Final R Project

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23/04/2021

setwd("~/msc data science/2nd Sem/mdsc206/University\_Ranking\_Proj")

library(funModeling)

## Loading required package: Hmisc

## Loading required package: lattice

## Loading required package: survival

## Loading required package: Formula

## Loading required package: ggplot2

##   
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:base':  
##   
## format.pval, units

## funModeling v.1.9.4 :)  
## Examples and tutorials at livebook.datascienceheroes.com  
## / Now in Spanish: librovivodecienciadedatos.ai

library(GGally)

## Registered S3 method overwritten by 'GGally':  
## method from   
## +.gg ggplot2

##   
## Attaching package: 'GGally'

## The following object is masked from 'package:funModeling':  
##   
## range01

library(lattice)  
library(tidyverse)

## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.0 ──

## ✓ tibble 3.0.5 ✓ dplyr 1.0.3  
## ✓ tidyr 1.1.2 ✓ stringr 1.4.0  
## ✓ readr 1.4.0 ✓ forcats 0.5.0  
## ✓ purrr 0.3.4

## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()  
## x dplyr::src() masks Hmisc::src()  
## x dplyr::summarize() masks Hmisc::summarize()

library(leaps)  
library(ggplot2)

#E.D.A

univdata <- read.csv("all.csv")  
univdata\_num <- read.csv("all.csv")  
univdata\_1 <- read.csv("all.csv")  
head(univdata)

## institute\_id name  
## 1 IR-A-U-0573 Indian Institute of Technology Kharagpur  
## 2 IR-A-U-0560 Indian Institute of Technology Roorkee  
## 3 IR-A-U-0263 National Institute of Technology Calicut  
## 4 IR-A-U-0127 Centre for Environmental Planning and Technology University  
## 5 IR-A-U-0116 School of Planning and Architecture  
## 6 IR-A-U-0584 Indian Institute of Engineering Science and Technology  
## tlr rpc go oi perception city state rank category  
## 1 78.58 79.73 91.80 71.71 75.54 Kharagpur West Bengal 1 architecture  
## 2 81.32 85.34 87.15 70.90 56.30 Roorkee Uttarakhand 2 architecture  
## 3 89.70 27.93 75.96 66.96 58.79 Kozhikode Kerala 3 architecture  
## 4 70.14 43.18 82.53 59.98 74.72 Ahmedabad Gujarat 4 architecture  
## 5 74.58 20.51 73.47 70.15 100.00 New Delhi Delhi 5 architecture  
## 6 71.68 62.31 74.67 52.88 37.00 Shibpur West Bengal 6 architecture

attach(univdata)  
summary(univdata)

## institute\_id name tlr rpc   
## Length:460 Length:460 Min. :35.51 Min. : 0.000   
## Class :character Class :character 1st Qu.:56.72 1st Qu.: 7.905   
## Mode :character Mode :character Median :64.53 Median :20.275   
## Mean :64.73 Mean :24.883   
## 3rd Qu.:71.72 3rd Qu.:35.925   
## Max. :95.42 Max. :96.570   
## go oi perception city   
## Min. :13.06 Min. :29.97 Min. : 0.00 Length:460   
## 1st Qu.:54.26 1st Qu.:50.27 1st Qu.: 5.90 Class :character   
## Median :64.22 Median :55.73 Median : 19.29 Mode :character   
## Mean :66.18 Mean :56.68 Mean : 27.05   
## 3rd Qu.:78.07 3rd Qu.:63.83 3rd Qu.: 43.31   
## Max. :98.48 Max. :81.64 Max. :100.00   
## state rank category   
## Length:460 Min. : 1.00 Length:460   
## Class :character 1st Qu.: 17.00 Class :character   
## Mode :character Median : 40.50 Mode :character   
## Mean : 59.77   
## 3rd Qu.: 85.25   
## Max. :200.00

dim(univdata)

## [1] 460 11

univdata\_num %>% select\_if(is.numeric)

## tlr rpc go oi perception rank  
## 1 78.58 79.73 91.80 71.71 75.54 1  
## 2 81.32 85.34 87.15 70.90 56.30 2  
## 3 89.70 27.93 75.96 66.96 58.79 3  
## 4 70.14 43.18 82.53 59.98 74.72 4  
## 5 74.58 20.51 73.47 70.15 100.00 5  
## 6 71.68 62.31 74.67 52.88 37.00 6  
## 7 79.91 22.57 74.12 73.51 52.25 7  
## 8 49.63 52.10 83.90 59.37 73.03 8  
## 9 74.20 5.20 82.32 68.21 56.30 9  
## 10 66.06 0.67 87.09 78.60 44.47 10  
## 11 57.69 25.46 92.24 54.30 37.00 11  
## 12 61.52 0.00 79.85 70.35 54.99 12  
## 13 51.76 40.71 60.95 60.59 53.64 13  
## 14 63.40 0.01 77.67 57.88 54.99 14  
## 15 56.44 34.30 71.03 55.22 25.28 15  
## 16 40.68 50.18 88.25 40.73 34.91 16  
## 17 47.68 24.60 78.55 51.00 54.99 17  
## 18 46.60 25.50 58.10 52.83 80.87 18  
## 19 44.44 51.07 59.84 58.42 27.90 19  
## 20 53.75 19.68 80.14 47.84 22.48 20  
## 21 86.86 75.47 92.13 53.76 100.00 1  
## 22 83.05 79.41 71.63 76.42 74.72 2  
## 23 79.92 80.24 81.41 57.36 63.00 3  
## 24 82.66 60.57 74.93 63.38 80.44 4  
## 25 81.76 45.05 86.56 72.98 82.19 5  
## 26 78.72 55.20 73.87 72.41 65.62 6  
## 27 78.27 55.21 71.42 59.28 60.20 7  
## 28 71.10 45.00 92.13 52.56 60.20 8  
## 29 73.92 45.61 95.99 56.37 37.72 9  
## 30 76.08 40.98 80.87 70.69 57.20 10  
## 31 78.67 44.21 88.53 63.18 19.29 11  
## 32 79.84 37.00 97.12 63.62 19.29 12  
## 33 69.43 41.74 90.41 73.89 26.38 13  
## 34 73.65 44.38 84.45 54.45 32.43 14  
## 35 81.55 44.47 64.81 48.59 50.45 15  
## 36 73.33 41.46 68.72 60.36 60.20 16  
## 37 77.27 33.07 77.48 65.81 50.45 17  
## 38 85.39 12.11 92.16 59.45 46.63 18  
## 39 78.86 36.28 55.20 73.84 50.45 19  
## 40 77.63 32.69 63.60 67.91 53.96 20  
## 41 73.69 36.70 74.06 60.48 32.43 21  
## 42 74.23 24.35 91.54 55.54 26.38 22  
## 43 70.73 17.36 86.58 67.18 46.63 23  
## 44 76.43 17.89 85.12 70.85 26.38 24  
## 45 65.62 26.42 80.63 66.37 46.63 25  
## 46 75.98 10.38 84.85 57.14 57.20 26  
## 47 67.82 32.71 93.44 51.67 0.00 27  
## 48 71.58 24.15 72.61 66.19 32.43 28  
## 49 69.84 23.70 92.17 63.83 0.00 29  
## 50 64.76 20.21 72.47 62.87 63.00 30  
## 51 95.42 94.64 83.90 61.31 100.00 1  
## 52 90.79 96.15 80.36 64.81 94.46 2  
## 53 91.00 93.37 77.60 49.99 92.51 3  
## 54 86.22 82.08 88.44 54.21 85.78 4  
## 55 77.32 87.11 83.21 56.62 89.31 5  
## 56 77.21 76.57 89.65 61.71 60.55 6  
## 57 83.04 70.73 83.03 59.13 62.45 7  
## 58 82.51 52.47 71.54 55.98 60.42 8  
## 59 72.11 50.04 74.71 61.49 63.68 9  
## 60 79.89 53.31 72.09 57.76 27.15 10  
## 61 72.34 47.77 77.77 56.07 53.49 11  
## 62 64.02 63.12 72.11 55.07 39.78 12  
## 63 68.93 46.03 78.67 55.24 55.59 13  
## 64 64.62 54.07 61.50 51.62 68.24 14  
## 65 56.79 64.06 63.07 58.21 46.29 15  
## 66 64.38 57.82 74.30 47.23 30.48 16  
## 67 53.73 62.04 76.45 40.45 51.61 17  
## 68 68.13 54.04 74.66 45.17 25.98 18  
## 69 73.38 38.12 74.21 57.81 36.91 19  
## 70 65.77 56.76 59.00 60.07 28.01 20  
## 71 69.57 47.62 63.17 47.92 45.56 21  
## 72 77.05 37.17 64.77 56.27 39.56 22  
## 73 71.05 31.30 78.29 63.87 38.04 23  
## 74 83.76 34.55 55.15 57.90 38.26 24  
## 75 79.11 30.54 70.31 59.24 30.75 25  
## 76 78.20 39.24 62.28 51.86 28.57 26  
## 77 67.70 45.19 69.73 53.77 15.56 27  
## 78 63.16 48.11 71.43 58.00 11.13 28  
## 79 65.95 47.65 65.69 54.82 17.42 29  
## 80 61.95 34.87 77.36 56.26 42.47 30  
## 81 70.38 36.80 67.11 64.70 21.26 31  
## 82 71.22 50.11 51.01 56.94 8.05 32  
## 83 78.65 24.02 62.88 62.97 33.32 33  
## 84 74.73 29.41 68.18 64.26 10.70 34  
## 85 71.41 41.69 59.89 54.40 8.95 35  
## 86 63.36 31.12 73.21 53.07 36.91 36  
## 87 73.13 33.81 64.89 56.60 10.70 37  
## 88 70.07 34.81 58.75 51.57 30.48 38  
## 89 70.58 45.83 56.57 40.89 10.70 39  
## 90 63.85 41.64 61.65 54.75 17.42 40  
## 91 61.27 41.96 63.57 61.06 11.55 41  
## 92 66.08 25.80 65.80 75.70 17.79 42  
## 93 53.01 36.66 73.92 52.91 24.77 43  
## 94 66.01 31.10 63.81 53.47 20.25 44  
## 95 70.32 24.86 54.60 62.23 33.57 45  
## 96 61.63 35.41 62.30 51.68 19.21 46  
## 97 54.76 36.98 64.42 50.22 29.68 47  
## 98 59.71 30.56 69.00 50.72 22.89 48  
## 99 69.35 19.73 52.14 48.69 51.77 49  
## 100 61.94 21.89 67.56 51.85 29.40 50  
## 101 59.06 31.77 64.14 64.20 2.69 51  
## 102 66.18 25.99 59.76 58.66 9.84 52  
## 103 67.71 26.19 56.17 59.29 8.05 53  
## 104 57.49 31.20 62.46 55.13 9.84 54  
## 105 66.34 30.98 53.14 49.19 6.18 55  
## 106 55.18 29.80 67.58 41.15 18.86 56  
## 107 71.72 29.24 40.88 53.90 11.13 57  
## 108 70.69 28.57 44.25 54.50 6.18 58  
## 109 65.53 13.98 62.74 55.31 18.15 59  
## 110 68.66 18.42 54.26 62.06 5.21 60  
## 111 66.27 20.64 54.64 59.35 7.59 61  
## 112 59.63 17.63 63.93 57.99 17.79 62  
## 113 64.43 32.96 44.38 47.56 2.69 63  
## 114 59.67 18.32 59.11 51.54 27.44 64  
## 115 52.55 28.36 64.27 47.33 3.20 65  
## 116 64.22 6.80 58.52 52.43 36.68 66  
## 117 58.88 24.26 56.99 50.70 1.63 67  
## 118 55.66 14.20 64.10 56.64 19.90 68  
## 119 65.32 10.04 63.72 54.35 5.69 69  
## 120 63.06 13.29 59.79 48.30 13.20 70  
## 121 57.29 11.04 68.16 52.93 11.55 71  
## 122 40.82 43.55 51.63 40.27 7.59 72  
## 123 62.07 11.92 55.53 52.58 17.79 73  
## 124 70.18 5.41 53.50 58.94 9.84 74  
## 125 57.69 21.55 48.22 55.37 10.27 75  
## 126 49.60 22.68 62.41 44.55 13.60 76  
## 127 57.39 18.33 52.11 56.77 11.13 77  
## 128 69.41 18.63 41.79 48.00 1.10 78  
## 129 56.64 12.85 64.87 45.15 11.13 79  
## 130 56.50 20.50 50.75 54.83 6.65 80  
## 131 45.42 30.89 59.40 43.47 1.63 81  
## 132 63.11 11.35 54.41 45.37 14.79 82  
## 133 62.69 4.26 63.05 48.54 12.79 83  
## 134 64.38 4.74 51.98 74.73 2.16 84  
## 135 59.37 10.39 55.58 49.98 16.31 85  
## 136 46.40 32.31 49.33 47.61 3.71 86  
## 137 58.12 15.20 48.55 65.11 2.16 87  
## 138 60.88 4.28 65.20 53.66 4.72 88  
## 139 58.70 12.89 48.00 58.38 14.00 89  
## 140 64.87 6.88 45.81 48.63 26.86 90  
## 141 60.33 13.44 54.58 50.17 1.63 91  
## 142 52.49 16.60 59.09 43.42 13.20 92  
## 143 59.49 5.07 58.70 57.65 10.70 93  
## 144 57.56 12.20 55.31 49.22 10.27 93  
## 145 57.70 24.09 36.36 59.88 0.55 95  
## 146 50.85 19.39 53.38 50.64 9.84 96  
## 147 58.25 10.41 59.54 50.97 1.63 97  
## 148 45.32 22.62 60.94 45.84 5.69 98  
## 149 54.62 3.35 65.40 66.06 6.18 99  
## 150 45.99 17.51 62.35 53.20 7.59 100  
## 151 49.72 18.31 52.51 47.18 18.86 101  
## 152 61.29 7.89 52.51 53.47 8.95 102  
## 153 42.80 15.69 68.87 44.19 16.69 103  
## 154 68.53 31.00 13.06 43.60 2.69 104  
## 155 53.25 9.94 51.64 53.90 24.15 104  
## 156 62.19 4.51 57.76 51.77 2.69 106  
## 157 59.79 11.96 46.62 56.11 5.21 107  
## 158 57.03 6.36 58.74 58.23 3.20 108  
## 159 54.68 2.33 64.18 62.39 6.65 109  
## 160 54.88 13.94 56.91 48.16 0.00 110  
## 161 47.25 10.86 68.33 49.81 7.12 111  
## 162 53.75 22.22 46.02 47.26 0.00 112  
## 163 60.35 5.29 56.88 51.33 4.22 113  
## 164 55.94 5.26 63.07 55.65 0.55 114  
## 165 48.53 18.76 54.81 46.44 7.59 115  
## 166 57.31 13.41 51.16 47.33 3.71 116  
## 167 49.08 23.49 46.44 53.20 1.10 117  
## 168 59.21 8.03 49.36 57.20 5.21 118  
## 169 51.53 19.97 47.54 46.54 5.21 119  
## 170 60.17 6.39 55.19 47.37 1.63 120  
## 171 53.96 3.72 59.10 64.06 1.10 121  
## 172 55.46 15.73 43.96 40.61 12.79 122  
## 173 62.25 8.72 45.67 45.18 4.72 123  
## 174 57.82 2.01 57.52 50.22 8.50 124  
## 175 53.58 7.74 59.93 46.69 2.16 125  
## 176 51.56 6.69 57.99 54.63 5.69 126  
## 177 62.78 6.38 44.97 50.33 2.16 127  
## 178 58.44 6.10 49.40 53.09 4.22 128  
## 179 58.78 7.54 43.77 59.09 3.71 129  
## 180 54.57 3.41 54.45 58.82 7.12 130  
## 181 53.90 10.82 50.60 46.14 7.12 131  
## 182 55.76 3.86 54.88 51.44 8.05 132  
## 183 58.73 5.43 50.17 48.85 5.69 133  
## 184 56.16 7.55 56.28 42.16 0.00 134  
## 185 58.13 5.76 46.86 44.25 14.79 135  
## 186 56.85 8.11 48.85 49.29 1.63 136  
## 187 59.28 17.63 27.04 55.09 2.69 137  
## 188 60.56 4.32 47.57 48.17 3.71 138  
## 189 46.65 9.68 61.00 49.25 0.55 139  
## 190 51.75 8.58 53.65 52.42 0.00 139  
## 191 57.68 1.21 54.84 51.32 1.10 141  
## 192 54.46 5.15 53.30 46.28 6.18 142  
## 193 57.23 4.18 52.41 48.49 0.00 143  
## 194 41.84 24.72 48.59 39.99 0.00 144  
## 195 64.04 9.76 33.30 43.05 5.69 145  
## 196 42.33 8.13 63.06 53.96 5.21 145  
## 197 59.25 0.71 51.11 54.45 0.00 147  
## 198 54.46 2.27 58.68 41.41 6.65 148  
## 199 49.09 12.43 41.93 66.36 0.55 149  
## 200 53.05 6.12 52.87 46.82 5.21 150  
## 201 56.06 5.17 48.62 51.89 2.16 151  
## 202 51.06 4.37 58.86 46.60 3.71 152  
## 203 42.43 27.73 38.00 42.67 3.71 153  
## 204 52.26 4.90 50.40 54.15 6.18 154  
## 205 54.27 2.25 54.24 53.21 1.10 155  
## 206 55.02 5.36 47.11 53.23 2.69 156  
## 207 41.49 16.75 52.96 47.42 2.69 157  
## 208 54.89 8.29 42.86 53.25 1.63 158  
## 209 47.89 1.88 63.26 53.12 1.10 159  
## 210 53.65 6.81 52.88 42.44 0.00 160  
## 211 62.29 1.91 31.20 62.13 12.38 160  
## 212 56.79 1.40 54.03 46.10 0.00 162  
## 213 49.15 6.80 50.20 55.80 4.22 163  
## 214 57.13 2.86 49.94 45.99 2.16 164  
## 215 47.21 6.45 59.26 44.53 3.20 165  
## 216 59.15 2.31 46.82 42.34 6.65 166  
## 217 48.86 14.26 39.13 53.15 4.22 167  
## 218 50.11 4.15 54.99 47.43 3.71 168  
## 219 48.02 4.04 51.43 53.36 11.13 169  
## 220 50.61 7.28 45.04 54.16 4.72 170  
## 221 51.95 2.84 59.03 39.37 0.55 171  
## 222 53.11 2.72 52.44 48.87 1.10 172  
## 223 50.80 2.95 52.51 53.89 2.16 173  
## 224 51.95 4.10 51.73 49.28 1.10 174  
## 225 51.97 2.65 51.05 50.57 5.21 175  
## 226 56.18 4.91 48.74 38.31 2.16 176  
## 227 49.08 11.97 50.34 33.80 3.20 177  
## 228 50.08 14.19 38.55 44.77 5.69 178  
## 229 52.90 2.66 47.20 56.20 2.69 179  
## 230 56.55 1.44 43.97 54.98 0.55 180  
## 231 48.34 7.56 47.86 53.83 0.00 181  
## 232 35.51 7.80 57.62 53.05 18.15 182  
## 233 47.49 15.84 44.10 35.10 2.69 183  
## 234 54.06 1.24 50.93 47.58 0.00 184  
## 235 55.12 3.96 48.19 36.84 4.72 185  
## 236 55.66 1.11 46.87 50.80 0.00 186  
## 237 48.80 0.75 56.58 50.47 2.16 187  
## 238 54.28 1.69 45.48 48.12 6.65 188  
## 239 53.98 5.99 42.90 46.85 1.10 189  
## 240 53.11 1.15 48.27 51.60 2.69 190  
## 241 43.74 7.80 51.73 52.96 2.16 191  
## 242 48.89 2.80 54.08 47.67 2.16 192  
## 243 49.40 2.29 59.12 36.87 2.69 193  
## 244 41.95 12.14 53.25 43.08 0.55 194  
## 245 41.05 13.82 51.92 40.13 3.71 195  
## 246 49.69 1.66 53.63 48.50 1.63 196  
## 247 46.11 7.36 50.73 48.76 0.55 197  
## 248 53.60 3.82 45.75 47.25 0.00 198  
## 249 49.16 0.46 53.74 52.98 1.63 199  
## 250 50.56 9.06 39.36 46.21 7.12 200  
## 251 84.30 41.07 85.13 75.03 100.00 1  
## 252 90.73 45.21 67.77 74.67 65.36 2  
## 253 83.28 39.74 77.73 73.22 70.96 3  
## 254 81.00 73.78 69.16 67.68 39.07 4  
## 255 74.48 26.85 78.05 65.16 44.35 5  
## 256 70.52 35.19 68.59 69.75 57.09 6  
## 257 69.67 35.83 68.56 67.92 36.15 7  
## 258 72.00 16.72 67.48 77.47 36.15 8  
## 259 59.24 35.00 72.20 76.31 33.01 9  
## 260 62.14 29.23 59.13 72.22 29.62 10  
## 261 62.79 2.46 78.65 48.12 36.15 11  
## 262 76.11 27.06 39.66 71.84 12.36 12  
## 263 46.95 26.48 91.05 34.70 33.01 13  
## 264 63.82 22.69 49.13 60.51 46.76 14  
## 265 54.42 29.60 60.50 71.80 25.93 15  
## 266 70.55 22.57 37.44 67.42 21.88 16  
## 267 54.39 24.98 58.53 55.54 39.07 17  
## 268 52.36 15.06 57.02 59.29 60.60 18  
## 269 50.08 24.79 70.81 35.39 41.79 19  
## 270 50.51 18.36 54.32 65.82 49.04 20  
## 271 92.87 63.06 98.46 66.78 95.99 1  
## 272 91.46 57.43 98.48 69.45 100.00 2  
## 273 90.68 56.79 97.18 71.85 95.26 3  
## 274 86.93 48.58 93.71 71.35 73.17 4  
## 275 63.67 72.34 89.66 68.45 48.63 5  
## 276 81.27 44.07 94.41 63.24 71.63 6  
## 277 83.18 43.42 93.74 67.49 55.67 7  
## 278 58.85 72.08 81.33 62.55 53.97 8  
## 279 87.81 31.60 98.15 64.00 52.64 9  
## 280 79.56 46.04 94.54 69.12 24.51 10  
## 281 74.93 51.74 86.46 59.65 45.02 11  
## 282 56.75 75.17 76.86 59.00 20.34 12  
## 283 77.51 43.86 92.77 66.83 12.30 12  
## 284 67.19 48.90 79.17 59.09 51.96 14  
## 285 77.93 23.77 89.15 65.37 59.08 15  
## 286 70.79 49.79 79.81 58.94 24.95 16  
## 287 82.11 30.12 84.23 69.23 21.30 17  
## 288 73.32 21.80 97.99 71.12 16.78 18  
## 289 70.51 28.83 90.07 67.91 15.15 19  
## 290 70.40 18.91 92.07 68.82 38.92 20  
## 291 63.80 32.83 88.68 71.99 19.85 21  
## 292 79.78 14.76 94.56 66.62 18.85 22  
## 293 83.89 16.46 84.14 68.75 19.85 23  
## 294 77.88 18.05 90.20 69.48 16.78 24  
## 295 70.70 34.08 72.38 76.20 16.78 25  
## 296 74.90 18.22 86.23 58.00 40.15 26  
## 297 71.19 23.44 85.65 69.71 23.62 27  
## 298 70.75 27.85 85.77 66.38 12.88 28  
## 299 72.92 44.32 53.02 56.63 22.71 29  
## 300 72.49 12.46 91.82 58.51 38.61 30  
## 301 67.49 18.62 91.76 52.95 30.66 31  
## 302 72.68 17.87 77.97 74.64 19.35 32  
## 303 67.09 24.88 84.06 60.48 16.24 33  
## 304 65.78 27.65 75.45 73.76 9.23 34  
## 305 47.47 40.13 75.43 66.73 24.51 35  
## 306 65.41 20.94 77.96 59.88 20.34 36  
## 307 65.00 19.31 78.25 62.15 11.10 37  
## 308 69.74 19.34 75.13 64.43 0.79 37  
## 309 70.01 9.44 81.67 65.23 7.93 39  
## 310 66.35 3.15 86.44 63.33 29.10 40  
## 311 65.72 32.47 51.86 64.14 11.10 41  
## 312 64.89 19.59 74.96 60.93 7.93 42  
## 313 62.21 12.93 85.09 62.00 13.46 43  
## 314 74.60 9.04 72.37 63.32 8.59 44  
## 315 61.42 28.82 69.89 47.94 8.59 45  
## 316 61.69 17.06 74.98 51.94 28.71 46  
## 317 65.03 9.69 81.75 70.85 7.93 47  
## 318 66.07 12.54 74.21 68.63 13.46 48  
## 319 71.79 21.32 57.99 70.53 0.00 49  
## 320 63.56 6.59 85.92 56.10 26.66 50  
## 321 71.79 5.85 73.89 81.64 1.56 51  
## 322 69.83 9.60 75.77 63.17 9.23 52  
## 323 63.66 7.36 84.69 73.93 5.22 53  
## 324 62.21 35.18 53.86 58.48 3.06 54  
## 325 60.46 42.81 42.50 46.78 17.31 55  
## 326 68.65 4.55 84.19 60.30 6.60 56  
## 327 63.78 17.77 74.51 51.30 7.27 57  
## 328 61.28 22.12 56.88 58.95 28.31 58  
## 329 51.32 36.21 47.94 51.29 38.29 59  
## 330 69.97 4.53 79.51 61.49 3.06 60  
## 331 66.22 6.65 72.17 70.31 10.48 61  
## 332 70.70 6.76 70.23 63.05 6.60 62  
## 333 68.25 8.24 69.69 62.18 9.23 63  
## 334 67.27 0.43 73.06 74.17 16.78 63  
## 335 64.74 8.19 73.14 72.25 2.32 65  
## 336 70.42 17.99 53.68 62.32 2.32 66  
## 337 64.57 4.71 79.07 67.76 0.79 67  
## 338 68.54 4.45 77.35 56.63 3.79 68  
## 339 63.55 6.81 77.91 63.85 3.06 69  
## 340 74.06 6.77 58.93 68.82 3.79 70  
## 341 70.14 10.34 65.77 54.97 4.51 71  
## 342 54.41 10.55 81.69 53.54 15.15 72  
## 343 66.20 2.53 79.30 58.47 2.32 73  
## 344 59.21 17.50 75.31 41.70 2.32 74  
## 345 61.69 6.61 73.95 70.31 0.00 75  
## 346 92.69 96.57 83.25 72.56 100.00 1  
## 347 81.14 82.46 86.16 66.08 71.44 2  
## 348 82.96 46.37 97.02 64.20 89.35 3  
## 349 87.05 59.18 78.39 58.07 59.80 4  
## 350 83.18 58.05 90.81 51.24 45.59 5  
## 351 72.09 52.73 89.09 57.44 37.07 6  
## 352 75.74 44.82 84.59 70.59 42.39 7  
## 353 75.64 38.35 71.93 69.55 76.32 8  
## 354 67.41 39.78 84.42 72.01 66.14 9  
## 355 74.03 44.22 90.23 43.53 43.21 10  
## 356 88.82 34.60 77.57 58.31 32.06 11  
## 357 72.68 17.49 98.06 55.61 66.14 12  
## 358 72.29 27.29 83.30 66.91 46.73 13  
## 359 72.22 29.16 84.98 65.68 38.47 14  
## 360 66.90 37.56 87.00 56.48 18.30 15  
## 361 74.25 25.25 89.28 59.03 25.12 16  
## 362 69.43 26.43 80.40 55.08 49.62 17  
## 363 74.87 20.34 85.79 65.89 26.97 18  
## 364 65.59 37.94 74.63 61.41 28.73 19  
## 365 67.75 18.25 85.80 68.37 45.20 20  
## 366 66.91 21.12 82.32 69.77 39.81 21  
## 367 65.91 41.49 60.00 68.94 17.55 22  
## 368 71.83 18.65 83.40 63.20 25.75 23  
## 369 71.73 20.49 78.60 69.79 16.80 24  
## 370 69.66 19.06 84.00 58.92 26.97 25  
## 371 77.05 15.27 87.32 53.00 12.77 26  
## 372 74.89 12.31 88.67 49.49 16.02 27  
## 373 72.58 8.00 79.75 62.86 40.25 27  
## 374 70.47 15.11 82.59 68.35 11.91 29  
## 375 75.28 10.16 74.57 60.71 34.14 30  
## 376 68.90 28.13 61.80 59.90 16.02 31  
## 377 67.66 15.80 68.10 65.88 29.31 32  
## 378 68.99 16.49 69.80 61.98 23.19 33  
## 379 69.69 20.51 58.00 66.40 11.91 34  
## 380 59.48 23.66 73.12 46.60 22.53 35  
## 381 69.62 7.71 67.45 69.19 26.97 36  
## 382 70.04 13.65 68.86 63.93 7.35 37  
## 383 69.83 6.74 78.12 52.19 21.17 38  
## 384 66.34 7.88 76.22 59.17 25.12 38  
## 385 67.64 10.50 67.26 74.49 12.77 40  
## 386 78.18 85.18 80.85 57.65 95.70 1  
## 387 76.05 83.43 76.47 71.53 95.05 2  
## 388 79.78 61.99 79.53 62.88 100.00 3  
## 389 79.12 65.11 86.13 53.79 86.32 4  
## 390 81.75 57.70 87.19 65.18 80.23 5  
## 391 88.39 60.82 74.71 67.95 64.47 6  
## 392 77.24 44.74 73.25 68.83 93.03 7  
## 393 84.97 39.56 76.69 66.33 63.08 8  
## 394 77.54 28.53 90.20 73.65 83.81 9  
## 395 76.16 28.41 82.33 68.59 98.82 10  
## 396 84.16 30.80 70.57 66.68 51.78 11  
## 397 72.88 52.84 67.02 37.78 49.89 12  
## 398 77.13 34.25 81.91 60.45 20.00 13  
## 399 66.72 42.86 77.34 52.01 41.30 14  
## 400 58.11 53.78 66.30 63.83 36.24 15  
## 401 66.30 42.30 59.38 60.42 60.15 16  
## 402 62.01 41.58 69.74 52.36 47.90 17  
## 403 83.31 30.27 53.00 59.59 43.62 18  
## 404 59.20 57.11 51.76 50.28 45.82 19  
## 405 70.47 26.18 82.42 74.82 15.83 20  
## 406 67.88 53.39 44.28 59.01 33.46 21  
## 407 64.87 28.05 72.51 54.85 65.82 22  
## 408 60.10 47.00 68.05 39.71 45.82 23  
## 409 72.89 22.54 59.30 53.51 75.25 24  
## 410 54.43 23.66 74.93 56.92 80.23 25  
## 411 68.36 28.66 64.27 52.00 43.62 26  
## 412 84.16 15.25 61.81 29.98 63.08 27  
## 413 61.05 33.46 62.92 51.91 49.89 28  
## 414 62.85 42.93 50.95 58.07 27.27 29  
## 415 71.55 23.01 70.38 52.48 23.79 30  
## 416 69.08 29.60 54.62 46.26 45.82 31  
## 417 49.60 41.37 61.22 53.75 43.62 32  
## 418 63.38 27.92 70.05 48.98 23.79 33  
## 419 52.45 29.77 65.83 45.03 63.08 34  
## 420 68.54 33.57 58.84 29.97 30.48 35  
## 421 56.60 35.82 58.70 47.65 36.24 36  
## 422 68.06 13.55 63.24 64.67 41.30 37  
## 423 62.88 18.18 64.92 61.89 38.85 38  
## 424 61.66 29.75 66.24 50.11 0.00 39  
## 425 61.95 18.71 55.00 55.61 43.62 40  
## 426 67.23 7.42 63.01 53.20 45.82 41  
## 427 64.33 19.20 61.05 52.52 20.00 42  
## 428 63.09 37.93 45.40 49.60 0.00 43  
## 429 70.73 32.84 46.52 37.95 0.00 44  
## 430 67.11 7.91 52.61 52.29 58.61 45  
## 431 61.61 33.56 44.13 44.07 20.00 46  
## 432 67.07 1.12 64.68 52.04 41.30 47  
## 433 65.28 4.86 61.75 53.39 38.85 48  
## 434 67.96 9.13 53.04 56.72 30.48 49  
## 435 60.62 2.28 67.33 57.50 43.62 49  
## 436 57.47 10.50 59.59 53.19 45.82 51  
## 437 64.83 13.29 39.61 60.23 43.62 52  
## 438 63.92 14.81 56.70 48.64 15.83 53  
## 439 58.63 3.56 67.27 50.72 41.30 54  
## 440 62.47 3.32 61.68 57.14 33.46 55  
## 441 69.43 27.04 31.87 51.44 5.97 56  
## 442 63.83 0.81 56.13 53.24 49.89 57  
## 443 64.11 10.93 45.05 52.27 38.85 58  
## 444 46.32 28.61 58.05 45.13 20.00 59  
## 445 59.80 5.95 57.80 64.33 27.27 60  
## 446 61.49 4.37 62.24 47.08 27.27 61  
## 447 54.41 9.56 58.14 41.94 45.82 62  
## 448 63.89 10.99 56.35 50.72 5.97 63  
## 449 52.07 10.70 63.41 44.91 27.27 64  
## 450 63.19 4.34 59.34 52.15 11.19 65  
## 451 65.50 0.18 44.39 44.12 51.78 66  
## 452 62.96 2.95 59.31 46.89 15.83 67  
## 453 67.49 1.35 51.43 53.30 15.83 68  
## 454 64.49 1.59 56.86 59.21 5.97 69  
## 455 57.42 3.19 51.62 58.36 33.46 70  
## 456 60.10 1.52 60.56 53.10 15.83 71  
## 457 56.49 8.58 60.49 40.97 15.83 72  
## 458 57.24 6.55 58.13 54.12 11.19 73  
## 459 68.68 1.95 48.93 51.96 11.19 73  
## 460 59.77 14.22 55.01 34.25 5.97 75

univdata\_num<- univdata\_num %>% select\_if(is.numeric)

