]), col] = mean(waterQuality_2020_Avg[, col]
```

```
  }
}


for (col in numCols) {
  # Create the histogram plot
  hist(waterQuality_2020_Avg[[col]], main = col, xlab = col)
}
```

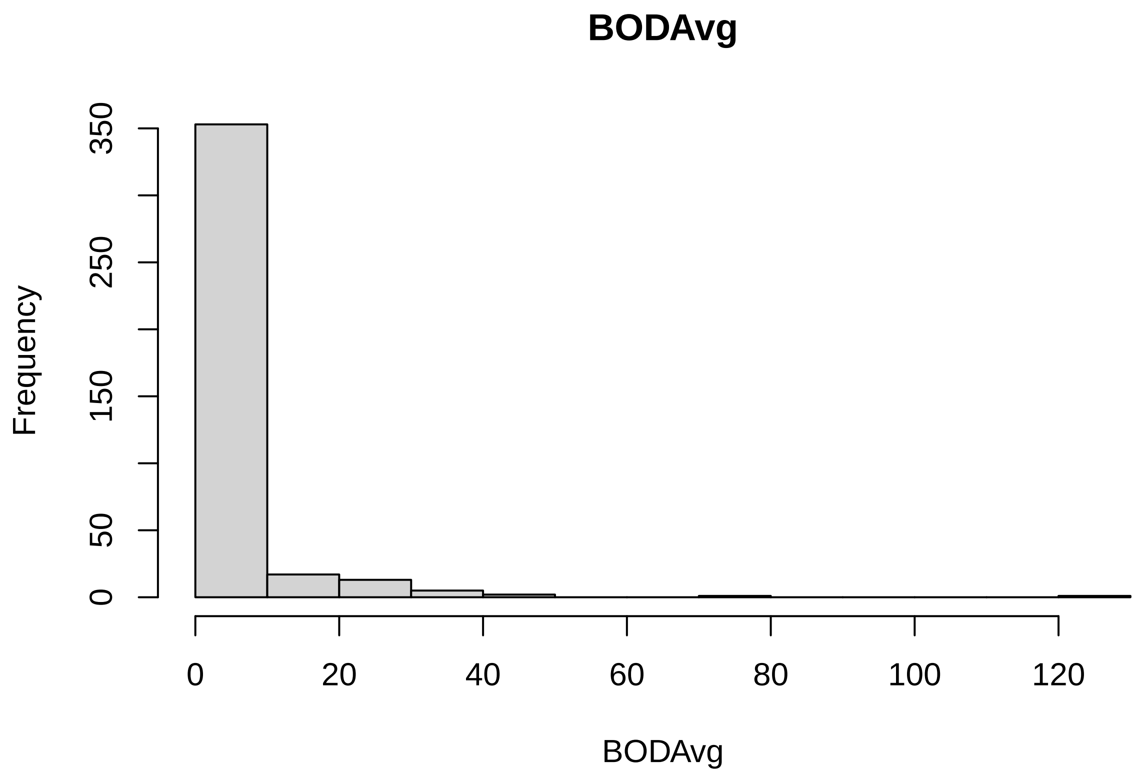


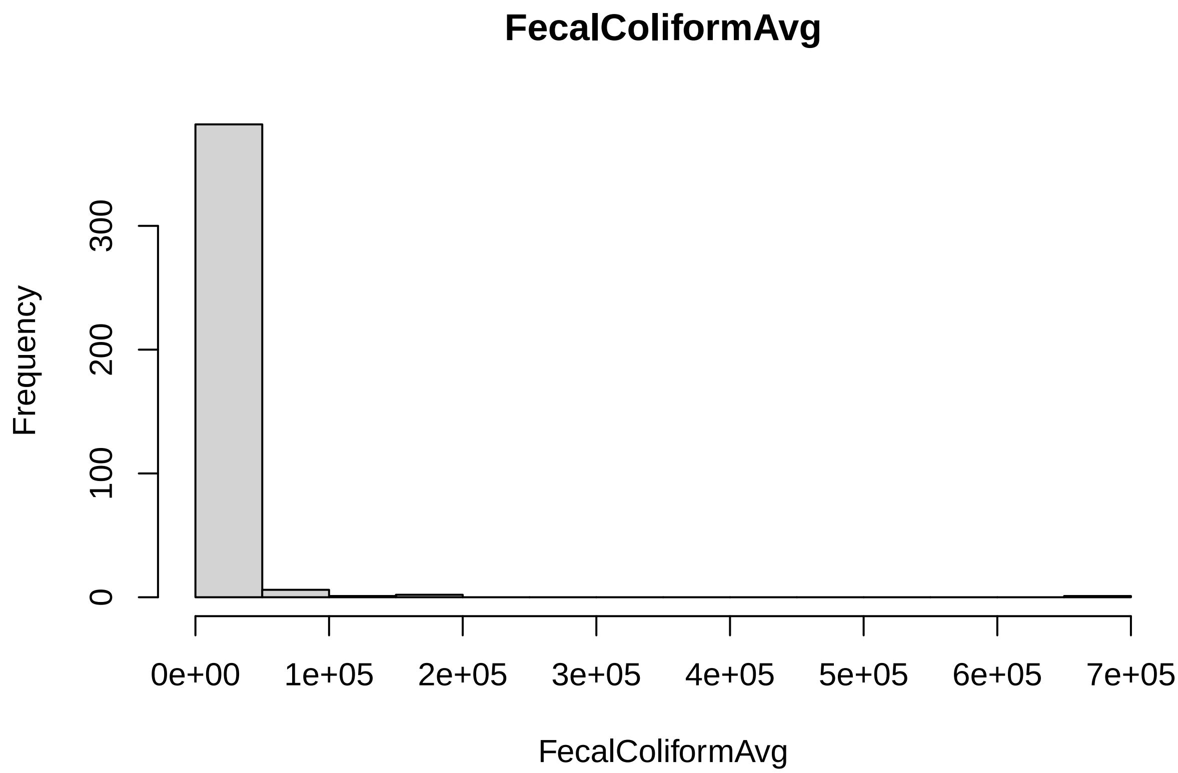

DissolvedO2Avg
Frequency
0
20
40
60
80
120
0
2
4
6
8
10
DissolvedO2Avg

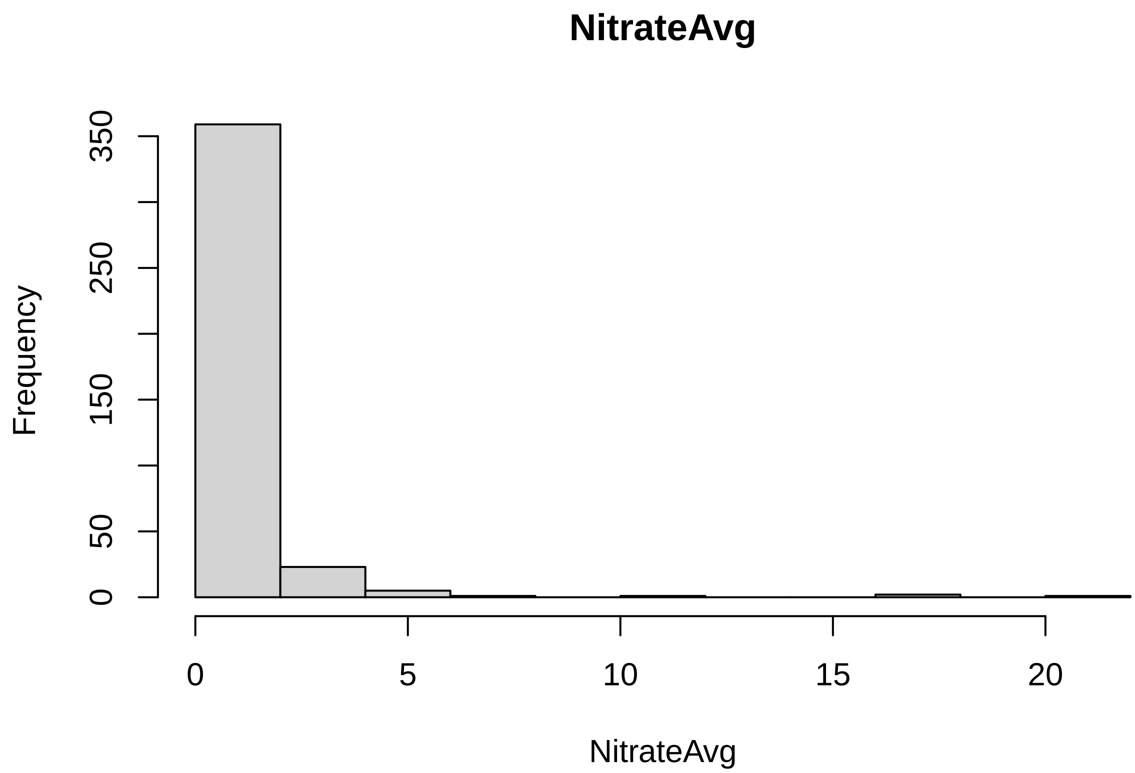

pHAvg
Frequency
0
50
100
150
3
4
5
6
7
8
9
pHAvg

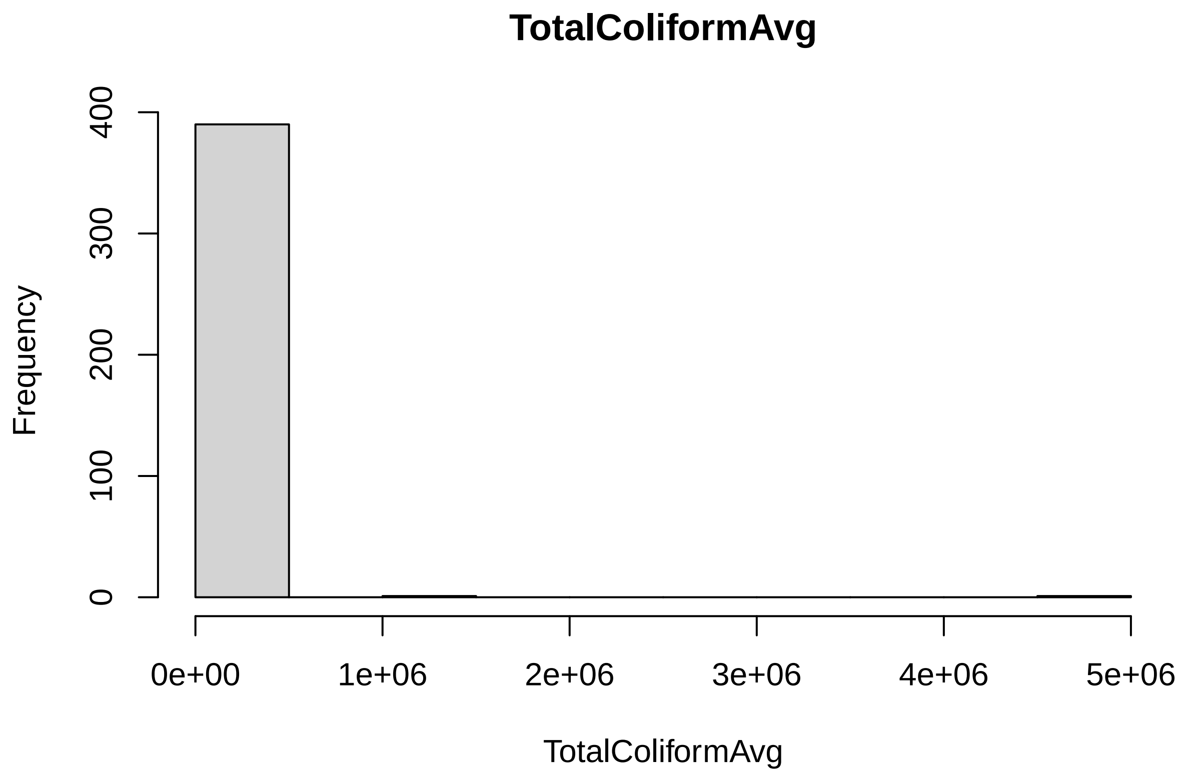


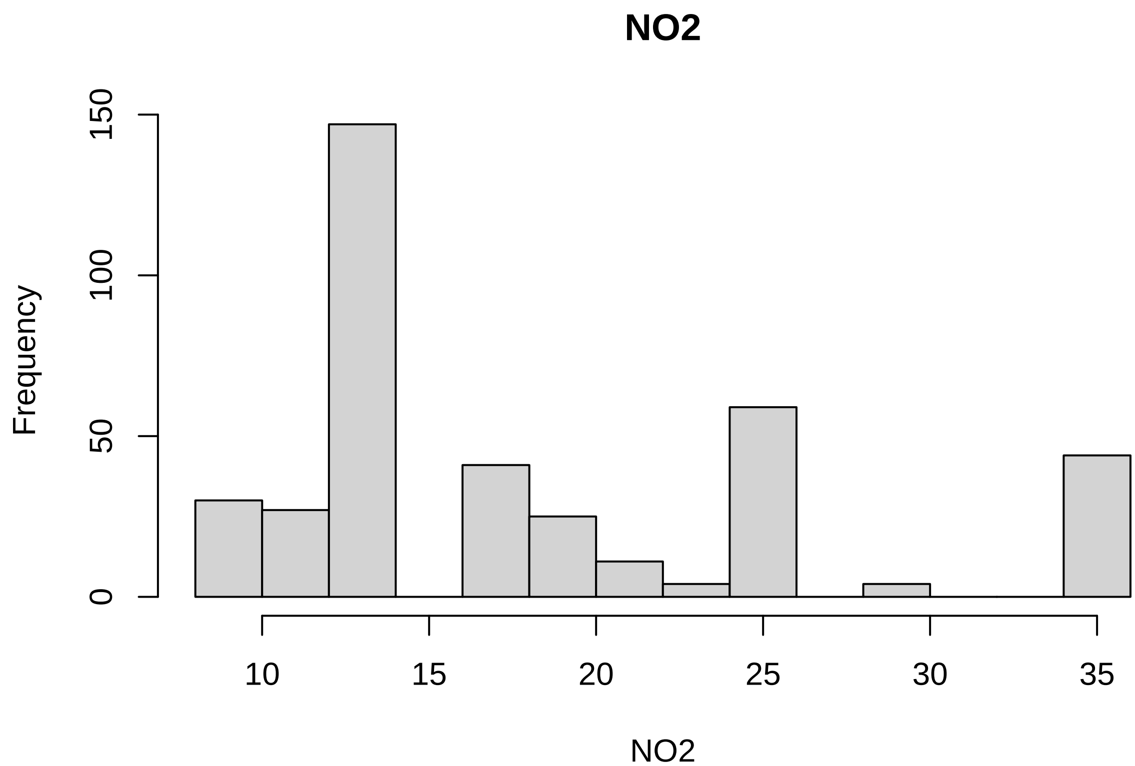
ConductivityAvg
Frequency
0
50
150
250
350
0
10000
20000
30000
40000
ConductivityAvg

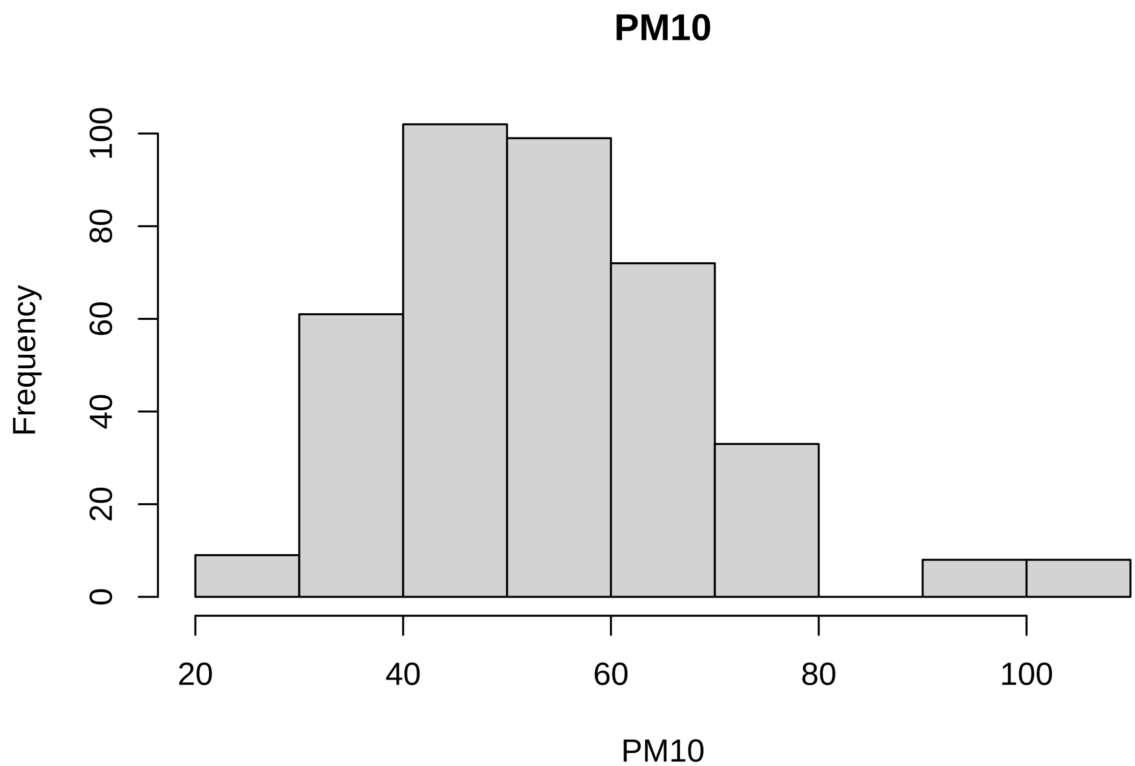

BODAvg
Frequency
0
50
150
250
350
0
20
40
60
80
100
120
BODAvg

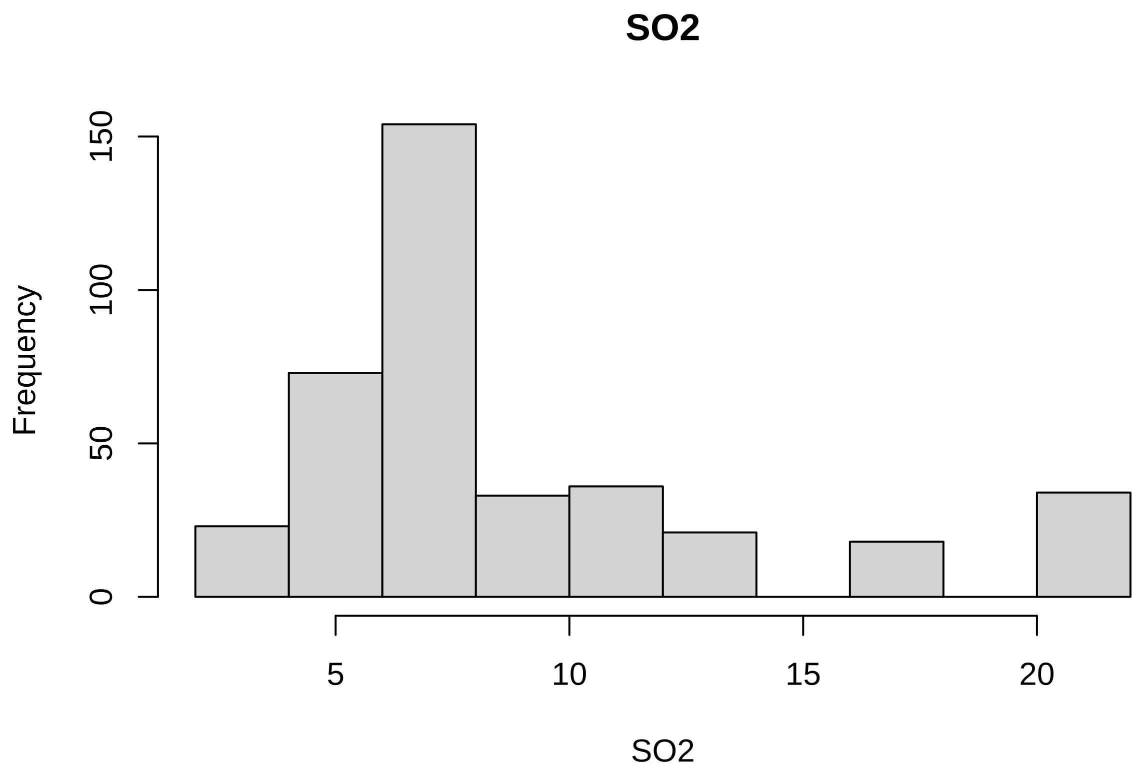

FecalColiformAvg
Frequency
0
100
200
300
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
6e+05
7e+05
FecalColiformAvg

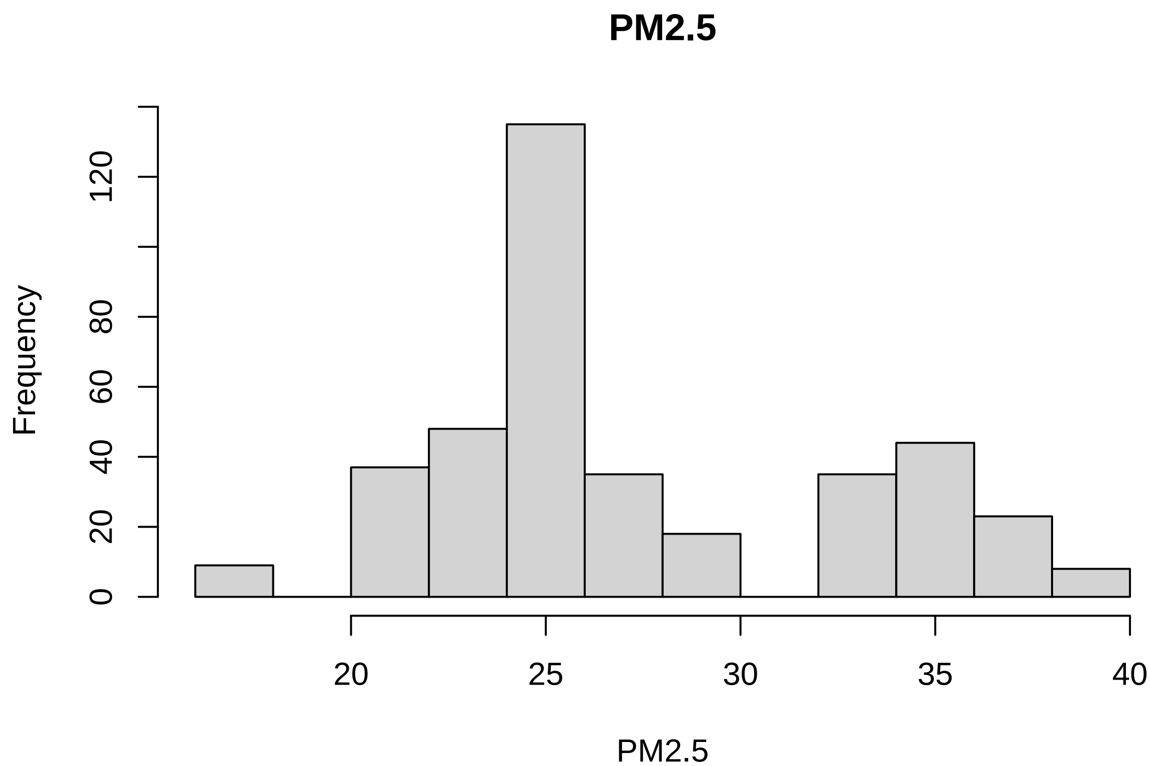

NitrateAvg
Frequency
0
50
150
250
350
0
5
10
15
20
NitrateAvg


TotalColiformAvg
Frequency
0
100
200
300
400
0e+00
1e+06
2e+06
3e+06
4e+06
5e+06
TotalColiformAvg

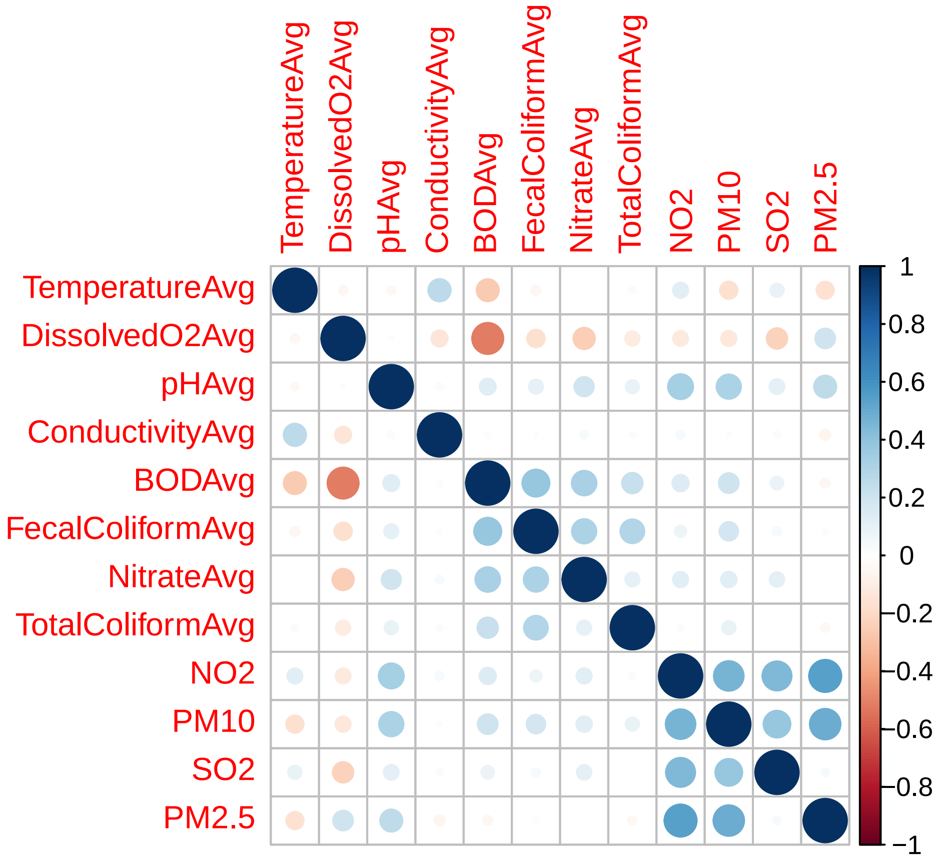

NO2
Frequency
0
50
100
150
10
15
20
25
30
35
NO2


PM10
Frequency
0
20
40
60
80
100
20
40
60
80
100
PM10


SO2
Frequency
0
50
100
150
5
10
15
20
SO2