#Category wise data

arch\_data <- univdata\_1 %>% filter(univdata\_1$category == "architecture")  
dent\_data <- univdata\_1 %>% filter(univdata\_1$category == "dental")  
engi\_data <- univdata\_1 %>% filter(univdata\_1$category == "engineering")  
law\_data <- univdata\_1 %>% filter(univdata\_1$category == "law")  
mana\_data <- univdata\_1 %>% filter(univdata\_1$category == "management")  
medi\_data <- univdata\_1 %>% filter(univdata\_1$category == "medical")  
phar\_data <-univdata\_1 %>% filter(univdata\_1$category == "pharmacy")

arch\_data\_num<- arch\_data %>% select\_if(is.numeric)  
dent\_data\_num<- dent\_data %>% select\_if(is.numeric)  
engi\_data\_num<- engi\_data %>% select\_if(is.numeric)  
law\_data\_num<- law\_data %>% select\_if(is.numeric)  
mana\_data\_num<- mana\_data %>% select\_if(is.numeric)  
medi\_data\_num<- medi\_data %>% select\_if(is.numeric)  
phar\_data\_num<- phar\_data %>% select\_if(is.numeric)

univdata\_num$oi <- as.numeric(univdata\_num$oi)  
univdata\_num$tlr <- as.numeric(univdata\_num$tlr)  
univdata\_num$rpc <- as.numeric(univdata\_num$rpc)  
univdata\_num$go <- as.numeric(univdata\_num$go)  
univdata\_num$perception <- as.numeric(univdata\_num$perception)  
univdata\_num$rank <- as.numeric(univdata\_num$rank)

univdata\_num

## tlr rpc go oi perception rank  
## 1 78.58 79.73 91.80 71.71 75.54 1  
## 2 81.32 85.34 87.15 70.90 56.30 2  
## 3 89.70 27.93 75.96 66.96 58.79 3  
## 4 70.14 43.18 82.53 59.98 74.72 4  
## 5 74.58 20.51 73.47 70.15 100.00 5  
## 6 71.68 62.31 74.67 52.88 37.00 6  
## 7 79.91 22.57 74.12 73.51 52.25 7  
## 8 49.63 52.10 83.90 59.37 73.03 8  
## 9 74.20 5.20 82.32 68.21 56.30 9  
## 10 66.06 0.67 87.09 78.60 44.47 10  
## 11 57.69 25.46 92.24 54.30 37.00 11  
## 12 61.52 0.00 79.85 70.35 54.99 12  
## 13 51.76 40.71 60.95 60.59 53.64 13  
## 14 63.40 0.01 77.67 57.88 54.99 14  
## 15 56.44 34.30 71.03 55.22 25.28 15  
## 16 40.68 50.18 88.25 40.73 34.91 16  
## 17 47.68 24.60 78.55 51.00 54.99 17  
## 18 46.60 25.50 58.10 52.83 80.87 18  
## 19 44.44 51.07 59.84 58.42 27.90 19  
## 20 53.75 19.68 80.14 47.84 22.48 20  
## 21 86.86 75.47 92.13 53.76 100.00 1  
## 22 83.05 79.41 71.63 76.42 74.72 2  
## 23 79.92 80.24 81.41 57.36 63.00 3  
## 24 82.66 60.57 74.93 63.38 80.44 4  
## 25 81.76 45.05 86.56 72.98 82.19 5  
## 26 78.72 55.20 73.87 72.41 65.62 6  
## 27 78.27 55.21 71.42 59.28 60.20 7  
## 28 71.10 45.00 92.13 52.56 60.20 8  
## 29 73.92 45.61 95.99 56.37 37.72 9  
## 30 76.08 40.98 80.87 70.69 57.20 10  
## 31 78.67 44.21 88.53 63.18 19.29 11  
## 32 79.84 37.00 97.12 63.62 19.29 12  
## 33 69.43 41.74 90.41 73.89 26.38 13  
## 34 73.65 44.38 84.45 54.45 32.43 14  
## 35 81.55 44.47 64.81 48.59 50.45 15  
## 36 73.33 41.46 68.72 60.36 60.20 16  
## 37 77.27 33.07 77.48 65.81 50.45 17  
## 38 85.39 12.11 92.16 59.45 46.63 18  
## 39 78.86 36.28 55.20 73.84 50.45 19  
## 40 77.63 32.69 63.60 67.91 53.96 20  
## 41 73.69 36.70 74.06 60.48 32.43 21  
## 42 74.23 24.35 91.54 55.54 26.38 22  
## 43 70.73 17.36 86.58 67.18 46.63 23  
## 44 76.43 17.89 85.12 70.85 26.38 24  
## 45 65.62 26.42 80.63 66.37 46.63 25  
## 46 75.98 10.38 84.85 57.14 57.20 26  
## 47 67.82 32.71 93.44 51.67 0.00 27  
## 48 71.58 24.15 72.61 66.19 32.43 28  
## 49 69.84 23.70 92.17 63.83 0.00 29  
## 50 64.76 20.21 72.47 62.87 63.00 30  
## 51 95.42 94.64 83.90 61.31 100.00 1  
## 52 90.79 96.15 80.36 64.81 94.46 2  
## 53 91.00 93.37 77.60 49.99 92.51 3  
## 54 86.22 82.08 88.44 54.21 85.78 4  
## 55 77.32 87.11 83.21 56.62 89.31 5  
## 56 77.21 76.57 89.65 61.71 60.55 6  
## 57 83.04 70.73 83.03 59.13 62.45 7  
## 58 82.51 52.47 71.54 55.98 60.42 8  
## 59 72.11 50.04 74.71 61.49 63.68 9  
## 60 79.89 53.31 72.09 57.76 27.15 10  
## 61 72.34 47.77 77.77 56.07 53.49 11  
## 62 64.02 63.12 72.11 55.07 39.78 12  
## 63 68.93 46.03 78.67 55.24 55.59 13  
## 64 64.62 54.07 61.50 51.62 68.24 14  
## 65 56.79 64.06 63.07 58.21 46.29 15  
## 66 64.38 57.82 74.30 47.23 30.48 16  
## 67 53.73 62.04 76.45 40.45 51.61 17  
## 68 68.13 54.04 74.66 45.17 25.98 18  
## 69 73.38 38.12 74.21 57.81 36.91 19  
## 70 65.77 56.76 59.00 60.07 28.01 20  
## 71 69.57 47.62 63.17 47.92 45.56 21  
## 72 77.05 37.17 64.77 56.27 39.56 22  
## 73 71.05 31.30 78.29 63.87 38.04 23  
## 74 83.76 34.55 55.15 57.90 38.26 24  
## 75 79.11 30.54 70.31 59.24 30.75 25  
## 76 78.20 39.24 62.28 51.86 28.57 26  
## 77 67.70 45.19 69.73 53.77 15.56 27  
## 78 63.16 48.11 71.43 58.00 11.13 28  
## 79 65.95 47.65 65.69 54.82 17.42 29  
## 80 61.95 34.87 77.36 56.26 42.47 30  
## 81 70.38 36.80 67.11 64.70 21.26 31  
## 82 71.22 50.11 51.01 56.94 8.05 32  
## 83 78.65 24.02 62.88 62.97 33.32 33  
## 84 74.73 29.41 68.18 64.26 10.70 34  
## 85 71.41 41.69 59.89 54.40 8.95 35  
## 86 63.36 31.12 73.21 53.07 36.91 36  
## 87 73.13 33.81 64.89 56.60 10.70 37  
## 88 70.07 34.81 58.75 51.57 30.48 38  
## 89 70.58 45.83 56.57 40.89 10.70 39  
## 90 63.85 41.64 61.65 54.75 17.42 40  
## 91 61.27 41.96 63.57 61.06 11.55 41  
## 92 66.08 25.80 65.80 75.70 17.79 42  
## 93 53.01 36.66 73.92 52.91 24.77 43  
## 94 66.01 31.10 63.81 53.47 20.25 44  
## 95 70.32 24.86 54.60 62.23 33.57 45  
## 96 61.63 35.41 62.30 51.68 19.21 46  
## 97 54.76 36.98 64.42 50.22 29.68 47  
## 98 59.71 30.56 69.00 50.72 22.89 48  
## 99 69.35 19.73 52.14 48.69 51.77 49  
## 100 61.94 21.89 67.56 51.85 29.40 50  
## 101 59.06 31.77 64.14 64.20 2.69 51  
## 102 66.18 25.99 59.76 58.66 9.84 52  
## 103 67.71 26.19 56.17 59.29 8.05 53  
## 104 57.49 31.20 62.46 55.13 9.84 54  
## 105 66.34 30.98 53.14 49.19 6.18 55  
## 106 55.18 29.80 67.58 41.15 18.86 56  
## 107 71.72 29.24 40.88 53.90 11.13 57  
## 108 70.69 28.57 44.25 54.50 6.18 58  
## 109 65.53 13.98 62.74 55.31 18.15 59  
## 110 68.66 18.42 54.26 62.06 5.21 60  
## 111 66.27 20.64 54.64 59.35 7.59 61  
## 112 59.63 17.63 63.93 57.99 17.79 62  
## 113 64.43 32.96 44.38 47.56 2.69 63  
## 114 59.67 18.32 59.11 51.54 27.44 64  
## 115 52.55 28.36 64.27 47.33 3.20 65  
## 116 64.22 6.80 58.52 52.43 36.68 66  
## 117 58.88 24.26 56.99 50.70 1.63 67  
## 118 55.66 14.20 64.10 56.64 19.90 68  
## 119 65.32 10.04 63.72 54.35 5.69 69  
## 120 63.06 13.29 59.79 48.30 13.20 70  
## 121 57.29 11.04 68.16 52.93 11.55 71  
## 122 40.82 43.55 51.63 40.27 7.59 72  
## 123 62.07 11.92 55.53 52.58 17.79 73  
## 124 70.18 5.41 53.50 58.94 9.84 74  
## 125 57.69 21.55 48.22 55.37 10.27 75  
## 126 49.60 22.68 62.41 44.55 13.60 76  
## 127 57.39 18.33 52.11 56.77 11.13 77  
## 128 69.41 18.63 41.79 48.00 1.10 78  
## 129 56.64 12.85 64.87 45.15 11.13 79  
## 130 56.50 20.50 50.75 54.83 6.65 80  
## 131 45.42 30.89 59.40 43.47 1.63 81  
## 132 63.11 11.35 54.41 45.37 14.79 82  
## 133 62.69 4.26 63.05 48.54 12.79 83  
## 134 64.38 4.74 51.98 74.73 2.16 84  
## 135 59.37 10.39 55.58 49.98 16.31 85  
## 136 46.40 32.31 49.33 47.61 3.71 86  
## 137 58.12 15.20 48.55 65.11 2.16 87  
## 138 60.88 4.28 65.20 53.66 4.72 88  
## 139 58.70 12.89 48.00 58.38 14.00 89  
## 140 64.87 6.88 45.81 48.63 26.86 90  
## 141 60.33 13.44 54.58 50.17 1.63 91  
## 142 52.49 16.60 59.09 43.42 13.20 92  
## 143 59.49 5.07 58.70 57.65 10.70 93  
## 144 57.56 12.20 55.31 49.22 10.27 93  
## 145 57.70 24.09 36.36 59.88 0.55 95  
## 146 50.85 19.39 53.38 50.64 9.84 96  
## 147 58.25 10.41 59.54 50.97 1.63 97  
## 148 45.32 22.62 60.94 45.84 5.69 98  
## 149 54.62 3.35 65.40 66.06 6.18 99  
## 150 45.99 17.51 62.35 53.20 7.59 100  
## 151 49.72 18.31 52.51 47.18 18.86 101  
## 152 61.29 7.89 52.51 53.47 8.95 102  
## 153 42.80 15.69 68.87 44.19 16.69 103  
## 154 68.53 31.00 13.06 43.60 2.69 104  
## 155 53.25 9.94 51.64 53.90 24.15 104  
## 156 62.19 4.51 57.76 51.77 2.69 106  
## 157 59.79 11.96 46.62 56.11 5.21 107  
## 158 57.03 6.36 58.74 58.23 3.20 108  
## 159 54.68 2.33 64.18 62.39 6.65 109  
## 160 54.88 13.94 56.91 48.16 0.00 110  
## 161 47.25 10.86 68.33 49.81 7.12 111  
## 162 53.75 22.22 46.02 47.26 0.00 112  
## 163 60.35 5.29 56.88 51.33 4.22 113  
## 164 55.94 5.26 63.07 55.65 0.55 114  
## 165 48.53 18.76 54.81 46.44 7.59 115  
## 166 57.31 13.41 51.16 47.33 3.71 116  
## 167 49.08 23.49 46.44 53.20 1.10 117  
## 168 59.21 8.03 49.36 57.20 5.21 118  
## 169 51.53 19.97 47.54 46.54 5.21 119  
## 170 60.17 6.39 55.19 47.37 1.63 120  
## 171 53.96 3.72 59.10 64.06 1.10 121  
## 172 55.46 15.73 43.96 40.61 12.79 122  
## 173 62.25 8.72 45.67 45.18 4.72 123  
## 174 57.82 2.01 57.52 50.22 8.50 124  
## 175 53.58 7.74 59.93 46.69 2.16 125  
## 176 51.56 6.69 57.99 54.63 5.69 126  
## 177 62.78 6.38 44.97 50.33 2.16 127  
## 178 58.44 6.10 49.40 53.09 4.22 128  
## 179 58.78 7.54 43.77 59.09 3.71 129  
## 180 54.57 3.41 54.45 58.82 7.12 130  
## 181 53.90 10.82 50.60 46.14 7.12 131  
## 182 55.76 3.86 54.88 51.44 8.05 132  
## 183 58.73 5.43 50.17 48.85 5.69 133  
## 184 56.16 7.55 56.28 42.16 0.00 134  
## 185 58.13 5.76 46.86 44.25 14.79 135  
## 186 56.85 8.11 48.85 49.29 1.63 136  
## 187 59.28 17.63 27.04 55.09 2.69 137  
## 188 60.56 4.32 47.57 48.17 3.71 138  
## 189 46.65 9.68 61.00 49.25 0.55 139  
## 190 51.75 8.58 53.65 52.42 0.00 139  
## 191 57.68 1.21 54.84 51.32 1.10 141  
## 192 54.46 5.15 53.30 46.28 6.18 142  
## 193 57.23 4.18 52.41 48.49 0.00 143  
## 194 41.84 24.72 48.59 39.99 0.00 144  
## 195 64.04 9.76 33.30 43.05 5.69 145  
## 196 42.33 8.13 63.06 53.96 5.21 145  
## 197 59.25 0.71 51.11 54.45 0.00 147  
## 198 54.46 2.27 58.68 41.41 6.65 148  
## 199 49.09 12.43 41.93 66.36 0.55 149  
## 200 53.05 6.12 52.87 46.82 5.21 150  
## 201 56.06 5.17 48.62 51.89 2.16 151  
## 202 51.06 4.37 58.86 46.60 3.71 152  
## 203 42.43 27.73 38.00 42.67 3.71 153  
## 204 52.26 4.90 50.40 54.15 6.18 154  
## 205 54.27 2.25 54.24 53.21 1.10 155  
## 206 55.02 5.36 47.11 53.23 2.69 156  
## 207 41.49 16.75 52.96 47.42 2.69 157  
## 208 54.89 8.29 42.86 53.25 1.63 158  
## 209 47.89 1.88 63.26 53.12 1.10 159  
## 210 53.65 6.81 52.88 42.44 0.00 160  
## 211 62.29 1.91 31.20 62.13 12.38 160  
## 212 56.79 1.40 54.03 46.10 0.00 162  
## 213 49.15 6.80 50.20 55.80 4.22 163  
## 214 57.13 2.86 49.94 45.99 2.16 164  
## 215 47.21 6.45 59.26 44.53 3.20 165  
## 216 59.15 2.31 46.82 42.34 6.65 166  
## 217 48.86 14.26 39.13 53.15 4.22 167  
## 218 50.11 4.15 54.99 47.43 3.71 168  
## 219 48.02 4.04 51.43 53.36 11.13 169  
## 220 50.61 7.28 45.04 54.16 4.72 170  
## 221 51.95 2.84 59.03 39.37 0.55 171  
## 222 53.11 2.72 52.44 48.87 1.10 172  
## 223 50.80 2.95 52.51 53.89 2.16 173  
## 224 51.95 4.10 51.73 49.28 1.10 174  
## 225 51.97 2.65 51.05 50.57 5.21 175  
## 226 56.18 4.91 48.74 38.31 2.16 176  
## 227 49.08 11.97 50.34 33.80 3.20 177  
## 228 50.08 14.19 38.55 44.77 5.69 178  
## 229 52.90 2.66 47.20 56.20 2.69 179  
## 230 56.55 1.44 43.97 54.98 0.55 180  
## 231 48.34 7.56 47.86 53.83 0.00 181  
## 232 35.51 7.80 57.62 53.05 18.15 182  
## 233 47.49 15.84 44.10 35.10 2.69 183  
## 234 54.06 1.24 50.93 47.58 0.00 184  
## 235 55.12 3.96 48.19 36.84 4.72 185  
## 236 55.66 1.11 46.87 50.80 0.00 186  
## 237 48.80 0.75 56.58 50.47 2.16 187  
## 238 54.28 1.69 45.48 48.12 6.65 188  
## 239 53.98 5.99 42.90 46.85 1.10 189  
## 240 53.11 1.15 48.27 51.60 2.69 190  
## 241 43.74 7.80 51.73 52.96 2.16 191  
## 242 48.89 2.80 54.08 47.67 2.16 192  
## 243 49.40 2.29 59.12 36.87 2.69 193  
## 244 41.95 12.14 53.25 43.08 0.55 194  
## 245 41.05 13.82 51.92 40.13 3.71 195  
## 246 49.69 1.66 53.63 48.50 1.63 196  
## 247 46.11 7.36 50.73 48.76 0.55 197  
## 248 53.60 3.82 45.75 47.25 0.00 198  
## 249 49.16 0.46 53.74 52.98 1.63 199  
## 250 50.56 9.06 39.36 46.21 7.12 200  
## 251 84.30 41.07 85.13 75.03 100.00 1  
## 252 90.73 45.21 67.77 74.67 65.36 2  
## 253 83.28 39.74 77.73 73.22 70.96 3  
## 254 81.00 73.78 69.16 67.68 39.07 4  
## 255 74.48 26.85 78.05 65.16 44.35 5  
## 256 70.52 35.19 68.59 69.75 57.09 6  
## 257 69.67 35.83 68.56 67.92 36.15 7  
## 258 72.00 16.72 67.48 77.47 36.15 8  
## 259 59.24 35.00 72.20 76.31 33.01 9  
## 260 62.14 29.23 59.13 72.22 29.62 10  
## 261 62.79 2.46 78.65 48.12 36.15 11  
## 262 76.11 27.06 39.66 71.84 12.36 12  
## 263 46.95 26.48 91.05 34.70 33.01 13  
## 264 63.82 22.69 49.13 60.51 46.76 14  
## 265 54.42 29.60 60.50 71.80 25.93 15  
## 266 70.55 22.57 37.44 67.42 21.88 16  
## 267 54.39 24.98 58.53 55.54 39.07 17  
## 268 52.36 15.06 57.02 59.29 60.60 18  
## 269 50.08 24.79 70.81 35.39 41.79 19  
## 270 50.51 18.36 54.32 65.82 49.04 20  
## 271 92.87 63.06 98.46 66.78 95.99 1  
## 272 91.46 57.43 98.48 69.45 100.00 2  
## 273 90.68 56.79 97.18 71.85 95.26 3  
## 274 86.93 48.58 93.71 71.35 73.17 4  
## 275 63.67 72.34 89.66 68.45 48.63 5  
## 276 81.27 44.07 94.41 63.24 71.63 6  
## 277 83.18 43.42 93.74 67.49 55.67 7  
## 278 58.85 72.08 81.33 62.55 53.97 8  
## 279 87.81 31.60 98.15 64.00 52.64 9  
## 280 79.56 46.04 94.54 69.12 24.51 10  
## 281 74.93 51.74 86.46 59.65 45.02 11  
## 282 56.75 75.17 76.86 59.00 20.34 12  
## 283 77.51 43.86 92.77 66.83 12.30 12  
## 284 67.19 48.90 79.17 59.09 51.96 14  
## 285 77.93 23.77 89.15 65.37 59.08 15  
## 286 70.79 49.79 79.81 58.94 24.95 16  
## 287 82.11 30.12 84.23 69.23 21.30 17  
## 288 73.32 21.80 97.99 71.12 16.78 18  
## 289 70.51 28.83 90.07 67.91 15.15 19  
## 290 70.40 18.91 92.07 68.82 38.92 20  
## 291 63.80 32.83 88.68 71.99 19.85 21  
## 292 79.78 14.76 94.56 66.62 18.85 22  
## 293 83.89 16.46 84.14 68.75 19.85 23  
## 294 77.88 18.05 90.20 69.48 16.78 24  
## 295 70.70 34.08 72.38 76.20 16.78 25  
## 296 74.90 18.22 86.23 58.00 40.15 26  
## 297 71.19 23.44 85.65 69.71 23.62 27  
## 298 70.75 27.85 85.77 66.38 12.88 28  
## 299 72.92 44.32 53.02 56.63 22.71 29  
## 300 72.49 12.46 91.82 58.51 38.61 30  
## 301 67.49 18.62 91.76 52.95 30.66 31  
## 302 72.68 17.87 77.97 74.64 19.35 32  
## 303 67.09 24.88 84.06 60.48 16.24 33  
## 304 65.78 27.65 75.45 73.76 9.23 34  
## 305 47.47 40.13 75.43 66.73 24.51 35  
## 306 65.41 20.94 77.96 59.88 20.34 36  
## 307 65.00 19.31 78.25 62.15 11.10 37  
## 308 69.74 19.34 75.13 64.43 0.79 37  
## 309 70.01 9.44 81.67 65.23 7.93 39  
## 310 66.35 3.15 86.44 63.33 29.10 40  
## 311 65.72 32.47 51.86 64.14 11.10 41  
## 312 64.89 19.59 74.96 60.93 7.93 42  
## 313 62.21 12.93 85.09 62.00 13.46 43  
## 314 74.60 9.04 72.37 63.32 8.59 44  
## 315 61.42 28.82 69.89 47.94 8.59 45  
## 316 61.69 17.06 74.98 51.94 28.71 46  
## 317 65.03 9.69 81.75 70.85 7.93 47  
## 318 66.07 12.54 74.21 68.63 13.46 48  
## 319 71.79 21.32 57.99 70.53 0.00 49  
## 320 63.56 6.59 85.92 56.10 26.66 50  
## 321 71.79 5.85 73.89 81.64 1.56 51  
## 322 69.83 9.60 75.77 63.17 9.23 52  
## 323 63.66 7.36 84.69 73.93 5.22 53  
## 324 62.21 35.18 53.86 58.48 3.06 54  
## 325 60.46 42.81 42.50 46.78 17.31 55  
## 326 68.65 4.55 84.19 60.30 6.60 56  
## 327 63.78 17.77 74.51 51.30 7.27 57  
## 328 61.28 22.12 56.88 58.95 28.31 58  
## 329 51.32 36.21 47.94 51.29 38.29 59  
## 330 69.97 4.53 79.51 61.49 3.06 60  
## 331 66.22 6.65 72.17 70.31 10.48 61  
## 332 70.70 6.76 70.23 63.05 6.60 62  
## 333 68.25 8.24 69.69 62.18 9.23 63  
## 334 67.27 0.43 73.06 74.17 16.78 63  
## 335 64.74 8.19 73.14 72.25 2.32 65  
## 336 70.42 17.99 53.68 62.32 2.32 66  
## 337 64.57 4.71 79.07 67.76 0.79 67  
## 338 68.54 4.45 77.35 56.63 3.79 68  
## 339 63.55 6.81 77.91 63.85 3.06 69  
## 340 74.06 6.77 58.93 68.82 3.79 70  
## 341 70.14 10.34 65.77 54.97 4.51 71  
## 342 54.41 10.55 81.69 53.54 15.15 72  
## 343 66.20 2.53 79.30 58.47 2.32 73  
## 344 59.21 17.50 75.31 41.70 2.32 74  
## 345 61.69 6.61 73.95 70.31 0.00 75  
## 346 92.69 96.57 83.25 72.56 100.00 1  
## 347 81.14 82.46 86.16 66.08 71.44 2  
## 348 82.96 46.37 97.02 64.20 89.35 3  
## 349 87.05 59.18 78.39 58.07 59.80 4  
## 350 83.18 58.05 90.81 51.24 45.59 5  
## 351 72.09 52.73 89.09 57.44 37.07 6  
## 352 75.74 44.82 84.59 70.59 42.39 7  
## 353 75.64 38.35 71.93 69.55 76.32 8  
## 354 67.41 39.78 84.42 72.01 66.14 9  
## 355 74.03 44.22 90.23 43.53 43.21 10  
## 356 88.82 34.60 77.57 58.31 32.06 11  
## 357 72.68 17.49 98.06 55.61 66.14 12  
## 358 72.29 27.29 83.30 66.91 46.73 13  
## 359 72.22 29.16 84.98 65.68 38.47 14  
## 360 66.90 37.56 87.00 56.48 18.30 15  
## 361 74.25 25.25 89.28 59.03 25.12 16  
## 362 69.43 26.43 80.40 55.08 49.62 17  
## 363 74.87 20.34 85.79 65.89 26.97 18  
## 364 65.59 37.94 74.63 61.41 28.73 19  
## 365 67.75 18.25 85.80 68.37 45.20 20  
## 366 66.91 21.12 82.32 69.77 39.81 21  
## 367 65.91 41.49 60.00 68.94 17.55 22  
## 368 71.83 18.65 83.40 63.20 25.75 23  
## 369 71.73 20.49 78.60 69.79 16.80 24  
## 370 69.66 19.06 84.00 58.92 26.97 25  
## 371 77.05 15.27 87.32 53.00 12.77 26  
## 372 74.89 12.31 88.67 49.49 16.02 27  
## 373 72.58 8.00 79.75 62.86 40.25 27  
## 374 70.47 15.11 82.59 68.35 11.91 29  
## 375 75.28 10.16 74.57 60.71 34.14 30  
## 376 68.90 28.13 61.80 59.90 16.02 31  
## 377 67.66 15.80 68.10 65.88 29.31 32  
## 378 68.99 16.49 69.80 61.98 23.19 33  
## 379 69.69 20.51 58.00 66.40 11.91 34  
## 380 59.48 23.66 73.12 46.60 22.53 35  
## 381 69.62 7.71 67.45 69.19 26.97 36  
## 382 70.04 13.65 68.86 63.93 7.35 37  
## 383 69.83 6.74 78.12 52.19 21.17 38  
## 384 66.34 7.88 76.22 59.17 25.12 38  
## 385 67.64 10.50 67.26 74.49 12.77 40  
## 386 78.18 85.18 80.85 57.65 95.70 1  
## 387 76.05 83.43 76.47 71.53 95.05 2  
## 388 79.78 61.99 79.53 62.88 100.00 3  
## 389 79.12 65.11 86.13 53.79 86.32 4  
## 390 81.75 57.70 87.19 65.18 80.23 5  
## 391 88.39 60.82 74.71 67.95 64.47 6  
## 392 77.24 44.74 73.25 68.83 93.03 7  
## 393 84.97 39.56 76.69 66.33 63.08 8  
## 394 77.54 28.53 90.20 73.65 83.81 9  
## 395 76.16 28.41 82.33 68.59 98.82 10  
## 396 84.16 30.80 70.57 66.68 51.78 11  
## 397 72.88 52.84 67.02 37.78 49.89 12  
## 398 77.13 34.25 81.91 60.45 20.00 13  
## 399 66.72 42.86 77.34 52.01 41.30 14  
## 400 58.11 53.78 66.30 63.83 36.24 15  
## 401 66.30 42.30 59.38 60.42 60.15 16  
## 402 62.01 41.58 69.74 52.36 47.90 17  
## 403 83.31 30.27 53.00 59.59 43.62 18  
## 404 59.20 57.11 51.76 50.28 45.82 19  
## 405 70.47 26.18 82.42 74.82 15.83 20  
## 406 67.88 53.39 44.28 59.01 33.46 21  
## 407 64.87 28.05 72.51 54.85 65.82 22  
## 408 60.10 47.00 68.05 39.71 45.82 23  
## 409 72.89 22.54 59.30 53.51 75.25 24  
## 410 54.43 23.66 74.93 56.92 80.23 25  
## 411 68.36 28.66 64.27 52.00 43.62 26  
## 412 84.16 15.25 61.81 29.98 63.08 27  
## 413 61.05 33.46 62.92 51.91 49.89 28  
## 414 62.85 42.93 50.95 58.07 27.27 29  
## 415 71.55 23.01 70.38 52.48 23.79 30  
## 416 69.08 29.60 54.62 46.26 45.82 31  
## 417 49.60 41.37 61.22 53.75 43.62 32  
## 418 63.38 27.92 70.05 48.98 23.79 33  
## 419 52.45 29.77 65.83 45.03 63.08 34  
## 420 68.54 33.57 58.84 29.97 30.48 35  
## 421 56.60 35.82 58.70 47.65 36.24 36  
## 422 68.06 13.55 63.24 64.67 41.30 37  
## 423 62.88 18.18 64.92 61.89 38.85 38  
## 424 61.66 29.75 66.24 50.11 0.00 39  
## 425 61.95 18.71 55.00 55.61 43.62 40  
## 426 67.23 7.42 63.01 53.20 45.82 41  
## 427 64.33 19.20 61.05 52.52 20.00 42  
## 428 63.09 37.93 45.40 49.60 0.00 43  
## 429 70.73 32.84 46.52 37.95 0.00 44  
## 430 67.11 7.91 52.61 52.29 58.61 45  
## 431 61.61 33.56 44.13 44.07 20.00 46  
## 432 67.07 1.12 64.68 52.04 41.30 47  
## 433 65.28 4.86 61.75 53.39 38.85 48  
## 434 67.96 9.13 53.04 56.72 30.48 49  
## 435 60.62 2.28 67.33 57.50 43.62 49  
## 436 57.47 10.50 59.59 53.19 45.82 51  
## 437 64.83 13.29 39.61 60.23 43.62 52  
## 438 63.92 14.81 56.70 48.64 15.83 53  
## 439 58.63 3.56 67.27 50.72 41.30 54  
## 440 62.47 3.32 61.68 57.14 33.46 55  
## 441 69.43 27.04 31.87 51.44 5.97 56  
## 442 63.83 0.81 56.13 53.24 49.89 57  
## 443 64.11 10.93 45.05 52.27 38.85 58  
## 444 46.32 28.61 58.05 45.13 20.00 59  
## 445 59.80 5.95 57.80 64.33 27.27 60  
## 446 61.49 4.37 62.24 47.08 27.27 61  
## 447 54.41 9.56 58.14 41.94 45.82 62  
## 448 63.89 10.99 56.35 50.72 5.97 63  
## 449 52.07 10.70 63.41 44.91 27.27 64  
## 450 63.19 4.34 59.34 52.15 11.19 65  
## 451 65.50 0.18 44.39 44.12 51.78 66  
## 452 62.96 2.95 59.31 46.89 15.83 67  
## 453 67.49 1.35 51.43 53.30 15.83 68  
## 454 64.49 1.59 56.86 59.21 5.97 69  
## 455 57.42 3.19 51.62 58.36 33.46 70  
## 456 60.10 1.52 60.56 53.10 15.83 71  
## 457 56.49 8.58 60.49 40.97 15.83 72  
## 458 57.24 6.55 58.13 54.12 11.19 73  
## 459 68.68 1.95 48.93 51.96 11.19 73  
## 460 59.77 14.22 55.01 34.25 5.97 75

## Correlation Of Full Data

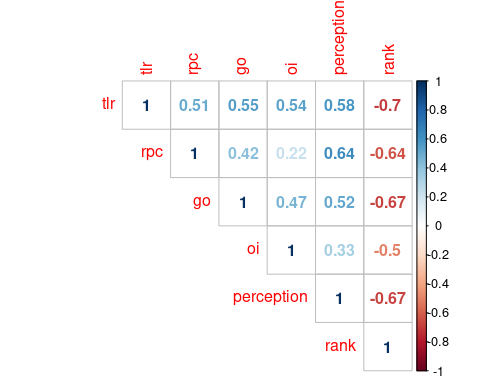
cor(univdata\_num, use = "complete.obs")

## tlr rpc go oi perception rank  
## tlr 1.0000000 0.5085836 0.5519768 0.5353762 0.5841083 -0.6971153  
## rpc 0.5085836 1.0000000 0.4151417 0.2234212 0.6398205 -0.6377772  
## go 0.5519768 0.4151417 1.0000000 0.4699512 0.5173559 -0.6715505  
## oi 0.5353762 0.2234212 0.4699512 1.0000000 0.3310690 -0.5046141  
## perception 0.5841083 0.6398205 0.5173559 0.3310690 1.0000000 -0.6735481  
## rank -0.6971153 -0.6377772 -0.6715505 -0.5046141 -0.6735481 1.0000000

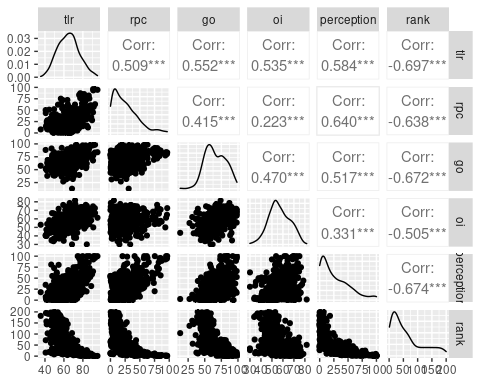
library(corrplot)

## corrplot 0.84 loaded

corrplot(cor(univdata\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)



ggpairs(univdata\_num)

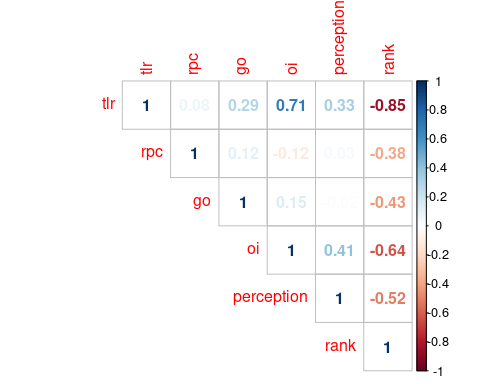


## Correlation of Universities in “Architecture” Category

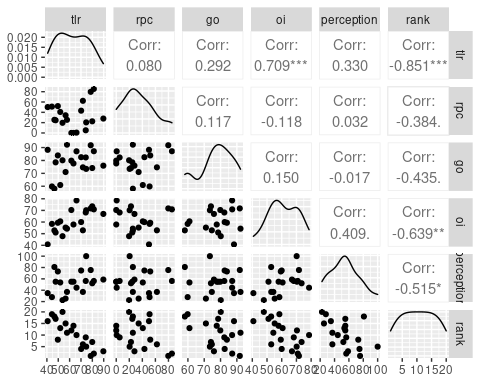
cor(arch\_data\_num, use = "complete.obs")

## tlr rpc go oi perception  
## tlr 1.00000000 0.07989551 0.29236335 0.7085080 0.33039065  
## rpc 0.07989551 1.00000000 0.11728750 -0.1179376 0.03209874  
## go 0.29236335 0.11728750 1.00000000 0.1498479 -0.01711361  
## oi 0.70850795 -0.11793755 0.14984794 1.0000000 0.40917362  
## perception 0.33039065 0.03209874 -0.01711361 0.4091736 1.00000000  
## rank -0.85070926 -0.38440319 -0.43475182 -0.6387909 -0.51532270  
## rank  
## tlr -0.8507093  
## rpc -0.3844032  
## go -0.4347518  
## oi -0.6387909  
## perception -0.5153227  
## rank 1.0000000

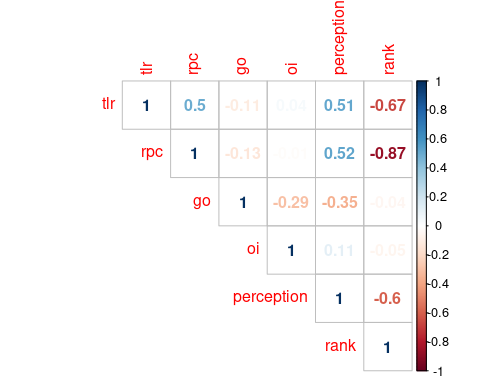
library(corrplot)  
corrplot(cor(arch\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
   
)



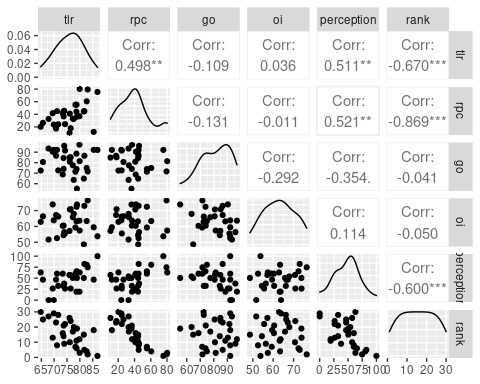
ggpairs(arch\_data\_num)

 ## Correlation of Universities in “Dental” Category

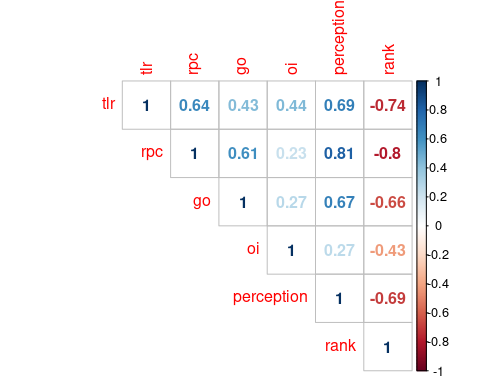
library(corrplot)  
corrplot(cor(dent\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)



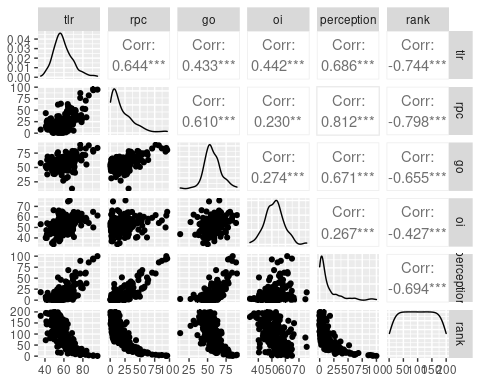
ggpairs(dent\_data\_num)

 ## Correlation of Universities in **“Engineering”** Category

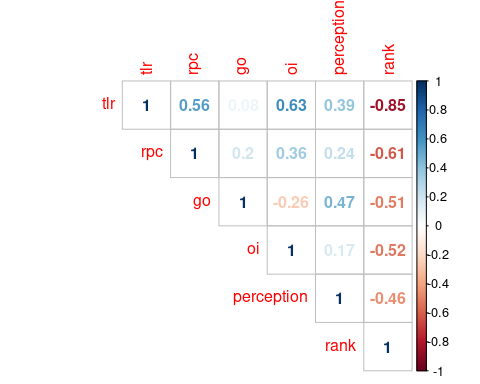
library(corrplot)  
corrplot(cor(engi\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)



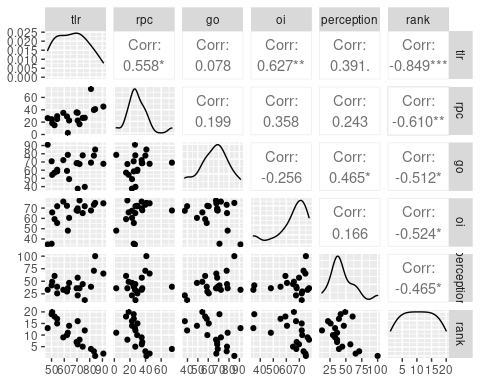
ggpairs(engi\_data\_num)

 ## Correlation of Universities in **“Law”** Category

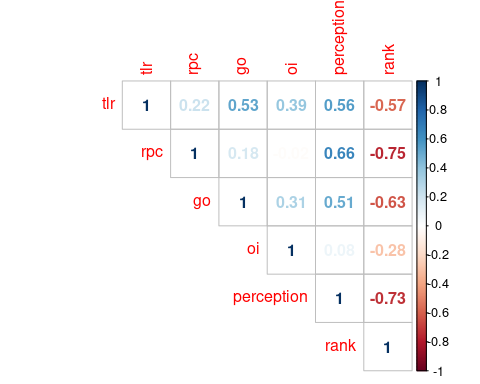
library(corrplot)  
corrplot(cor(law\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)



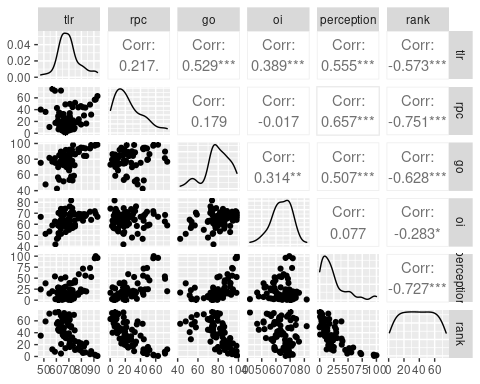
ggpairs(law\_data\_num)

 ## Correlation of Universities in **“Management”** Category

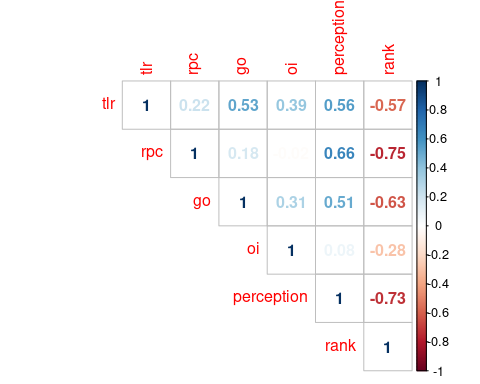
library(corrplot)  
corrplot(cor(mana\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)



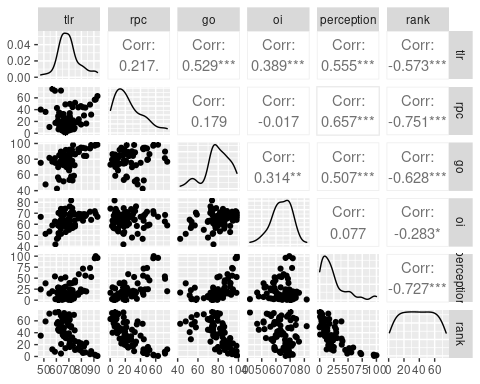
ggpairs(mana\_data\_num)

 ## Correlation of Universities in **“Medical”** Category

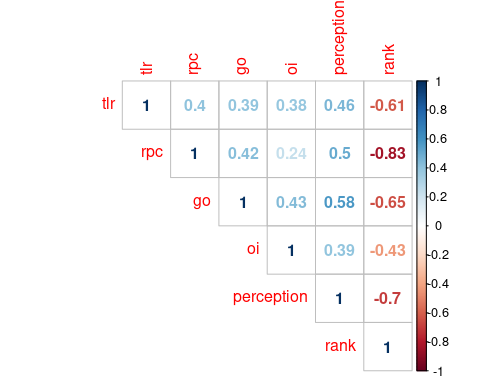
library(corrplot)  
corrplot(cor(mana\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)



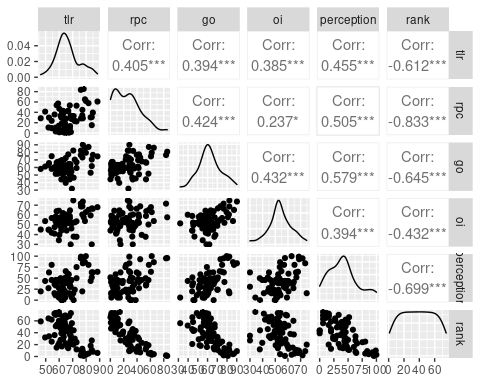
ggpairs(mana\_data\_num)

 ## Correlation of Universities in “pharmacy” Category

library(corrplot)  
corrplot(cor(phar\_data\_num),  
 method = "number",  
 type = "upper" # show only upper side  
)

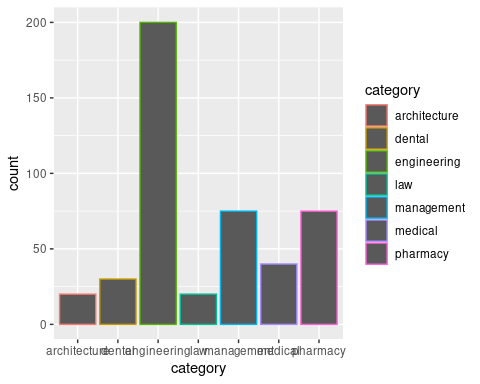


ggpairs(phar\_data\_num)

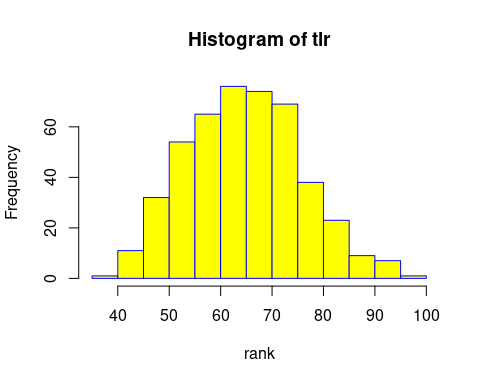


### Number Of Universities Category wise in Top Rankings

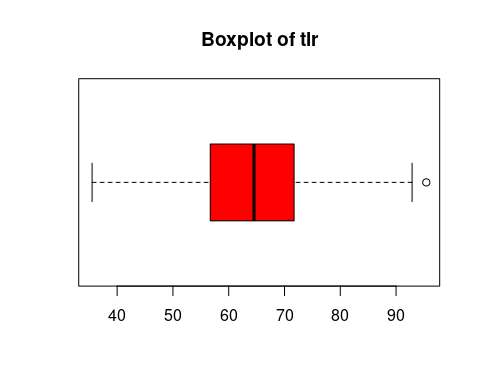
ggplot(data = univdata) +  
 geom\_bar(mapping = aes(x = category,colour=category))



hist(tlr,xlab = "rank",col = "yellow",border = "blue")



boxplot(tlr,col = "Red", horizontal = TRUE, main = "Boxplot of tlr")



## View Categorical Data

freq(univdata)

## Warning in freq\_logic(data = data, input = input[i], plot, na.rm, path\_out =  
## path\_out): Skipping plot for variable 'institute\_id' (more than 100 categories)

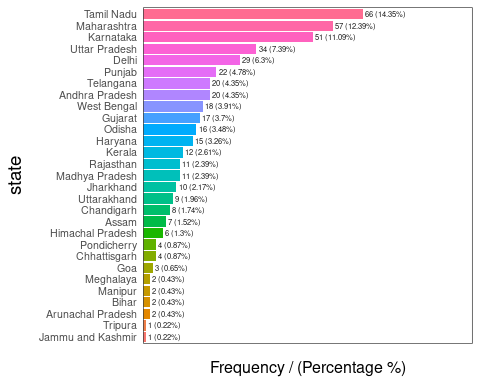
## institute\_id frequency percentage cumulative\_perc  
## 1 IR-A-C-26794 1 0.22 0.22  
## 2 IR-A-C-43708 1 0.22 0.44  
## 3 IR-A-C-46330 1 0.22 0.66  
## 4 IR-A-C-57952 1 0.22 0.88  
## 5 IR-A-U-0108 1 0.22 1.10  
## 6 IR-A-U-0116 1 0.22 1.32  
## 7 IR-A-U-0127 1 0.22 1.54  
## 8 IR-A-U-0189 1 0.22 1.76  
## 9 IR-A-U-0202 1 0.22 1.98  
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## 17 IR-A-U-0573 1 0.22 3.74  
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## 19 IR-A-U-0626 1 0.22 4.18  
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## 28 IR-D-C-40345 1 0.22 6.16  
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## 30 IR-D-C-45515 1 0.22 6.60  
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## 38 IR-D-I-1110 1 0.22 8.36  
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## 41 IR-D-I-1486 1 0.22 9.02  
## 42 IR-D-N-15 1 0.22 9.24  
## 43 IR-D-N-17 1 0.22 9.46  
## 44 IR-D-N-33 1 0.22 9.68  
## 45 IR-D-U-0036 1 0.22 9.90  
## 46 IR-D-U-0079 1 0.22 10.12  
## 47 IR-D-U-0106 1 0.22 10.34  
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## 165 IR-E-U-0130 1 0.22 36.30  
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## 419 IR-P-I-1243 1 0.22 92.18  
## 420 IR-P-I-1256 1 0.22 92.40  
## 421 IR-P-I-1262 1 0.22 92.62  
## 422 IR-P-I-1280 1 0.22 92.84  
## 423 IR-P-I-1289 1 0.22 93.06  
## 424 IR-P-I-1335 1 0.22 93.28  
## 425 IR-P-I-1450 1 0.22 93.50  
## 426 IR-P-I-1486 1 0.22 93.72  
## 427 IR-P-N-10 1 0.22 93.94  
## 428 IR-P-N-14 1 0.22 94.16  
## 429 IR-P-N-26 1 0.22 94.38  
## 430 IR-P-S-10906 1 0.22 94.60  
## 431 IR-P-U-0034 1 0.22 94.82  
## 432 IR-P-U-0051 1 0.22 95.04  
## 433 IR-P-U-0078 1 0.22 95.26  
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## 436 IR-P-U-0107 1 0.22 95.92  
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## 438 IR-P-U-0146 1 0.22 96.36  
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## 440 IR-P-U-0168 1 0.22 96.80  
## 441 IR-P-U-0190 1 0.22 97.02  
## 442 IR-P-U-0202 1 0.22 97.24  
## 443 IR-P-U-0308 1 0.22 97.46  
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## 445 IR-P-U-0373 1 0.22 97.90  
## 446 IR-P-U-0379 1 0.22 98.12  
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## 448 IR-P-U-0383 1 0.22 98.56  
## 449 IR-P-U-0389 1 0.22 98.78  
## 450 IR-P-U-0391 1 0.22 99.00  
## 451 IR-P-U-0436 1 0.22 99.22  
## 452 IR-P-U-0443 1 0.22 99.44  
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## 454 IR-P-U-0491 1 0.22 99.88  
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## 456 IR-P-U-0519 1 0.22 100.32  
## 457 IR-P-U-0536 1 0.22 100.54  
## 458 IR-P-U-0562 1 0.22 100.76  
## 459 IR-P-U-0724 1 0.22 100.98  
## 460 IR-P-U-0938 1 0.22 100.00

## Warning in freq\_logic(data = data, input = input[i], plot, na.rm, path\_out =  
## path\_out): Skipping plot for variable 'name' (more than 100 categories)