```
cov_mat = cov(waterQuality_2020_Avg[, numCols])

corr_matrix = cor(waterQuality_2020_Avg[, numCols])

library(corrplot)

corrplot(corr_matrix)
```




```
waterQuality_2020_Avg = aggregate(cbind(TemperatureAvg,
                             DissolvedO2Avg,
                             pHAvg,
                             ConductivityAvg,
                             BODAvg,
                             NitrateAvg,
                             TotalColiformAvg,
                             FecalColiformAvg,
                             NO2,
                             PM10,
                             SO2,
                             PM2.5) ~ State,
                      data = waterQuality_2020_Avg,
                      mean)

pca_data = waterQuality_2020_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"FecalColiformAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
```

```r
,"PM2.5")]

# Center and scale the data
pca_data_scaled = scale(pca_data)

# Perform PCA
pca_result = princomp(pca_data_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(pca_data_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```r
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.9806715 1.4406720 1.2680676 1.0803567 0.91731267
## Proportion of Variance 0.3432677 0.1816094 0.1406996 0.1021274 0.07362797
## Cumulative Proportion  0.3432677 0.5248771 0.6655767 0.7677041 0.84133208
##                            Comp.6     Comp.7    Comp.8     Comp.9    Comp.10
## Standard deviation     0.80442642 0.59145607 0.5211887 0.45981530 0.44478427
## Proportion of Variance 0.05662141 0.03060927 0.0237683 0.01850013 0.01731039
## Cumulative Proportion  0.89795350 0.92856277 0.9523311 0.97083120 0.98814159
##                            Comp.11     Comp.12
## Standard deviation     0.305279536 0.205740221
## Proportion of Variance 0.008154615 0.003703791
## Cumulative Proportion  0.996296209 1.000000000
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