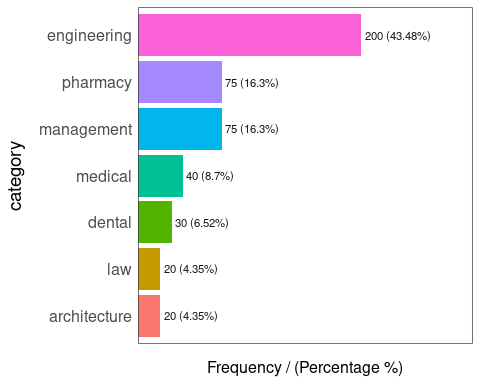
## name  
## 1 Aligarh Muslim University  
## 2 Jamia Millia Islamia  
## 3 Kalinga Institute of Industrial Technology  
## 4 Panjab University  
## 5 Birla Institute of Technology  
## 6 Indian Institute of Technology Kharagpur  
## 7 Amity University Noida  
## 8 Anna University  
## 9 Banaras Hindu University  
## 10 Chitkara University  
## 11 Indian Institute of Technology Roorkee  
## 12 Institute of Management Technology  
## 13 International Management Institute  
## 14 Lovely Professional University  
## 15 Maharishi Markandeshwar  
## 16 National Institute of Technology Tiruchirappalli  
## 17 National Law University  
## 18 Nirma University  
## 19 S R M Institute of Science and Technology  
## 20 Saveetha Institute of Medical and Technical Sciences  
## 21 School of Planning and Architecture  
## 22 Siksha O Anusandhan  
## 23 Sri Ramachandra Institute of Higher Education And Research  
## 24 SVKM s Narsee Monjee Institute of Management Studies  
## 25 Alliance University  
## 26 Annamalai University  
## 27 Bharati Vidyapeeth s College of Pharmacy  
## 28 Birla Institute of Technology Science  
## 29 Chandigarh University  
## 30 Christian Medical College  
## 31 College of Engineering Trivandrum  
## 32 Datta Meghe Institute of Medical Sciences  
## 33 Dr D Y Patil Vidyapeeth  
## 34 Dr Vishwanath Karad MIT World Peace University  
## 35 Guru Gobind Singh Indraprastha University  
## 36 Guru Jambheshwar University of Science and Technology  
## 37 Hindustan Institute of Technology and Science HITS  
## 38 Indian Institute of Engineering Science and Technology  
## 39 Indian Institute of Technology Bombay  
## 40 Indian Institute of Technology Delhi  
## 41 Indian Institute of Technology Indian School of Mines  
## 42 Indian Institute of Technology Kanpur  
## 43 Indian Institute of Technology Madras  
## 44 Institute of Chemical Technology  
## 45 Jaipuria Institute of Management  
## 46 Jamia Hamdard  
## 47 JSS College of Pharmacy  
## 48 Kasturba Medical College  
## 49 Koneru Lakshmaiah Education Foundation University  
## 50 M S Ramaiah University of Applied Sciences  
## 51 Maharaja Sayajirao University of Baroda  
## 52 Manipal College of Dental Sciences  
## 53 Maulana Azad National Institute of Technology  
## 54 National Institute of Technology Calicut  
## 55 National Institute of Technology Hamirpur  
## 56 Pandit Deendayal Petroleum University  
## 57 PSG College of Technology  
## 58 Shoolini University of Biotechnology and Management Sciences  
## 59 Thapar Institute of Engineering Technology  
## 60 The Rashtrasant Tukadoji Maharaj Nagpur University  
## 61 Thiagarajar College of Engineering  
## 62 University College of Engineering  
## 63 University of Petroleum and Energy Studies  
## 64 Vellore Institute of Technology  
## 65 Visvesvaraya Technological University  
## 66 A B S M Institute of Dental Sciences  
## 67 Acharya Nagarjuna University College of Pharmaceutical Sciences  
## 68 All India Institute of Medical Sciences  
## 69 Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial College of Pharmacy  
## 70 Amity University Gwalior  
## 71 Amrita Institute of Medical Sciences Research  
## 72 Amrita School of Dentistry  
## 73 Amrita School of Engineering  
## 74 Amrita School of Pharmacy  
## 75 Anurag Group of Institutions  
## 76 Army College of Dental Sciences  
## 77 Army Institute of Technology  
## 78 Atal Bihari Vajpayee Indian Institute of Information Technology and Management  
## 79 AU College of Pharmaceutical Sciences Andhra University  
## 80 B M S College of Engineering  
## 81 B S Abdur Rahman Crescent Institute of Science and Technology  
## 82 Banasthali Vidyapith  
## 83 Bapuji Dental College Hospital  
## 84 Bharati Vidyapeeth Deemed University College of Engineering  
## 85 Bharati Vidyapeeth s Institute of Management and Entrepreneurship Development  
## 86 Bharatiya Vidya Bhavan s Sardar Patel Institute of Technology  
## 87 Birla Institute of Management Technology  
## 88 BML Munjal University  
## 89 BMS College of Arhitecture  
## 90 BMS Institute of Technology Management  
## 91 BNM Institute of Technology  
## 92 Bombay College of Pharmacy  
## 93 BVRIT Hyderabad  
## 94 C U Shah College of Pharmacy  
## 95 C V Raman Global University  
## 96 Centre for Environmental Planning and Technology University  
## 97 Chaitanya Bharathi Institute of Technology  
## 98 Chalapathi Institute of Pharmaceutical Sciences  
## 99 Christ University  
## 100 Christian Dental College  
## 101 Coimbatore Institute of Technology  
## 102 College of Dental Sciences  
## 103 College of Engineering A  
## 104 College of Engineering Pune  
## 105 College of Pharmacy Madras Medical College  
## 106 CVR College Of Engineering  
## 107 Dayalbagh Educational Institute  
## 108 Dayanand Medical College  
## 109 Dayananda Sagar College of Engineering  
## 110 Defence Institute of Advanced Technology  
## 111 Delhi Institute of Pharmaceutical Sciences Research  
## 112 Delhi Technological University  
## 113 Dharmsinh Desai University  
## 114 Dhirubhai Ambani Institute of Information and Communication Technology  
## 115 Dibrugarh University  
## 116 DIT University  
## 117 Dr B R Ambedkar National Institute of Technology  
## 118 Dr D Y Patil Institute of Technology  
## 119 Dr Ram Manohar Lohiya National Law University  
## 120 FORE School of Management  
## 121 G H Raisoni College of Engineering  
## 122 G Pulla Reddy Engineering College  
## 123 Gayatri Vidya Parishad College of Engineering  
## 124 Girijananda Chowdhury Institute of Pharmaceutical Science  
## 125 Goa College of Pharmacy  
## 126 Goa Institute of Management  
## 127 Goka Raju Ranga Raju Institute of Engineering Technology  
## 128 Government College of Technology  
## 129 Government Dental College  
## 130 Government Engineering College  
## 131 Govt Medical College Hospital  
## 132 Graphic Era University  
## 133 Great Lakes Institute of Management  
## 134 Gujarat National Law University  
## 135 Guru Ghasidas Vishwavidyalaya  
## 136 Guru Nanak Institute of Pharmaceutical Science Technology  
## 137 Haldia Institute of Technology  
## 138 Harcourt Butler Technical University  
## 139 Heritage Institute of Technology  
## 140 I S F College of Pharmacy  
## 141 ICFAI Foundation for Higher Education  
## 142 IIHMR UNIVERSITY  
## 143 Indian Institute of Food Processing Technology IIFPT  
## 144 Indian Institute of Foreign Trade  
## 145 Indian Institute of Forest Management  
## 146 Indian Institute of Information Technology Allahabad  
## 147 Indian Institute of Information Technology Design Manufacturing  
## 148 Indian Institute of Information Technology Design Manufacturing Jabalpur  
## 149 Indian Institute of Information Technology Guwahati  
## 150 Indian Institute of Management  
## 151 Indian Institute of Management Ahmedabad  
## 152 Indian Institute of Management Bangalore  
## 153 Indian Institute of Management Calcutta  
## 154 Indian Institute of Management Indore  
## 155 Indian Institute of Management Kashipur  
## 156 Indian Institute of Management Kozhikode  
## 157 Indian Institute of Management Lucknow  
## 158 Indian Institute of Management Raipur  
## 159 Indian Institute of Management Ranchi  
## 160 Indian Institute of Management Rohtak  
## 161 Indian Institute of Management Shillong  
## 162 Indian Institute of Management Tiruchirappalli  
## 163 Indian Institute of Management Udaipur  
## 164 Indian Institute of Space Science and Technology  
## 165 Indian Institute of Technology BHU Varanasi  
## 166 Indian Institute of Technology Bhubaneswar  
## 167 Indian Institute of Technology Gandhinagar  
## 168 Indian Institute of Technology Guwahati  
## 169 Indian Institute of Technology Hyderabad  
## 170 Indian Institute of Technology Indore  
## 171 Indian Institute of Technology Jodhpur  
## 172 Indian Institute of Technology Mandi  
## 173 Indian Institute of Technology Patna  
## 174 Indian Institute of Technology Ropar  
## 175 Indian Law Institute  
## 176 Indira Gandhi Delhi Technical University for Women  
## 177 Indraprastha Institute of Information Technology Delhi  
## 178 Institute for Financial Management and Research  
## 179 Institute of Aeronautical Engineering  
## 180 Institute of Engineering Management  
## 181 Institute of Liver and Biliary Sciences  
## 182 Institute of Medical Sciences  
## 183 Institute of Rural Management Anand  
## 184 Integral University  
## 185 International Institute of Information Technology Bangalore  
## 186 International Institute of Information Technology Hyderabad  
## 187 Jadavpur University  
## 188 Jagan Institute of Management Studies  
## 189 Jain University  
## 190 Jawaharlal Institute of Post Graduate Medical Education Research  
## 191 Jawaharlal Nehru Technological University  
## 192 Jaypee Institute of Information Technology  
## 193 Jaypee University of Information Technology  
## 194 JNTUA College of Engineering  
## 195 JSS Dental College and Hospital  
## 196 JSS Medical College  
## 197 JSS Science and Technology University  
## 198 K J Somaiya College of Engineering  
## 199 K J Somaiya Institute of Management Studies Research  
## 200 K S Hegde Medical Academy  
## 201 Kalasalingam Academy of Research and Higher Education  
## 202 Karunya Institute of Technology and Sciences  
## 203 King George s Medical University  
## 204 KLE College of Pharmacy  
## 205 KLE Technological University  
## 206 KLE Vishwanath Katti Institute of Dental Sciences  
## 207 KMCH College of Pharmacy  
## 208 Kongu Engineering College  
## 209 Krishna Institute of Medical Sciences  
## 210 Kumaraguru College of Technology  
## 211 Kumaun University Nainital  
## 212 L M College of Pharmacy  
## 213 Loyola Institute of Business Administration  
## 214 M G R Educational and Research Institute  
## 215 M S Ramaiah Institute of Technology  
## 216 M S Ramaiah Medical College  
## 217 Madan Mohan Malaviya University of Technology  
## 218 Madras Medical College and Government General Hospital  
## 219 Maharshi Dayanand University  
## 220 Maharshi Karve Stree Shikshan Samstha s Cummins College of Engineering for Women  
## 221 Mahatma Gandhi Medical College and Research Institute  
## 222 Malaviya National Institute of Technology  
## 223 Management Development Institute  
## 224 ManavRachna International Institute of Research Studies  
## 225 Manipal Academy of Higher Education  
## 226 Manipal College of Pharmaceutical Sciences  
## 227 Manipal Institute of Technology  
## 228 Maulana Abul Kalam Azad University of Technology  
## 229 Maulana Azad Institute of Dental Sciences  
## 230 Maulana Azad Medical College  
## 231 Mepco Schlenk Engineering College  
## 232 Motilal Nehru National Institute of Technology  
## 233 N G S M Institute of Pharmaceutical Sciences  
## 234 N M A M Institute of Technology  
## 235 Nair Hospital Dental College  
## 236 Nalsar University of Law  
## 237 National Engineering College  
## 238 National Institute of Food Technology Enterprenurship Management  
## 239 National Institute of Foundry and Forge Technology NIFFT  
## 240 National Institute of Industrial Engineering  
## 241 National Institute of Mental Health Neuro Sciences  
## 242 National Institute of Pharmaceutical Education and Research Ahmedabad  
## 243 National Institute of Pharmaceutical Education and Research Guwahati  
## 244 National Institute of Pharmaceutical Education and Research Hyderabad  
## 245 National Institute of Pharmaceutical Education and Research Kolkata  
## 246 National Institute of Pharmaceutical Education and Research Mohali  
## 247 National Institute of Pharmaceutical Education and Research Raebareli  
## 248 National Institute of Technology Agartala  
## 249 National Institute of Technology Arunachal Pradesh  
## 250 National Institute of Technology Durgapur  
## 251 National Institute of Technology Goa  
## 252 National Institute of Technology Jamshedpur  
## 253 National Institute of Technology Karnataka  
## 254 National Institute of Technology Kurukshetra  
## 255 National Institute of Technology Manipur  
## 256 National Institute of Technology Meghalaya  
## 257 National Institute of Technology Patna  
## 258 National Institute of Technology Puducherry  
## 259 National Institute of Technology Raipur  
## 260 National Institute of Technology Rourkela  
## 261 National Institute of Technology Silchar  
## 262 National Institute of Technology Warangal  
## 263 National Law Institute University Bhopal  
## 264 National Law School of India University  
## 265 National Law University and Judicial Academy  
## 266 Netaji Subhas University of Technology NSUT  
## 267 New Horizon College of Engineering  
## 268 Nitte Meenakshi Institute of Technology  
## 269 Noida Institute of Engineering And Technology Pharmacy Institute  
## 270 North Eastern Regional Institute of Science Technology  
## 271 NSHM Knowledge Campus  
## 272 P E S College of Engineering  
## 273 P E Society s Modern College of Pharmacy  
## 274 Pacific Dental College  
## 275 Padamshree Dr D Y Patil College of Pharmacy  
## 276 Padmashree Dr D Y Patil Institute of Pharmaceutical Sciences and Research  
## 277 PES University  
## 278 Pimpri Chinchwad College of Engineering  
## 279 Pondicherry Engineering College  
## 280 Poona College of Pharmacy Pune  
## 281 Post Graduate Institute of Medical Education and Research  
## 282 Postgraduate Institute of Dental Sciences  
## 283 Principal K M Kundnani College of Pharmacy  
## 284 Principal L N Welingkar Institute of Management Development and Research  
## 285 PSG College of Pharmacy  
## 286 PSG Institute of Medical Sciences Research  
## 287 Pt Ravishankar Shukla University  
## 288 Punjab Engineering College Deemed To Be University  
## 289 Punjab Technical University  
## 290 Punjabi University  
## 291 R C Patel Institute of Pharmaceutical Education Research  
## 292 R M K Engineering College  
## 293 R V College of Engineering  
## 294 Raghavendra Institute of Pharmaceuatical Education Research  
## 295 Rajalakshmi Engineering College  
## 296 Rajiv Gandhi Institute of Petroleum Technology  
## 297 Ramrao Adik Institute of Technology  
## 298 Regional Institute of Medical Sciences  
## 299 S P Jain Institute of Management and Research  
## 300 Sam Higginbottom Institute of Agriculture Technology Sciences  
## 301 Sanjay Gandhi Postgraduate Institute of Medical Sciences  
## 302 Sant Longowal Institute of Engineering Technology  
## 303 Sardar Vallabhbhai National Institute of Technology  
## 304 Sathyabama Institute of Science and Technology  
## 305 Sawai Man Singh Medical College  
## 306 School of Engineering Cochin University of Science and Technology  
## 307 Shanmugha Arts Science Technology Research Academy  
## 308 Shri Mata Vaishno Devi University  
## 309 Shri Ramdeobaba College of Engineering and Management  
## 310 Siddaganga Institute of Technology  
## 311 Silicon Institute of Technology SIT Bhubaneswar  
## 312 Smt Kishoritai Bhoyar College of Pharmacy  
## 313 Sona College of Technology  
## 314 SR Engineering College  
## 315 Sree Vidyanikethan Engineering College  
## 316 Sri Dharmasthala Manjunatheswara College of Dharwad  
## 317 Sri Krishna College of Engineering and Technology  
## 318 Sri Krishna College of Technology  
## 319 Sri Padmavathi Mahila Visva Vidyalayam  
## 320 Sri Ramakrishna Engineering College  
## 321 Sri Ramakrishna Institute of Paramedical Sciences  
## 322 Sri Sai Ram Institute of Technology  
## 323 Sri Sairam Engineering College  
## 324 Sri Sivasubramaniya Nadar College of Engineering  
## 325 Sri Venkateshwara College of Pharmacy  
## 326 Sri Venkateswara College of Engineering  
## 327 Sri Venkateswara Institute of Medical Sciences  
## 328 Sri Venkateswara University  
## 329 SRM Dental College  
## 330 St John s Medical College  
## 331 St Josephs College of Engineering  
## 332 SVKM s Dr Bhanuben Nanavati College of Pharmacy  
## 333 Symbiosis Institute of Business Management  
## 334 Symbiosis Law School  
## 335 T A Pai Management Institute  
## 336 The LNM Institute of Information Technology  
## 337 The National Institute of Engineering  
## 338 The Northcap University  
## 339 The Rajiv Gandhi National University of Law  
## 340 The West Bengal National University of Juridicial Sciences  
## 341 University College of Medical Sciences  
## 342 Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology  
## 343 Vardhaman College of Engineering  
## 344 Vardhman Mahavir Medical College Safdarjung Hospital  
## 345 Vasavi College of Engineering  
## 346 Veer Surendra Sai University of Technology  
## 347 Veermata Jijabai Technological Institute  
## 348 Vel Tech Rangarajan Dr Sagunthala R D Institute of Science and Technology  
## 349 Velagapudi Ramakrishna Siddhartha Engineering College  
## 350 Vels Institute of Science Technology Advanced Studies VISTAS  
## 351 Vignan s Foundation for Science Technology Research  
## 352 Vishwakarma Institute of Technology  
## 353 Visvesvaraya National Institute of Technology  
## 354 Vivekanand Education Society s College of Pharmacy  
## 355 Walchand College of Engineering  
## 356 Xavier Institute of Management XIMB  
## 357 Xavier Labour Relations Institute XLRI  
## 358 Y B Chavan College of Pharmacy  
## 359 Yenepoya Dental College  
## 360 Yeshwantrao Chavan College of Engineering  
## 361 YMCA University of Science and Technology  
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## 2 5 1.09 2.18  
## 3 5 1.09 3.27  
## 4 5 1.09 4.36  
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## 6 4 0.87 6.10  
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## 15 3 0.65 11.95  
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## 18 3 0.65 13.90  
## 19 3 0.65 14.55  
## 20 3 0.65 15.20  
## 21 3 0.65 15.85  
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## 23 3 0.65 17.15  
## 24 3 0.65 17.80  
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## 217 1 0.22 68.87  
## 218 1 0.22 69.09  
## 219 1 0.22 69.31  
## 220 1 0.22 69.53  
## 221 1 0.22 69.75  
## 222 1 0.22 69.97  
## 223 1 0.22 70.19  
## 224 1 0.22 70.41  
## 225 1 0.22 70.63  
## 226 1 0.22 70.85  
## 227 1 0.22 71.07  
## 228 1 0.22 71.29  
## 229 1 0.22 71.51  
## 230 1 0.22 71.73  
## 231 1 0.22 71.95  
## 232 1 0.22 72.17  
## 233 1 0.22 72.39  
## 234 1 0.22 72.61  
## 235 1 0.22 72.83  
## 236 1 0.22 73.05  
## 237 1 0.22 73.27  
## 238 1 0.22 73.49  
## 239 1 0.22 73.71  
## 240 1 0.22 73.93  
## 241 1 0.22 74.15  
## 242 1 0.22 74.37  
## 243 1 0.22 74.59  
## 244 1 0.22 74.81  
## 245 1 0.22 75.03  
## 246 1 0.22 75.25  
## 247 1 0.22 75.47  
## 248 1 0.22 75.69  
## 249 1 0.22 75.91  
## 250 1 0.22 76.13  
## 251 1 0.22 76.35  
## 252 1 0.22 76.57  
## 253 1 0.22 76.79  
## 254 1 0.22 77.01  
## 255 1 0.22 77.23  
## 256 1 0.22 77.45  
## 257 1 0.22 77.67  
## 258 1 0.22 77.89  
## 259 1 0.22 78.11  
## 260 1 0.22 78.33  
## 261 1 0.22 78.55  
## 262 1 0.22 78.77  
## 263 1 0.22 78.99  
## 264 1 0.22 79.21  
## 265 1 0.22 79.43  
## 266 1 0.22 79.65  
## 267 1 0.22 79.87  
## 268 1 0.22 80.09  
## 269 1 0.22 80.31  
## 270 1 0.22 80.53  
## 271 1 0.22 80.75  
## 272 1 0.22 80.97  
## 273 1 0.22 81.19  
## 274 1 0.22 81.41  
## 275 1 0.22 81.63  
## 276 1 0.22 81.85  
## 277 1 0.22 82.07  
## 278 1 0.22 82.29  
## 279 1 0.22 82.51  
## 280 1 0.22 82.73  
## 281 1 0.22 82.95  
## 282 1 0.22 83.17  
## 283 1 0.22 83.39  
## 284 1 0.22 83.61  
## 285 1 0.22 83.83  
## 286 1 0.22 84.05  
## 287 1 0.22 84.27  
## 288 1 0.22 84.49  
## 289 1 0.22 84.71  
## 290 1 0.22 84.93  
## 291 1 0.22 85.15  
## 292 1 0.22 85.37  
## 293 1 0.22 85.59  
## 294 1 0.22 85.81  
## 295 1 0.22 86.03  
## 296 1 0.22 86.25  
## 297 1 0.22 86.47  
## 298 1 0.22 86.69  
## 299 1 0.22 86.91  
## 300 1 0.22 87.13  
## 301 1 0.22 87.35  
## 302 1 0.22 87.57  
## 303 1 0.22 87.79  
## 304 1 0.22 88.01  
## 305 1 0.22 88.23  
## 306 1 0.22 88.45  
## 307 1 0.22 88.67  
## 308 1 0.22 88.89  
## 309 1 0.22 89.11  
## 310 1 0.22 89.33  
## 311 1 0.22 89.55  
## 312 1 0.22 89.77  
## 313 1 0.22 89.99  
## 314 1 0.22 90.21  
## 315 1 0.22 90.43  
## 316 1 0.22 90.65  
## 317 1 0.22 90.87  
## 318 1 0.22 91.09  
## 319 1 0.22 91.31  
## 320 1 0.22 91.53  
## 321 1 0.22 91.75  
## 322 1 0.22 91.97  
## 323 1 0.22 92.19  
## 324 1 0.22 92.41  
## 325 1 0.22 92.63  
## 326 1 0.22 92.85  
## 327 1 0.22 93.07  
## 328 1 0.22 93.29  
## 329 1 0.22 93.51  
## 330 1 0.22 93.73  
## 331 1 0.22 93.95  
## 332 1 0.22 94.17  
## 333 1 0.22 94.39  
## 334 1 0.22 94.61  
## 335 1 0.22 94.83  
## 336 1 0.22 95.05  
## 337 1 0.22 95.27  
## 338 1 0.22 95.49  
## 339 1 0.22 95.71  
## 340 1 0.22 95.93  
## 341 1 0.22 96.15  
## 342 1 0.22 96.37  
## 343 1 0.22 96.59  
## 344 1 0.22 96.81  
## 345 1 0.22 97.03  
## 346 1 0.22 97.25  
## 347 1 0.22 97.47  
## 348 1 0.22 97.69  
## 349 1 0.22 97.91  
## 350 1 0.22 98.13  
## 351 1 0.22 98.35  
## 352 1 0.22 98.57  
## 353 1 0.22 98.79  
## 354 1 0.22 99.01  
## 355 1 0.22 99.23  
## 356 1 0.22 99.45  
## 357 1 0.22 99.67  
## 358 1 0.22 99.89  
## 359 1 0.22 100.11  
## 360 1 0.22 100.33  
## 361 1 0.22 100.00

## Warning in freq\_logic(data = data, input = input[i], plot, na.rm, path\_out =  
## path\_out): Skipping plot for variable 'city' (more than 100 categories)

## city frequency percentage cumulative\_perc  
## 1 Chennai 29 6.30 6.30  
## 2 New Delhi 23 5.00 11.30  
## 3 Mumbai 20 4.35 15.65  
## 4 Pune 19 4.13 19.78  
## 5 Bengaluru 18 3.91 23.69  
## 6 Hyderabad 15 3.26 26.95  
## 7 Bhubaneswar 13 2.83 29.78  
## 8 Coimbatore 13 2.83 32.61  
## 9 Kolkata 9 1.96 34.57  
## 10 Chandigarh 8 1.74 36.31  
## 11 Nagpur 8 1.74 38.05  
## 12 Ahmedabad 6 1.30 39.35  
## 13 Gandhinagar 6 1.30 40.65  
## 14 Lucknow 6 1.30 41.95  
## 15 Ranchi 6 1.30 43.25  
## 16 Aligarh 5 1.09 44.34  
## 17 Bhopal 5 1.09 45.43  
## 18 Delhi 5 1.09 46.52  
## 19 Mangaluru 5 1.09 47.61  
## 20 Varanasi 5 1.09 48.70  
## 21 Belgaum 4 0.87 49.57  
## 22 Dehradun 4 0.87 50.44  
## 23 Guwahati 4 0.87 51.31  
## 24 Jaipur 4 0.87 52.18  
## 25 Kancheepuram 4 0.87 53.05  
## 26 Kharagpur 4 0.87 53.92  
## 27 Patiala 4 0.87 54.79  
## 28 Tiruchirappalli 4 0.87 55.66  
## 29 Ambala 3 0.65 56.31  
## 30 Bangalore 3 0.65 56.96  
## 31 Gautam Budh Nagar 3 0.65 57.61  
## 32 Guntur 3 0.65 58.26  
## 33 Indore 3 0.65 58.91  
## 34 Kochi 3 0.65 59.56  
## 35 Kozhikode 3 0.65 60.21  
## 36 Ludhiana 3 0.65 60.86  
## 37 Manipal 3 0.65 61.51  
## 38 Mohali 3 0.65 62.16  
## 39 Mysore 3 0.65 62.81  
## 40 Phagwara 3 0.65 63.46  
## 41 Puducherry 3 0.65 64.11  
## 42 Raipur 3 0.65 64.76  
## 43 Rajpura 3 0.65 65.41  
## 44 Rohtak 3 0.65 66.06  
## 45 Roorkee 3 0.65 66.71  
## 46 Solan 3 0.65 67.36  
## 47 Thiruvananthapuram 3 0.65 68.01  
## 48 Udupi 3 0.65 68.66  
## 49 Vellore 3 0.65 69.31  
## 50 Visakhapatnam 3 0.65 69.96  
## 51 Allahabad 2 0.43 70.39  
## 52 Anantapur 2 0.43 70.82  
## 53 Annamalainagar 2 0.43 71.25  
## 54 Davangere 2 0.43 71.68  
## 55 Dhanbad 2 0.43 72.11  
## 56 Dharwad 2 0.43 72.54  
## 57 Faridabad 2 0.43 72.97  
## 58 Greater Noida 2 0.43 73.40  
## 59 Gurgaon 2 0.43 73.83  
## 60 Gwalior 2 0.43 74.26  
## 61 Hamirpur 2 0.43 74.69  
## 62 Hisar 2 0.43 75.12  
## 63 Itanagar 2 0.43 75.55  
## 64 Jamshedpur 2 0.43 75.98  
## 65 Jodhpur 2 0.43 76.41  
## 66 Kanpur 2 0.43 76.84  
## 67 Madurai 2 0.43 77.27  
## 68 Mysuru 2 0.43 77.70  
## 69 Navi Mumbai 2 0.43 78.13  
## 70 Noida 2 0.43 78.56  
## 71 Patna 2 0.43 78.99  
## 72 Pilani 2 0.43 79.42  
## 73 Shibpur 2 0.43 79.85  
## 74 Shillong 2 0.43 80.28  
## 75 Thanjavur 2 0.43 80.71  
## 76 Tirupati 2 0.43 81.14  
## 77 Udaipur 2 0.43 81.57  
## 78 Vaddeswaram 2 0.43 82.00  
## 79 Vadodara 2 0.43 82.43  
## 80 Vijayawada 2 0.43 82.86  
## 81 Warangal 2 0.43 83.29  
## 82 Wardha 2 0.43 83.72  
## 83 A.Rangampet 1 0.22 83.94  
## 84 Agra 1 0.22 84.16  
## 85 Agratala 1 0.22 84.38  
## 86 Amethi 1 0.22 84.60  
## 87 Amritapuri 1 0.22 84.82  
## 88 Anand 1 0.22 85.04  
## 89 Aurangabad 1 0.22 85.26  
## 90 Banasthali 1 0.22 85.48  
## 91 Bela 1 0.22 85.70  
## 92 Bengluru 1 0.22 85.92  
## 93 Bilaspur 1 0.22 86.14  
## 94 Burla 1 0.22 86.36  
## 95 Chittoor 1 0.22 86.58  
## 96 Cochin 1 0.22 86.80  
## 97 Cuttack 1 0.22 87.02  
## 98 Dibrugarh 1 0.22 87.24  
## 99 Durgapur 1 0.22 87.46  
## 100 Ghaziabad 1 0.22 87.68  
## 101 Gorakhpur 1 0.22 87.90  
## 102 Gurugram 1 0.22 88.12  
## 103 Haldia 1 0.22 88.34  
## 104 Ibrahimpatan 1 0.22 88.56  
## 105 Imphal 1 0.22 88.78  
## 106 Imphal West 1 0.22 89.00  
## 107 Jabalpur 1 0.22 89.22  
## 108 Jalandhar 1 0.22 89.44  
## 109 Kakinada 1 0.22 89.66  
## 110 Kamrup 1 0.22 89.88  
## 111 Kanpur Nagar 1 0.22 90.10  
## 112 Kapurthala 1 0.22 90.32  
## 113 Karad 1 0.22 90.54  
## 114 Karaikal 1 0.22 90.76  
## 115 Kashipur 1 0.22 90.98  
## 116 Katra 1 0.22 91.20  
## 117 Kolhapur 1 0.22 91.42  
## 118 Kovilpatti 1 0.22 91.64  
## 119 Kurnool 1 0.22 91.86  
## 120 Kurukshetra 1 0.22 92.08  
## 121 Longowal 1 0.22 92.30  
## 122 LUCKNOW 1 0.22 92.52  
## 123 Mandi 1 0.22 92.74  
## 124 Mandya 1 0.22 92.96  
## 125 Mangalore 1 0.22 93.18  
## 126 Moga 1 0.22 93.40  
## 127 Nadia 1 0.22 93.62  
## 128 Nadiad 1 0.22 93.84  
## 129 NAGPUR 1 0.22 94.06  
## 130 Nainital 1 0.22 94.28  
## 131 Nitte, \nUdupi 1 0.22 94.50  
## 132 Ooty 1 0.22 94.72  
## 133 Panaji 1 0.22 94.94  
## 134 Perundurai 1 0.22 95.16  
## 135 Ponda 1 0.22 95.38  
## 136 Prayagraj (Allahabad) 1 0.22 95.60  
## 137 Rangareddy 1 0.22 95.82  
## 138 Rourkela 1 0.22 96.04  
## 139 Rupnagar 1 0.22 96.26  
## 140 Salem 1 0.22 96.48  
## 141 Sangli 1 0.22 96.70  
## 142 Sanquelim 1 0.22 96.92  
## 143 Secunderabd 1 0.22 97.14  
## 144 Shirpur 1 0.22 97.36  
## 145 Silchar 1 0.22 97.58  
## 146 Sivakasi 1 0.22 97.80  
## 147 Sonipat 1 0.22 98.02  
## 148 South West 1 0.22 98.24  
## 149 Sri City, Chittoor 1 0.22 98.46  
## 150 Srivilliputtur 1 0.22 98.68  
## 151 Surat 1 0.22 98.90  
## 152 Surathkal 1 0.22 99.12  
## 153 Thiruvallur 1 0.22 99.34  
## 154 Thrissur 1 0.22 99.56  
## 155 Tirupathi 1 0.22 99.78  
## 156 Tumkur 1 0.22 100.00



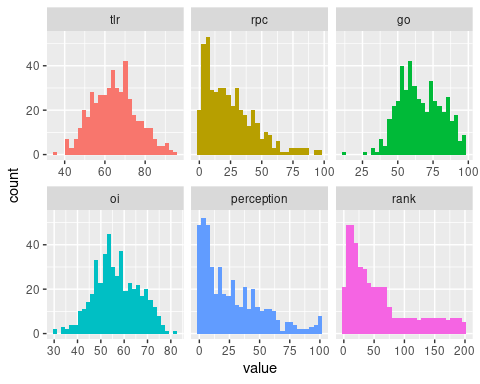
## state frequency percentage cumulative\_perc  
## 1 Tamil Nadu 66 14.35 14.35  
## 2 Maharashtra 57 12.39 26.74  
## 3 Karnataka 51 11.09 37.83  
## 4 Uttar Pradesh 34 7.39 45.22  
## 5 Delhi 29 6.30 51.52  
## 6 Punjab 22 4.78 56.30  
## 7 Andhra Pradesh 20 4.35 60.65  
## 8 Telangana 20 4.35 65.00  
## 9 West Bengal 18 3.91 68.91  
## 10 Gujarat 17 3.70 72.61  
## 11 Odisha 16 3.48 76.09  
## 12 Haryana 15 3.26 79.35  
## 13 Kerala 12 2.61 81.96  
## 14 Madhya Pradesh 11 2.39 84.35  
## 15 Rajasthan 11 2.39 86.74  
## 16 Jharkhand 10 2.17 88.91  
## 17 Uttarakhand 9 1.96 90.87  
## 18 Chandigarh 8 1.74 92.61  
## 19 Assam 7 1.52 94.13  
## 20 Himachal Pradesh 6 1.30 95.43  
## 21 Chhattisgarh 4 0.87 96.30  
## 22 Pondicherry 4 0.87 97.17  
## 23 Goa 3 0.65 97.82  
## 24 Arunachal Pradesh 2 0.43 98.25  
## 25 Bihar 2 0.43 98.68  
## 26 Manipur 2 0.43 99.11  
## 27 Meghalaya 2 0.43 99.54  
## 28 Jammu and Kashmir 1 0.22 99.76  
## 29 Tripura 1 0.22 100.00



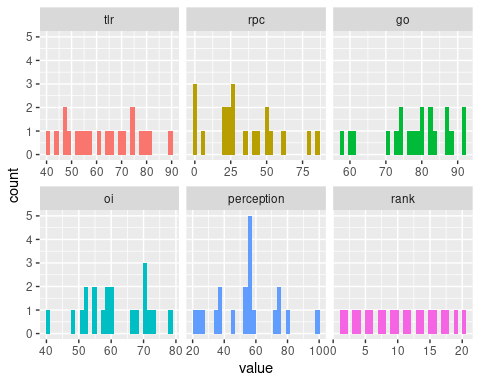
## category frequency percentage cumulative\_perc  
## 1 engineering 200 43.48 43.48  
## 2 management 75 16.30 59.78  
## 3 pharmacy 75 16.30 76.08  
## 4 medical 40 8.70 84.78  
## 5 dental 30 6.52 91.30  
## 6 architecture 20 4.35 95.65  
## 7 law 20 4.35 100.00

## [1] "Variables processed: institute\_id, name, city, state, category"

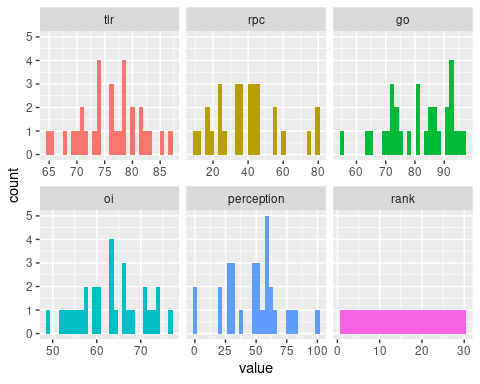
plot\_num(univdata,bins=30)



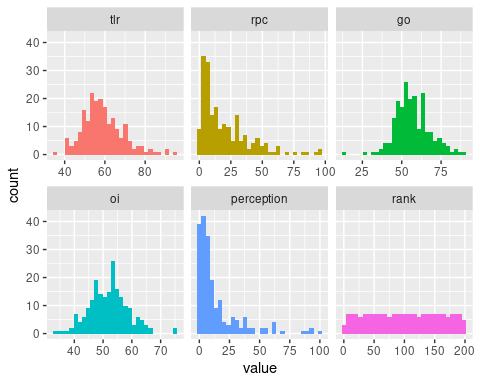
plot\_num(arch\_data,bins=30)



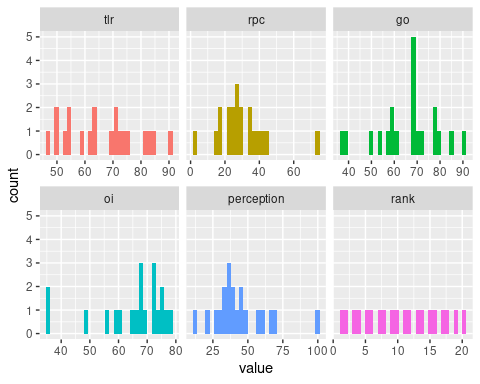
plot\_num(dent\_data,bins=30)



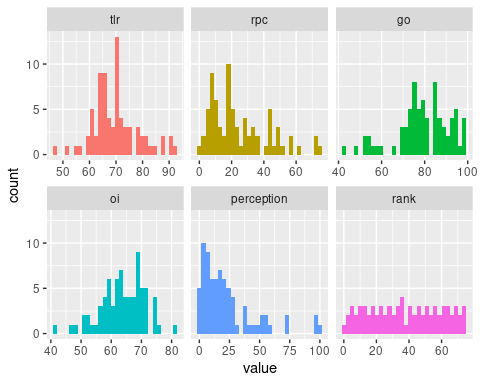
plot\_num(engi\_data,bins=30)



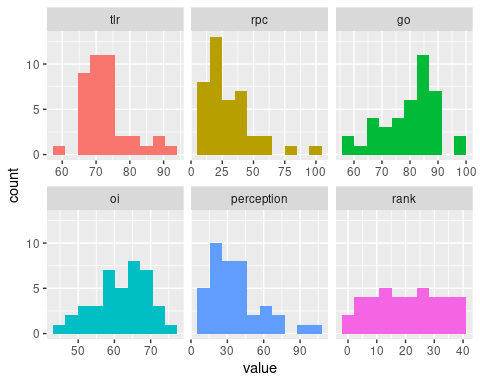
plot\_num(law\_data,bins=30)



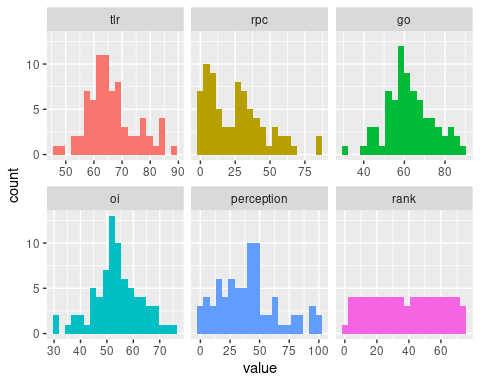
plot\_num(mana\_data,bins=30)



plot\_num(medi\_data,bins=10)



plot\_num(phar\_data,bins=20)



## Cross Tables and Pivot Table

# Cross table  
table(category)

## category  
## architecture dental engineering law management medical   
## 20 30 200 20 75 40   
## pharmacy   
## 75

table(univdata$category,univdata$state)

##   
## Andhra Pradesh Arunachal Pradesh Assam Bihar Chandigarh  
## architecture 1 0 0 0 0  
## dental 0 0 0 0 1  
## engineering 10 2 3 2 2  
## law 0 0 1 0 1  
## management 2 0 0 0 1  
## medical 1 0 0 0 2  
## pharmacy 6 0 3 0 1  
##   
## Chhattisgarh Delhi Goa Gujarat Haryana Himachal Pradesh  
## architecture 0 2 0 1 0 1  
## dental 0 2 0 0 2 0  
## engineering 1 7 1 7 6 4  
## law 0 3 0 1 0 0  
## management 1 7 1 4 3 0  
## medical 0 6 0 0 1 0  
## pharmacy 2 2 1 4 3 1  
##   
## Jammu and Kashmir Jharkhand Karnataka Kerala Madhya Pradesh  
## architecture 0 1 2 2 2  
## dental 0 0 10 1 1  
## engineering 1 4 21 6 5  
## law 0 0 2 0 1  
## management 0 4 4 1 2  
## medical 0 0 7 1 0  
## pharmacy 0 1 5 1 0  
##   
## Maharashtra Manipur Meghalaya Odisha Pondicherry Punjab  
## architecture 0 0 0 0 0 0  
## dental 3 0 0 2 0 1  
## engineering 22 1 1 7 2 8  
## law 1 0 0 2 0 1  
## management 10 0 1 3 0 4  
## medical 3 1 0 2 2 2  
## pharmacy 18 0 0 0 0 6  
##   
## Rajasthan Tamil Nadu Telangana Tripura Uttar Pradesh Uttarakhand  
## architecture 0 4 0 0 1 1  
## dental 1 4 1 0 1 0  
## engineering 4 34 15 1 11 4  
## law 1 0 1 0 3 0  
## management 2 8 2 0 9 3  
## medical 1 7 0 0 4 0  
## pharmacy 2 9 1 0 5 1  
##   
## West Bengal  
## architecture 2  
## dental 0  
## engineering 8  
## law 2  
## management 3  
## medical 0  
## pharmacy 3

library(caTools)  
set.seed(456)  
randomVar <- sample.split(univdata,SplitRatio=0.8)  
utrain <- subset(univdata,randomVar==TRUE)  
utest <- subset(univdata,randomVar==FALSE)  
  
nrow(utrain)

## [1] 334

nrow(utest)

## [1] 126

head(utrain)

## institute\_id name tlr  
## 1 IR-A-U-0573 Indian Institute of Technology Kharagpur 78.58  
## 2 IR-A-U-0560 Indian Institute of Technology Roorkee 81.32  
## 6 IR-A-U-0584 Indian Institute of Engineering Science and Technology 71.68  
## 7 IR-A-U-0626 School of Planning and Architecture 79.91  
## 8 IR-A-U-0467 National Institute of Technology Tiruchirappalli 49.63  
## 9 IR-A-U-0627 School of Planning and Architecture 74.20  
## rpc go oi perception city state rank category  
## 1 79.73 91.80 71.71 75.54 Kharagpur West Bengal 1 architecture  
## 2 85.34 87.15 70.90 56.30 Roorkee Uttarakhand 2 architecture  
## 6 62.31 74.67 52.88 37.00 Shibpur West Bengal 6 architecture  
## 7 22.57 74.12 73.51 52.25 Bhopal Madhya Pradesh 7 architecture  
## 8 52.10 83.90 59.37 73.03 Tiruchirappalli Tamil Nadu 8 architecture  
## 9 5.20 82.32 68.21 56.30 Vijayawada Andhra Pradesh 9 architecture

head(utest)

## institute\_id name  
## 3 IR-A-U-0263 National Institute of Technology Calicut  
## 4 IR-A-U-0127 Centre for Environmental Planning and Technology University  
## 5 IR-A-U-0116 School of Planning and Architecture  
## 14 IR-A-C-57952 BMS College of Arhitecture  
## 15 IR-A-U-0284 Maulana Azad National Institute of Technology  
## 16 IR-A-U-0496 Aligarh Muslim University  
## tlr rpc go oi perception city state rank  
## 3 89.70 27.93 75.96 66.96 58.79 Kozhikode Kerala 3  
## 4 70.14 43.18 82.53 59.98 74.72 Ahmedabad Gujarat 4  
## 5 74.58 20.51 73.47 70.15 100.00 New Delhi Delhi 5  
## 14 63.40 0.01 77.67 57.88 54.99 Bengaluru Karnataka 14  
## 15 56.44 34.30 71.03 55.22 25.28 Bhopal Madhya Pradesh 15  
## 16 40.68 50.18 88.25 40.73 34.91 Aligarh Uttar Pradesh 16  
## category  
## 3 architecture  
## 4 architecture  
## 5 architecture  
## 14 architecture  
## 15 architecture  
## 16 architecture

utrain

## institute\_id  
## 1 IR-A-U-0573  
## 2 IR-A-U-0560  
## 6 IR-A-U-0584  
## 7 IR-A-U-0626  
## 8 IR-A-U-0467  
## 9 IR-A-U-0627  
## 10 IR-A-U-0108  
## 11 IR-A-C-43708  
## 12 IR-A-C-46330  
## 13 IR-A-U-0202  
## 17 IR-A-C-26794  
## 18 IR-A-U-0439  
## 19 IR-A-U-0189  
## 20 IR-A-U-0454  
## 21 IR-N-C-28507  
## 22 IR-N-C-7254  
## 23 IR-N-I-1110  
## 24 IR-N-I-1441  
## 28 IR-N-N-153  
## 29 IR-N-N-352  
## 30 IR-N-C-35008  
## 31 IR-N-U-0724  
## 32 IR-N-U-0363  
## 33 IR-N-U-0436  
## 34 IR-N-U-0295  
## 35 IR-N-C-30756  
## 39 IR-N-U-0108  
## 40 IR-N-C-8528  
## 41 IR-N-C-40192  
## 42 IR-N-C-29701  
## 43 IR-N-N-73  
## 44 IR-N-C-24504  
## 45 IR-N-U-0168  
## 46 IR-N-C-40531  
## 50 IR-N-N-71  
## 51 IR-E-U-0456  
## 52 IR-E-I-1074  
## 53 IR-E-U-0306  
## 54 IR-E-I-1075  
## 55 IR-E-U-0573  
## 56 IR-E-U-0560  
## 57 IR-E-U-0053  
## 61 IR-E-U-0701  
## 62 IR-E-U-0205  
## 63 IR-E-U-0237  
## 64 IR-E-U-0439  
## 65 IR-E-U-0490  
## 66 IR-E-U-0357  
## 67 IR-E-U-0575  
## 68 IR-E-U-0308  
## 72 IR-E-U-0355  
## 73 IR-E-U-0263  
## 74 IR-E-U-0139  
## 75 IR-E-U-0378  
## 76 IR-E-U-0064  
## 77 IR-E-U-0334  
## 78 IR-E-U-0108  
## 79 IR-E-I-1480  
## 83 IR-E-U-0255  
## 84 IR-E-U-0363  
## 85 IR-E-U-0410  
## 86 IR-E-U-0098  
## 87 IR-E-U-0476  
## 88 IR-E-U-0202  
## 89 IR-E-U-0496  
## 90 IR-E-U-0172  
## 94 IR-E-C-16604  
## 95 IR-E-C-7252  
## 96 IR-E-U-0055  
## 97 IR-E-U-0577  
## 98 IR-E-U-0530  
## 99 IR-E-C-37013  
## 100 IR-E-C-41593  
## 101 IR-E-U-0474  
## 105 IR-E-U-0249  
## 106 IR-E-U-0105  
## 107 IR-E-U-0017  
## 108 IR-E-U-0020  
## 109 IR-E-C-1331  
## 110 IR-E-U-0458  
## 111 IR-E-U-0619  
## 112 IR-E-U-0221  
## 116 IR-E-U-0795  
## 117 IR-E-U-0092  
## 118 IR-E-U-0080  
## 119 IR-E-C-24004  
## 120 IR-E-C-1269  
## 121 IR-E-C-33641  
## 122 IR-E-U-0078  
## 123 IR-E-C-1262  
## 127 IR-E-U-0620  
## 128 IR-E-U-0201  
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## name  
## 1 Indian Institute of Technology Kharagpur  
## 2 Indian Institute of Technology Roorkee  
## 6 Indian Institute of Engineering Science and Technology  
## 7 School of Planning and Architecture  
## 8 National Institute of Technology Tiruchirappalli  
## 9 School of Planning and Architecture  
## 10 Jamia Millia Islamia  
## 11 College of Engineering Trivandrum  
## 12 Manipal Academy of Higher Education  
## 13 Birla Institute of Technology  
## 17 Thiagarajar College of Engineering  
## 18 Anna University  
## 19 National Institute of Technology Hamirpur  
## 20 Hindustan Institute of Technology and Science HITS  
## 21 Maulana Azad Institute of Dental Sciences  
## 22 Manipal College of Dental Sciences  
## 23 Dr D Y Patil Vidyapeeth  
## 24 Saveetha Institute of Medical and Technical Sciences  
## 28 Nair Hospital Dental College  
## 29 SRM Dental College  
## 30 JSS Dental College and Hospital  
## 31 M S Ramaiah University of Applied Sciences  
## 32 Siksha O Anusandhan  
## 33 Amrita School of Dentistry  
## 34 Datta Meghe Institute of Medical Sciences  
## 35 Postgraduate Institute of Dental Sciences  
## 39 Jamia Millia Islamia  
## 40 Yenepoya Dental College  
## 41 College of Dental Sciences  
## 42 Government Dental College  
## 43 Army College of Dental Sciences  
## 44 KLE Vishwanath Katti Institute of Dental Sciences  
## 45 Maharishi Markandeshwar  
## 46 Sri Dharmasthala Manjunatheswara College of Dharwad  
## 50 Institute of Medical Sciences  
## 51 Indian Institute of Technology Madras  
## 52 Indian Institute of Technology Delhi  
## 53 Indian Institute of Technology Bombay  
## 54 Indian Institute of Technology Kanpur  
## 55 Indian Institute of Technology Kharagpur  
## 56 Indian Institute of Technology Roorkee  
## 57 Indian Institute of Technology Guwahati  
## 61 Indian Institute of Technology BHU Varanasi  
## 62 Indian Institute of Technology Indian School of Mines  
## 63 National Institute of Technology Karnataka  
## 64 Anna University  
## 65 Vellore Institute of Technology  
## 66 National Institute of Technology Rourkela  
## 67 Jadavpur University  
## 68 Institute of Chemical Technology  
## 72 Indian Institute of Technology Bhubaneswar  
## 73 National Institute of Technology Calicut  
## 74 Indian Institute of Technology Gandhinagar  
## 75 Indian Institute of Technology Ropar  
## 76 Indian Institute of Technology Patna  
## 77 Visvesvaraya National Institute of Technology  
## 78 Jamia Millia Islamia  
## 79 Thapar Institute of Engineering Technology  
## 83 Indian Institute of Space Science and Technology  
## 84 Siksha O Anusandhan  
## 85 Malaviya National Institute of Technology  
## 86 Delhi Technological University  
## 87 Shanmugha Arts Science Technology Research Academy  
## 88 Birla Institute of Technology  
## 89 Aligarh Muslim University  
## 90 National Institute of Technology Kurukshetra  
## 94 Sri Sivasubramaniya Nadar College of Engineering  
## 95 Manipal Institute of Technology  
## 96 National Institute of Technology Silchar  
## 97 National Institute of Technology Durgapur  
## 98 Motilal Nehru National Institute of Technology  
## 99 PSG College of Technology  
## 100 College of Engineering Pune  
## 101 Sathyabama Institute of Science and Technology  
## 105 Visvesvaraya Technological University  
## 106 Indraprastha Institute of Information Technology Delhi  
## 107 Jawaharlal Nehru Technological University  
## 108 Koneru Lakshmaiah Education Foundation University  
## 109 M S Ramaiah Institute of Technology  
## 110 Kalasalingam Academy of Research and Higher Education  
## 111 National Institute of Technology Meghalaya  
## 112 International Institute of Information Technology Bangalore  
## 116 Indian Institute of Information Technology Guwahati  
## 117 National Institute of Technology Raipur  
## 118 Punjab Engineering College Deemed To Be University  
## 119 College of Engineering A  
## 120 R V College of Engineering  
## 121 Veermata Jijabai Technological Institute  
## 122 Panjab University  
## 123 B M S College of Engineering  
## 127 National Institute of Technology Goa  
## 128 Shri Mata Vaishno Devi University  
## 129 National Institute of Technology Jamshedpur  
## 130 Karunya Institute of Technology and Sciences  
## 131 Indian Institute of Information Technology Design Manufacturing Jabalpur  
## 132 Kumaraguru College of Technology  
## 133 Sri Krishna College of Engineering and Technology  
## 134 Chandigarh University  
## 138 University College of Engineering  
## 139 Graphic Era University  
## 140 Coimbatore Institute of Technology  
## 141 Siddaganga Institute of Technology  
## 142 National Institute of Technology Patna  
## 143 C V Raman Global University  
## 144 PES University  
## 145 Vel Tech Rangarajan Dr Sagunthala R D Institute of Science and Technology  
## 149 Bharati Vidyapeeth Deemed University College of Engineering  
## 150 Atal Bihari Vajpayee Indian Institute of Information Technology and Management  
## 151 Mepco Schlenk Engineering College  
## 152 Dayalbagh Educational Institute  
## 153 Indian Institute of Information Technology Allahabad  
## 154 Punjab Technical University  
## 155 Government College of Technology  
## 156 Rajalakshmi Engineering College  
## 160 The Northcap University  
## 161 Dhirubhai Ambani Institute of Information and Communication Technology  
## 162 Shoolini University of Biotechnology and Management Sciences  
## 163 Shri Ramdeobaba College of Engineering and Management  
## 164 New Horizon College of Engineering  
## 165 Jaypee University of Information Technology  
## 166 Maharaja Sayajirao University of Baroda  
## 167 Jain University  
## 171 National Institute of Food Technology Enterprenurship Management  
## 172 Pondicherry Engineering College  
## 173 B S Abdur Rahman Crescent Institute of Science and Technology  
## 174 Chaitanya Bharathi Institute of Technology  
## 175 Bharatiya Vidya Bhavan s Sardar Patel Institute of Technology  
## 176 Dayananda Sagar College of Engineering  
## 177 Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology  
## 178 Nitte Meenakshi Institute of Technology  
## 182 JSS Science and Technology University  
## 183 N M A M Institute of Technology  
## 184 Rajiv Gandhi Institute of Petroleum Technology  
## 185 Kongu Engineering College  
## 186 KLE Technological University  
## 187 Sant Longowal Institute of Engineering Technology  
## 188 Dr Vishwanath Karad MIT World Peace University  
## 189 G H Raisoni College of Engineering  
## 193 Vardhaman College of Engineering  
## 194 The Rashtrasant Tukadoji Maharaj Nagpur University  
## 195 North Eastern Regional Institute of Science Technology  
## 196 Indira Gandhi Delhi Technical University for Women  
## 197 P E S College of Engineering  
## 198 National Institute of Foundry and Forge Technology NIFFT  
## 199 Saveetha Institute of Medical and Technical Sciences  
## 200 Sona College of Technology  
## 204 Heritage Institute of Technology  
## 205 R M K Engineering College  
## 206 Velagapudi Ramakrishna Siddhartha Engineering College  
## 207 Maulana Abul Kalam Azad University of Technology  
## 208 National Institute of Technology Manipur  
## 209 Alliance University  
## 210 St Josephs College of Engineering  
## 211 SR Engineering College  
## 215 Vishwakarma Institute of Technology  
## 216 Harcourt Butler Technical University  
## 217 University of Petroleum and Energy Studies  
## 218 Walchand College of Engineering  
## 219 BMS Institute of Technology Management  
## 220 Institute of Aeronautical Engineering  
## 221 K J Somaiya College of Engineering  
## 222 Goka Raju Ranga Raju Institute of Engineering Technology  
## 226 Sri Venkateswara College of Engineering  
## 227 Pandit Deendayal Petroleum University  
## 228 School of Engineering Cochin University of Science and Technology  
## 229 Silicon Institute of Technology SIT Bhubaneswar  
## 230 Anurag Group of Institutions  
## 231 Chitkara University  
## 232 Indian Institute of Information Technology Design Manufacturing  
## 233 Madan Mohan Malaviya University of Technology  
## 237 Vasavi College of Engineering  
## 238 Gayatri Vidya Parishad College of Engineering  
## 239 National Engineering College  
## 240 G Pulla Reddy Engineering College  
## 241 Institute of Engineering Management  
## 242 Sri Sai Ram Institute of Technology  
## 243 Dharmsinh Desai University  
## 244 The LNM Institute of Information Technology  
## 248 Ramrao Adik Institute of Technology  
## 249 BVRIT Hyderabad  
## 250 National Institute of Technology Arunachal Pradesh  
## 251 National Law School of India University  
## 252 National Law University  
## 253 Nalsar University of Law  
## 254 Indian Institute of Technology Kharagpur  
## 255 National Law University  
## 259 Jamia Millia Islamia  
## 260 The Rajiv Gandhi National University of Law  
## 261 Dr Ram Manohar Lohiya National Law University  
## 262 Kalinga Institute of Industrial Technology  
## 263 Aligarh Muslim University  
## 264 National Law University  
## 265 Panjab University  
## 266 National Law University and Judicial Academy  
## 270 Christ University  
## 271 Indian Institute of Management Ahmedabad  
## 272 Indian Institute of Management Bangalore  
## 273 Indian Institute of Management Calcutta  
## 274 Indian Institute of Management Lucknow  
## 275 Indian Institute of Technology Kharagpur  
## 276 Indian Institute of Management Kozhikode  
## 277 Indian Institute of Management Indore  
## 281 Indian Institute of Technology Bombay  
## 282 Indian Institute of Technology Roorkee  
## 283 National Institute of Industrial Engineering  
## 284 Indian Institute of Technology Madras  
## 285 Indian Institute of Management Tiruchirappalli  
## 286 Indian Institute of Technology Kanpur  
## 287 Indian Institute of Management Udaipur  
## 288 S P Jain Institute of Management and Research  
## 292 Symbiosis Institute of Business Management  
## 293 Great Lakes Institute of Management  
## 294 SVKM s Narsee Monjee Institute of Management Studies  
## 295 ICFAI Foundation for Higher Education  
## 296 Indian Institute of Foreign Trade  
## 297 T A Pai Management Institute  
## 298 International Management Institute  
## 299 Indian Institute of Technology Indian School of Mines  
## 303 Indian Institute of Management Kashipur  
## 304 Jamia Millia Islamia  
## 305 National Institute of Technology Tiruchirappalli  
## 306 Banaras Hindu University  
## 307 Institute of Management Technology  
## 308 BML Munjal University  
## 309 Alliance University  
## 310 Indian Institute of Management  
## 314 Nirma University  
## 315 Aligarh Muslim University  
## 316 PSG College of Technology  
## 317 Birla Institute of Management Technology  
## 318 Goa Institute of Management  
## 319 Lovely Professional University  
## 320 Loyola Institute of Business Administration  
## 321 Chandigarh University  
## 325 Vellore Institute of Technology  
## 326 K J Somaiya Institute of Management Studies Research  
## 327 Guru Gobind Singh Indraprastha University  
## 328 Birla Institute of Technology  
## 329 Anna University  
## 330 Institute of Management Technology  
## 331 Institute of Management Technology  
## 332 Indian Institute of Forest Management  
## 336 University of Petroleum and Energy Studies  
## 337 Jagan Institute of Management Studies  
## 338 Principal L N Welingkar Institute of Management Development and Research  
## 339 Jaipuria Institute of Management  
## 340 Koneru Lakshmaiah Education Foundation University  
## 341 Visvesvaraya Technological University  
## 342 Institute of Rural Management Anand  
## 343 Jaipuria Institute of Management  
## 347 Post Graduate Institute of Medical Education and Research  
## 348 Christian Medical College  
## 349 National Institute of Mental Health Neuro Sciences  
## 350 Sanjay Gandhi Postgraduate Institute of Medical Sciences  
## 351 Banaras Hindu University  
## 352 Amrita Institute of Medical Sciences Research  
## 353 Jawaharlal Institute of Post Graduate Medical Education Research  
## 354 Kasturba Medical College  
## 358 Sri Ramachandra Institute of Higher Education And Research  
## 359 St John s Medical College  
## 360 Aligarh Muslim University  
## 361 Vardhman Mahavir Medical College Safdarjung Hospital  
## 362 Maulana Azad Medical College  
## 363 Christian Medical College  
## 364 University College of Medical Sciences  
## 365 JSS Medical College  
## 369 Dr D Y Patil Vidyapeeth  
## 370 Govt Medical College Hospital  
## 371 Dayanand Medical College  
## 372 Sawai Man Singh Medical College  
## 373 PSG Institute of Medical Sciences Research  
## 374 Datta Meghe Institute of Medical Sciences  
## 375 M S Ramaiah Medical College  
## 376 S R M Institute of Science and Technology  
## 380 Annamalai University  
## 381 K S Hegde Medical Academy  
## 382 Krishna Institute of Medical Sciences  
## 383 Sri Venkateswara Institute of Medical Sciences  
## 384 Regional Institute of Medical Sciences  
## 385 Mahatma Gandhi Medical College and Research Institute  
## 386 Jamia Hamdard  
## 387 Panjab University  
## 391 Birla Institute of Technology Science  
## 392 Manipal College of Pharmaceutical Sciences  
## 393 National Institute of Pharmaceutical Education and Research Ahmedabad  
## 394 JSS College of Pharmacy  
## 395 JSS College of Pharmacy  
## 396 National Institute of Pharmaceutical Education and Research Guwahati  
## 397 Annamalai University  
## 398 SVKM s Narsee Monjee Institute of Management Studies  
## 402 Nirma University  
## 403 National Institute of Pharmaceutical Education and Research Raebareli  
## 404 S R M Institute of Science and Technology  
## 405 Banasthali Vidyapith  
## 406 Amity University Noida  
## 407 Poona College of Pharmacy Pune  
## 408 Punjabi University  
## 409 Bombay College of Pharmacy  
## 413 Maharishi Markandeshwar  
## 414 Lovely Professional University  
## 415 SVKM s Dr Bhanuben Nanavati College of Pharmacy  
## 416 Guru Jambheshwar University of Science and Technology  
## 417 I S F College of Pharmacy  
## 418 The Rashtrasant Tukadoji Maharaj Nagpur University  
## 419 AU College of Pharmaceutical Sciences Andhra University  
## 420 Dibrugarh University  
## 424 Shoolini University of Biotechnology and Management Sciences  
## 425 Y B Chavan College of Pharmacy  
## 426 Padmashree Dr D Y Patil Institute of Pharmaceutical Sciences and Research  
## 427 Sri Padmavathi Mahila Visva Vidyalayam  
## 428 Vels Institute of Science Technology Advanced Studies VISTAS  
## 429 Guru Ghasidas Vishwavidyalaya  
## 430 L M College of Pharmacy  
## 431 Integral University  
## 435 Noida Institute of Engineering And Technology Pharmacy Institute  
## 436 PSG College of Pharmacy  
## 437 M S Ramaiah University of Applied Sciences  
## 438 R C Patel Institute of Pharmaceutical Education Research  
## 439 Chalapathi Institute of Pharmaceutical Sciences  
## 440 Raghavendra Institute of Pharmaceuatical Education Research  
## 441 Sam Higginbottom Institute of Agriculture Technology Sciences  
## 442 College of Pharmacy Madras Medical College  
## 446 NSHM Knowledge Campus  
## 447 Bharati Vidyapeeth s College of Pharmacy  
## 448 Vivekanand Education Society s College of Pharmacy  
## 449 Acharya Nagarjuna University College of Pharmaceutical Sciences  
## 450 C U Shah College of Pharmacy  
## 451 Sri Ramakrishna Institute of Paramedical Sciences  
## 452 Guru Nanak Institute of Pharmaceutical Science Technology  
## 453 P E Society s Modern College of Pharmacy  
## 457 Girijananda Chowdhury Institute of Pharmaceutical Science  
## 458 Principal K M Kundnani College of Pharmacy  
## 459 Dr Vishwanath Karad MIT World Peace University  
## 460 Kumaun University Nainital  
## tlr rpc go oi perception city state  
## 1 78.58 79.73 91.80 71.71 75.54 Kharagpur West Bengal  
## 2 81.32 85.34 87.15 70.90 56.30 Roorkee Uttarakhand  
## 6 71.68 62.31 74.67 52.88 37.00 Shibpur West Bengal  
## 7 79.91 22.57 74.12 73.51 52.25 Bhopal Madhya Pradesh  
## 8 49.63 52.10 83.90 59.37 73.03 Tiruchirappalli Tamil Nadu  
## 9 74.20 5.20 82.32 68.21 56.30 Vijayawada Andhra Pradesh  
## 10 66.06 0.67 87.09 78.60 44.47 New Delhi Delhi  
## 11 57.69 25.46 92.24 54.30 37.00 Thiruvananthapuram Kerala  
## 12 61.52 0.00 79.85 70.35 54.99 Udupi Karnataka  
## 13 51.76 40.71 60.95 60.59 53.64 Ranchi Jharkhand  
## 17 47.68 24.60 78.55 51.00 54.99 Madurai Tamil Nadu  
## 18 46.60 25.50 58.10 52.83 80.87 Chennai Tamil Nadu  
## 19 44.44 51.07 59.84 58.42 27.90 Hamirpur Himachal Pradesh  
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## 21 86.86 75.47 92.13 53.76 100.00 Delhi Delhi  
## 22 83.05 79.41 71.63 76.42 74.72 Udupi Karnataka  
## 23 79.92 80.24 81.41 57.36 63.00 Pune Maharashtra  
## 24 82.66 60.57 74.93 63.38 80.44 Chennai Tamil Nadu  
## 28 71.10 45.00 92.13 52.56 60.20 Mumbai Maharashtra  
## 29 73.92 45.61 95.99 56.37 37.72 Chennai Tamil Nadu  
## 30 76.08 40.98 80.87 70.69 57.20 Mysuru Karnataka  
## 31 78.67 44.21 88.53 63.18 19.29 Bangalore Karnataka  
## 32 79.84 37.00 97.12 63.62 19.29 Bhubaneswar Odisha  
## 33 69.43 41.74 90.41 73.89 26.38 Kochi Kerala  
## 34 73.65 44.38 84.45 54.45 32.43 Wardha Maharashtra  
## 35 81.55 44.47 64.81 48.59 50.45 Rohtak Haryana  
## 39 78.86 36.28 55.20 73.84 50.45 New Delhi Delhi  
## 40 77.63 32.69 63.60 67.91 53.96 Mangaluru Karnataka  
## 41 73.69 36.70 74.06 60.48 32.43 Davangere Karnataka  
## 42 74.23 24.35 91.54 55.54 26.38 Indore Madhya Pradesh  
## 43 70.73 17.36 86.58 67.18 46.63 Secunderabd Telangana  
## 44 76.43 17.89 85.12 70.85 26.38 Belgaum Karnataka  
## 45 65.62 26.42 80.63 66.37 46.63 Ambala Haryana  
## 46 75.98 10.38 84.85 57.14 57.20 Dharwad Karnataka  
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## rank category  
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## name  
## 3 National Institute of Technology Calicut  
## 4 Centre for Environmental Planning and Technology University  
## 5 School of Planning and Architecture  
## 14 BMS College of Arhitecture  
## 15 Maulana Azad National Institute of Technology  
## 16 Aligarh Muslim University  
## 25 A B S M Institute of Dental Sciences  
## 26 Manipal College of Dental Sciences  
## 27 Sri Ramachandra Institute of Higher Education And Research  
## 36 Bapuji Dental College Hospital  
## 37 Kalinga Institute of Industrial Technology  
## 38 Christian Dental College  
## 47 M G R Educational and Research Institute  
## 48 Panjab University  
## 49 Pacific Dental College  
## 58 Indian Institute of Technology Hyderabad  
## 59 National Institute of Technology Tiruchirappalli  
## 60 Indian Institute of Technology Indore  
## 69 National Institute of Technology Warangal  
## 70 Amrita School of Engineering  
## 71 Indian Institute of Engineering Science and Technology  
## 80 Birla Institute of Technology Science  
## 81 Indian Institute of Technology Mandi  
## 82 Amity University Noida  
## 91 S R M Institute of Science and Technology  
## 92 Kalinga Institute of Industrial Technology  
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## 104 Sardar Vallabhbhai National Institute of Technology  
## 113 Defence Institute of Advanced Technology  
## 114 Thiagarajar College of Engineering  
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## 124 Indian Institute of Food Processing Technology IIFPT  
## 125 National Institute of Technology Agartala  
## 126 Netaji Subhas University of Technology NSUT  
## 135 College of Engineering Trivandrum  
## 136 Guru Gobind Singh Indraprastha University  
## 137 Lovely Professional University  
## 146 Jaypee Institute of Information Technology  
## 147 University College of Engineering  
## 148 National Institute of Technology Hamirpur  
## 157 Hindustan Institute of Technology and Science HITS  
## 158 Sri Sairam Engineering College  
## 159 Army Institute of Technology  
## 168 Vignan s Foundation for Science Technology Research  
## 169 Veer Surendra Sai University of Technology  
## 170 YMCA University of Science and Technology  
## 179 DIT University  
## 180 National Institute of Technology Puducherry  
## 181 Nirma University  
## 190 Yeshwantrao Chavan College of Engineering  
## 191 CVR College Of Engineering  
## 192 Sri Ramakrishna Engineering College  
## 201 SVKM s Narsee Monjee Institute of Management Studies  
## 202 Sri Krishna College of Technology  
## 203 Sri Venkateswara University  
## 212 Amity University Gwalior  
## 213 Haldia Institute of Technology  
## 214 Government Engineering College  
## 223 Maharshi Karve Stree Shikshan Samstha s Cummins College of Engineering for Women  
## 224 ManavRachna International Institute of Research Studies  
## 225 The National Institute of Engineering  
## 234 Sree Vidyanikethan Engineering College  
## 235 JNTUA College of Engineering  
## 236 BNM Institute of Technology  
## 245 Guru Jambheshwar University of Science and Technology  
## 246 Dr D Y Patil Institute of Technology  
## 247 Pimpri Chinchwad College of Engineering  
## 256 The West Bengal National University of Juridicial Sciences  
## 257 Gujarat National Law University  
## 258 Symbiosis Law School  
## 267 National Law Institute University Bhopal  
## 268 Indian Law Institute  
## 269 Banaras Hindu University  
## 278 Indian Institute of Technology Delhi  
## 279 Xavier Labour Relations Institute XLRI  
## 280 Management Development Institute  
## 289 Indian Institute of Management Raipur  
## 290 Indian Institute of Management Ranchi  
## 291 Indian Institute of Management Rohtak  
## 300 Indian Institute of Management Shillong  
## 301 Xavier Institute of Management XIMB  
## 302 Kalinga Institute of Industrial Technology  
## 311 Amity University Noida  
## 312 Panjab University  
## 313 FORE School of Management  
## 322 International Management Institute  
## 323 Institute for Financial Management and Research  
## 324 Thapar Institute of Engineering Technology  
## 333 International Management Institute  
## 334 Bharati Vidyapeeth s Institute of Management and Entrepreneurship Development  
## 335 IIHMR UNIVERSITY  
## 344 Pandit Deendayal Petroleum University  
## 345 Chitkara University  
## 346 All India Institute of Medical Sciences  
## 355 King George s Medical University  
## 356 Institute of Liver and Biliary Sciences  
## 357 Madras Medical College and Government General Hospital  
## 366 Kasturba Medical College  
## 367 Jamia Hamdard  
## 368 Siksha O Anusandhan  
## 377 Kalinga Institute of Industrial Technology  
## 378 Maharishi Markandeshwar  
## 379 Saveetha Institute of Medical and Technical Sciences  
## 388 National Institute of Pharmaceutical Education and Research Mohali  
## 389 Institute of Chemical Technology  
## 390 National Institute of Pharmaceutical Education and Research Hyderabad  
## 399 Maharaja Sayajirao University of Baroda  
## 400 Amrita School of Pharmacy  
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## 410 Delhi Institute of Pharmaceutical Sciences Research  
## 411 Sri Ramachandra Institute of Higher Education And Research  
## 412 National Institute of Pharmaceutical Education and Research Kolkata  
## 421 Maharshi Dayanand University  
## 422 KLE College of Pharmacy  
## 423 Chitkara University  
## 432 Goa College of Pharmacy  
## 433 Smt Kishoritai Bhoyar College of Pharmacy  
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## 443 Bharati Vidyapeeth s College of Pharmacy  
## 444 Pt Ravishankar Shukla University  
## 445 Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial College of Pharmacy  
## 454 Sri Venkateshwara College of Pharmacy  
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## 411 68.36 28.66 64.27 52.00 43.62 Chennai Tamil Nadu 26  
## 412 84.16 15.25 61.81 29.98 63.08 Kolkata West Bengal 27  
## 421 56.60 35.82 58.70 47.65 36.24 Rohtak Haryana 36  
## 422 68.06 13.55 63.24 64.67 41.30 Belgaum Karnataka 37  
## 423 62.88 18.18 64.92 61.89 38.85 Rajpura Punjab 38  
## 432 67.07 1.12 64.68 52.04 41.30 Panaji Goa 47  
## 433 65.28 4.86 61.75 53.39 38.85 NAGPUR Maharashtra 48  
## 434 67.96 9.13 53.04 56.72 30.48 Mangaluru Karnataka 49  
## 443 64.11 10.93 45.05 52.27 38.85 Navi Mumbai Maharashtra 58  
## 444 46.32 28.61 58.05 45.13 20.00 Raipur Chhattisgarh 59  
## 445 59.80 5.95 57.80 64.33 27.27 Bela Punjab 60  
## 454 64.49 1.59 56.86 59.21 5.97 Chittoor Andhra Pradesh 69  
## 455 57.42 3.19 51.62 58.36 33.46 Coimbatore Tamil Nadu 70  
## 456 60.10 1.52 60.56 53.10 15.83 Pune Maharashtra 71  
## category  
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## Inferential Statistics

reguniv.fwd = regsubsets(rank~.,data = univdata\_num,nvmax=8,method="forward")

summary(reguniv.fwd)

## Subset selection object  
## Call: regsubsets.formula(rank ~ ., data = univdata\_num, nvmax = 8,   
## method = "forward")  
## 5 Variables (and intercept)  
## Forced in Forced out  
## tlr FALSE FALSE  
## rpc FALSE FALSE  
## go FALSE FALSE  
## oi FALSE FALSE  
## perception FALSE FALSE  
## 1 subsets of each size up to 5  
## Selection Algorithm: forward  
## tlr rpc go oi perception  
## 1 ( 1 ) "\*" " " " " " " " "   
## 2 ( 1 ) "\*" " " "\*" " " " "   
## 3 ( 1 ) "\*" "\*" "\*" " " " "   
## 4 ( 1 ) "\*" "\*" "\*" " " "\*"   
## 5 ( 1 ) "\*" "\*" "\*" "\*" "\*"

## Check the normality using shapiro test

In this test

If - value is < 0.001 then Reject otherwise accept

round(shapiro.test(univdata[,"tlr"])$p.value,7)

## [1] 0.1199744

round(shapiro.test(univdata[,"go"])$p.value,7)

## [1] 1.68e-05

round(shapiro.test(univdata[,"rpc"])$p.value,7)

## [1] 0

round(shapiro.test(univdata[,"perception"])$p.value,7)

## [1] 0

round(shapiro.test(univdata[,"oi"])$p.value,7)

## [1] 0.0185238

as the pvalue in the case “go”,rpc“,”perception" is <0.001 therefore we infer that the data is not normal “tlr”and “oi” data are normal.