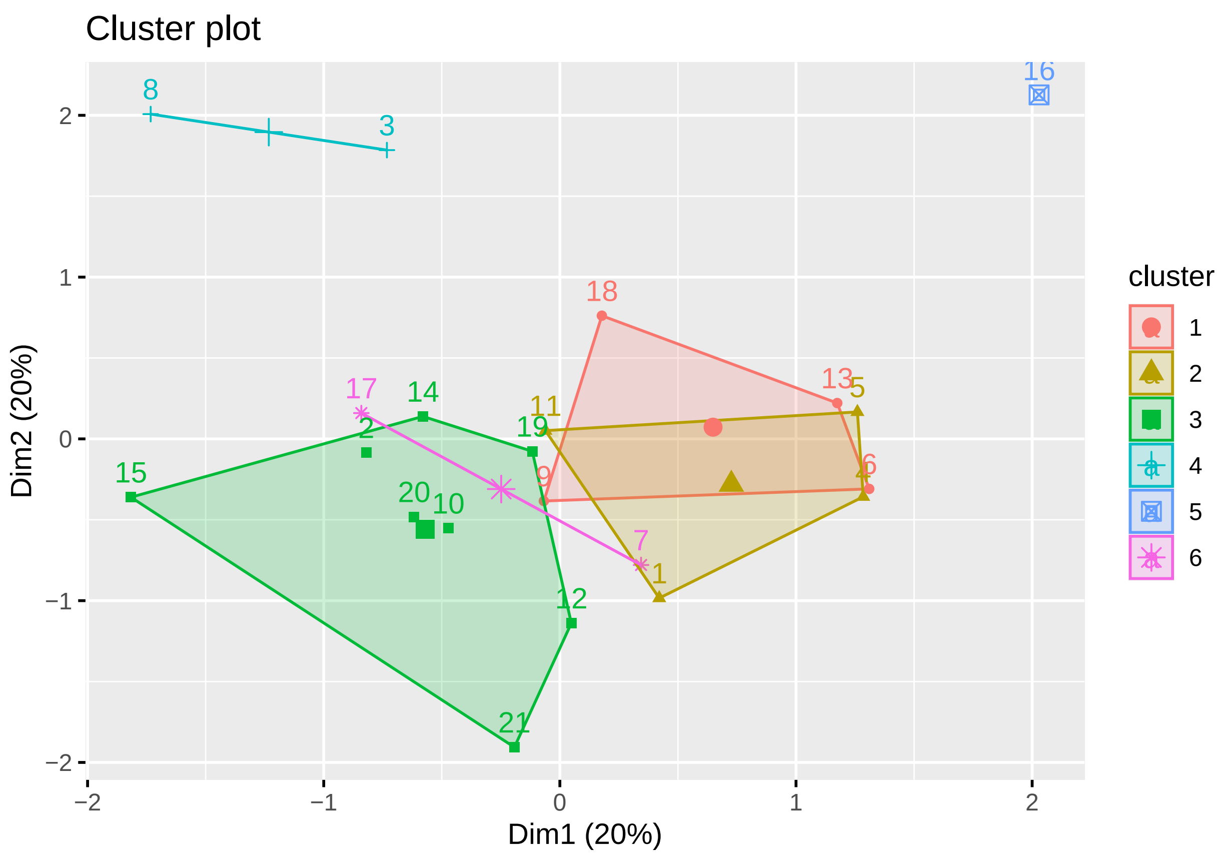
```
##      Comp.1      Comp.2      Comp.3      Comp.4      Comp.5      Comp.6
## 0.343267702 0.181609393 0.140699593 0.102127422 0.073627972 0.056621413
##      Comp.7      Comp.8      Comp.9     Comp.10     Comp.11     Comp.12
## 0.030609274 0.023768298 0.018500135 0.017310392 0.008154615 0.003703791
```

```r
pc.comp = pca_result$scores

#85%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
```

```r
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5 = -1*pc.comp[,5]

library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5)

X
```

```
##         pc.comp1     pc.comp2   pc.comp3    pc.comp4    pc.comp5
##  [1,] -1.2851263 -1.603192702 -0.4016635 -0.03474576 -1.19930610
##  [2,] -0.9138134 -0.108013419  1.0875392  0.06643863 -0.15829311
##  [3,]  1.7175469  2.141605360  0.9108770 -1.53822055  0.29335600
##  [4,] -0.3009693 -0.908990601 -1.5576557 -0.46685337 -0.74984955
##  [5,] -1.9893890 -1.596157639 -1.3232075 -0.26714779  0.74629048
##  [6,]  0.5153036  0.214451174 -1.8688284  1.01657301  0.93632983
##  [7,]  6.0970644 -1.832311523 -0.1829389 -0.89976873 -1.92133652
##  [8,] -1.0818856  1.718973391  2.3722424 -2.04953517  0.01046893
##  [9,]  1.6856088  3.162821763 -0.6585425  1.81948042  0.56017980
## [10,] -1.5881729 -0.120274458  0.5537967  0.16851132 -0.82377412
## [11,] -1.9339509 -1.110578970  0.3112428 -0.23962803  0.17666075
## [12,] -0.7879074 -0.093031918 -0.2582152  0.74464123 -1.05476673
## [13,]  0.1194263  1.581320396 -1.8163063 -0.04424074 -0.05728972
## [14,] -0.6922020  0.610882466  0.6766816 -0.10324749 -0.20513970
## [15,] -1.2687802 -0.859114341  2.4786095  0.60758067  0.19117899
## [16,] -1.1084725 -0.939002621 -2.0654284 -2.26884560  1.53085453
## [17,]  4.0150105 -2.370852652  1.5406457  0.93129527  2.31689262
## [18,]  1.4912822  2.295692516 -0.5293420 -0.50194919 -0.10700039
## [19,] -0.5436541 -0.202156507  0.1758895  0.10007912  0.05094236
## [20,] -1.4531568  0.010012591  0.6983938  0.84071992  0.14785912
## [21,] -0.6937623  0.007917696 -0.1437899  2.11886283 -0.68425748
```

```r
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2020_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2020_Avg$State,waterQuality_2020_Avg$cluster)
```

```
##
##                                            1 2 3 4 5 6
##   ANDHRA PRADESH                           0 1 0 0 0 0
##   ASSAM                                    0 0 1 0 0 0
##   BIHAR                                    0 0 0 1 0 0
##   DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI 0 1 0 0 0 0
##   GOA                                      0 1 0 0 0 0
##   GUJARAT                                  1 0 0 0 0 0
##   HARYANA                                  0 0 0 0 0 1
##   HIMACHAL\r\nPRADESH                      0 0 0 1 0 0
##   JHARKHAND                                1 0 0 0 0 0
##   KARNATAKA                                0 0 1 0 0 0
##   KERALA                                   0 1 0 0 0 0
##   MADHYA PRADESH                           0 0 1 0 0 0
##   MAHARASHTRA                              1 0 0 0 0 0
##   MANIPUR                                  0 0 1 0 0 0
##   MEGHALAYA                                0 0 1 0 0 0
##   PUDUCHERRY                               0 0 0 0 1 0
##   PUNJAB                                   0 0 0 0 0 1
##   RAJASTHAN                                1 0 0 0 0 0
##   State Name                               0 0 1 0 0 0
```

```
##   TAMIL NADU                                  0 0 1 0 0 0
##   TRIPURA                                     0 0 1 0 0 0
```

```
waterQuality_2020_Avg
```

```
##                                              State TemperatureAvg DissolvedO2Avg
## 1                                   ANDHRA PRADESH       24.11111       6.422222
## 2                                            ASSAM       19.36364       6.368182
## 3                                            BIHAR       17.00000       6.537500
## 4  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI       28.20000       5.485000
## 5                                              GOA       26.96154       6.263462
## 6                                          GUJARAT       23.83333       5.130556
## 7                                          HARYANA       19.55820       5.030000
## 8                             HIMACHAL\r\nPRADESH       13.98459       8.536957
## 9                                        JHARKHAND       15.12500       6.175000
## 10                                       KARNATAKA       24.78571       7.303571
## 11                                          KERALA       24.50685       6.441781
## 12                                  MADHYA PRADESH       20.81818       6.681818
## 13                                     MAHARASHTRA       25.05556       6.551389
## 14                                         MANIPUR       18.83871       6.675806
## 15                                       MEGHALAYA       13.96667       6.810000
## 16                                      PUDUCHERRY       26.00000       5.375000
## 17                                          PUNJAB       12.94268       3.369444
## 18                                       RAJASTHAN       17.25000       5.675000
## 19                                      State Name       21.32275       6.340409
## 20                                      TAMIL NADU       23.14286       6.653571
## 21                                         TRIPURA       22.15385       6.071154
##       pHAvg ConductivityAvg    BODAvg NitrateAvg TotalColiformAvg
## 1  7.716667       4570.8889  2.022222  1.5838889         188.1667
## 2  7.354545        115.2045  1.788636  0.9340909        1212.6818
## 3  7.650000        357.0000  2.362500  0.3275000       85950.0000
## 4  7.620000       4554.4614  2.030000  2.8535000        2800.5422
## 5  6.955769      11764.1538  1.673077  0.7192308        3935.1154
## 6  7.594444       6617.8889 11.122222  0.4672222        1794.9957
## 7  8.020000       1294.5500 22.500000  6.3640000      249930.0000
## 8  7.667391        429.1957  1.178261  0.7326589        3478.2609
## 9  7.287500       1589.6195  6.056250  1.1773077       18630.8166
## 10 7.321429        160.4286  2.325000  0.5121429         660.3214
## 11 7.003425       4043.2945  1.606849  0.6297945        2820.1164
## 12 7.804545       2688.3636  1.377273  0.8377273         108.0000
## 13 7.538889       5099.4028  4.312500  1.2609722        2433.0417
## 14 7.333871        283.9839  3.403226  1.1030769         229.0484
## 15 6.781667        171.7833  5.876667  0.9856667       10756.2667
## 16 7.600000      13066.5000  1.000000  1.3182692       24374.4222
## 17 7.586111        880.7500 24.638889  1.4944444      307158.3889
## 18 8.350000        818.7500  1.825000  1.5037500         121.3750
## 19 7.293606       2956.6140  4.527621  1.1030769       24374.4222
## 20 6.732143        367.2500  3.600000  0.4275000         177.3571
## 21 7.113462        146.8077  1.211538  1.3053846         163.6731
##    FecalColiformAvg       NO2      PM10       SO2    PM2.5 cluster
## 1          22.72222 17.562500  28.25000  7.125000 17.56250       2
## 2         513.63636 13.429487  58.08731  7.089744 25.67907       3
## 3       80997.50000 22.136364  94.04545  8.818922 39.12783       4
## 4         787.21108 18.077739  55.24444  8.949573 27.48306       2
```

```
## 5        2320.28846 13.411765  59.06424  7.021524 21.26011       2
## 6         545.28393 24.562963  67.99259 16.120823 29.08395       1
## 7      109189.00000 24.576923  78.03846 12.346154 26.32933       6
## 8        1241.78261 11.119048  71.55952  2.226190 36.89954       4
## 9        4225.33311 34.255556 104.85260 21.177778 35.46457       1
## 10        322.35714 17.102624  47.58049  7.824026 24.67611       3
## 11       1888.94521 12.891386  43.55600  4.900582 24.99776       2
## 12         19.77273 20.947368  40.36842 13.243725 20.94737       3
## 13       1322.68056 34.694938  67.94619 11.944126 35.15770       1
## 14         56.51613 24.231229  38.50000  7.254072 32.64061       3
## 15       3377.03333  9.928571  39.37500  6.562912 23.85490       3
## 16       5564.61082 11.500000  41.83333  6.500000 39.28123       5
## 17      16130.61111 17.832208  67.48132  7.546342 23.52170       6
## 18         67.25000 28.032680  99.91756  9.937908 32.46874       1
## 19       5564.61082 18.077739  55.24444  8.949573 27.48306       3
## 20         49.50000 18.077739  55.24444  8.949573 27.48306       3
## 21         43.28846 13.000000  55.75000 21.000000 24.25000       3
```

```
Result_2020= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_group$Di


Result_2020$Rank=c("A", "B", "C", "D", "E","F")

class(Result_2020$cluster)
```

```
## [1] "integer"
```

```
class(waterQuality_2020_Avg$cluster)
```

```
## [1] "integer"
```

```
WaterAir2020 = merge(waterQuality_2020_Avg, Result_2020[,c("cluster","Rank")], by = "cluster", all.x = 

WaterQualityAlone = waterQuality_2020_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
)]

# Center and scale the data
WaterQualityAlone_scaled = scale(WaterQualityAlone)

# Perform PCA
pca_result = princomp(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```r
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3     Comp.4     Comp.5
## Standard deviation     1.8771194 1.2726958 0.9838068 0.82960438 0.62402420
## Proportion of Variance 0.4624695 0.2125928 0.1270337 0.09033195 0.05110956
## Cumulative Proportion  0.4624695 0.6750623 0.8020960 0.89242796 0.94353752
##                            Comp.6     Comp.7      Comp.8
## Standard deviation     0.47911831 0.37045978 0.251784608
## Proportion of Variance 0.03012901 0.01801281 0.008320658
## Cumulative Proportion  0.97366653 0.99167934 1.000000000
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

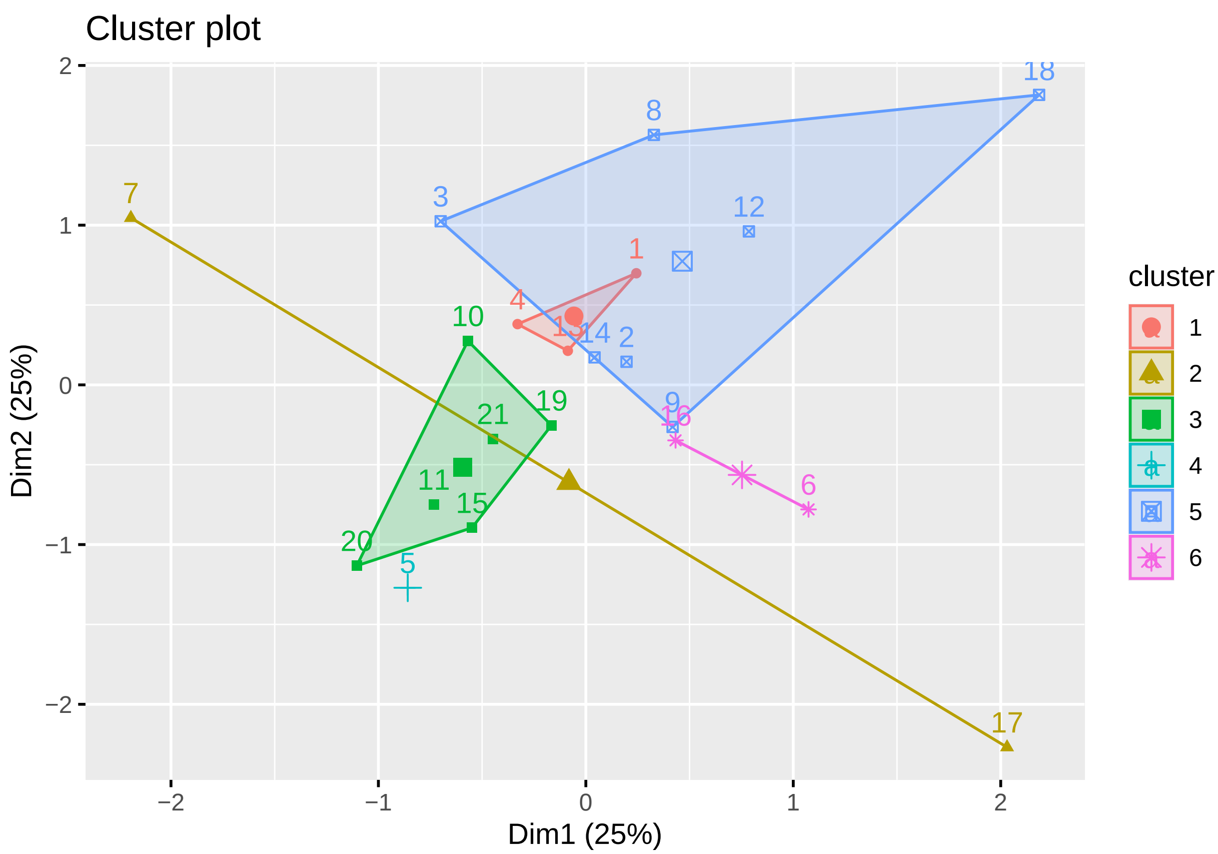
```
##      Comp.1      Comp.2      Comp.3      Comp.4      Comp.5      Comp.6
## 0.462469526 0.212592787 0.127033698 0.090331950 0.051109564 0.030129009
##      Comp.7      Comp.8
## 0.018012809 0.008320658
```

```r
pc.comp = pca_result$scores

#86%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]


library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4)

X
```

```
##          pc.comp1    pc.comp2     pc.comp3     pc.comp4
##   [1,] -0.59382232 -0.76925689 -0.772846752  0.387567670
##   [2,] -0.66143537  0.84505098  0.020412417  0.127970744
##   [3,]  1.01692079  1.31005220 -0.972798278 -0.495115617
```

```
##  [4,] -0.09908167 -1.80653118 -0.721192501 -0.072426382
##  [5,] -1.59354983 -2.19632599  0.779877532 -0.786923189
##  [6,]  0.05972456 -1.36028433  0.792242785  0.855895315
##  [7,]  6.23694452 -0.65622353 -1.585274542 -1.594438885
##  [8,] -1.07274269  2.22150454 -1.177658587  0.395178519
##  [9,]  0.04092148  1.07046771  0.509690234  0.222593203
## [10,] -1.35304852  0.49441055 -0.315154957 -0.461551771
## [11,] -1.33414751 -0.40513278  0.549406960 -0.719231672
## [12,] -0.69795231  0.19661060 -0.784029822  0.817551813
## [13,] -0.71470244 -0.85790635 -0.361812573  0.029591625
## [14,] -0.61018309  0.96942982 -0.018792223 -0.005035955
## [15,] -0.53850118  1.84996560  1.073130654 -0.758119227
## [16,] -0.56918713 -2.84219278  0.006200914  0.508146848
## [17,]  4.59421978  0.47136491  2.758546805  1.249273184
## [18,]  0.45262717  0.44095246 -1.333389764  2.124703385
## [19,] -0.41223652  0.05452284  0.230855995 -0.188709303
## [20,] -1.37260978  0.60786634  1.015840765 -1.174409782
## [21,] -0.77815794  0.36165528  0.306744937 -0.462510523
```

```
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2020_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2020_Avg$State,waterQuality_2020_Avg$cluster)
```

```
##
##                                            1 2 3 4 5 6
##   ANDHRA PRADESH                           1 0 0 0 0 0
##   ASSAM                                    0 0 0 0 1 0
##   BIHAR                                    0 0 0 0 1 0
##   DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI 1 0 0 0 0 0
##   GOA                                      0 0 0 1 0 0
##   GUJARAT                                  0 0 0 0 0 1
##   HARYANA                                  0 1 0 0 0 0
##   HIMACHAL\r\nPRADESH                      0 0 0 0 1 0
##   JHARKHAND                                0 0 0 0 1 0
##   KARNATAKA                                0 0 1 0 0 0
##   KERALA                                   0 0 1 0 0 0
##   MADHYA PRADESH                           0 0 0 0 1 0
##   MAHARASHTRA                              1 0 0 0 0 0
##   MANIPUR                                  0 0 0 0 1 0
##   MEGHALAYA                                0 0 1 0 0 0
##   PUDUCHERRY                               0 0 0 0 0 1
##   PUNJAB                                   0 1 0 0 0 0
##   RAJASTHAN                                0 0 0 0 1 0
##   State Name                               0 0 1 0 0 0
```

```
##   TAMIL NADU                                    0 0 1 0 0 0
##   TRIPURA                                       0 0 1 0 0 0
```

```
WaterQualityAlone
```

```
##    TemperatureAvg DissolvedO2Avg    pHAvg ConductivityAvg    BODAvg
## 1        24.11111       6.422222 7.716667       4570.8889  2.022222
## 2        19.36364       6.368182 7.354545        115.2045  1.788636
## 3        17.00000       6.537500 7.650000        357.0000  2.362500
## 4        28.20000       5.485000 7.620000       4554.4614  2.030000
## 5        26.96154       6.263462 6.955769      11764.1538  1.673077
## 6        23.83333       5.130556 7.594444       6617.8889 11.122222
## 7        19.55820       5.030000 8.020000       1294.5500 22.500000
## 8        13.98459       8.536957 7.667391        429.1957  1.178261
## 9        15.12500       6.175000 7.287500       1589.6195  6.056250
## 10       24.78571       7.303571 7.321429        160.4286  2.325000
## 11       24.50685       6.441781 7.003425       4043.2945  1.606849
## 12       20.81818       6.681818 7.804545       2688.3636  1.377273
## 13       25.05556       6.551389 7.538889       5099.4028  4.312500
## 14       18.83871       6.675806 7.333871        283.9839  3.403226
## 15       13.96667       6.810000 6.781667        171.7833  5.876667
## 16       26.00000       5.375000 7.600000      13066.5000  1.000000
## 17       12.94268       3.369444 7.586111        880.7500 24.638889
## 18       17.25000       5.675000 8.350000        818.7500  1.825000
## 19       21.32275       6.340409 7.293606       2956.6140  4.527621
## 20       23.14286       6.653571 6.732143        367.2500  3.600000
## 21       22.15385       6.071154 7.113462        146.8077  1.211538
##    FecalColiformAvg NitrateAvg TotalColiformAvg
## 1          22.72222  1.5838889         188.1667
## 2         513.63636  0.9340909        1212.6818
## 3       80997.50000  0.3275000       85950.0000
## 4         787.21108  2.8535000        2800.5422
## 5        2320.28846  0.7192308        3935.1154
## 6         545.28393  0.4672222        1794.9957
## 7      109189.00000  6.3640000      249930.0000
## 8        1241.78261  0.7326589        3478.2609
## 9        4225.33311  1.1773077       18630.8166
## 10        322.35714  0.5121429         660.3214
## 11       1888.94521  0.6297945        2820.1164
## 12         19.77273  0.8377273         108.0000
## 13       1322.68056  1.2609722        2433.0417
## 14         56.51613  1.1030769         229.0484
## 15       3377.03333  0.9856667       10756.2667
## 16       5564.61082  1.3182692       24374.4222
## 17      16130.61111  1.4944444      307158.3889
## 18         67.25000  1.5037500         121.3750
## 19       5564.61082  1.1030769       24374.4222
## 20         49.50000  0.4275000         177.3571
## 21         43.28846  1.3053846         163.6731
```

```
Result_2020_water= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_gr
```

```
Result_2020_water$Rank=c("A", "B", "C", "D", "E","F")

class(waterQuality_2020_Avg$cluster)
```

```
## [1] "integer"
```

```
class(waterQuality_2020_Avg$cluster)
```

```
## [1] "integer"
```

```
Water2020 = merge(waterQuality_2020_Avg, Result_2020_water[,c("cluster","Rank")], by = "cluster", all.x
```

```
waterQuality_2021=finalDataset[finalDataset$year == 2021,]
waterQuality_2021$TemperatureMin     =as.numeric(waterQuality_2021$TemperatureMin)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$TemperatureMax     =as.numeric(waterQuality_2021$TemperatureMin)
waterQuality_2021$DissolvedO2Min     =as.numeric(waterQuality_2021$DissolvedO2Min)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$DissolvedO2Max     =as.numeric(waterQuality_2021$DissolvedO2Max)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$pHMin              =as.numeric(waterQuality_2021$pHMin)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$pHMax              =as.numeric(waterQuality_2021$pHMax)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$ConductivityMin    =as.numeric(waterQuality_2021$ConductivityMin)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$ConductivityMax    =as.numeric(waterQuality_2021$ConductivityMax)
```

```
## Warning: NAs introduced by coercion
```

```
waterQuality_2021$BODMin             =as.numeric(waterQuality_2021$BODMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$BODMax             =as.numeric(waterQuality_2021$BODMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$NitrateMin         =as.numeric(waterQuality_2021$NitrateMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$NitrateMax         =as.numeric(waterQuality_2021$NitrateMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$FecalColiformMin   =as.numeric(waterQuality_2021$FecalColiformMin)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$FecalColiformMax   =as.numeric(waterQuality_2021$FecalColiformMax)
```

```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$TotalColiformMin   =as.numeric(waterQuality_2021$TotalColiformMin)
```

```
## Warning: NAs introduced by coercion
```

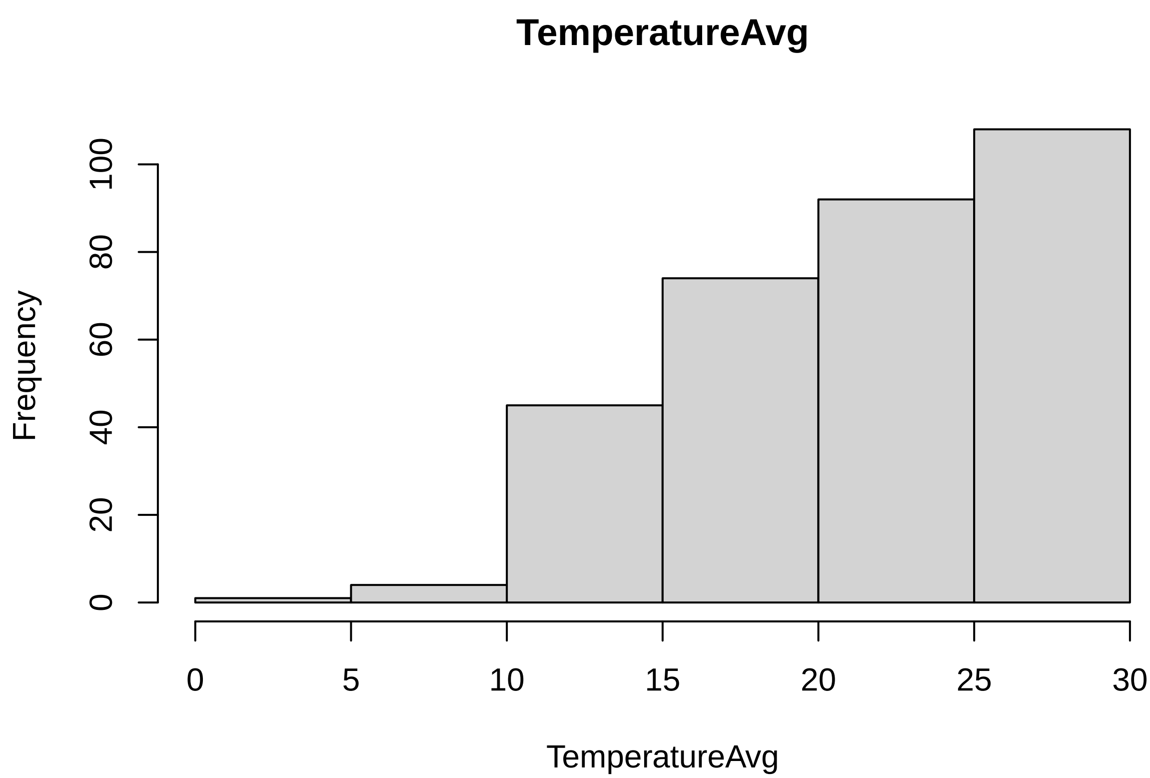
```r
waterQuality_2021$TotalColiformMax   =as.numeric(waterQuality_2021$TotalColiformMax)
```

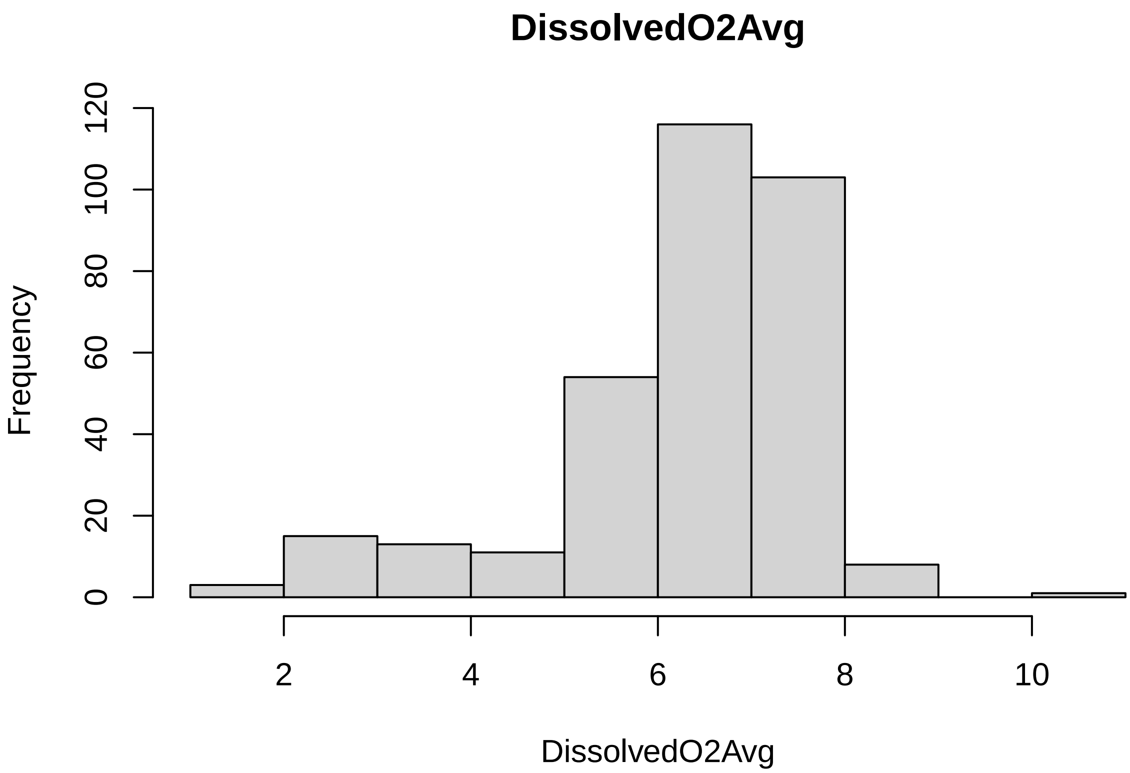
```
## Warning: NAs introduced by coercion
```

```r
waterQuality_2021$NO2                =as.numeric(waterQuality_2021$NO2)
waterQuality_2021$PM10               =as.numeric(waterQuality_2021$PM10)

cols=c("TemperatureMin"
,"TemperatureMax"
,"DissolvedO2Min"
,"DissolvedO2Max"
,"pHMin"
,"pHMax"
,"ConductivityMin"
,"ConductivityMax"
,"BODMin"
,"BODMax"
,"NitrateMin"
,"NitrateMax"
,"FecalColiformMin"
,"FecalColiformMax"
,"TotalColiformMin"
,"TotalColiformMax"
,"NO2"
```

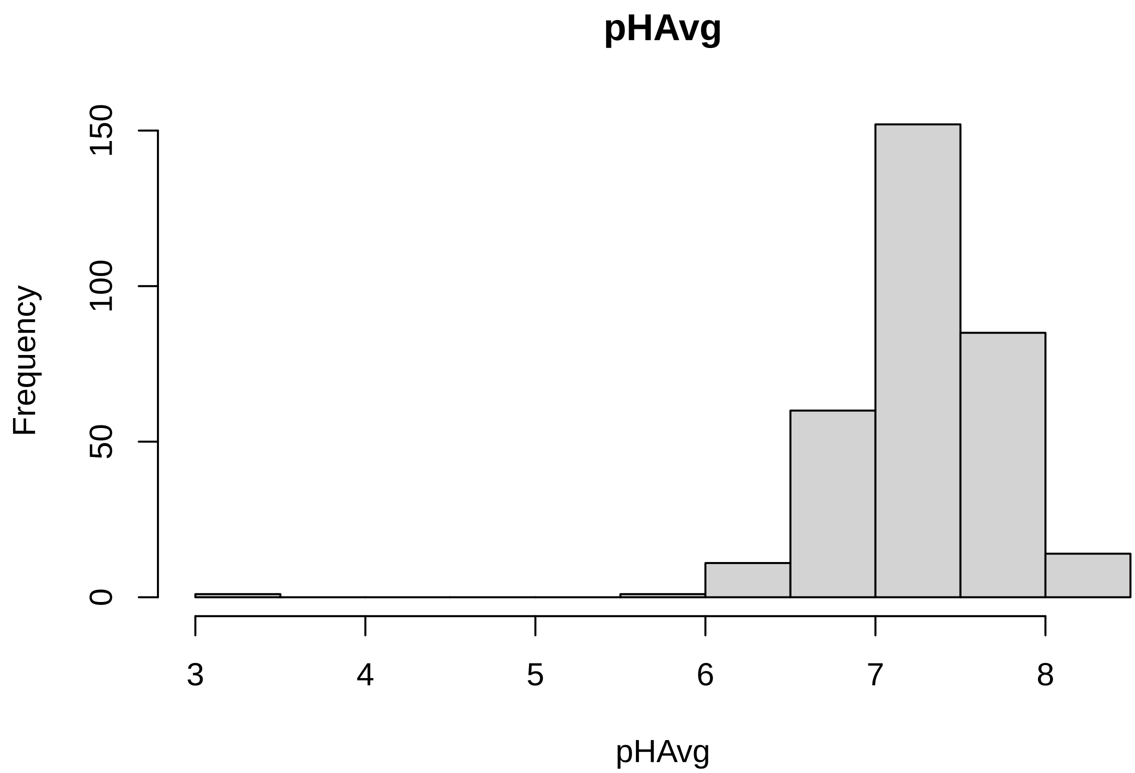
```
,"PM10"
,"SO2"
,"PM2.5")

waterQuality_2021_Avg=waterQuality_2021


# Calculate the average values for each variable
waterQuality_2021_Avg$TemperatureAvg = (waterQuality_2021_Avg$TemperatureMin + waterQuality_2021_Avg$Te
waterQuality_2021_Avg$DissolvedO2Avg = (waterQuality_2021_Avg$DissolvedO2Min + waterQuality_2021_Avg$Di
waterQuality_2021_Avg$pHAvg = (waterQuality_2021_Avg$pHMin + waterQuality_2021_Avg$pHMax) / 2
waterQuality_2021_Avg$ConductivityAvg = (waterQuality_2021_Avg$ConductivityMin + waterQuality_2021_Avg$
waterQuality_2021_Avg$FecalColiformAvg = (waterQuality_2021_Avg$FecalColiformMin + waterQuality_2021_Av
waterQuality_2021_Avg$BODAvg = (waterQuality_2021_Avg$BODMin + waterQuality_2021_Avg$BODMax) / 2
waterQuality_2021_Avg$NitrateAvg = (waterQuality_2021_Avg$NitrateMin + waterQuality_2021_Avg$NitrateMax

waterQuality_2021_Avg$TotalColiformAvg = (waterQuality_2021_Avg$TotalColiformMin + waterQuality_2021_Av

waterQuality_2021_Avg = subset(waterQuality_2021_Avg,select=-c(TemperatureMin
,TemperatureMax
,DissolvedO2Min
,DissolvedO2Max
,pHMin
,pHMax
,ConductivityMin
,ConductivityMax
,BODMin
,BODMax
,NitrateMin
,NitrateMax
,FecalColiformMin
,FecalColiformMax
,TotalColiformMin
,TotalColiformMax))

numCols=c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
,"PM2.5")

for (col in colnames(waterQuality_2021_Avg)) {
  # Check if column has any NAs
  if (sum(is.na(waterQuality_2021_Avg[, col])) > 0) {
    # Replace NAs with mean value of the column
    waterQuality_2021_Avg[is.na(waterQuality_2021_Avg[, col]), col] = mean(waterQuality_2021_Avg[, col]
  }
```

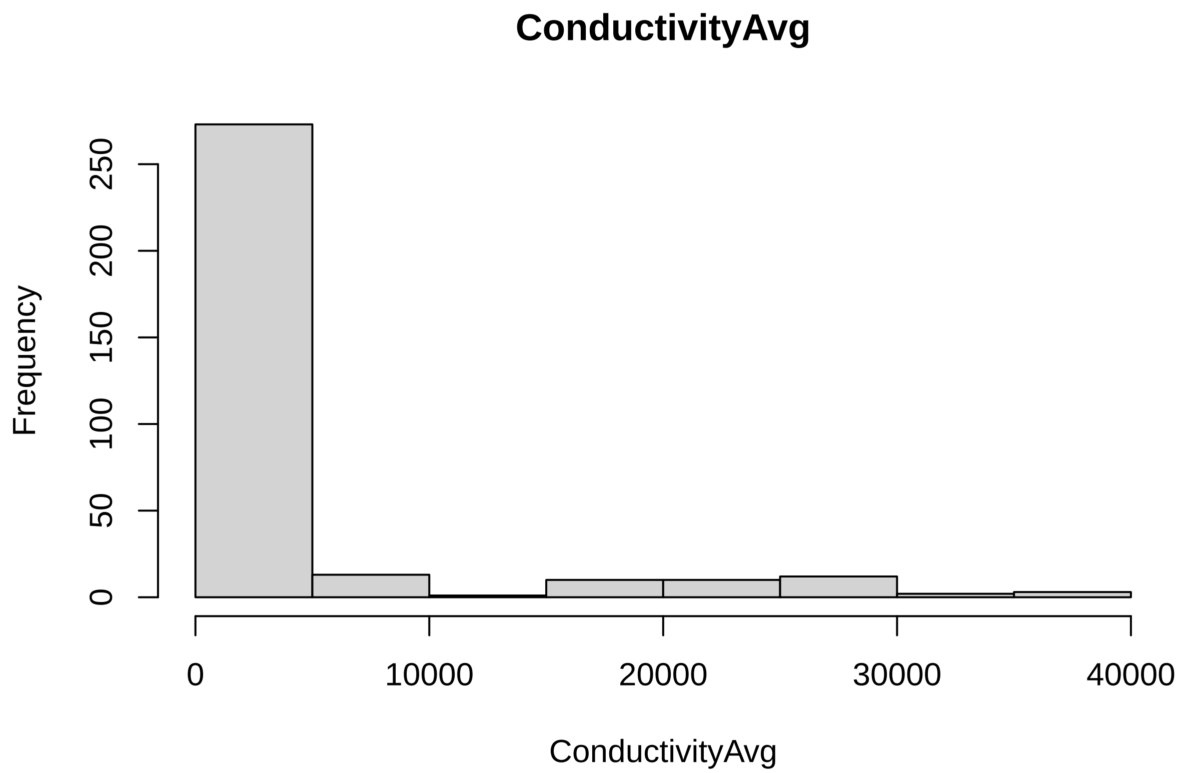
```
}