##Forward method of choosing models

Model1 <- lm(rank ~ tlr, data = utrain)  
summary(Model1)

##   
## Call:  
## lm(formula = rank ~ tlr, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -111.029 -22.120 -2.185 19.659 99.312   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 282.0817 12.5305 22.51 <2e-16 \*\*\*  
## tlr -3.4215 0.1899 -18.02 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 38.84 on 332 degrees of freedom  
## Multiple R-squared: 0.4944, Adjusted R-squared: 0.4929   
## F-statistic: 324.7 on 1 and 332 DF, p-value: < 2.2e-16

Model2 <- lm(rank ~ tlr+go, data = utrain)  
summary(Model2)

##   
## Call:  
## lm(formula = rank ~ tlr + go, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -97.860 -20.024 -2.279 22.516 86.777   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 305.7734 11.2594 27.157 <2e-16 \*\*\*  
## tlr -2.3497 0.1984 -11.841 <2e-16 \*\*\*  
## go -1.4120 0.1417 -9.968 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 34.11 on 331 degrees of freedom  
## Multiple R-squared: 0.6112, Adjusted R-squared: 0.6088   
## F-statistic: 260.1 on 2 and 331 DF, p-value: < 2.2e-16

Model3 <- lm(rank ~ tlr+go +rpc, data = utrain)  
summary(Model3)

##   
## Call:  
## lm(formula = rank ~ tlr + go + rpc, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -84.435 -18.927 -5.509 18.422 79.670   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 271.63625 11.09794 24.476 < 2e-16 \*\*\*  
## tlr -1.71671 0.19706 -8.712 < 2e-16 \*\*\*  
## go -1.21238 0.13165 -9.209 < 2e-16 \*\*\*  
## rpc -0.79702 0.09747 -8.177 6.34e-15 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 31.16 on 330 degrees of freedom  
## Multiple R-squared: 0.6767, Adjusted R-squared: 0.6737   
## F-statistic: 230.2 on 3 and 330 DF, p-value: < 2.2e-16

Model4 <- lm(rank ~ tlr +go +rpc + perception, data = utrain)  
summary(Model4)

##   
## Call:  
## lm(formula = rank ~ tlr + go + rpc + perception, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -70.72 -19.83 -7.60 17.05 79.15   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 255.96963 11.62377 22.021 < 2e-16 \*\*\*  
## tlr -1.52628 0.19945 -7.652 2.21e-13 \*\*\*  
## go -1.08874 0.13301 -8.185 6.04e-15 \*\*\*  
## rpc -0.59378 0.10934 -5.431 1.09e-07 \*\*\*  
## perception -0.36943 0.09671 -3.820 0.00016 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 30.53 on 329 degrees of freedom  
## Multiple R-squared: 0.6904, Adjusted R-squared: 0.6866   
## F-statistic: 183.4 on 4 and 329 DF, p-value: < 2.2e-16

Model5 <- lm(rank ~ tlr +go +rpc + perception+oi, data = utrain)  
summary(Model5)

##   
## Call:  
## lm(formula = rank ~ tlr + go + rpc + perception + oi, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -60.936 -19.875 -6.702 16.853 79.666   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 270.21403 12.40819 21.777 < 2e-16 \*\*\*  
## tlr -1.28310 0.21276 -6.031 4.40e-09 \*\*\*  
## go -0.97306 0.13683 -7.111 7.24e-12 \*\*\*  
## rpc -0.63978 0.10907 -5.866 1.09e-08 \*\*\*  
## perception -0.35692 0.09562 -3.733 0.000223 \*\*\*  
## oi -0.65372 0.21587 -3.028 0.002654 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 30.16 on 328 degrees of freedom  
## Multiple R-squared: 0.6988, Adjusted R-squared: 0.6942   
## F-statistic: 152.2 on 5 and 328 DF, p-value: < 2.2e-16

## Linear Model for Rank Estimation Model is where

and testing Hypothesis is given as

$$H\_0: \beta\_0=\beta\_1=\beta\_2=0\\beta\_3=\\beta\_4=\\beta\_5=$$

###The Best Model From the above models is Model5

Model5 <- lm(rank ~ tlr +go +rpc + perception+oi, data = utrain)  
summary(Model5)

##   
## Call:  
## lm(formula = rank ~ tlr + go + rpc + perception + oi, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -60.936 -19.875 -6.702 16.853 79.666   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 270.21403 12.40819 21.777 < 2e-16 \*\*\*  
## tlr -1.28310 0.21276 -6.031 4.40e-09 \*\*\*  
## go -0.97306 0.13683 -7.111 7.24e-12 \*\*\*  
## rpc -0.63978 0.10907 -5.866 1.09e-08 \*\*\*  
## perception -0.35692 0.09562 -3.733 0.000223 \*\*\*  
## oi -0.65372 0.21587 -3.028 0.002654 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 30.16 on 328 degrees of freedom  
## Multiple R-squared: 0.6988, Adjusted R-squared: 0.6942   
## F-statistic: 152.2 on 5 and 328 DF, p-value: < 2.2e-16

from summary we can say that null hypothesis is rejected as p value is almost equal to 0 From the summary, we can conclude that the linear model is

## This means that whenever the all regressor variable are increasing the rank is decreasing ##The Estimated error is 30.16 and Adjusted - R Squared value is 0.6942 ## cyl has a significant value but carb is not significant

## MVN normality test

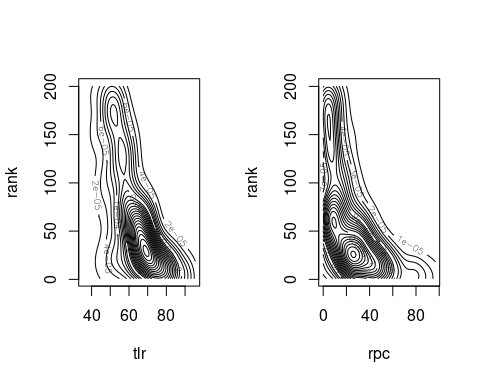
library(MVN)

## sROC 0.1-2 loaded

par(mfrow=c(1,2))  
univdata[,c(3,10)] %>% mvn(multivariatePlot = "contour")

## $multivariateNormality  
## Test Statistic p value Result  
## 1 Mardia Skewness 155.565897393576 1.30534955790987e-32 NO  
## 2 Mardia Kurtosis 2.02764343482283 0.0425966526086463 NO  
## 3 MVN <NA> <NA> NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk tlr 0.9948 0.12 YES   
## 2 Shapiro-Wilk rank 0.8593 <0.001 NO   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew  
## tlr 460 64.72778 11.07823 64.53 35.51 95.42 56.7225 71.7225 0.166418  
## rank 460 59.76739 54.55021 40.50 1.00 200.00 17.0000 85.2500 1.042135  
## Kurtosis  
## tlr -0.32828633  
## rank -0.05060892

univdata[,c(4,10)] %>% mvn(multivariatePlot = "contour")

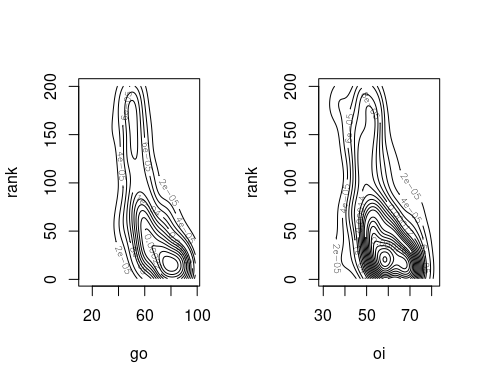


## $multivariateNormality  
## Test Statistic p value Result  
## 1 Mardia Skewness 241.889430854056 3.63530169743323e-51 NO  
## 2 Mardia Kurtosis 2.94334494186803 0.00324686426057363 NO  
## 3 MVN <NA> <NA> NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk rpc 0.9049 <0.001 NO   
## 2 Shapiro-Wilk rank 0.8593 <0.001 NO   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew Kurtosis  
## rpc 460 24.88300 20.27158 20.275 0 96.57 7.905 35.925 1.104003 0.99782567  
## rank 460 59.76739 54.55021 40.500 1 200.00 17.000 85.250 1.042135 -0.05060892

univdata[,c(5,10)] %>% mvn(multivariatePlot = "contour")

## $multivariateNormality  
## Test Statistic p value Result  
## 1 Mardia Skewness 130.614812044296 2.87684176872778e-27 NO  
## 2 Mardia Kurtosis -0.612542992512317 0.540178562361447 YES  
## 3 MVN <NA> <NA> NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk go 0.9819 <0.001 NO   
## 2 Shapiro-Wilk rank 0.8593 <0.001 NO   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew  
## go 460 66.18250 15.29114 64.225 13.06 98.48 54.255 78.0675 0.06460484  
## rank 460 59.76739 54.55021 40.500 1.00 200.00 17.000 85.2500 1.04213496  
## Kurtosis  
## go -0.61629519  
## rank -0.05060892

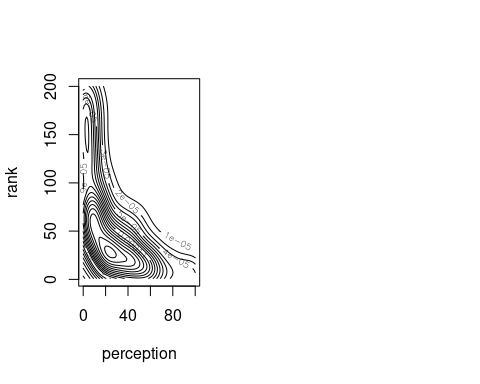
univdata[,c(6,10)] %>% mvn(multivariatePlot = "contour")



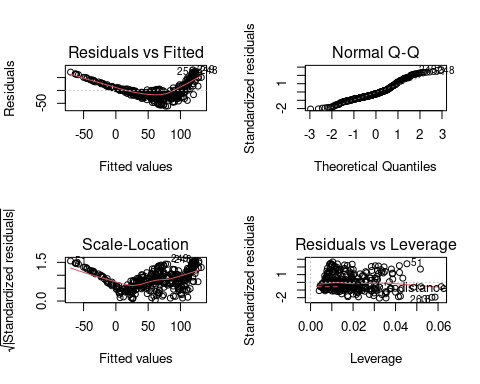
## $multivariateNormality  
## Test Statistic p value Result  
## 1 Mardia Skewness 105.091140379155 8.0997640115694e-22 NO  
## 2 Mardia Kurtosis -0.197876263119566 0.843141876245551 YES  
## 3 MVN <NA> <NA> NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk oi 0.9923 0.0185 NO   
## 2 Shapiro-Wilk rank 0.8593 <0.001 NO   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew  
## oi 460 56.68052 9.491897 55.725 29.97 81.64 50.265 63.83 0.04013327  
## rank 460 59.76739 54.550213 40.500 1.00 200.00 17.000 85.25 1.04213496  
## Kurtosis  
## oi -0.41122757  
## rank -0.05060892

univdata[,c(7,10)] %>% mvn(multivariatePlot = "contour")

## $multivariateNormality  
## Test Statistic p value Result  
## 1 Mardia Skewness 242.670386338555 2.46800797082642e-51 NO  
## 2 Mardia Kurtosis 0.718728403886428 0.47230827879266 YES  
## 3 MVN <NA> <NA> NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk perception 0.8826 <0.001 NO   
## 2 Shapiro-Wilk rank 0.8593 <0.001 NO   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th Skew  
## perception 460 27.04598 25.33636 19.29 0 100 5.9 43.3125 1.035908  
## rank 460 59.76739 54.55021 40.50 1 200 17.0 85.2500 1.042135  
## Kurtosis  
## perception 0.35802047  
## rank -0.05060892

 # Two ellipse are being seen with tlr and rank , partially normal data . . . ## Plotting model with diffrent parameters

par(mfrow=c(2,2))  
plot(Model5)

 ##INFERENCE - **Residuals vs Fitted:** This plot shows that residuals have non-linear patterns it means the data is not linear.Therefore its not a good model. - **Normal Q-Q plot:** This plot shows that residuals are not normally distributed.

* **Scale-Location plot:** It’s also called Spread-Location plot. This plot shows if residuals are spread equally along the ranges of predictors. This is how you can check the assumption of equal variance . It’s good if you see a horizontal line with equally (randomly) spread points.
* **Resudual vs Leverage:** This plot helps us to find influential cases (i.e., subjects) if any.

result1 <-mvn(univdata\_num, mvnTest = "mardia")  
result1

## $multivariateNormality  
## Test Statistic p value Result  
## 1 Mardia Skewness 724.271096412396 6.49553816863461e-117 NO  
## 2 Mardia Kurtosis 6.17289310476249 6.7051542096408e-10 NO  
## 3 MVN <NA> <NA> NO  
##   
## $univariateNormality  
## Test Variable Statistic p value Normality  
## 1 Shapiro-Wilk tlr 0.9948 0.12 YES   
## 2 Shapiro-Wilk rpc 0.9049 <0.001 NO   
## 3 Shapiro-Wilk go 0.9819 <0.001 NO   
## 4 Shapiro-Wilk oi 0.9923 0.0185 NO   
## 5 Shapiro-Wilk perception 0.8826 <0.001 NO   
## 6 Shapiro-Wilk rank 0.8593 <0.001 NO   
##   
## $Descriptives  
## n Mean Std.Dev Median Min Max 25th 75th  
## tlr 460 64.72778 11.078227 64.530 35.51 95.42 56.7225 71.7225  
## rpc 460 24.88300 20.271577 20.275 0.00 96.57 7.9050 35.9250  
## go 460 66.18250 15.291144 64.225 13.06 98.48 54.2550 78.0675  
## oi 460 56.68052 9.491897 55.725 29.97 81.64 50.2650 63.8300  
## perception 460 27.04598 25.336356 19.290 0.00 100.00 5.9000 43.3125  
## rank 460 59.76739 54.550213 40.500 1.00 200.00 17.0000 85.2500  
## Skew Kurtosis  
## tlr 0.16641795 -0.32828633  
## rpc 1.10400263 0.99782567  
## go 0.06460484 -0.61629519  
## oi 0.04013327 -0.41122757  
## perception 1.03590817 0.35802047  
## rank 1.04213496 -0.05060892

library(broom)  
glance(Model5) %>% dplyr::select(adj.r.squared,sigma,AIC,BIC)

## # A tibble: 1 x 4  
## adj.r.squared sigma AIC BIC  
## <dbl> <dbl> <dbl> <dbl>  
## 1 0.694 30.2 3231. 3258.

AIC value of Model 1 = 3408 AIC value of Model 5 = 3231 (the lower the value of AIC the better is the model)

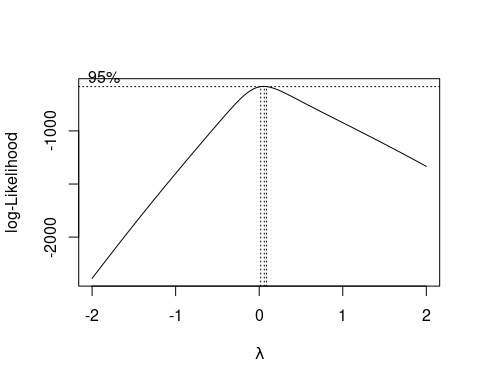
Normalizing the Data

# xu = utrain[ , c("tlr","go","rpc","perception","oi")]  
# yu = utrain$rank  
# xu  
library(MASS)

##   
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':  
##   
## select

bc\_u <- boxcox(rank ~ tlr +go +rpc + perception+oi, data = utrain)