for (col in numCols) {
  # Create the histogram plot
  hist(waterQuality_2021_Avg[[col]], main = col, xlab = col)
}
```

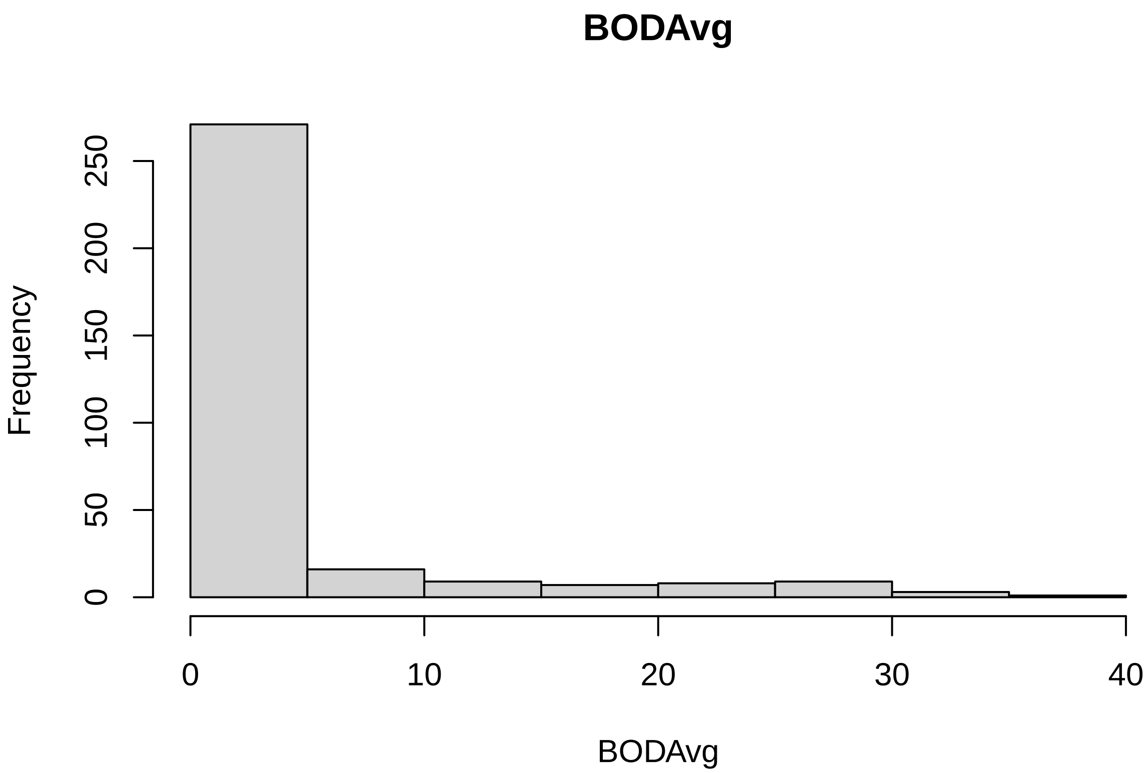




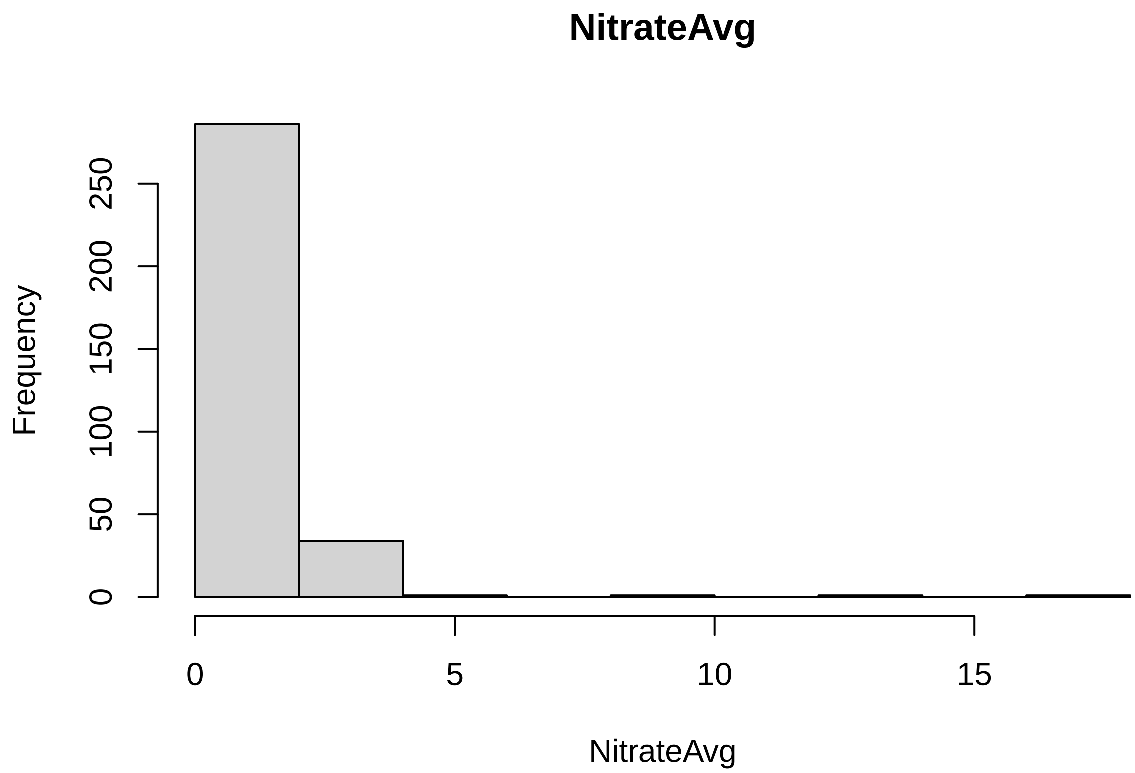
DissolvedO2Avg
Frequency
0
20
40
60
80
100
120
2
4
6
8
10
DissolvedO2Avg

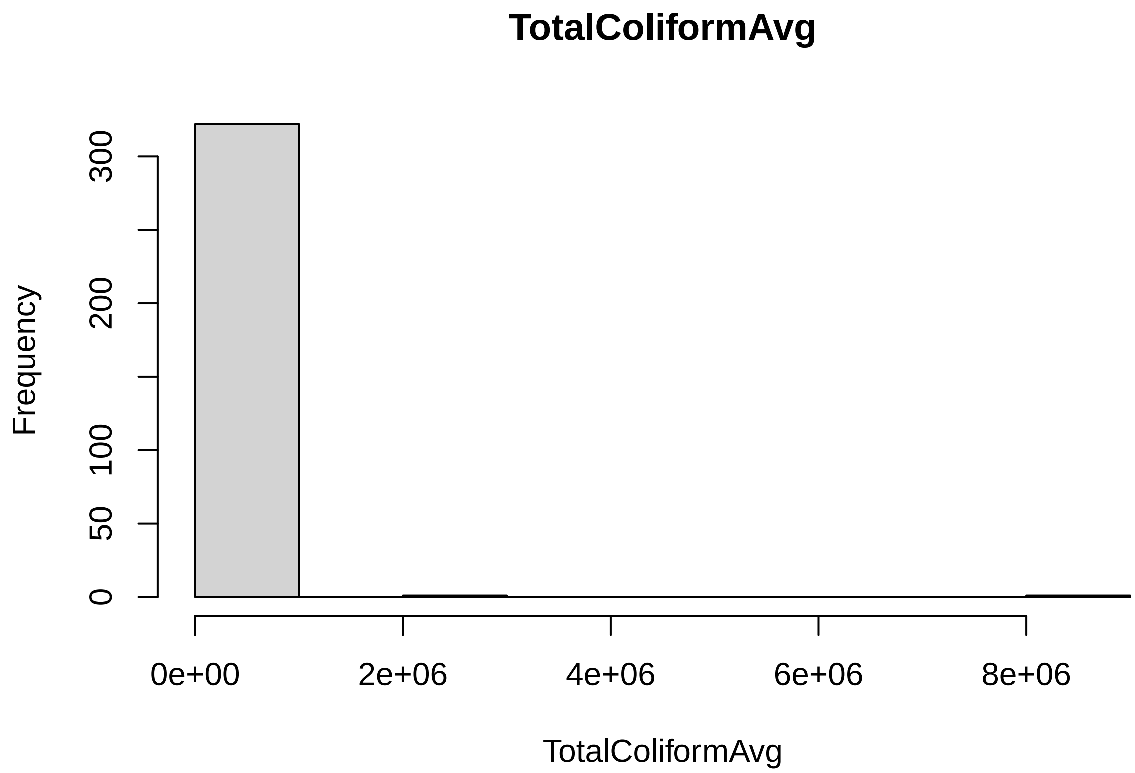

pHAvg
Frequency
0
50
100
150
3
4
5
6
7
8
pHAvg


ConductivityAvg
Frequency
0
50
100
150
200
250
0
10000
20000
30000
40000
ConductivityAvg

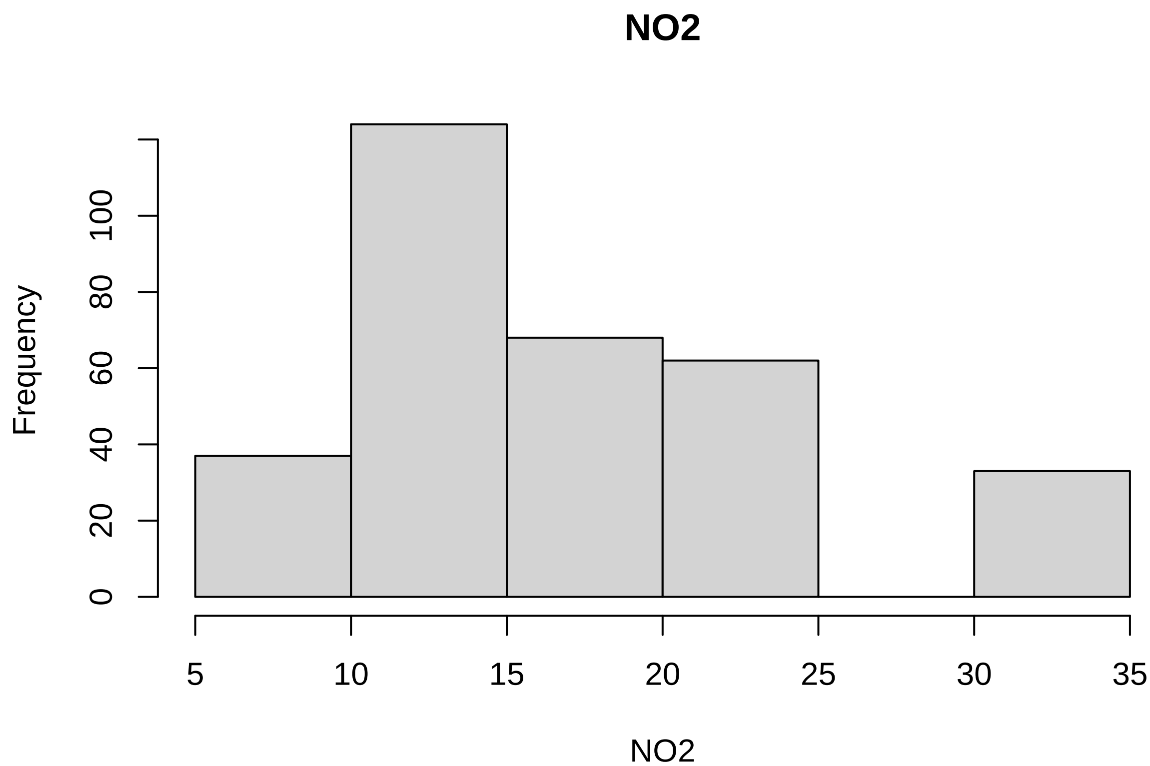


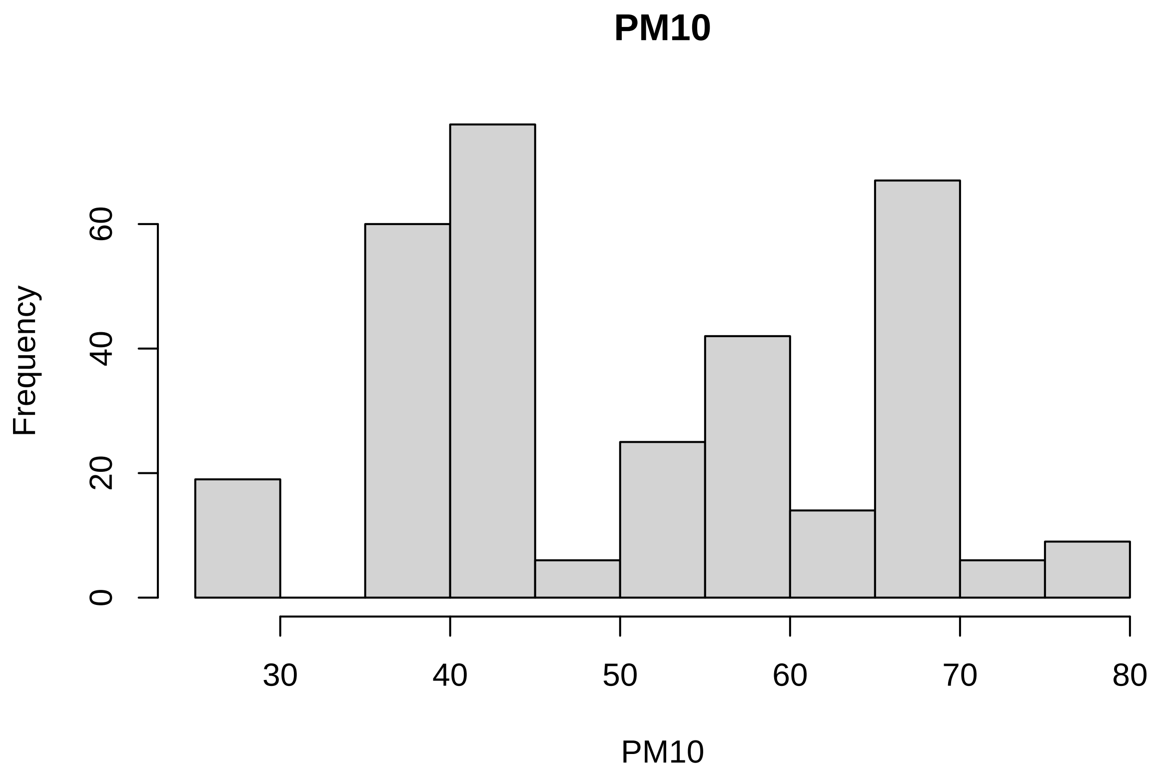
BODAvg
Frequency
0
50
100
150
200
250
0
10
20
30
40
BODAvg

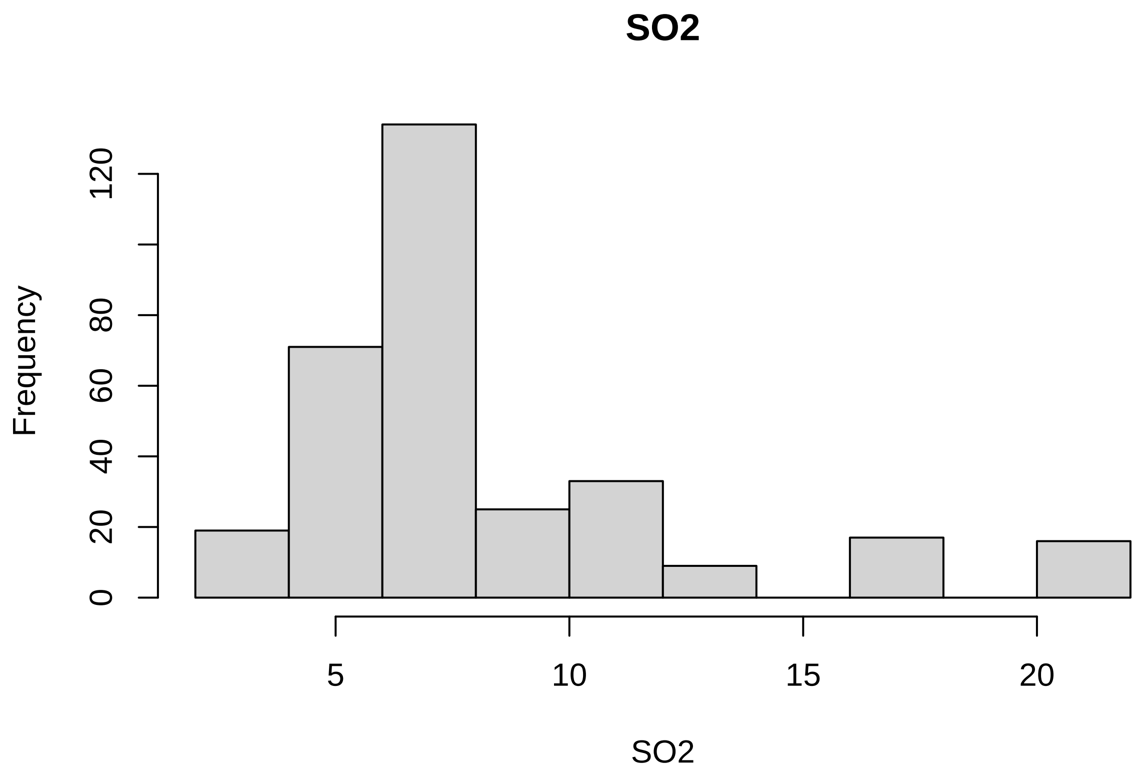

NitrateAvg
Frequency
0
50
100
150
200
250
0
5
10
15
NitrateAvg

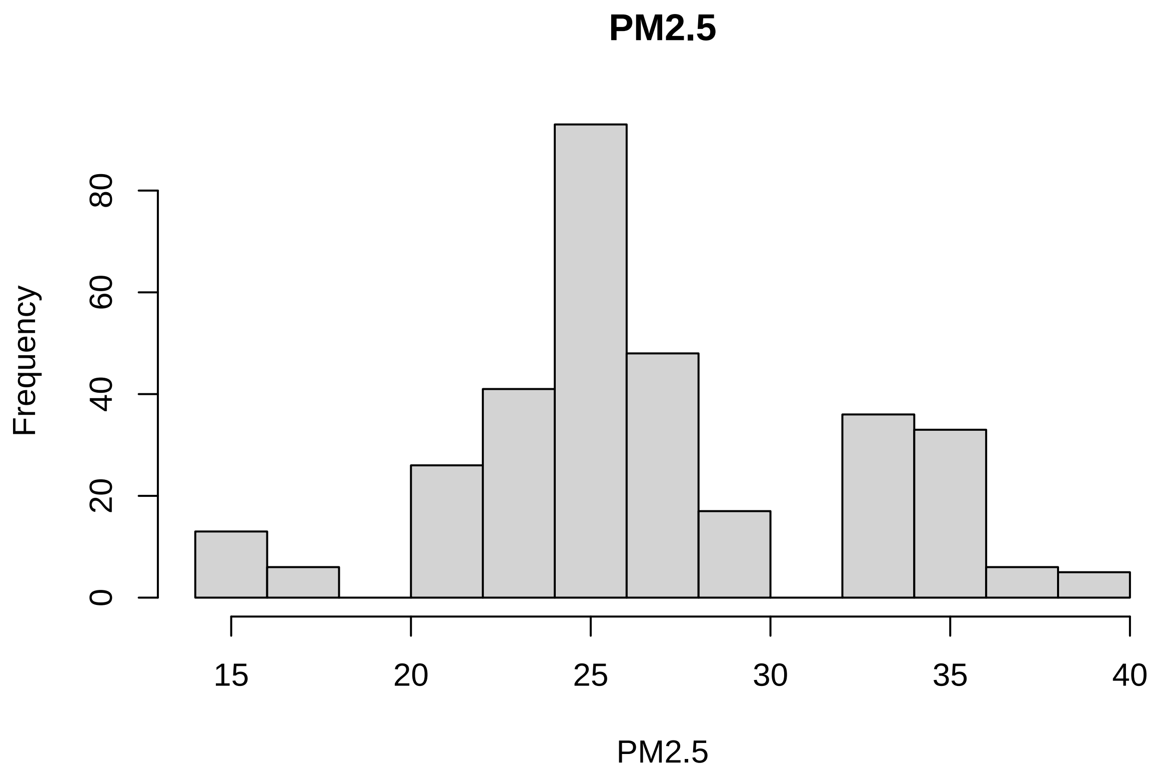


TotalColiformAvg
Frequency
0
50
100
200
300
0e+00
2e+06
4e+06
6e+06
8e+06
TotalColiformAvg

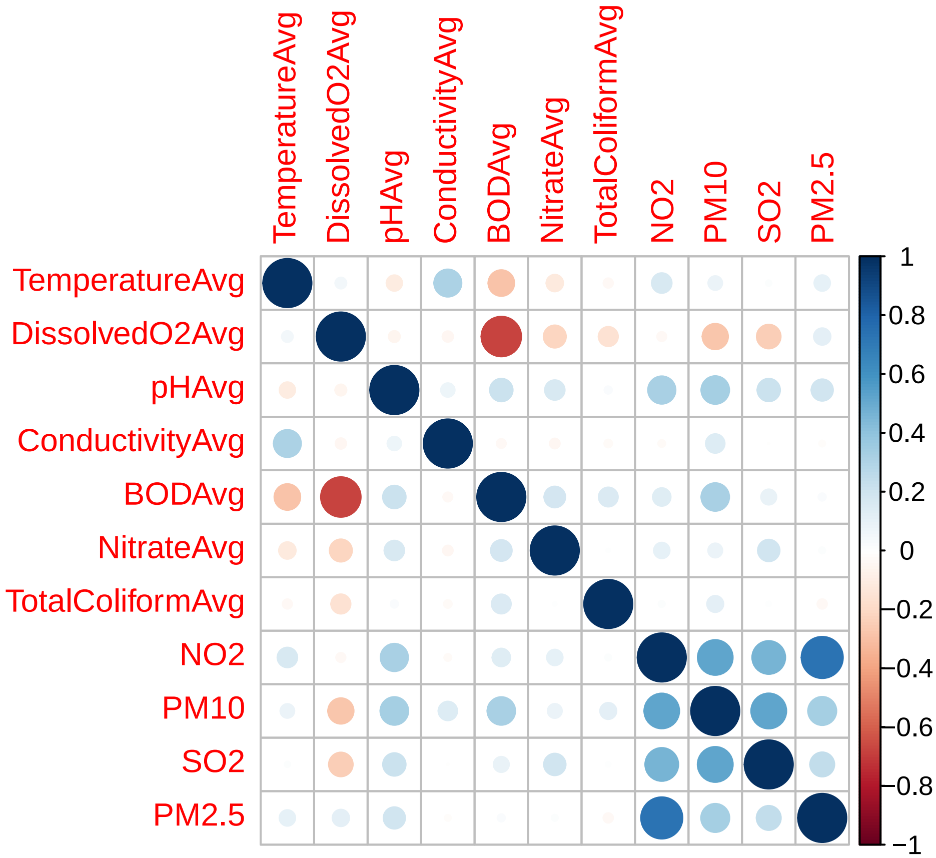

NO2
Frequency
0
20
40
60
80
100
5
10
15
20
25
30
35
NO2


PM10
Frequency
0
20
40
60
30
40
50
60
70
80
PM10


SO2
Frequency
0
20
40
60
80
120
5
10
15
20
SO2




```
cov_mat = cov(waterQuality_2021_Avg[, numCols])

corr_matrix = cor(waterQuality_2021_Avg[, numCols])

library(corrplot)

corrplot(corr_matrix)
```




```r
waterQuality_2021_Avg = aggregate(cbind(TemperatureAvg,
                          DissolvedO2Avg,
                          pHAvg,
                          ConductivityAvg,
                          BODAvg,
                          NitrateAvg,
                          TotalColiformAvg,
                          FecalColiformAvg,
                          NO2,
                          PM10,
                          SO2,
                          PM2.5) ~ State,
                    data = waterQuality_2021_Avg,
                    mean)

pca_data = waterQuality_2021_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"NitrateAvg"
,"FecalColiformAvg"
,"TotalColiformAvg"
,"NO2"
,"PM10"
,"SO2"
```

```
,"PM2.5")]

# Center and scale the data
pca_data_scaled = scale(pca_data)

# Perform PCA
pca_result = princomp(pca_data_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(pca_data_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.9376299 1.4515835 1.2424905 1.0652976 0.92710471
## Proportion of Variance 0.3312714 0.1859201 0.1362161 0.1001346 0.07584028
## Cumulative Proportion  0.3312714 0.5171916 0.6534077 0.7535423 0.82938256
##                           Comp.6     Comp.7     Comp.8     Comp.9     Comp.10
## Standard deviation     0.7818993 0.68406166 0.61860516 0.55749759 0.333196286
## Proportion of Variance 0.0539441 0.04128885 0.03376521 0.02742384 0.009795862
## Cumulative Proportion  0.8833267 0.92461551 0.95838072 0.98580456 0.995600426
##                            Comp.11     Comp.12
## Standard deviation     0.186938080 0.122131030
## Proportion of Variance 0.003083457 0.001316117
## Cumulative Proportion  0.998683883 1.000000000
```

```
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

```
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

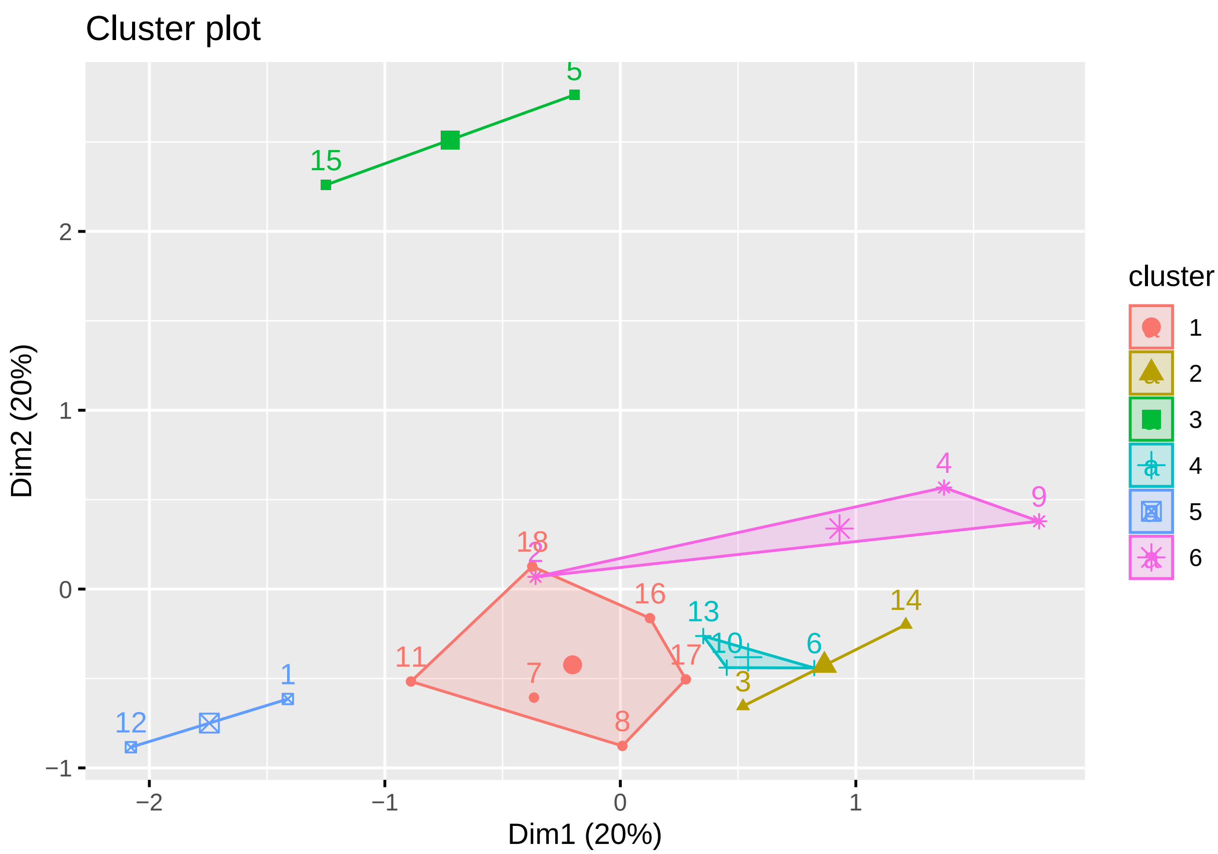
```
##      Comp.1      Comp.2      Comp.3      Comp.4      Comp.5      Comp.6
## 0.331271449 0.185920105 0.136216118 0.100134608 0.075840278 0.053944101
##      Comp.7      Comp.8      Comp.9     Comp.10     Comp.11     Comp.12
## 0.041288855 0.033765207 0.027423843 0.009795862 0.003083457 0.001316117
```

```
pc.comp = pca_result$scores

#85%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
```

```r
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]
pc.comp5 = -1*pc.comp[,5]


library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4,pc.comp5)

X
```

```
##         pc.comp1    pc.comp2    pc.comp3    pc.comp4    pc.comp5
##  [1,] -1.2256159  1.21290290 -1.09905181 -0.26748734 -1.95934192
##  [2,]  0.1361639 -0.44459065 -1.35355321 -0.38420450 -1.82227074
##  [3,] -1.3054933 -1.34471786  1.24277836 -2.05127525  0.38093732
##  [4,]  1.1320970 -2.26109729 -0.55426752 -0.68091507  0.32014166
##  [5,]  5.5096568  0.08379829  0.37463154  0.38626322 -0.68143113
##  [6,] -0.8799462 -0.22837961  1.10496637  2.74552006  0.44619980
##  [7,] -1.2101904  0.51312963 -1.28112658 -0.01164555 -0.20454280
##  [8,] -1.7484002  0.02625637  0.95987475 -0.86039828  0.67342956
##  [9,]  0.7555221 -2.33286275 -1.78801173  0.96761355  0.34123699
## [10,] -0.8761098 -0.06120426 -0.33734481  1.07126141  0.60422233
## [11,] -1.0300754  2.05497936  0.71272611 -0.18642264  1.36875777
## [12,] -1.7634714  2.67003031  1.02592796 -0.06283341 -1.24224080
## [13,] -0.5237739 -0.03817130  0.24834157  1.66783716 -0.01851435
## [14,] -0.3970150 -2.62600786  2.38221075 -0.65952544 -0.78205788
## [15,]  4.5051909  2.07587258  1.16496386 -0.54046226  0.51827932
## [16,] -0.3245045 -0.08311863  0.06883471 -0.15944735  0.33948840
## [17,] -1.0067379 -0.19861999 -0.23621440  0.21250565  0.34113454
## [18,]  0.2527034  0.98180077 -2.63568590 -1.18638398  1.37657195
```

```r
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2021_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2021_Avg$State,waterQuality_2021_Avg$cluster)
```

```
##
##                                                1 2 3 4 5 6
##   ANDHRA PRADESH                               0 0 0 0 1 0
##   DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI 0 0 0 0 0 1
##   GOA                                          0 1 0 0 0 0
##   GUJARAT                                      0 0 0 0 0 1
##   HARYANA                                      0 0 1 0 0 0
##   HIMACHAL\r\nPRADESH                          0 0 0 1 0 0
##   KARNATAKA                                    1 0 0 0 0 0
##   KERALA                                       1 0 0 0 0 0
##   MAHARASHTRA                                  0 0 0 0 0 1
##   MANIPUR                                      0 0 0 1 0 0
##   MEGHALAYA                                    1 0 0 0 0 0
##   MIZORAM                                      0 0 0 0 1 0
##   ODISHA                                       0 0 0 1 0 0
##   PUDUCHERRY                                   0 1 0 0 0 0
##   PUNJAB                                       0 0 1 0 0 0
##   State Name                                   1 0 0 0 0 0
##   TAMIL NADU                                   1 0 0 0 0 0
##   TRIPURA                                      1 0 0 0 0 0
```

```r
waterQuality_2021_Avg
```

```
##                                           State TemperatureAvg DissolvedO2Avg
## 1                                ANDHRA PRADESH       23.50000       6.983333
## 2  DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI       26.11000       5.940000
## 3                                           GOA       27.17308       6.292308
## 4                                       GUJARAT       24.29412       5.002941
## 5                                       HARYANA       21.38959       5.094444
## 6                           HIMACHAL\r\nPRADESH       17.33333       7.883333
## 7                                     KARNATAKA       25.00000       7.416667
## 8                                        KERALA       25.36620       6.465493
## 9                                   MAHARASHTRA       24.99701       6.506061
## 10                                      MANIPUR       19.08333       6.937500
## 11                                    MEGHALAYA       14.55833       6.345833
## 12                                      MIZORAM       16.61538       6.734615
## 13                                       ODISHA       15.50000       7.378571
## 14                                   PUDUCHERRY       26.80000       6.060000
## 15                                       PUNJAB       13.95294       3.532353
## 16                                   State Name       21.90126       6.294272
## 17                                   TAMIL NADU       24.50000       6.957143
## 18                                      TRIPURA       18.53125       5.690625
##       pHAvg ConductivityAvg    BODAvg NitrateAvg TotalColiformAvg
## 1  7.708333        366.1667  1.783333  1.7633333         150.2500
## 2  7.820000       5236.6500  4.065000  2.3830000        1827.7500
## 3  7.023077      14549.1923  1.671154  0.5980769        3225.5577
## 4  7.750000       7829.2353  4.994118  0.6073529        1097.5000
## 5  7.822222       1273.0556 20.177778  1.3876593      406828.5000
## 6  7.575000        726.3333  2.091667  0.8416667       14344.6667
## 7  7.175000        121.5833  2.250000  1.9233333         637.5000
## 8  6.942958       3742.0000  1.700704  0.5437324        2565.9155
## 9  7.534848       3783.1818  4.351515  1.4557576        1550.6515
## 10 7.269444        260.6250  3.397222  1.0101272         221.8750
## 11 6.922917        146.6042  6.875000  1.0356250       12142.9167
## 12 7.603846        213.9231  1.546154  1.0138462       17167.3474
## 13 7.742857       3743.0714  1.425000  0.8921429        2275.8929
## 14 7.670000      15654.2000  9.830000  0.3800000       34615.2025
## 15 7.514706        764.7941 21.176471  1.5891176      532942.0588
## 16 7.296440       3526.7307  4.499845  1.0513112       43034.0032
## 17 7.271429        285.9643  2.617857  0.8671429         159.3929
## 18 7.153125        172.5938  1.787500  2.2262500         237.6875
##    FecalColiformAvg       NO2     PM10       SO2    PM2.5 cluster
## 1          12.83333 17.562500 28.25000  7.125000 17.56250       5
## 2        1128.35000 17.758012 51.72925  8.230870 26.77126       6
## 3        1854.50000 13.411765 59.06424  7.021524 21.26011       2
## 4         789.00000 24.562963 67.99259 16.120823 29.08395       6
## 5      253693.94444 24.576923 78.03846 12.346154 26.32933       3
## 6       10861.25000 11.119048 71.55952  2.226190 36.89954       4
## 7         556.83333 17.102624 47.58049  7.824026 24.67611       1
## 8        1392.42254 12.891386 43.55600  4.900582 24.99776       1
## 9         284.66667 34.694938 67.94619 11.944126 35.15770       6
## 10         72.31944 24.231229 38.50000  7.254072 32.64061       4
## 11       3798.75000  9.928571 39.37500  6.562912 23.85490       1
## 12       4610.55843  5.071429 29.77914  2.571429 14.86606       5
```

```
## 13        961.10714 17.290323 63.40261  7.091398 27.53333       4
## 14       9147.68153 11.500000 41.83333  6.500000 39.28123       2
## 15      54922.88235 17.832208 67.48132  7.546342 23.52170       3
## 16      11396.85191 17.758012 51.72925  8.230870 26.77126       1
## 17         50.07143 17.758012 51.72925  8.230870 26.77126       1
## 18         55.50000 13.000000 55.75000 21.000000 24.25000       1
```

```
Result_2021= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_group$Di


Result_2021$Rank=c("A", "B", "C", "D", "E","F")

class(Result_2021$cluster)
```

```
## [1] "integer"
```

```
class(waterQuality_2021_Avg$cluster)
```

```
## [1] "integer"
```

```
WaterAir2021 = merge(waterQuality_2021_Avg, Result_2021[,c("cluster","Rank")], by = "cluster", all.x = 

WaterQualityAlone = waterQuality_2021_Avg[, c("TemperatureAvg"
,"DissolvedO2Avg"
,"pHAvg"
,"ConductivityAvg"
,"BODAvg"
,"FecalColiformAvg"
,"NitrateAvg"
,"TotalColiformAvg"
)]

# Center and scale the data
WaterQualityAlone_scaled = scale(WaterQualityAlone)

# Perform PCA
pca_result = princomp(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE)
```

```
## Warning: In princomp.default(WaterQualityAlone_scaled, center = TRUE, scale. = TRUE) :
##  extra arguments 'center', 'scale.' will be disregarded
```

```
# Print the summary of PCA results
summary(pca_result)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4     Comp.5
## Standard deviation     1.8028738 1.2809666 0.9985130 0.8835962 0.74712918
## Proportion of Variance 0.4301939 0.2171747 0.1319596 0.1033335 0.07387968
## Cumulative Proportion  0.4301939 0.6473686 0.7793282 0.8826618 0.95654145
##                            Comp.6     Comp.7      Comp.8
## Standard deviation     0.40284370 0.34949074 0.209586853
## Proportion of Variance 0.02147864 0.01616609 0.005813821
## Cumulative Proportion  0.97802009 0.99418618 1.000000000
```