lambda\_u <- bc\_u$x[which.max(bc\_u$y)]  
lambda\_u

## [1] 0.06060606

bc\_u

## $x  
## [1] -2.00000000 -1.95959596 -1.91919192 -1.87878788 -1.83838384 -1.79797980  
## [7] -1.75757576 -1.71717172 -1.67676768 -1.63636364 -1.59595960 -1.55555556  
## [13] -1.51515152 -1.47474747 -1.43434343 -1.39393939 -1.35353535 -1.31313131  
## [19] -1.27272727 -1.23232323 -1.19191919 -1.15151515 -1.11111111 -1.07070707  
## [25] -1.03030303 -0.98989899 -0.94949495 -0.90909091 -0.86868687 -0.82828283  
## [31] -0.78787879 -0.74747475 -0.70707071 -0.66666667 -0.62626263 -0.58585859  
## [37] -0.54545455 -0.50505051 -0.46464646 -0.42424242 -0.38383838 -0.34343434  
## [43] -0.30303030 -0.26262626 -0.22222222 -0.18181818 -0.14141414 -0.10101010  
## [49] -0.06060606 -0.02020202 0.02020202 0.06060606 0.10101010 0.14141414  
## [55] 0.18181818 0.22222222 0.26262626 0.30303030 0.34343434 0.38383838  
## [61] 0.42424242 0.46464646 0.50505051 0.54545455 0.58585859 0.62626263  
## [67] 0.66666667 0.70707071 0.74747475 0.78787879 0.82828283 0.86868687  
## [73] 0.90909091 0.94949495 0.98989899 1.03030303 1.07070707 1.11111111  
## [79] 1.15151515 1.19191919 1.23232323 1.27272727 1.31313131 1.35353535  
## [85] 1.39393939 1.43434343 1.47474747 1.51515152 1.55555556 1.59595960  
## [91] 1.63636364 1.67676768 1.71717172 1.75757576 1.79797980 1.83838384  
## [97] 1.87878788 1.91919192 1.95959596 2.00000000  
##   
## $y  
## [1] -2389.0730 -2347.5551 -2306.1488 -2264.8574 -2223.6840 -2182.6316  
## [7] -2141.7036 -2100.9031 -2060.2332 -2019.6970 -1979.2974 -1939.0375  
## [13] -1898.9200 -1858.9473 -1819.1219 -1779.4458 -1739.9207 -1700.5477  
## [19] -1661.3279 -1622.2613 -1583.3475 -1544.5857 -1505.9734 -1467.5084  
## [25] -1429.1864 -1391.0026 -1352.9513 -1315.0252 -1277.2163 -1239.5158  
## [31] -1201.9138 -1164.4012 -1126.9690 -1089.6096 -1052.3213 -1015.1056  
## [37] -977.9762 -940.9652 -904.1159 -867.5273 -831.3205 -795.6960  
## [43] -760.9573 -727.4577 -695.7666 -666.5241 -640.4613 -618.4131  
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## name  
## 1 Indian Institute of Technology Kharagpur  
## 2 Indian Institute of Technology Roorkee  
## 6 Indian Institute of Engineering Science and Technology  
## 7 School of Planning and Architecture  
## 8 National Institute of Technology Tiruchirappalli  
## 9 School of Planning and Architecture  
## 10 Jamia Millia Islamia  
## 11 College of Engineering Trivandrum  
## 12 Manipal Academy of Higher Education  
## 13 Birla Institute of Technology  
## 17 Thiagarajar College of Engineering  
## 18 Anna University  
## 19 National Institute of Technology Hamirpur  
## 20 Hindustan Institute of Technology and Science HITS  
## 21 Maulana Azad Institute of Dental Sciences  
## 22 Manipal College of Dental Sciences  
## 23 Dr D Y Patil Vidyapeeth  
## 24 Saveetha Institute of Medical and Technical Sciences  
## 28 Nair Hospital Dental College  
## 29 SRM Dental College  
## 30 JSS Dental College and Hospital  
## 31 M S Ramaiah University of Applied Sciences  
## 32 Siksha O Anusandhan  
## 33 Amrita School of Dentistry  
## 34 Datta Meghe Institute of Medical Sciences  
## 35 Postgraduate Institute of Dental Sciences  
## 39 Jamia Millia Islamia  
## 40 Yenepoya Dental College  
## 41 College of Dental Sciences  
## 42 Government Dental College  
## 43 Army College of Dental Sciences  
## 44 KLE Vishwanath Katti Institute of Dental Sciences  
## 45 Maharishi Markandeshwar  
## 46 Sri Dharmasthala Manjunatheswara College of Dharwad  
## 50 Institute of Medical Sciences  
## 51 Indian Institute of Technology Madras  
## 52 Indian Institute of Technology Delhi  
## 53 Indian Institute of Technology Bombay  
## 54 Indian Institute of Technology Kanpur  
## 55 Indian Institute of Technology Kharagpur  
## 56 Indian Institute of Technology Roorkee  
## 57 Indian Institute of Technology Guwahati  
## 61 Indian Institute of Technology BHU Varanasi  
## 62 Indian Institute of Technology Indian School of Mines  
## 63 National Institute of Technology Karnataka  
## 64 Anna University  
## 65 Vellore Institute of Technology  
## 66 National Institute of Technology Rourkela  
## 67 Jadavpur University  
## 68 Institute of Chemical Technology  
## 72 Indian Institute of Technology Bhubaneswar  
## 73 National Institute of Technology Calicut  
## 74 Indian Institute of Technology Gandhinagar  
## 75 Indian Institute of Technology Ropar  
## 76 Indian Institute of Technology Patna  
## 77 Visvesvaraya National Institute of Technology  
## 78 Jamia Millia Islamia  
## 79 Thapar Institute of Engineering Technology  
## 83 Indian Institute of Space Science and Technology  
## 84 Siksha O Anusandhan  
## 85 Malaviya National Institute of Technology  
## 86 Delhi Technological University  
## 87 Shanmugha Arts Science Technology Research Academy  
## 88 Birla Institute of Technology  
## 89 Aligarh Muslim University  
## 90 National Institute of Technology Kurukshetra  
## 94 Sri Sivasubramaniya Nadar College of Engineering  
## 95 Manipal Institute of Technology  
## 96 National Institute of Technology Silchar  
## 97 National Institute of Technology Durgapur  
## 98 Motilal Nehru National Institute of Technology  
## 99 PSG College of Technology  
## 100 College of Engineering Pune  
## 101 Sathyabama Institute of Science and Technology  
## 105 Visvesvaraya Technological University  
## 106 Indraprastha Institute of Information Technology Delhi  
## 107 Jawaharlal Nehru Technological University  
## 108 Koneru Lakshmaiah Education Foundation University  
## 109 M S Ramaiah Institute of Technology  
## 110 Kalasalingam Academy of Research and Higher Education  
## 111 National Institute of Technology Meghalaya  
## 112 International Institute of Information Technology Bangalore  
## 116 Indian Institute of Information Technology Guwahati  
## 117 National Institute of Technology Raipur  
## 118 Punjab Engineering College Deemed To Be University  
## 119 College of Engineering A  
## 120 R V College of Engineering  
## 121 Veermata Jijabai Technological Institute  
## 122 Panjab University  
## 123 B M S College of Engineering  
## 127 National Institute of Technology Goa  
## 128 Shri Mata Vaishno Devi University  
## 129 National Institute of Technology Jamshedpur  
## 130 Karunya Institute of Technology and Sciences  
## 131 Indian Institute of Information Technology Design Manufacturing Jabalpur  
## 132 Kumaraguru College of Technology  
## 133 Sri Krishna College of Engineering and Technology  
## 134 Chandigarh University  
## 138 University College of Engineering  
## 139 Graphic Era University  
## 140 Coimbatore Institute of Technology  
## 141 Siddaganga Institute of Technology  
## 142 National Institute of Technology Patna  
## 143 C V Raman Global University  
## 144 PES University  
## 145 Vel Tech Rangarajan Dr Sagunthala R D Institute of Science and Technology  
## 149 Bharati Vidyapeeth Deemed University College of Engineering  
## 150 Atal Bihari Vajpayee Indian Institute of Information Technology and Management  
## 151 Mepco Schlenk Engineering College  
## 152 Dayalbagh Educational Institute  
## 153 Indian Institute of Information Technology Allahabad  
## 154 Punjab Technical University  
## 155 Government College of Technology  
## 156 Rajalakshmi Engineering College  
## 160 The Northcap University  
## 161 Dhirubhai Ambani Institute of Information and Communication Technology  
## 162 Shoolini University of Biotechnology and Management Sciences  
## 163 Shri Ramdeobaba College of Engineering and Management  
## 164 New Horizon College of Engineering  
## 165 Jaypee University of Information Technology  
## 166 Maharaja Sayajirao University of Baroda  
## 167 Jain University  
## 171 National Institute of Food Technology Enterprenurship Management  
## 172 Pondicherry Engineering College  
## 173 B S Abdur Rahman Crescent Institute of Science and Technology  
## 174 Chaitanya Bharathi Institute of Technology  
## 175 Bharatiya Vidya Bhavan s Sardar Patel Institute of Technology  
## 176 Dayananda Sagar College of Engineering  
## 177 Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology  
## 178 Nitte Meenakshi Institute of Technology  
## 182 JSS Science and Technology University  
## 183 N M A M Institute of Technology  
## 184 Rajiv Gandhi Institute of Petroleum Technology  
## 185 Kongu Engineering College  
## 186 KLE Technological University  
## 187 Sant Longowal Institute of Engineering Technology  
## 188 Dr Vishwanath Karad MIT World Peace University  
## 189 G H Raisoni College of Engineering  
## 193 Vardhaman College of Engineering  
## 194 The Rashtrasant Tukadoji Maharaj Nagpur University  
## 195 North Eastern Regional Institute of Science Technology  
## 196 Indira Gandhi Delhi Technical University for Women  
## 197 P E S College of Engineering  
## 198 National Institute of Foundry and Forge Technology NIFFT  
## 199 Saveetha Institute of Medical and Technical Sciences  
## 200 Sona College of Technology  
## 204 Heritage Institute of Technology  
## 205 R M K Engineering College  
## 206 Velagapudi Ramakrishna Siddhartha Engineering College  
## 207 Maulana Abul Kalam Azad University of Technology  
## 208 National Institute of Technology Manipur  
## 209 Alliance University  
## 210 St Josephs College of Engineering  
## 211 SR Engineering College  
## 215 Vishwakarma Institute of Technology  
## 216 Harcourt Butler Technical University  
## 217 University of Petroleum and Energy Studies  
## 218 Walchand College of Engineering  
## 219 BMS Institute of Technology Management  
## 220 Institute of Aeronautical Engineering  
## 221 K J Somaiya College of Engineering  
## 222 Goka Raju Ranga Raju Institute of Engineering Technology  
## 226 Sri Venkateswara College of Engineering  
## 227 Pandit Deendayal Petroleum University  
## 228 School of Engineering Cochin University of Science and Technology  
## 229 Silicon Institute of Technology SIT Bhubaneswar  
## 230 Anurag Group of Institutions  
## 231 Chitkara University  
## 232 Indian Institute of Information Technology Design Manufacturing  
## 233 Madan Mohan Malaviya University of Technology  
## 237 Vasavi College of Engineering  
## 238 Gayatri Vidya Parishad College of Engineering  
## 239 National Engineering College  
## 240 G Pulla Reddy Engineering College  
## 241 Institute of Engineering Management  
## 242 Sri Sai Ram Institute of Technology  
## 243 Dharmsinh Desai University  
## 244 The LNM Institute of Information Technology  
## 248 Ramrao Adik Institute of Technology  
## 249 BVRIT Hyderabad  
## 250 National Institute of Technology Arunachal Pradesh  
## 251 National Law School of India University  
## 252 National Law University  
## 253 Nalsar University of Law  
## 254 Indian Institute of Technology Kharagpur  
## 255 National Law University  
## 259 Jamia Millia Islamia  
## 260 The Rajiv Gandhi National University of Law  
## 261 Dr Ram Manohar Lohiya National Law University  
## 262 Kalinga Institute of Industrial Technology  
## 263 Aligarh Muslim University  
## 264 National Law University  
## 265 Panjab University  
## 266 National Law University and Judicial Academy  
## 270 Christ University  
## 271 Indian Institute of Management Ahmedabad  
## 272 Indian Institute of Management Bangalore  
## 273 Indian Institute of Management Calcutta  
## 274 Indian Institute of Management Lucknow  
## 275 Indian Institute of Technology Kharagpur  
## 276 Indian Institute of Management Kozhikode  
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## 286 Indian Institute of Technology Kanpur  
## 287 Indian Institute of Management Udaipur  
## 288 S P Jain Institute of Management and Research  
## 292 Symbiosis Institute of Business Management  
## 293 Great Lakes Institute of Management  
## 294 SVKM s Narsee Monjee Institute of Management Studies  
## 295 ICFAI Foundation for Higher Education  
## 296 Indian Institute of Foreign Trade  
## 297 T A Pai Management Institute  
## 298 International Management Institute  
## 299 Indian Institute of Technology Indian School of Mines  
## 303 Indian Institute of Management Kashipur  
## 304 Jamia Millia Islamia  
## 305 National Institute of Technology Tiruchirappalli  
## 306 Banaras Hindu University  
## 307 Institute of Management Technology  
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## 309 Alliance University  
## 310 Indian Institute of Management  
## 314 Nirma University  
## 315 Aligarh Muslim University  
## 316 PSG College of Technology  
## 317 Birla Institute of Management Technology  
## 318 Goa Institute of Management  
## 319 Lovely Professional University  
## 320 Loyola Institute of Business Administration  
## 321 Chandigarh University  
## 325 Vellore Institute of Technology  
## 326 K J Somaiya Institute of Management Studies Research  
## 327 Guru Gobind Singh Indraprastha University  
## 328 Birla Institute of Technology  
## 329 Anna University  
## 330 Institute of Management Technology  
## 331 Institute of Management Technology  
## 332 Indian Institute of Forest Management  
## 336 University of Petroleum and Energy Studies  
## 337 Jagan Institute of Management Studies  
## 338 Principal L N Welingkar Institute of Management Development and Research  
## 339 Jaipuria Institute of Management  
## 340 Koneru Lakshmaiah Education Foundation University  
## 341 Visvesvaraya Technological University  
## 342 Institute of Rural Management Anand  
## 343 Jaipuria Institute of Management  
## 347 Post Graduate Institute of Medical Education and Research  
## 348 Christian Medical College  
## 349 National Institute of Mental Health Neuro Sciences  
## 350 Sanjay Gandhi Postgraduate Institute of Medical Sciences  
## 351 Banaras Hindu University  
## 352 Amrita Institute of Medical Sciences Research  
## 353 Jawaharlal Institute of Post Graduate Medical Education Research  
## 354 Kasturba Medical College  
## 358 Sri Ramachandra Institute of Higher Education And Research  
## 359 St John s Medical College  
## 360 Aligarh Muslim University  
## 361 Vardhman Mahavir Medical College Safdarjung Hospital  
## 362 Maulana Azad Medical College  
## 363 Christian Medical College  
## 364 University College of Medical Sciences  
## 365 JSS Medical College  
## 369 Dr D Y Patil Vidyapeeth  
## 370 Govt Medical College Hospital  
## 371 Dayanand Medical College  
## 372 Sawai Man Singh Medical College  
## 373 PSG Institute of Medical Sciences Research  
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## 375 M S Ramaiah Medical College  
## 376 S R M Institute of Science and Technology  
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## 381 K S Hegde Medical Academy  
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## 383 Sri Venkateswara Institute of Medical Sciences  
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## 391 Birla Institute of Technology Science  
## 392 Manipal College of Pharmaceutical Sciences  
## 393 National Institute of Pharmaceutical Education and Research Ahmedabad  
## 394 JSS College of Pharmacy  
## 395 JSS College of Pharmacy  
## 396 National Institute of Pharmaceutical Education and Research Guwahati  
## 397 Annamalai University  
## 398 SVKM s Narsee Monjee Institute of Management Studies  
## 402 Nirma University  
## 403 National Institute of Pharmaceutical Education and Research Raebareli  
## 404 S R M Institute of Science and Technology  
## 405 Banasthali Vidyapith  
## 406 Amity University Noida  
## 407 Poona College of Pharmacy Pune  
## 408 Punjabi University  
## 409 Bombay College of Pharmacy  
## 413 Maharishi Markandeshwar  
## 414 Lovely Professional University  
## 415 SVKM s Dr Bhanuben Nanavati College of Pharmacy  
## 416 Guru Jambheshwar University of Science and Technology  
## 417 I S F College of Pharmacy  
## 418 The Rashtrasant Tukadoji Maharaj Nagpur University  
## 419 AU College of Pharmaceutical Sciences Andhra University  
## 420 Dibrugarh University  
## 424 Shoolini University of Biotechnology and Management Sciences  
## 425 Y B Chavan College of Pharmacy  
## 426 Padmashree Dr D Y Patil Institute of Pharmaceutical Sciences and Research  
## 427 Sri Padmavathi Mahila Visva Vidyalayam  
## 428 Vels Institute of Science Technology Advanced Studies VISTAS  
## 429 Guru Ghasidas Vishwavidyalaya  
## 430 L M College of Pharmacy  
## 431 Integral University  
## 435 Noida Institute of Engineering And Technology Pharmacy Institute  
## 436 PSG College of Pharmacy  
## 437 M S Ramaiah University of Applied Sciences  
## 438 R C Patel Institute of Pharmaceutical Education Research  
## 439 Chalapathi Institute of Pharmaceutical Sciences  
## 440 Raghavendra Institute of Pharmaceuatical Education Research  
## 441 Sam Higginbottom Institute of Agriculture Technology Sciences  
## 442 College of Pharmacy Madras Medical College  
## 446 NSHM Knowledge Campus  
## 447 Bharati Vidyapeeth s College of Pharmacy  
## 448 Vivekanand Education Society s College of Pharmacy  
## 449 Acharya Nagarjuna University College of Pharmaceutical Sciences  
## 450 C U Shah College of Pharmacy  
## 451 Sri Ramakrishna Institute of Paramedical Sciences  
## 452 Guru Nanak Institute of Pharmaceutical Science Technology  
## 453 P E Society s Modern College of Pharmacy  
## 457 Girijananda Chowdhury Institute of Pharmaceutical Science  
## 458 Principal K M Kundnani College of Pharmacy  
## 459 Dr Vishwanath Karad MIT World Peace University  
## 460 Kumaun University Nainital  
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## 2 81.32 85.34 87.15 70.90 56.30 Roorkee Uttarakhand  
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## 7 79.91 22.57 74.12 73.51 52.25 Bhopal Madhya Pradesh  
## 8 49.63 52.10 83.90 59.37 73.03 Tiruchirappalli Tamil Nadu  
## 9 74.20 5.20 82.32 68.21 56.30 Vijayawada Andhra Pradesh  
## 10 66.06 0.67 87.09 78.60 44.47 New Delhi Delhi  
## 11 57.69 25.46 92.24 54.30 37.00 Thiruvananthapuram Kerala  
## 12 61.52 0.00 79.85 70.35 54.99 Udupi Karnataka  
## 13 51.76 40.71 60.95 60.59 53.64 Ranchi Jharkhand  
## 17 47.68 24.60 78.55 51.00 54.99 Madurai Tamil Nadu  
## 18 46.60 25.50 58.10 52.83 80.87 Chennai Tamil Nadu  
## 19 44.44 51.07 59.84 58.42 27.90 Hamirpur Himachal Pradesh  
## 20 53.75 19.68 80.14 47.84 22.48 Chennai Tamil Nadu  
## 21 86.86 75.47 92.13 53.76 100.00 Delhi Delhi  
## 22 83.05 79.41 71.63 76.42 74.72 Udupi Karnataka  
## 23 79.92 80.24 81.41 57.36 63.00 Pune Maharashtra  
## 24 82.66 60.57 74.93 63.38 80.44 Chennai Tamil Nadu  
## 28 71.10 45.00 92.13 52.56 60.20 Mumbai Maharashtra  
## 29 73.92 45.61 95.99 56.37 37.72 Chennai Tamil Nadu  
## 30 76.08 40.98 80.87 70.69 57.20 Mysuru Karnataka  
## 31 78.67 44.21 88.53 63.18 19.29 Bangalore Karnataka  
## 32 79.84 37.00 97.12 63.62 19.29 Bhubaneswar Odisha  
## 33 69.43 41.74 90.41 73.89 26.38 Kochi Kerala  
## 34 73.65 44.38 84.45 54.45 32.43 Wardha Maharashtra  
## 35 81.55 44.47 64.81 48.59 50.45 Rohtak Haryana  
## 39 78.86 36.28 55.20 73.84 50.45 New Delhi Delhi  
## 40 77.63 32.69 63.60 67.91 53.96 Mangaluru Karnataka  
## 41 73.69 36.70 74.06 60.48 32.43 Davangere Karnataka  
## 42 74.23 24.35 91.54 55.54 26.38 Indore Madhya Pradesh  
## 43 70.73 17.36 86.58 67.18 46.63 Secunderabd Telangana  
## 44 76.43 17.89 85.12 70.85 26.38 Belgaum Karnataka  
## 45 65.62 26.42 80.63 66.37 46.63 Ambala Haryana  
## 46 75.98 10.38 84.85 57.14 57.20 Dharwad Karnataka  
## 50 64.76 20.21 72.47 62.87 63.00 Varanasi Uttar Pradesh  
## 51 95.42 94.64 83.90 61.31 100.00 Chennai Tamil Nadu  
## 52 90.79 96.15 80.36 64.81 94.46 New Delhi Delhi  
## 53 91.00 93.37 77.60 49.99 92.51 Mumbai Maharashtra  
## 54 86.22 82.08 88.44 54.21 85.78 Kanpur Uttar Pradesh  
## 55 77.32 87.11 83.21 56.62 89.31 Kharagpur West Bengal  
## 56 77.21 76.57 89.65 61.71 60.55 Roorkee Uttarakhand  
## 57 83.04 70.73 83.03 59.13 62.45 Guwahati Assam  
## 61 72.34 47.77 77.77 56.07 53.49 Varanasi Uttar Pradesh  
## 62 64.02 63.12 72.11 55.07 39.78 Dhanbad Jharkhand  
## 63 68.93 46.03 78.67 55.24 55.59 Surathkal Karnataka  
## 64 64.62 54.07 61.50 51.62 68.24 Chennai Tamil Nadu  
## 65 56.79 64.06 63.07 58.21 46.29 Vellore Tamil Nadu  
## 66 64.38 57.82 74.30 47.23 30.48 Rourkela Odisha  
## 67 53.73 62.04 76.45 40.45 51.61 Kolkata West Bengal  
## 68 68.13 54.04 74.66 45.17 25.98 Mumbai Maharashtra  
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## 73 71.05 31.30 78.29 63.87 38.04 Kozhikode Kerala  
## 74 83.76 34.55 55.15 57.90 38.26 Gandhinagar Gujarat  
## 75 79.11 30.54 70.31 59.24 30.75 Rupnagar Punjab  
## 76 78.20 39.24 62.28 51.86 28.57 Patna Bihar  
## 77 67.70 45.19 69.73 53.77 15.56 Nagpur Maharashtra  
## 78 63.16 48.11 71.43 58.00 11.13 New Delhi Delhi  
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## 84 74.73 29.41 68.18 64.26 10.70 Bhubaneswar Odisha  
## 85 71.41 41.69 59.89 54.40 8.95 Jaipur Rajasthan  
## 86 63.36 31.12 73.21 53.07 36.91 New Delhi Delhi  
## 87 73.13 33.81 64.89 56.60 10.70 Thanjavur Tamil Nadu  
## 88 70.07 34.81 58.75 51.57 30.48 Ranchi Jharkhand  
## 89 70.58 45.83 56.57 40.89 10.70 Aligarh Uttar Pradesh  
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## 94 66.01 31.10 63.81 53.47 20.25 Kancheepuram Tamil Nadu  
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## 99 69.35 19.73 52.14 48.69 51.77 Coimbatore Tamil Nadu  
## 100 61.94 21.89 67.56 51.85 29.40 Pune Maharashtra  
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## 110 68.66 18.42 54.26 62.06 5.21 Srivilliputtur Tamil Nadu  
## 111 66.27 20.64 54.64 59.35 7.59 Shillong Meghalaya  
## 112 59.63 17.63 63.93 57.99 17.79 Bengaluru Karnataka  
## 116 64.22 6.80 58.52 52.43 36.68 Guwahati Assam  
## 117 58.88 24.26 56.99 50.70 1.63 Raipur Chhattisgarh  
## 118 55.66 14.20 64.10 56.64 19.90 Chandigarh Chandigarh  
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## 120 63.06 13.29 59.79 48.30 13.20 Bengaluru Karnataka  
## 121 57.29 11.04 68.16 52.93 11.55 Mumbai Maharashtra  
## 122 40.82 43.55 51.63 40.27 7.59 Chandigarh Chandigarh  
## 123 62.07 11.92 55.53 52.58 17.79 Bengaluru Karnataka  
## 127 57.39 18.33 52.11 56.77 11.13 Ponda Goa  
## 128 69.41 18.63 41.79 48.00 1.10 Katra Jammu and Kashmir  
## 129 56.64 12.85 64.87 45.15 11.13 Jamshedpur Jharkhand  
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## 132 63.11 11.35 54.41 45.37 14.79 Coimbatore Tamil Nadu  
## 133 62.69 4.26 63.05 48.54 12.79 Coimbatore Tamil Nadu  
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## 153 42.80 15.69 68.87 44.19 16.69 Prayagraj (Allahabad) Uttar Pradesh  
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## 177 62.78 6.38 44.97 50.33 2.16 Hyderabad Telangana  
## 178 58.44 6.10 49.40 53.09 4.22 Bengaluru Karnataka  
## 182 55.76 3.86 54.88 51.44 8.05 Mysuru Karnataka  
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## 184 56.16 7.55 56.28 42.16 0.00 Amethi Uttar Pradesh  
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## 207 41.49 16.75 52.96 47.42 2.69 Nadia West Bengal  
## 208 54.89 8.29 42.86 53.25 1.63 Imphal Manipur  
## 209 47.89 1.88 63.26 53.12 1.10 Bengaluru Karnataka  
## 210 53.65 6.81 52.88 42.44 0.00 Kancheepuram Tamil Nadu  
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## 218 50.11 4.15 54.99 47.43 3.71 Sangli Maharashtra  
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## 227 49.08 11.97 50.34 33.80 3.20 Gandhinagar Gujarat  
## 228 50.08 14.19 38.55 44.77 5.69 Cochin Kerala  
## 229 52.90 2.66 47.20 56.20 2.69 Bhubaneswar Odisha  
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## 231 48.34 7.56 47.86 53.83 0.00 Rajpura Punjab  
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## 233 47.49 15.84 44.10 35.10 2.69 Gorakhpur Uttar Pradesh  
## 237 48.80 0.75 56.58 50.47 2.16 Hyderabad Telangana  
## 238 54.28 1.69 45.48 48.12 6.65 Visakhapatnam Andhra Pradesh  
## 239 53.98 5.99 42.90 46.85 1.10 Kovilpatti Tamil Nadu  
## 240 53.11 1.15 48.27 51.60 2.69 Kurnool Andhra Pradesh  
## 241 43.74 7.80 51.73 52.96 2.16 Kolkata West Bengal  
## 242 48.89 2.80 54.08 47.67 2.16 Chennai Tamil Nadu  
## 243 49.40 2.29 59.12 36.87 2.69 Nadiad Gujarat  
## 244 41.95 12.14 53.25 43.08 0.55 Jaipur Rajasthan  
## 248 53.60 3.82 45.75 47.25 0.00 Navi Mumbai Maharashtra  
## 249 49.16 0.46 53.74 52.98 1.63 Hyderabad Telangana  
## 250 50.56 9.06 39.36 46.21 7.12 Itanagar Arunachal Pradesh  
## 251 84.30 41.07 85.13 75.03 100.00 Bengaluru Karnataka  
## 252 90.73 45.21 67.77 74.67 65.36 New Delhi Delhi  
## 253 83.28 39.74 77.73 73.22 70.96 Hyderabad Telangana  
## 254 81.00 73.78 69.16 67.68 39.07 Kharagpur West Bengal  
## 255 74.48 26.85 78.05 65.16 44.35 Jodhpur Rajasthan  
## 259 59.24 35.00 72.20 76.31 33.01 New Delhi Delhi  
## 260 62.14 29.23 59.13 72.22 29.62 Patiala Punjab  
## 261 62.79 2.46 78.65 48.12 36.15 Lucknow Uttar Pradesh  
## 262 76.11 27.06 39.66 71.84 12.36 Bhubaneswar Odisha  
## 263 46.95 26.48 91.05 34.70 33.01 Aligarh Uttar Pradesh  
## 264 63.82 22.69 49.13 60.51 46.76 Cuttack Odisha  
## 265 54.42 29.60 60.50 71.80 25.93 Chandigarh Chandigarh  
## 266 70.55 22.57 37.44 67.42 21.88 Kamrup Assam  
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## 285 77.93 23.77 89.15 65.37 59.08 Tiruchirappalli Tamil Nadu  
## 286 70.79 49.79 79.81 58.94 24.95 Kanpur Uttar Pradesh  
## 287 82.11 30.12 84.23 69.23 21.30 Udaipur Rajasthan  
## 288 73.32 21.80 97.99 71.12 16.78 Mumbai Maharashtra  
## 292 79.78 14.76 94.56 66.62 18.85 Pune Maharashtra  
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## 305 47.47 40.13 75.43 66.73 24.51 Tiruchirappalli Tamil Nadu  
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## 397 72.88 52.84 67.02 37.78 49.89 Annamalainagar Tamil Nadu  
## 398 77.13 34.25 81.91 60.45 20.00 Mumbai Maharashtra  
## 402 62.01 41.58 69.74 52.36 47.90 Ahmedabad Gujarat  
## 403 83.31 30.27 53.00 59.59 43.62 LUCKNOW Uttar Pradesh  
## 404 59.20 57.11 51.76 50.28 45.82 Chennai Tamil Nadu  
## 405 70.47 26.18 82.42 74.82 15.83 Banasthali Rajasthan  
## 406 67.88 53.39 44.28 59.01 33.46 Gautam Budh Nagar Uttar Pradesh  
## 407 64.87 28.05 72.51 54.85 65.82 Pune Maharashtra  
## 408 60.10 47.00 68.05 39.71 45.82 Patiala Punjab  
## 409 72.89 22.54 59.30 53.51 75.25 Mumbai Maharashtra  
## 413 61.05 33.46 62.92 51.91 49.89 Ambala Haryana  
## 414 62.85 42.93 50.95 58.07 27.27 Phagwara Punjab  
## 415 71.55 23.01 70.38 52.48 23.79 Mumbai Maharashtra  
## 416 69.08 29.60 54.62 46.26 45.82 Hisar Haryana  
## 417 49.60 41.37 61.22 53.75 43.62 Moga Punjab  
## 418 63.38 27.92 70.05 48.98 23.79 Nagpur Maharashtra  
## 419 52.45 29.77 65.83 45.03 63.08 Visakhapatnam Andhra Pradesh  
## 420 68.54 33.57 58.84 29.97 30.48 Dibrugarh Assam  
## 424 61.66 29.75 66.24 50.11 0.00 Solan Himachal Pradesh  
## 425 61.95 18.71 55.00 55.61 43.62 Aurangabad Maharashtra  
## 426 67.23 7.42 63.01 53.20 45.82 Pune Maharashtra  
## 427 64.33 19.20 61.05 52.52 20.00 Tirupathi Andhra Pradesh  
## 428 63.09 37.93 45.40 49.60 0.00 Chennai Tamil Nadu  
## 429 70.73 32.84 46.52 37.95 0.00 Bilaspur Chhattisgarh  
## 430 67.11 7.91 52.61 52.29 58.61 Ahmedabad Gujarat  
## 431 61.61 33.56 44.13 44.07 20.00 Lucknow Uttar Pradesh  
## 435 60.62 2.28 67.33 57.50 43.62 Greater Noida Uttar Pradesh  
## 436 57.47 10.50 59.59 53.19 45.82 Coimbatore Tamil Nadu  
## 437 64.83 13.29 39.61 60.23 43.62 Bangalore Karnataka  
## 438 63.92 14.81 56.70 48.64 15.83 Shirpur Maharashtra  
## 439 58.63 3.56 67.27 50.72 41.30 Guntur Andhra Pradesh  
## 440 62.47 3.32 61.68 57.14 33.46 Anantapur Andhra Pradesh  
## 441 69.43 27.04 31.87 51.44 5.97 Allahabad Uttar Pradesh  
## 442 63.83 0.81 56.13 53.24 49.89 Chennai Tamil Nadu  
## 446 61.49 4.37 62.24 47.08 27.27 Kolkata West Bengal  
## 447 54.41 9.56 58.14 41.94 45.82 Kolhapur Maharashtra  
## 448 63.89 10.99 56.35 50.72 5.97 Mumbai Maharashtra  
## 449 52.07 10.70 63.41 44.91 27.27 Guntur Andhra Pradesh  
## 450 63.19 4.34 59.34 52.15 11.19 Mumbai Maharashtra  
## 451 65.50 0.18 44.39 44.12 51.78 Coimbatore Tamil Nadu  
## 452 62.96 2.95 59.31 46.89 15.83 Kolkata West Bengal  
## 453 67.49 1.35 51.43 53.30 15.83 Pune Maharashtra  
## 457 56.49 8.58 60.49 40.97 15.83 Guwahati Assam  
## 458 57.24 6.55 58.13 54.12 11.19 Mumbai Maharashtra  
## 459 68.68 1.95 48.93 51.96 11.19 Pune Maharashtra  
## 460 59.77 14.22 55.01 34.25 5.97 Nainital Uttarakhand  
## rank category  
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## 459 73 pharmacy  
## 460 75 pharmacy

utrain$y <- ((utrain$rank)^lambda\_u-1/lambda\_u)  
shapiro.test(utrain$rank)$p.value

## [1] 8.88782e-17

New\_model\_u <- lm(y ~ tlr +go +rpc + perception+oi, data = utrain)  
summary(New\_model\_u)

##   
## Call:  
## lm(formula = y ~ tlr + go + rpc + perception + oi, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.110096 -0.006615 0.004664 0.013777 0.065819   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -1.494e+01 9.707e-03 -1539.209 < 2e-16 \*\*\*  
## tlr -1.443e-03 1.664e-04 -8.669 < 2e-16 \*\*\*  
## go -1.248e-03 1.070e-04 -11.662 < 2e-16 \*\*\*  
## rpc -1.571e-03 8.533e-05 -18.413 < 2e-16 \*\*\*  
## perception -1.124e-03 7.480e-05 -15.024 < 2e-16 \*\*\*  
## oi -1.233e-03 1.689e-04 -7.300 2.19e-12 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.02359 on 328 degrees of freedom  
## Multiple R-squared: 0.9305, Adjusted R-squared: 0.9294   
## F-statistic: 877.7 on 5 and 328 DF, p-value: < 2.2e-16

glance(New\_model\_u) %>% dplyr::select(adj.r.squared,sigma,AIC,BIC)

## # A tibble: 1 x 4  
## adj.r.squared sigma AIC BIC  
## <dbl> <dbl> <dbl> <dbl>  
## 1 0.929 0.0236 -1547. -1520.

Prediction on Newmodel1

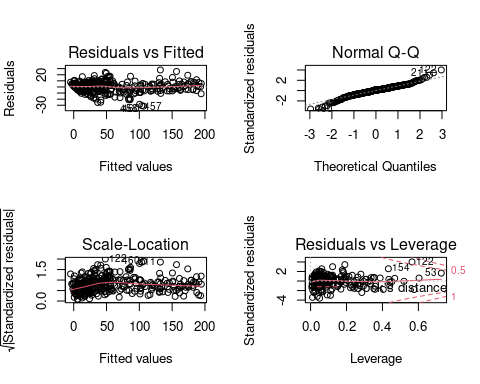
Model6 <- lm(rank ~ tlr \*go \*perception \* oi\*rpc , data = utrain)  
summary(Model6)

##   
## Call:  
## lm(formula = rank ~ tlr \* go \* perception \* oi \* rpc, data = utrain)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -31.4931 -4.7665 0.9197 5.0538 27.9046   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 1.843e+03 2.835e+02 6.501 3.30e-10 \*\*\*  
## tlr -2.382e+01 4.534e+00 -5.255 2.80e-07 \*\*\*  
## go -2.085e+01 4.615e+00 -4.518 8.97e-06 \*\*\*  
## perception -1.701e+01 1.098e+01 -1.549 0.122362   
## oi -1.509e+01 5.086e+00 -2.966 0.003254 \*\*   
## rpc -3.893e+01 1.123e+01 -3.466 0.000605 \*\*\*  
## tlr:go 2.712e-01 7.167e-02 3.784 0.000186 \*\*\*  
## tlr:perception 2.388e-01 1.635e-01 1.461 0.145104   
## go:perception 1.729e-01 1.578e-01 1.095 0.274323   
## tlr:oi 2.080e-01 8.067e-02 2.578 0.010404 \*   
## go:oi 1.873e-01 8.168e-02 2.293 0.022508 \*   
## perception:oi 6.962e-02 1.875e-01 0.371 0.710726   
## tlr:rpc 5.569e-01 1.714e-01 3.250 0.001285 \*\*   
## go:rpc 4.684e-01 1.784e-01 2.625 0.009097 \*\*   
## perception:rpc 6.498e-01 2.911e-01 2.232 0.026326 \*   
## oi:rpc 2.479e-01 2.039e-01 1.216 0.225019   
## tlr:go:perception -2.369e-03 2.331e-03 -1.016 0.310224   
## tlr:go:oi -2.503e-03 1.256e-03 -1.993 0.047158 \*   
## tlr:perception:oi -1.328e-03 2.761e-03 -0.481 0.630890   
## go:perception:oi -8.056e-04 2.655e-03 -0.303 0.761730   
## tlr:go:rpc -6.739e-03 2.652e-03 -2.541 0.011548 \*   
## tlr:perception:rpc -9.009e-03 3.989e-03 -2.258 0.024628 \*   
## go:perception:rpc -7.724e-03 4.027e-03 -1.918 0.056034 .   
## tlr:oi:rpc -4.173e-03 3.084e-03 -1.353 0.177045   
## go:oi:rpc -3.201e-03 3.133e-03 -1.022 0.307796   
## perception:oi:rpc -5.063e-03 5.090e-03 -0.995 0.320624   
## tlr:go:perception:oi 1.318e-05 3.875e-05 0.340 0.734026   
## tlr:go:perception:rpc 1.063e-04 5.462e-05 1.947 0.052519 .   
## tlr:go:oi:rpc 5.222e-05 4.631e-05 1.128 0.260361   
## tlr:perception:oi:rpc 7.722e-05 6.863e-05 1.125 0.261454   
## go:perception:oi:rpc 6.477e-05 6.922e-05 0.936 0.350210   
## tlr:go:perception:oi:rpc -9.499e-07 9.269e-07 -1.025 0.306290   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 9.011 on 302 degrees of freedom  
## Multiple R-squared: 0.9752, Adjusted R-squared: 0.9727   
## F-statistic: 383.9 on 31 and 302 DF, p-value: < 2.2e-16

glance(Model6) %>% dplyr::select(adj.r.squared,sigma,AIC,BIC)

## # A tibble: 1 x 4  
## adj.r.squared sigma AIC BIC  
## <dbl> <dbl> <dbl> <dbl>  
## 1 0.973 9.01 2449. 2575.

par(mfrow=c(2,2))  
plot(Model6)



Pre <- predict(Model6,utrain,interval = 'confidence')  
#Pre <- (lambda\_u\*Pre+1)\*\*(1/lambda\_u)  
Pre

## fit lwr upr  
## 1 1.8365820 -10.0825629 13.755727  
## 2 -2.8992150 -13.3707278 7.572298  
## 6 10.6897246 6.5991183 14.780331  
## 7 13.2087321 7.8075719 18.609892  
## 8 5.4788258 -4.3556500 15.313302  
## 9 16.3635511 11.9319883 20.795114  
## 10 22.5079605 11.8964875 33.119433  
## 11 16.6520334 11.6873787 21.616688  
## 12 16.7538493 7.4999486 26.007750  
## 13 17.8700182 10.8399998 24.900037  
## 17 18.4629273 9.7271540 27.198701  
## 18 12.8122440 2.5213428 23.103145  
## 19 9.4438769 0.9080174 17.979736  
## 20 41.4784131 37.6382406 45.318586  
## 21 11.4187516 -2.0412372 24.878740  
## 22 3.4549347 -8.3232104 15.233080  
## 23 1.8540233 -3.2580648 6.966111  
## 24 7.4798386 2.7298641 12.229813  
## 28 6.0215910 -0.3121191 12.355301  
## 29 7.6121529 2.9825219 12.241784  
## 30 9.0780993 6.1874123 11.968786  
## 31 10.6119969 5.6063466 15.617647  
## 32 11.0305236 5.1643364 16.896711  
## 33 20.6591575 13.7261713 27.592144  
## 34 12.7846941 9.1260762 16.443312  
## 35 20.4844605 14.3330888 26.635832  
## 39 11.2744052 3.0825912 19.466219  
## 40 13.7978476 9.0266941 18.569001  
## 41 18.7675476 16.8846806 20.650415  
## 42 18.3210202 14.5003997 22.141641  
## 43 17.8657693 14.4537960 21.277743  
## 44 24.1017547 19.9270778 28.276432  
## 45 17.9043514 14.8208861 20.987817  
## 46 18.3817191 10.5432566 26.220182  
## 50 13.1172500 9.1504430 17.084057  
## 51 -1.3236179 -13.0285024 10.381267  
## 52 -2.5184039 -13.5536324 8.516825  
## 53 -4.8091321 -19.9341071 10.315843  
## 54 2.8780698 -6.0891129 11.845253  
## 55 4.4888706 -3.6201717 12.597913  
## 56 0.1884595 -5.1591432 5.536062  
## 57 2.3885594 -1.9557495 6.732868  
## 61 12.4675390 9.6703644 15.264714  
## 62 10.4982867 7.0030402 13.993533  
## 63 12.8113665 9.7825686 15.840164  
## 64 23.7137334 16.8359293 30.591538  
## 65 6.7929204 -0.5240893 14.109930  
## 66 15.4745176 10.1961282 20.752907  
## 67 17.3433571 4.5560445 30.130670  
## 68 17.0825426 11.2008561 22.964229  
## 72 20.5943742 17.8281884 23.360560  
## 73 18.9605889 17.2028970 20.718281  
## 74 20.8125570 16.0279490 25.597165  
## 75 19.8902263 17.5404256 22.240027  
## 76 23.6458034 19.9947478 27.296859  
## 77 22.4614370 19.1754729 25.747401  
## 78 20.3971279 16.4190950 24.375161  
## 79 20.9092849 17.8365860 23.981984  
## 83 22.5318463 19.4103744 25.653318  
## 84 27.8497087 24.7815794 30.917838  
## 85 27.5444835 23.5422474 31.546720  
## 86 27.2157848 25.2953763 29.136193  
## 87 29.0076212 26.0133986 32.001844  
## 88 31.9378682 29.5303177 34.345419  
## 89 35.0607258 27.3712664 42.750185  
## 90 28.4851342 25.8457153 31.124553  
## 94 37.0671003 35.3109886 38.823212  
## 95 31.4428375 28.6413540 34.244321  
## 96 38.7054353 36.5061687 40.904702  
## 97 37.9465754 35.0610603 40.832090  
## 98 40.1769043 37.9642047 42.389604  
## 99 38.7037880 32.9467154 44.460861  
## 100 42.9240157 41.2913708 44.556661  
## 101 45.8947007 40.8051833 50.984218  
## 105 51.2648143 48.3494765 54.180152  
## 106 54.2283832 49.6313389 58.825428  
## 107 47.0665299 43.1532635 50.979796  
## 108 49.0008466 45.2357744 52.765919  
## 109 55.6668969 54.0051064 57.328688  
## 110 57.0481875 53.9086685 60.187707  
## 111 58.6971567 56.3421535 61.052160  
## 112 59.9493935 58.1893068 61.709480  
## 116 54.9871497 52.1946339 57.779666  
## 117 75.7823392 73.3860736 78.178605  
## 118 70.2234636 68.1136244 72.333303  
## 119 69.2971771 66.8672104 71.727144  
## 120 72.9065758 70.8356562 74.977495  
## 121 75.4531821 73.1150408 77.791323  
## 122 48.1748933 34.8508798 61.498907  
## 123 77.0742150 75.3778737 78.770556  
## 127 85.7354040 83.4572351 88.013573  
## 128 73.6638152 68.7584531 78.569177  
## 129 84.8765187 82.0750480 87.677989  
## 130 91.3522395 88.7095338 93.994945  
## 131 86.4831650 79.5919352 93.374395  
## 132 84.2518457 81.6475188 86.856173  
## 133 80.6129185 77.7694357 83.456401  
## 134 93.9290948 85.3402916 102.517898  
## 138 89.1478063 86.3567250 91.938888  
## 139 95.3334754 92.8113026 97.855648  
## 140 81.8844933 77.8417953 85.927191  
## 141 99.9290631 97.8616548 101.996471  
## 142 101.0744292 98.2313256 103.917533  
## 143 96.2798819 94.0648770 98.494887  
## 144 101.9264774 100.3103959 103.542559  
## 145 93.2570402 85.7785686 100.735512  
## 149 102.0738123 96.2958560 107.851769  
## 150 105.2715472 101.8206497 108.722445  
## 151 107.4576459 103.8560947 111.059197  
## 152 100.9927051 98.9367000 103.048710  
## 153 93.5395209 87.6648097 99.414232  
## 154 86.5387755 74.8707687 98.206782  
## 155 102.0219098 98.3284021 105.715417  
## 156 102.3649182 99.5767877 105.153049  
## 160 117.1070544 114.9659250 119.248184  
## 161 105.2472529 100.6348060 109.859700  
## 162 117.9640794 114.2435169 121.684642  
## 163 108.7621976 106.4094364 111.114959  
## 164 113.3691469 110.3201658 116.418128  
## 165 120.3976494 117.6806834 123.114615  
## 166 118.5699627 116.6504590 120.489466  
## 167 116.1901619 110.6790784 121.701245  
## 171 128.1031881 122.9265367 133.279839  
## 172 132.6042232 128.5613611 136.647085  
## 173 119.5843086 115.4631894 123.705428  
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actuals <-data.frame(cbind(actuals=utrain$rank,predicteds=Pre))   
actuals