```r
#reverse the signs
pca_result$rotation = -1*pca_result$rotation

#display principal components
pca_result$rotation
```

```
## numeric(0)
```

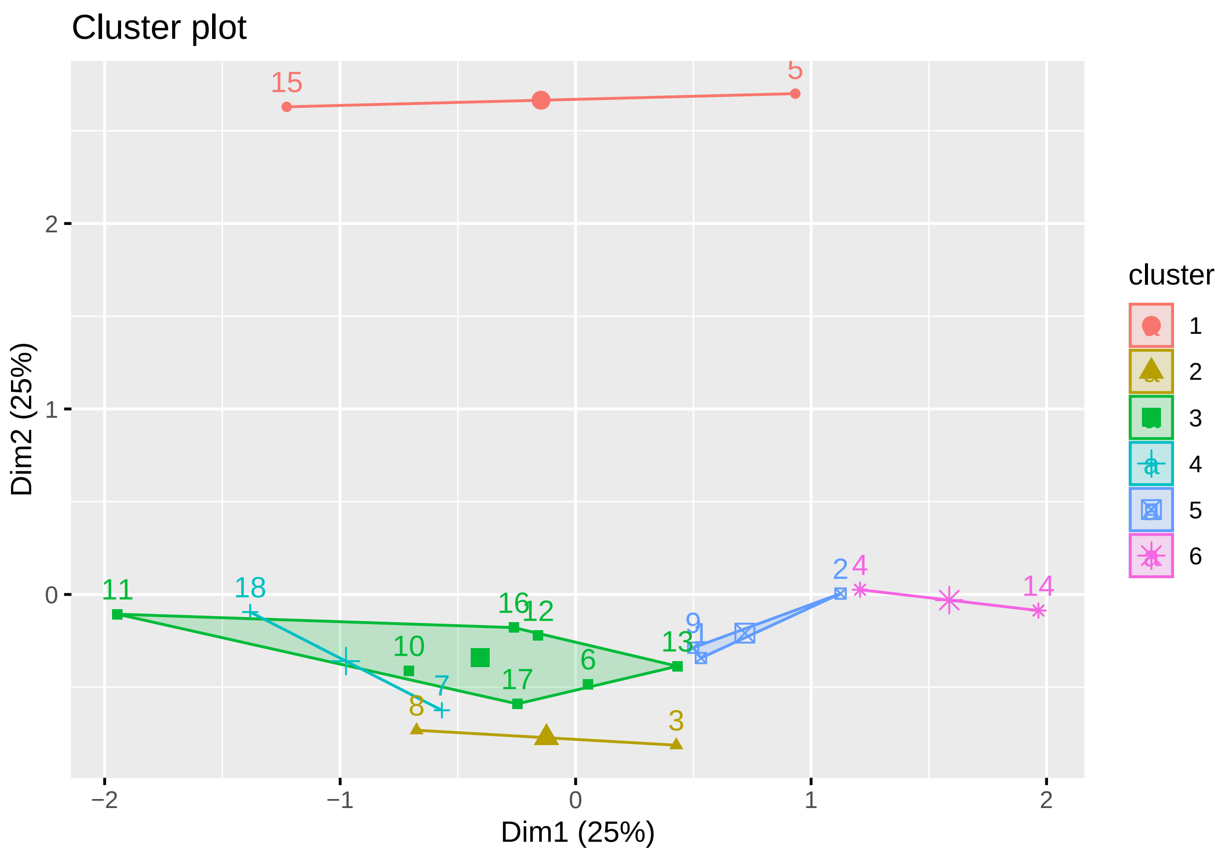
```r
var_explained = pca_result$sdev^2 / sum(pca_result$sdev^2)

print(var_explained)
```

```
##      Comp.1      Comp.2      Comp.3      Comp.4      Comp.5      Comp.6
## 0.430193912 0.217174699 0.131959623 0.103333540 0.073879678 0.021478639
##      Comp.7      Comp.8
## 0.016166088 0.005813821
```

```r
pc.comp = pca_result$scores

#86%
pc.comp1 = -1*pc.comp[,1]
pc.comp2 = -1*pc.comp[,2]
pc.comp3 = -1*pc.comp[,3]
pc.comp4 = -1*pc.comp[,4]


library(factoextra)
library(tidyr)
library(ggplot2)

X = cbind(pc.comp1, pc.comp2,pc.comp3, pc.comp4)

X
```

```
##           pc.comp1    pc.comp2    pc.comp3    pc.comp4
##  [1,] -0.636169984  0.74640330 -1.52009222  0.23349884
##  [2,]  0.008630588 -0.14172969 -2.51910497 -0.74004719
##  [3,] -1.507822991 -2.42625519  0.86949418 -0.92580545
##  [4,]  0.047543779 -1.73604674 -0.19928068  0.34068076
##  [5,]  5.009327289 -0.56402427 -0.55702984  0.71219905
##  [6,] -0.897242173  0.96542735  0.26189448  1.60434026
##  [7,] -1.158219322  1.02250860 -0.77648863 -0.97004579
##  [8,] -1.358170649 -0.59850240  1.21727004 -0.74128063
##  [9,] -0.532837835 -0.22189757 -0.88138808 -0.23232190
## [10,] -0.762517915  0.87664101  0.63350467  0.25805932
## [11,] -0.197234860  1.37099510  1.85912512 -0.39913068
## [12,] -0.411738613  1.02094634  0.17450769  1.09247423
## [13,] -0.717672270  0.62082816  0.07633468  1.80357220
## [14,] -0.160911080 -3.20598728  0.02287780  0.51602614
## [15,]  4.877243826  0.53139417  1.02721699 -0.83171684
## [16,] -0.331298567 -0.07550033  0.37451155 -0.21896807
## [17,] -1.094635812  0.17740950  0.25283244 -0.02728996
## [18,] -0.176273410  1.63738994 -0.31618522 -1.47424428
```

```
k =6
kmeans_model = kmeans(X, centers = k,nstart=1)


waterQuality_2021_Avg$cluster=kmeans_model$cluster


fviz_cluster(kmeans_model, data = X)
```




```
mean_by_group = aggregate(cbind(TemperatureAvg, DissolvedO2Avg, pHAvg,ConductivityAvg,BODAvg,NitrateAvg

table(waterQuality_2021_Avg$State,waterQuality_2021_Avg$cluster)
```

```
##
##                                              1 2 3 4 5 6
##   ANDHRA PRADESH                             0 0 0 0 1 0
##   DAMAN AND DIU,\r\nDADRA AND\r\nNAGAR HAVELI 0 0 0 0 1 0
##   GOA                                        0 1 0 0 0 0
##   GUJARAT                                    0 0 0 0 0 1
##   HARYANA                                    1 0 0 0 0 0
##   HIMACHAL\r\nPRADESH                        0 0 1 0 0 0
##   KARNATAKA                                  0 0 0 1 0 0
##   KERALA                                     0 1 0 0 0 0
##   MAHARASHTRA                                0 0 0 0 1 0
##   MANIPUR                                    0 0 1 0 0 0
```

```
##   MEGHALAYA                                          0 0 1 0 0 0
##   MIZORAM                                            0 0 1 0 0 0
##   ODISHA                                             0 0 1 0 0 0
##   PUDUCHERRY                                         0 0 0 0 0 1
##   PUNJAB                                             1 0 0 0 0 0
##   State Name                                         0 0 1 0 0 0
##   TAMIL NADU                                         0 0 1 0 0 0
##   TRIPURA                                            0 0 0 1 0 0
```

```
WaterQualityAlone
```

```
##    TemperatureAvg DissolvedO2Avg    pHAvg ConductivityAvg    BODAvg
## 1        23.50000       6.983333 7.708333        366.1667  1.783333
## 2        26.11000       5.940000 7.820000       5236.6500  4.065000
## 3        27.17308       6.292308 7.023077      14549.1923  1.671154
## 4        24.29412       5.002941 7.750000       7829.2353  4.994118
## 5        21.38959       5.094444 7.822222       1273.0556 20.177778
## 6        17.33333       7.883333 7.575000        726.3333  2.091667
## 7        25.00000       7.416667 7.175000        121.5833  2.250000
## 8        25.36620       6.465493 6.942958       3742.0000  1.700704
## 9        24.99701       6.506061 7.534848       3783.1818  4.351515
## 10       19.08333       6.937500 7.269444        260.6250  3.397222
## 11       14.55833       6.345833 6.922917        146.6042  6.875000
## 12       16.61538       6.734615 7.603846        213.9231  1.546154
## 13       15.50000       7.378571 7.742857       3743.0714  1.425000
## 14       26.80000       6.060000 7.670000      15654.2000  9.830000
## 15       13.95294       3.532353 7.514706        764.7941 21.176471
## 16       21.90126       6.294272 7.296440       3526.7307  4.499845
## 17       24.50000       6.957143 7.271429        285.9643  2.617857
## 18       18.53125       5.690625 7.153125        172.5938  1.787500
##    FecalColiformAvg NitrateAvg TotalColiformAvg
## 1          12.83333  1.7633333         150.2500
## 2        1128.35000  2.3830000        1827.7500
## 3        1854.50000  0.5980769        3225.5577
## 4         789.00000  0.6073529        1097.5000
## 5      253693.94444  1.3876593      406828.5000
## 6       10861.25000  0.8416667       14344.6667
## 7         556.83333  1.9233333         637.5000
## 8        1392.42254  0.5437324        2565.9155
## 9         284.66667  1.4557576        1550.6515
## 10         72.31944  1.0101272         221.8750
## 11       3798.75000  1.0356250       12142.9167
## 12       4610.55843  1.0138462       17167.3474
## 13        961.10714  0.8921429        2275.8929
## 14       9147.68153  0.3800000       34615.2025
## 15      54922.88235  1.5891176      532942.0588
## 16      11396.85191  1.0513112       43034.0032
## 17         50.07143  0.8671429         159.3929
## 18         55.50000  2.2262500         237.6875
```

```
Result_2021_water= mean_by_group[order(mean_by_group$TotalColiformAvg, mean_by_group$BODAvg, mean_by_gro
```

```r
Result_2021_water$Rank=c("A", "B", "C", "D", "E","F")

class(waterQuality_2021_Avg$cluster)
```

```
## [1] "integer"
```

```r
class(waterQuality_2021_Avg$cluster)
```

```
## [1] "integer"
```

```r
Water2021 = merge(waterQuality_2021_Avg, Result_2021_water[,c("cluster","Rank")], by = "cluster", all.x
```

```r
library(stringr)
library(ggplot2)
library(sf)
```

```
## Linking to GEOS 3.11.1, GDAL 3.6.2, PROJ 9.1.1; sf_use_s2() is TRUE
```

```r
plotD = WaterAir2017

# create a list of selected states with ranks
plotD$State[plotD$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(plotD$State)

ranks = plotD$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

```
## Reading layer 'IND_adm1' from data source
##   'C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp' using driver 'ESRI Shapefile'
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

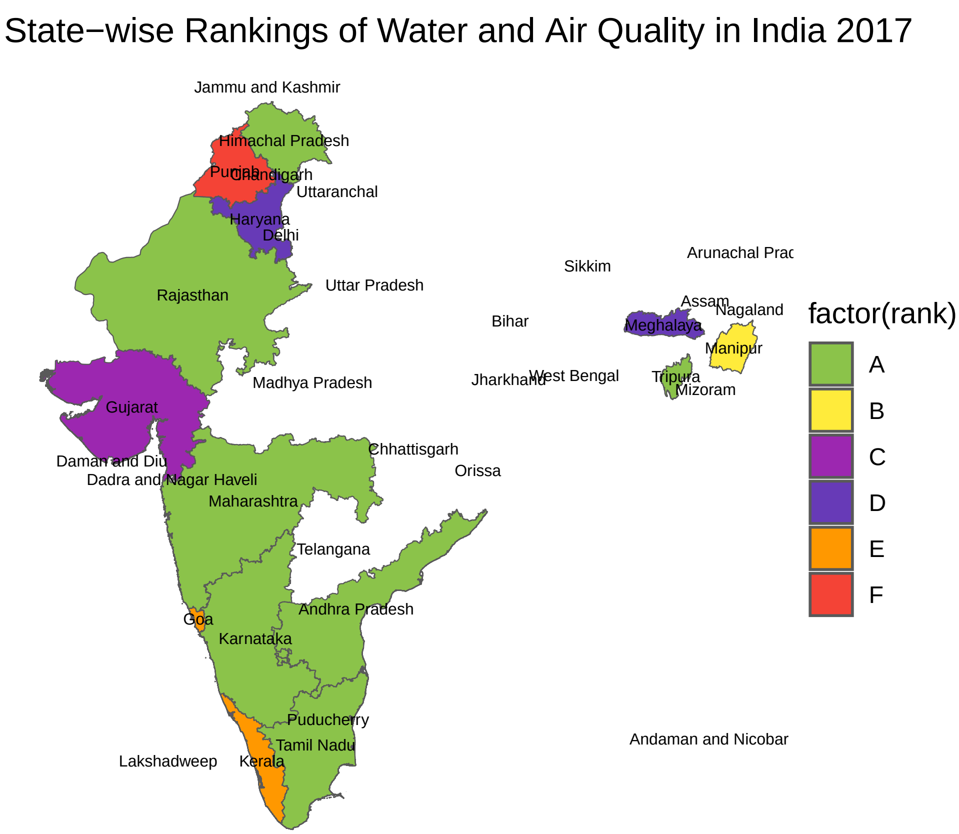
```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")



states <- india %>%
  st_centroid() %>%
```

```
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_te
  labs(title = "State-wise Rankings of Water and Air Quality in India 2017")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: ‘text‘
```




```
library(stringr)
library(ggplot2)
library(sf)

ploDWater = WaterAir2017

# create a list of selected states with ranks
```

```r
ploDWater$State[ploDWater$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(ploDWater$State)

ranks = ploDWater$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

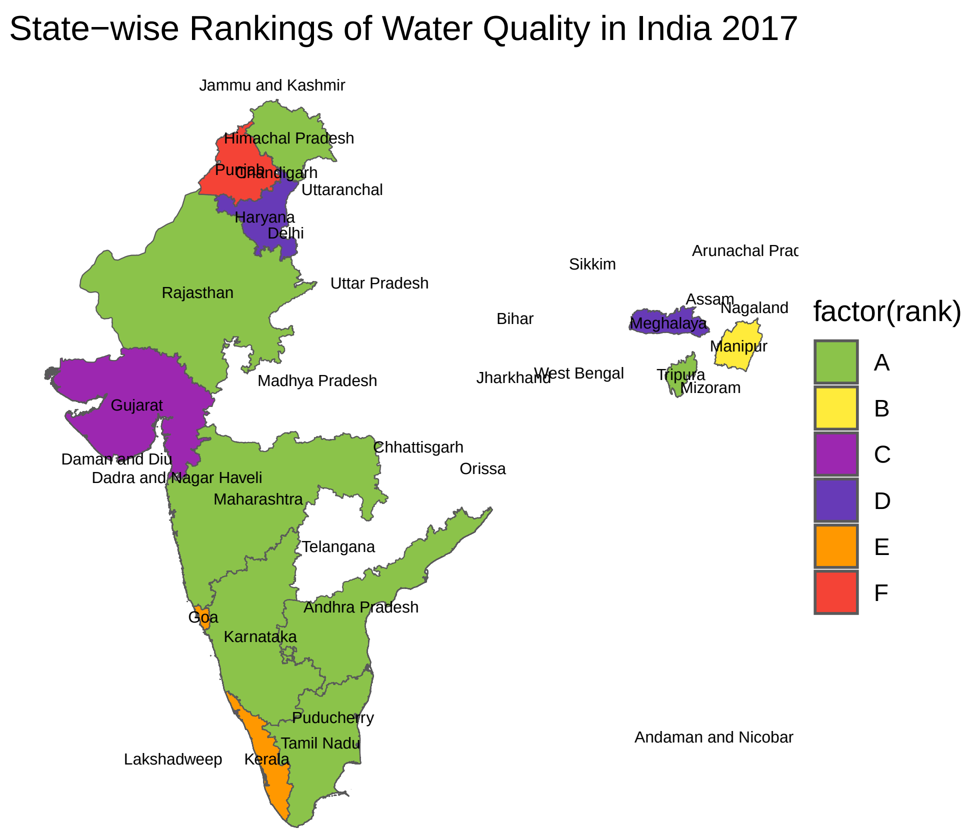
```
## Reading layer 'IND_adm1' from data source
##   'C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp' using driver 'ESRI Shapefile'
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")


states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_te
  labs(title = "State-wise Rankings of Water Quality in India 2017")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: 'text'
```




```r
library(stringr)
library(ggplot2)
library(sf)

plotD = WaterAir2018

# create a list of selected states with ranks
plotD$State[plotD$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(plotD$State)

ranks = plotD$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

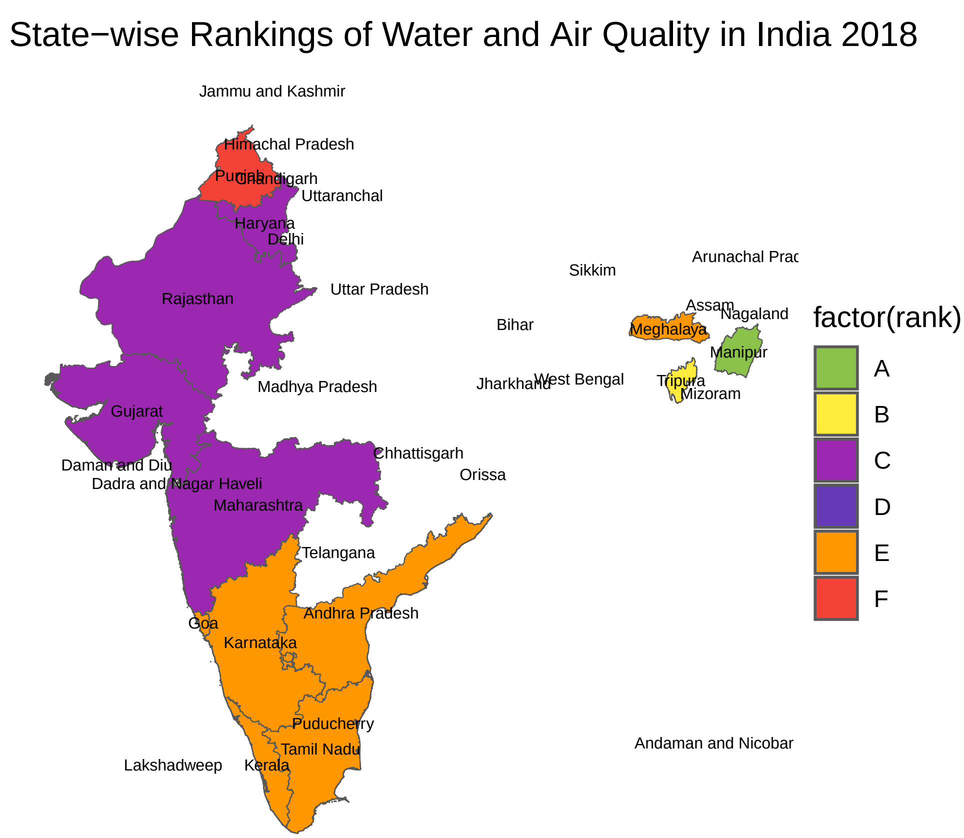
```
## Reading layer 'IND_adm1' from data source
##   'C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp' using driver 'ESRI Shapefile'
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")


states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_t
  labs(title = "State-wise Rankings of Water and Air Quality in India 2018")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: `text`
```



```r
library(stringr)
library(ggplot2)
library(sf)

ploDWater = Water2018

# create a list of selected states with ranks
ploDWater$State[ploDWater$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(ploDWater$State)

ranks = ploDWater$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

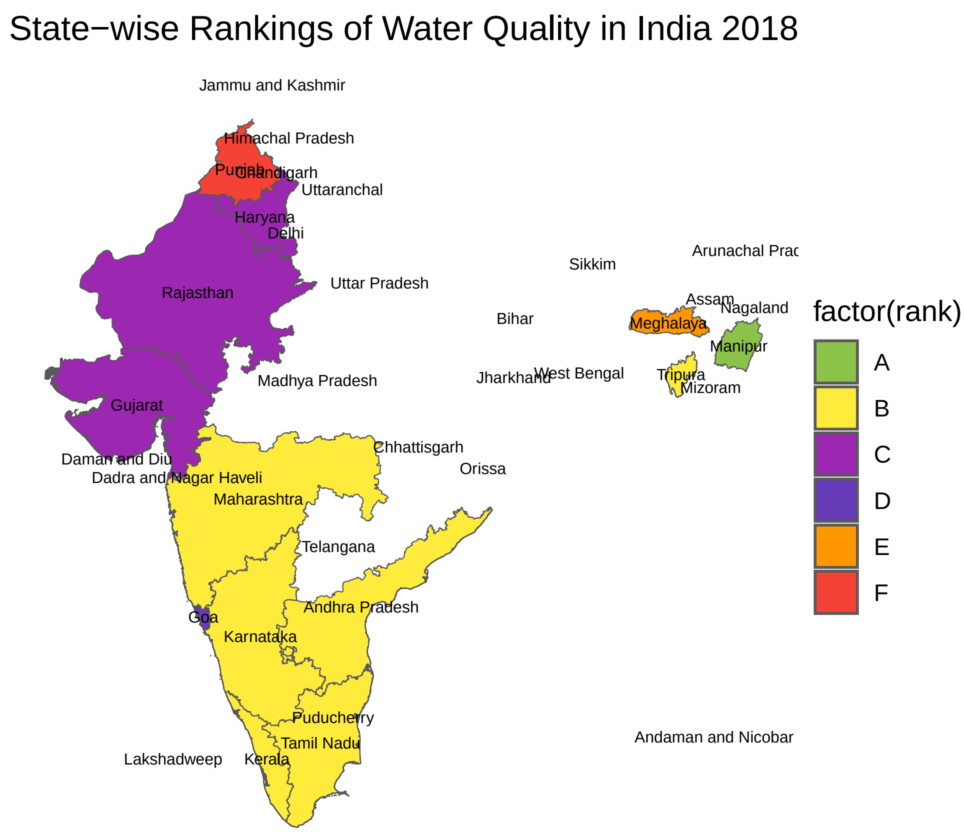
```
## Reading layer ‘IND_adm1’ from data source
##   ‘C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp’ using driver ‘ESRI Shapefile’
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")



states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_te
  labs(title = "State-wise Rankings of Water Quality in India 2018")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: ‘text‘
```




```r
library(stringr)
library(ggplot2)
library(sf)

plotD = WaterAir2019

# create a list of selected states with ranks
plotD$State[plotD$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(plotD$State)

ranks = plotD$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

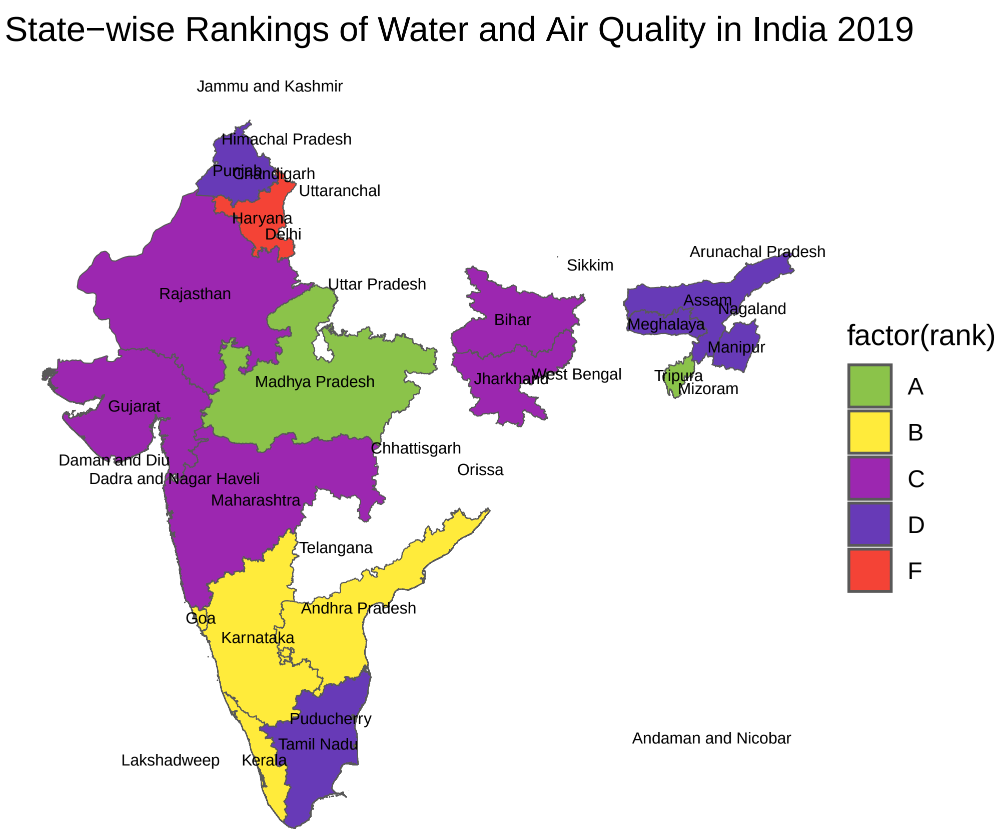
```
## Reading layer 'IND_adm1' from data source
##   'C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp' using driver 'ESRI Shapefile'
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")


states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_t
  labs(title = "State-wise Rankings of Water and Air Quality in India 2019")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: `text`
```



```
library(stringr)
library(ggplot2)
library(sf)

ploDWater = Water2019

# create a list of selected states with ranks
ploDWater$State[ploDWater$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(ploDWater$State)

ranks = ploDWater$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
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```
## Reading layer 'IND_adm1' from data source
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## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
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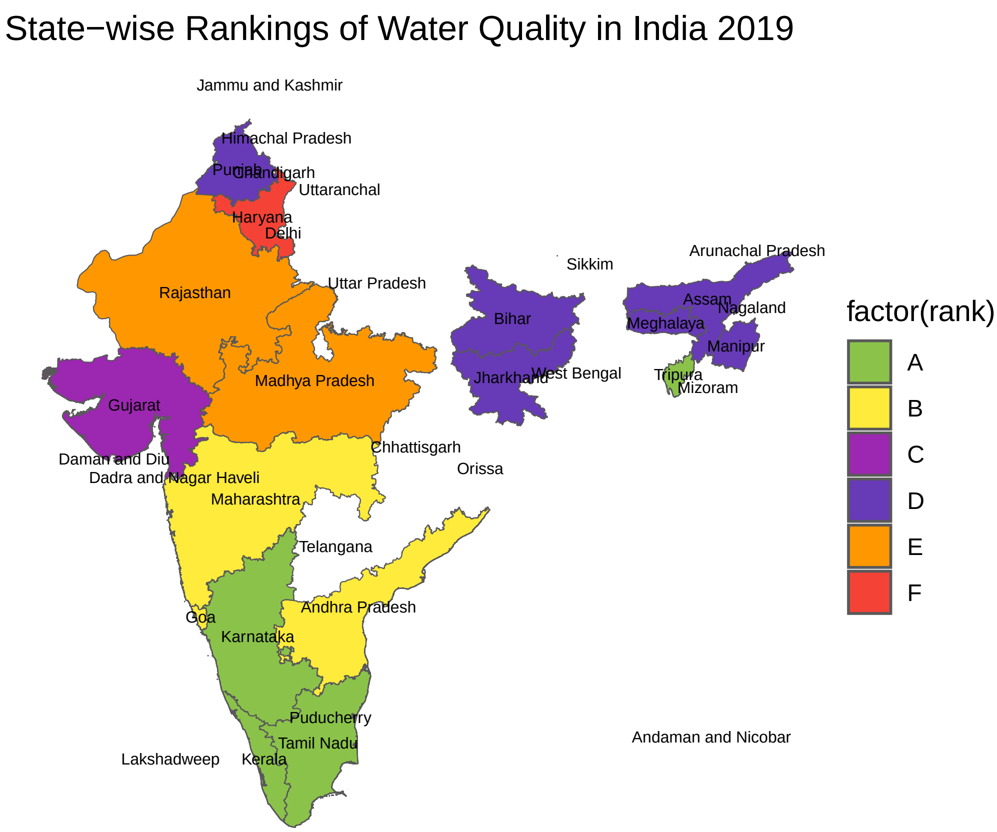
```
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")


states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_t
  labs(title = "State-wise Rankings of Water Quality in India 2019")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: `text`
```




```r
library(stringr)
library(ggplot2)
library(sf)

plotD = WaterAir2020

# create a list of selected states with ranks
plotD$State[plotD$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(plotD$State)

ranks = plotD$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

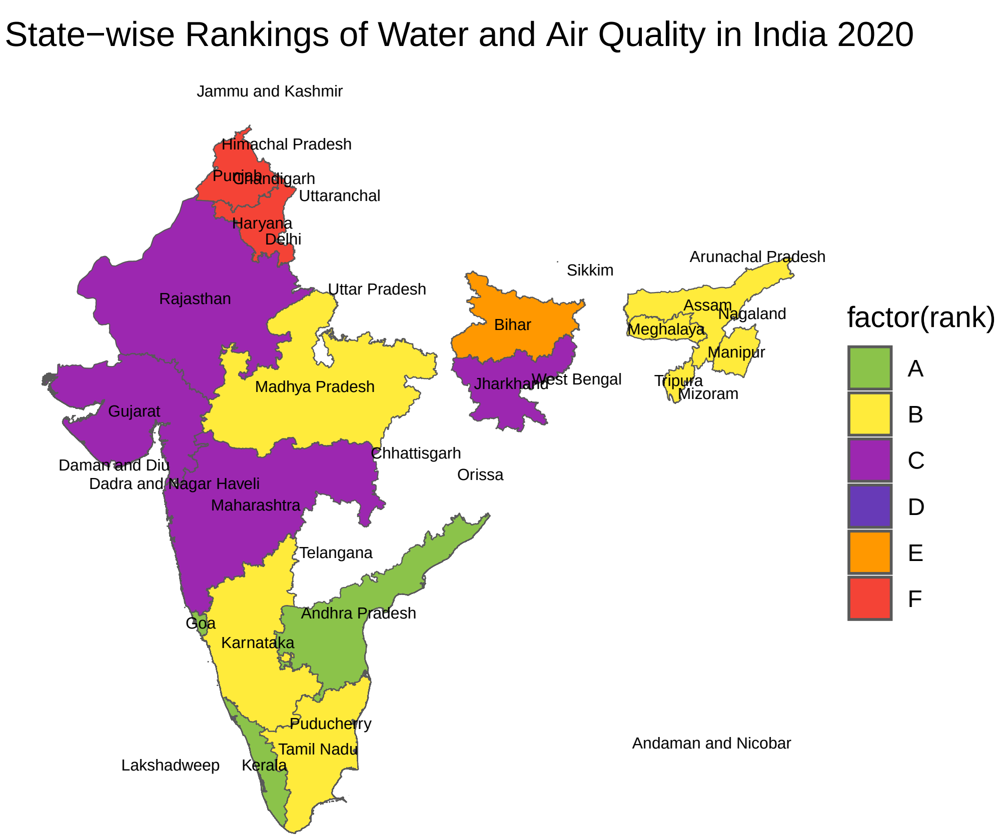
```
## Reading layer 'IND_adm1' from data source
##   'C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp' using driver 'ESRI Shapefile'
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")


states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_t
  labs(title = "State-wise Rankings of Water and Air Quality in India 2020")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: `text`
```



```r
library(stringr)
library(ggplot2)
library(sf)

ploDWater = Water2020

# create a list of selected states with ranks
ploDWater$State[ploDWater$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(ploDWater$State)

ranks = ploDWater$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

```
## Reading layer ‘IND_adm1’ from data source
##   ‘C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp’ using driver ‘ESRI Shapefile’
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")



states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_t
  labs(title = "State-wise Rankings of Water Quality in India 2020")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: ‘text‘
```


```r
library(stringr)
library(ggplot2)
library(sf)

plotD = WaterAir2021

# create a list of selected states with ranks
plotD$State[plotD$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(plotD$State)

ranks = plotD$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
```

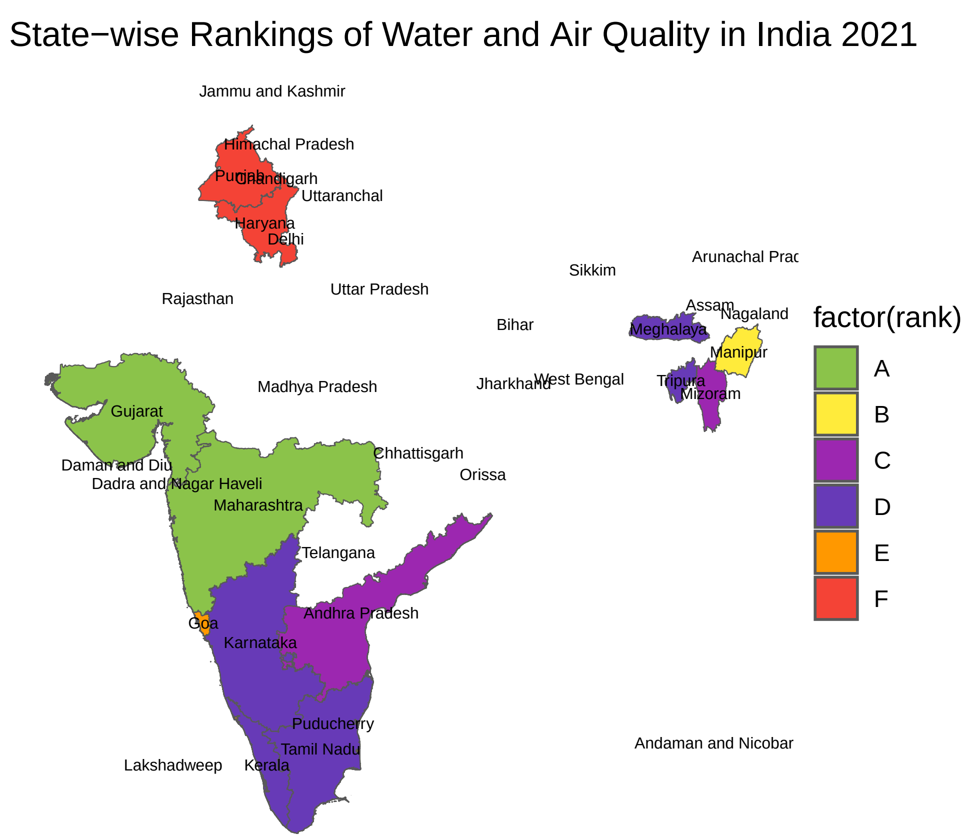
```
## Reading layer ‘IND_adm1’ from data source
##   ‘C:\Users\SRINU\Desktop\DPA Project\IND_adm1.shp’ using driver ‘ESRI Shapefile’
## Simple feature collection with 36 features and 9 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 68.18625 ymin: 6.754256 xmax: 97.41516 ymax: 35.50133
## Geodetic CRS:  WGS 84
```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")

# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")


states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
## Warning: st_centroid assumes attributes are constant over geometries
```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
  scale_fill_manual(values = colors) +
  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_te
  labs(title = "State-wise Rankings of Water and Air Quality in India 2021")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: `text`
```



```r
library(stringr)
library(ggplot2)
library(sf)

ploDWater = Water2021

# create a list of selected states with ranks
ploDWater$State[ploDWater$State == "DAMAN AND DIU, DADRA AND NAGAR HAVELI"] = "DAMAN AND DIU"

selected_states = str_to_title(ploDWater$State)

ranks = ploDWater$Rank
state_ranks = data.frame(state = selected_states, rank = ranks)

# read in the shapefile data for Indian states
india = st_read("C:/Users/SRINU/Desktop/DPA Project/IND_adm1.shp")
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## Reading layer ‘IND_adm1’ from data source
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```

```r
# join the state rank data with the shapefile data
india_ranks = merge(india, state_ranks, by.x = "NAME_1", by.y = "state")



# manually specify the colors for each rank
colors = c("#8BC34A", "#FFEB3B", "#9C27B0", "#673AB7","#FF9800", "#F44336")
names(colors) = c("A", "B", "C", "D", "E", "F")



states <- india %>%
  st_centroid() %>%
  st_coordinates() %>%
  as.data.frame() %>%
  mutate(state = india$NAME_1)
```

```
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```

```r
ggplot(data = india_ranks) +
  geom_sf(aes(fill = factor(rank))) +
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  theme_void() +
  geom_text(data = states, aes(x = X, y = Y, label = state), size = 2, color = "black",text = element_te
  labs(title = "State-wise Rankings of Water Quality in India 2021")
```

```
## Warning in geom_text(data = states, aes(x = X, y = Y, label = state), size = 2,
## : Ignoring unknown parameters: ‘text‘
```

State−wise Rankings of Water Quality in India 2021