## actuals fit lwr upr  
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## 6 6 10.6897246 6.5991183 14.780331  
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## 266 16 41.0928086 35.6938539 46.491763  
## 270 20 32.2728404 20.9913687 43.554312  
## 271 1 5.4307241 -4.8058903 15.667338  
## 272 2 3.6641951 -6.3480377 13.676428  
## 273 3 0.2978922 -9.5559333 10.151718  
## 274 4 1.8284213 -4.8189994 8.475842  
## 275 5 12.8685074 2.2249223 23.512092  
## 276 6 5.9306371 0.3910088 11.470265  
## 277 7 5.5538112 0.3261110 10.781511  
## 281 11 8.3199600 5.2972349 11.342685  
## 282 12 1.0606275 -8.3212908 10.442546  
## 283 12 12.8551013 5.5328814 20.177321  
## 284 14 12.0436543 9.3492751 14.738034  
## 285 15 12.2208811 7.6624337 16.779328  
## 286 16 14.2875422 11.0962878 17.478797  
## 287 17 16.4982601 11.5295541 21.466966  
## 288 18 25.4058887 19.8168793 30.994898  
## 292 22 24.2907165 17.0403630 31.541070  
## 293 23 21.7415552 14.8008662 28.682244  
## 294 24 25.3675045 19.4665833 31.268426  
## 295 25 23.4492658 18.8508919 28.047640  
## 296 26 19.7377442 15.6381867 23.837302  
## 297 27 25.7331033 22.8788032 28.587403  
## 298 28 27.3196230 24.2239133 30.415333  
## 299 29 24.7999517 20.3771403 29.222763  
## 303 33 29.6437259 27.2183914 32.069060  
## 304 34 36.3553193 31.6777580 41.032881  
## 305 35 29.2014877 21.4820360 36.920939  
## 306 36 34.9064917 32.9969705 36.816013  
## 307 37 41.2553393 38.7379824 43.772696  
## 308 37 42.9268824 40.2447349 45.609030  
## 309 39 41.8835620 38.4115181 45.355606  
## 310 40 31.1675850 27.2803973 35.054773  
## 314 44 40.2566718 36.8579893 43.655354  
## 315 45 46.7572451 43.2204585 50.294032  
## 316 46 39.1779469 36.8563030 41.499591  
## 317 47 48.8449101 43.0589610 54.630859  
## 318 48 47.2173728 44.2296344 50.205111  
## 319 49 45.8365547 40.2847572 51.388352  
## 320 50 31.3478971 27.4872659 35.208528  
## 321 51 56.3974499 47.3148434 65.480056  
## 325 55 42.7149975 37.2415661 48.188429  
## 326 56 42.8971816 38.6606275 47.133736  
## 327 57 49.3468172 46.3542928 52.339342  
## 328 58 48.5598024 46.4088402 50.710765  
## 329 59 48.5969928 42.3865057 54.807480  
## 330 60 48.4090677 44.4886008 52.329535  
## 331 61 56.5261084 52.6030939 60.449123  
## 332 62 51.8663744 48.8406050 54.892144  
## 336 66 55.3452891 51.4890403 59.201538  
## 337 67 60.8810402 54.7798052 66.982275  
## 338 68 51.1542951 46.9717510 55.336839  
## 339 69 59.3516852 54.8701570 63.833213  
## 340 70 53.5065430 45.9803467 61.032739  
## 341 71 54.2310121 51.0797111 57.382313  
## 342 72 49.6067826 45.1933020 54.020263  
## 343 73 55.4411682 51.1537851 59.728551  
## 347 2 0.2417631 -5.3406720 5.824198  
## 348 3 5.3180313 -2.5270819 13.163145  
## 349 4 7.0442947 2.4098950 11.678694  
## 350 5 -0.3864117 -10.9482943 10.175471  
## 351 6 9.0507680 5.1185142 12.983022  
## 352 7 10.8417550 7.1051383 14.578372  
## 353 8 6.2558451 1.3805950 11.131095  
## 354 9 7.8201901 1.6574282 13.982952  
## 358 13 15.8178091 13.4217481 18.213870  
## 359 14 17.7343190 15.5828113 19.885827  
## 360 15 21.5850263 17.9713382 25.198714  
## 361 16 19.8549242 16.9943175 22.715531  
## 362 17 18.0020202 14.4950588 21.508982  
## 363 18 23.1166997 20.4279779 25.805422  
## 364 19 22.3012583 20.1481259 24.454391  
## 365 20 18.9213170 15.0523706 22.790263  
## 369 24 31.4775980 28.8248189 34.130377  
## 370 25 26.1554731 23.8932568 28.417689  
## 371 26 24.6177056 17.8668159 31.368595  
## 372 27 25.0553014 17.2527598 32.857843  
## 373 27 25.2983946 22.3398595 28.256930  
## 374 29 36.3063025 33.0366755 39.575929  
## 375 30 27.5493215 24.6331502 30.465493  
## 376 31 36.4666353 34.4605815 38.472689  
## 380 35 43.8339278 41.2536129 46.414243  
## 381 36 40.2651063 36.5975362 43.932676  
## 382 37 47.8335244 45.4040520 50.262997  
## 383 38 37.5184851 33.4785621 41.558408  
## 384 38 40.3936810 38.0939591 42.693403  
## 385 40 51.8548461 47.8440150 55.865677  
## 386 1 6.4899286 -1.1955598 14.175417  
## 387 2 8.9252453 -2.8445572 20.695048  
## 391 6 5.9562683 0.4667880 11.445749  
## 392 7 4.6284020 -1.2968679 10.553672  
## 393 8 10.2164879 6.3345346 14.098441  
## 394 9 2.5730591 -6.5315429 11.677661  
## 395 10 0.4368691 -5.4211977 6.294936  
## 396 11 13.8854553 9.5921754 18.178735  
## 397 12 25.8516019 18.5685663 33.134637  
## 398 13 17.7401506 14.8123010 20.668000  
## 402 17 21.8981226 19.4186219 24.377623  
## 403 18 20.4066328 14.9199717 25.893294  
## 404 19 23.7707477 14.9468151 32.594680  
## 405 20 29.5747910 25.4119492 33.737633  
## 406 21 14.5592713 8.2403293 20.878213  
## 407 22 15.6512280 11.9024660 19.399990  
## 408 23 30.1139145 23.9299418 36.297887  
## 409 24 20.0386491 13.2010989 26.876199  
## 413 28 29.5364708 26.8500586 32.222883  
## 414 29 24.6175914 20.7088263 28.526356  
## 415 30 31.8224109 29.5910190 34.053803  
## 416 31 38.5515717 33.7227078 43.380436  
## 417 32 29.3630027 24.7842036 33.941802  
## 418 33 38.3501848 36.2836530 40.416717  
## 419 34 31.1983706 23.7019292 38.694812  
## 420 35 48.9770139 42.8460381 55.107990  
## 424 39 51.7260633 48.1864148 55.265712  
## 425 40 43.1991280 40.2562945 46.141962  
## 426 41 37.9621925 34.4513998 41.472985  
## 427 42 54.1240567 52.6092740 55.638840  
## 428 43 48.0693893 42.9321236 53.206655  
## 429 44 55.9769343 47.2422727 64.711596  
## 430 45 35.1640000 29.1250204 41.202980  
## 431 46 62.7635155 58.5322850 66.994746  
## 435 49 42.4572051 38.4780048 46.436405  
## 436 51 49.8889191 46.0282680 53.749570  
## 437 52 48.5537726 41.5579431 55.549602  
## 438 53 70.5824421 68.5999971 72.564887  
## 439 54 50.5505722 46.4157552 54.685389  
## 440 55 57.7729000 54.7852750 60.760525  
## 441 56 64.5085909 59.7204180 69.296764  
## 442 57 46.4001350 41.4771173 51.323153  
## 446 61 70.9154129 67.9785879 73.852238  
## 447 62 69.4397586 60.1503918 78.729125  
## 448 63 84.0815924 81.6852063 86.477978  
## 449 64 83.4799289 79.1667974 87.793060  
## 450 65 85.9599717 83.5707765 88.349167  
## 451 66 62.3670319 50.2313075 74.502756  
## 452 67 85.9147762 82.9403833 88.889169  
## 453 68 79.8559397 76.0967298 83.615150  
## 457 72 100.3790656 96.9610395 103.797092  
## 458 73 103.6992425 101.8388983 105.559587  
## 459 73 81.8184377 77.0676449 86.569230  
## 460 75 106.4931114 102.5072858 110.478937

#new data set containing Fit , lwr and upr values  
tble\_pred <- data.frame(actaul\_rank = actuals[,1] ,fit =round(actuals[,2],0), lwr = round(actuals[,3],0) , upr = round(actuals[,4],0) )  
head(tble\_pred)

## actaul\_rank fit lwr upr  
## 1 1 2 -10 14  
## 2 2 -3 -13 8  
## 3 6 11 7 15  
## 4 7 13 8 19  
## 5 8 5 -4 15  
## 6 9 16 12 21

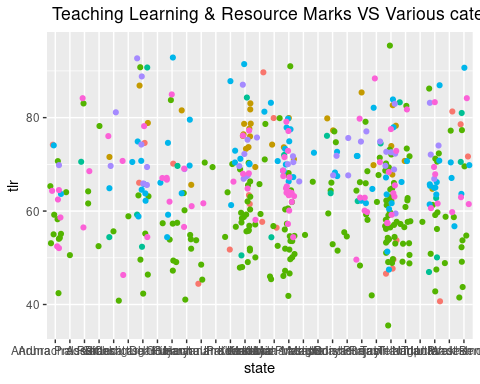
# tble\_pred$result2 <- ifelse(sapply(tble\_pred$actaul\_rank, function(p)   
# any(tble\_pred$fit > p)),"YES", NA)  
# tble\_pred

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ANOVA\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

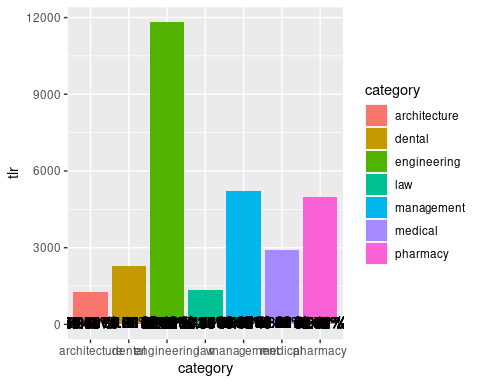
Quantative variable :tlr (Teaching Learning & Resource Marks) Categorical variable : category (Various categories of Universities)

Here, the factor is the target variable which contains 7 groups i.e (Architecture Dental Engineering Law Management Medical Pharmacy)

anv\_plot <- ggplot(univdata)+  
 aes(state,tlr,color=category)+ geom\_jitter()+  
 theme(legend.position="none")+  
 labs(title=" Teaching Learning & Resource Marks VS Various categories of Universities")  
  
anv\_plot

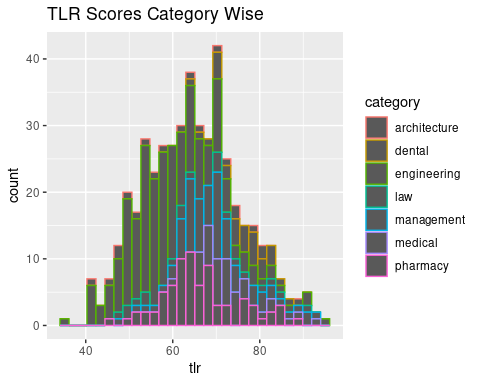
 This Plot basically shows all the points depecting TLR scores of various Universities Category wise The DataPoints for The Engineering Universities are more , and it is Evident in this Diagram and the least is for Architecture Universities

p4 <- ggplot() + geom\_bar(aes(y = tlr, x = category, fill = category), data = univdata,  
 stat="identity") + geom\_text(data=univdata, aes(x = category, y = tlr,  
 label = paste(tlr,"%")), size=4)  
p4

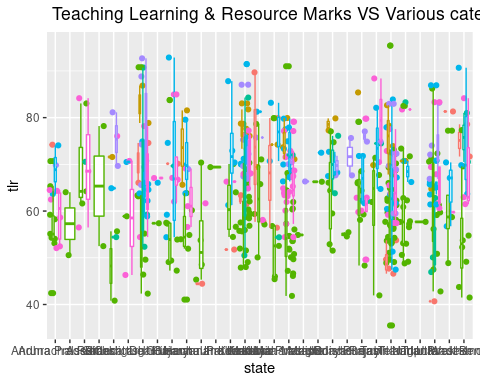
 Total Tlr Scores University Category Wise

ggplot(univdata)+  
 aes(tlr,color=category,)+geom\_histogram()+  
 labs(title="TLR Scores Category Wise")

## `stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.

 This Plot shows the Spread of TLR scores According to various Universities Categories

anv\_plot + geom\_boxplot()

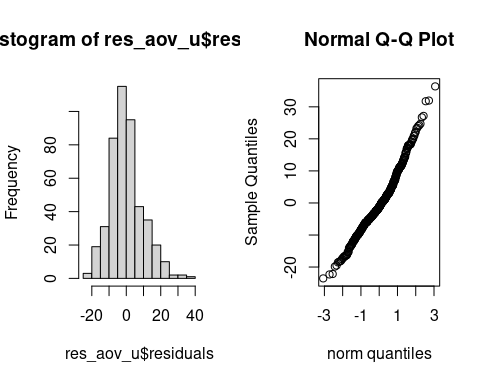
 Architectural and Pharmacy Colleges seems to have same Average TLR Scores Dental Colleges are having highest TLR Scores Engineering Universities are having lowest TLR Scores among all

##Normality:

res\_aov\_u <- aov(tlr ~ category,data=univdata  
 )

The null and alternative hypothesis of an ANOVA are: - The seven categories of Universities are equal in terms of TLR Scores - Mean is different. We can check normality visually:

par(mfrow=c(1,2)) # combine plots  
  
# histogram  
hist(res\_aov\_u$residuals)  
  
qqnorm(res\_aov\_u$residuals,xlab = "norm quantiles")



shapiro.test(res\_aov\_u$residuals)

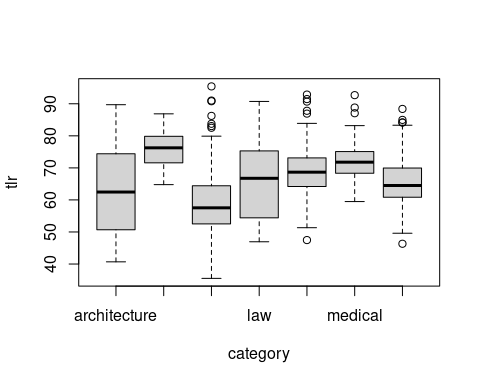
##   
## Shapiro-Wilk normality test  
##   
## data: res\_aov\_u$residuals  
## W = 0.97513, p-value = 4.616e-07

by observing plots or shapiro.test() results, we can conclude that the residuals are not normal.

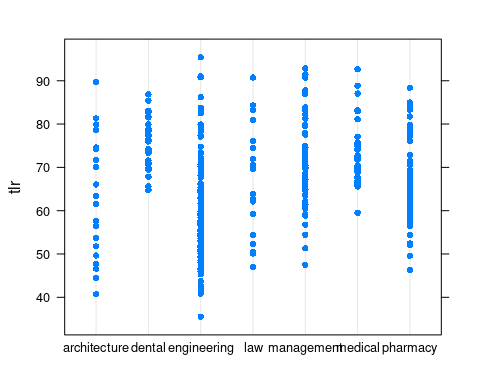
As the P-value is less than 0.001 there we reject The null Hypothesis and accept the Alternate Hypothesis, this means that the MEANS of TLR in all 7 categories of Universities are Different

Visually, we have

# Boxplot  
boxplot(tlr ~ category,data=univdata)



# Dotplot from lattice library  
dotplot(tlr ~ category,data=univdata)



Both the boxplot and the dotplot show a difference in variance for the tlr Score in different categories of Universities .

Testing Hypothesis for Levense Test:

Variances are equal at least one varaince is different

# Levene's test from car library  
library(car)

## Loading required package: carData

##   
## Attaching package: 'car'

## The following object is masked from 'package:dplyr':  
##   
## recode

## The following object is masked from 'package:purrr':  
##   
## some

leveneTest(tlr ~ category,data=univdata)

## Warning in leveneTest.default(y = y, group = group, ...): group coerced to  
## factor.

## Levene's Test for Homogeneity of Variance (center = median)  
## Df F value Pr(>F)   
## group 6 5.5363 1.496e-05 \*\*\*  
## 453   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

The p-value being smaller than the significance level of 0.05, we reject the null hypothesis, so we accept the hypothesis that variances are different among different University Categories (p-value = 1.496e-05).

group\_by(univdata, category) %>%   
 summarise(  
 mean = mean(tlr,na.rm=TRUE),  
 sd = sd(tlr,na.rm=TRUE)  
 )

## # A tibble: 7 x 3  
## category mean sd  
## \* <chr> <dbl> <dbl>  
## 1 architecture 63.0 14.1   
## 2 dental 76.0 5.59  
## 3 engineering 59.1 10.2   
## 4 law 66.5 12.8   
## 5 management 69.6 8.76  
## 6 medical 72.8 6.76  
## 7 pharmacy 66.2 8.73

summary (res\_aov\_u)

## Df Sum Sq Mean Sq F value Pr(>F)   
## category 6 14909 2484.8 27.17 <2e-16 \*\*\*  
## Residuals 453 41423 91.4   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Inference:

* Given that the p-value is smaller than 0.05, we reject the null hypothesis, so we reject the hypothesis that all means are equal.
* We can conclude that **at least one University Category is different than the others in terms of TLR scores** (p-value < 2.2e-16).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Manova\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##One Way Manova

# MANOVA test   
M\_model1 = manova(cbind(tlr,rpc,go,oi,perception) ~ category,data = univdata)  
summary(M\_model1)

## Df Pillai approx F num Df den Df Pr(>F)   
## category 6 0.97935 18.39 30 2265 < 2.2e-16 \*\*\*  
## Residuals 453   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

# Default "pillai", Other tests are "Wilks","Hotelling-Lawley", and "Roy"

reject null hypothsis and accept alternate hypothsis as P-value(< 2.2e-16) is very small

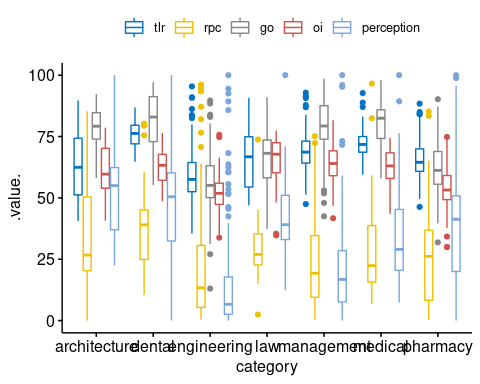
## Normality Test

shapiro.test(M\_model1$residuals)

##   
## Shapiro-Wilk normality test  
##   
## data: M\_model1$residuals  
## W = 0.91871, p-value < 2.2e-16

residuals is not in normal distribution as p value is not > 0.05

library(ggpubr)  
ggboxplot(  
 univdata, x = "category", y = c("tlr","rpc","go","oi","perception"),   
 merge = TRUE, palette = "jco"  
 )

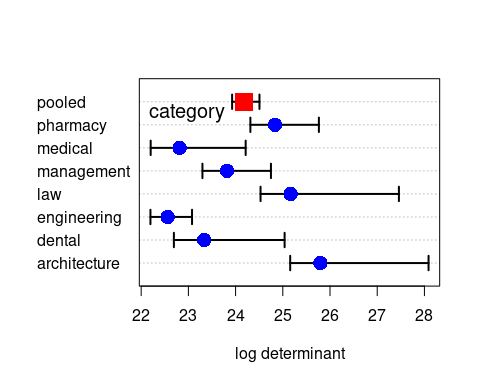


## COVARIANCE TEST

# install.packages("heplots")  
library(heplots)  
?boxM  
res\_ma <- boxM(univdata[,c(3,4,5,6,7)], univdata$category)  
res\_ma

##   
## Box's M-test for Homogeneity of Covariance Matrices  
##   
## data: univdata[, c(3, 4, 5, 6, 7)]  
## Chi-Sq (approx.) = 311.26, df = 90, p-value < 2.2e-16

plot(res\_ma, gplabel="category")



Covariance is not normal as P-value is very less (<2.2e-16)

Inference–> A one-way multivariate analysis of variance was being performed to determine the effect of different University Category on the five score determining variables(tlr,rpc,go,oi,perception). There are seven different categories: Architecture,Dental,Engineering,Law,Management,Medical and Pharmacy.

From the output above, it can be seen that the five variables(tlr,rpc,go,oi,perception) are highly significantly different among University Category.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_LDA\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

library(caret)

##   
## Attaching package: 'caret'

## The following object is masked from 'package:purrr':  
##   
## lift

## The following object is masked from 'package:survival':  
##   
## cluster

set.seed(430)  
# Data partition  
index <- createDataPartition(univdata$category, p = .80, list = FALSE)  
trainu <- univdata[index,]  
testu <- univdata[-index,]

trainu = subset(trainu, select = -c(institute\_id,name,state,city) )  
testu = subset(testu, select = -c(institute\_id,name,state,city))

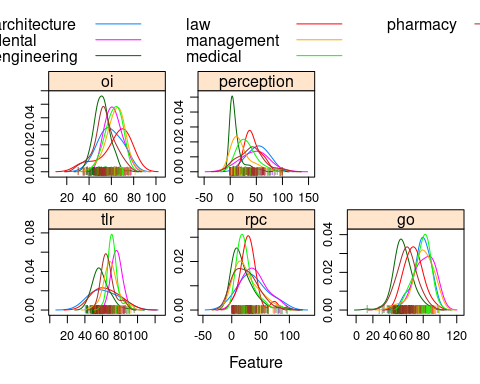
testu

## tlr rpc go oi perception rank category  
## 5 74.58 20.51 73.47 70.15 100.00 5 architecture  
## 9 74.20 5.20 82.32 68.21 56.30 9 architecture  
## 10 66.06 0.67 87.09 78.60 44.47 10 architecture  
## 19 44.44 51.07 59.84 58.42 27.90 19 architecture  
## 25 81.76 45.05 86.56 72.98 82.19 5 dental  
## 30 76.08 40.98 80.87 70.69 57.20 10 dental  
## 33 69.43 41.74 90.41 73.89 26.38 13 dental  
## 35 81.55 44.47 64.81 48.59 50.45 15 dental  
## 40 77.63 32.69 63.60 67.91 53.96 20 dental  
## 45 65.62 26.42 80.63 66.37 46.63 25 dental  
## 53 91.00 93.37 77.60 49.99 92.51 3 engineering  
## 57 83.04 70.73 83.03 59.13 62.45 7 engineering  
## 58 82.51 52.47 71.54 55.98 60.42 8 engineering  
## 63 68.93 46.03 78.67 55.24 55.59 13 engineering  
## 64 64.62 54.07 61.50 51.62 68.24 14 engineering  
## 65 56.79 64.06 63.07 58.21 46.29 15 engineering  
## 68 68.13 54.04 74.66 45.17 25.98 18 engineering  
## 72 77.05 37.17 64.77 56.27 39.56 22 engineering  
## 75 79.11 30.54 70.31 59.24 30.75 25 engineering  
## 76 78.20 39.24 62.28 51.86 28.57 26 engineering  
## 78 63.16 48.11 71.43 58.00 11.13 28 engineering  
## 88 70.07 34.81 58.75 51.57 30.48 38 engineering  
## 94 66.01 31.10 63.81 53.47 20.25 44 engineering  
## 97 54.76 36.98 64.42 50.22 29.68 47 engineering  
## 102 66.18 25.99 59.76 58.66 9.84 52 engineering  
## 108 70.69 28.57 44.25 54.50 6.18 58 engineering  
## 116 64.22 6.80 58.52 52.43 36.68 66 engineering  
## 118 55.66 14.20 64.10 56.64 19.90 68 engineering  
## 134 64.38 4.74 51.98 74.73 2.16 84 engineering  
## 137 58.12 15.20 48.55 65.11 2.16 87 engineering  
## 140 64.87 6.88 45.81 48.63 26.86 90 engineering  
## 148 45.32 22.62 60.94 45.84 5.69 98 engineering  
## 152 61.29 7.89 52.51 53.47 8.95 102 engineering  
## 155 53.25 9.94 51.64 53.90 24.15 104 engineering  
## 158 57.03 6.36 58.74 58.23 3.20 108 engineering  
## 159 54.68 2.33 64.18 62.39 6.65 109 engineering  
## 163 60.35 5.29 56.88 51.33 4.22 113 engineering  
## 168 59.21 8.03 49.36 57.20 5.21 118 engineering  
## 172 55.46 15.73 43.96 40.61 12.79 122 engineering  
## 173 62.25 8.72 45.67 45.18 4.72 123 engineering  
## 180 54.57 3.41 54.45 58.82 7.12 130 engineering  
## 189 46.65 9.68 61.00 49.25 0.55 139 engineering  
## 212 56.79 1.40 54.03 46.10 0.00 162 engineering  
## 213 49.15 6.80 50.20 55.80 4.22 163 engineering  
## 217 48.86 14.26 39.13 53.15 4.22 167 engineering  
## 218 50.11 4.15 54.99 47.43 3.71 168 engineering  
## 227 49.08 11.97 50.34 33.80 3.20 177 engineering  
## 230 56.55 1.44 43.97 54.98 0.55 180 engineering  
## 232 35.51 7.80 57.62 53.05 18.15 182 engineering  
## 245 41.05 13.82 51.92 40.13 3.71 195 engineering  
## 251 84.30 41.07 85.13 75.03 100.00 1 law  
## 262 76.11 27.06 39.66 71.84 12.36 12 law  
## 264 63.82 22.69 49.13 60.51 46.76 14 law  
## 266 70.55 22.57 37.44 67.42 21.88 16 law  
## 274 86.93 48.58 93.71 71.35 73.17 4 management  
## 279 87.81 31.60 98.15 64.00 52.64 9 management  
## 287 82.11 30.12 84.23 69.23 21.30 17 management  
## 291 63.80 32.83 88.68 71.99 19.85 21 management  
## 297 71.19 23.44 85.65 69.71 23.62 27 management  
## 311 65.72 32.47 51.86 64.14 11.10 41 management  
## 313 62.21 12.93 85.09 62.00 13.46 43 management  
## 316 61.69 17.06 74.98 51.94 28.71 46 management  
## 324 62.21 35.18 53.86 58.48 3.06 54 management  
## 328 61.28 22.12 56.88 58.95 28.31 58 management  
## 330 69.97 4.53 79.51 61.49 3.06 60 management  
## 331 66.22 6.65 72.17 70.31 10.48 61 management  
## 335 64.74 8.19 73.14 72.25 2.32 65 management  
## 336 70.42 17.99 53.68 62.32 2.32 66 management  
## 343 66.20 2.53 79.30 58.47 2.32 73 management  
## 346 92.69 96.57 83.25 72.56 100.00 1 medical  
## 348 82.96 46.37 97.02 64.20 89.35 3 medical  
## 350 83.18 58.05 90.81 51.24 45.59 5 medical  
## 353 75.64 38.35 71.93 69.55 76.32 8 medical  
## 354 67.41 39.78 84.42 72.01 66.14 9 medical  
## 355 74.03 44.22 90.23 43.53 43.21 10 medical  
## 360 66.90 37.56 87.00 56.48 18.30 15 medical  
## 378 68.99 16.49 69.80 61.98 23.19 33 medical  
## 386 78.18 85.18 80.85 57.65 95.70 1 pharmacy  
## 389 79.12 65.11 86.13 53.79 86.32 4 pharmacy  
## 390 81.75 57.70 87.19 65.18 80.23 5 pharmacy  
## 392 77.24 44.74 73.25 68.83 93.03 7 pharmacy  
## 398 77.13 34.25 81.91 60.45 20.00 13 pharmacy  
## 410 54.43 23.66 74.93 56.92 80.23 25 pharmacy  
## 417 49.60 41.37 61.22 53.75 43.62 32 pharmacy  
## 421 56.60 35.82 58.70 47.65 36.24 36 pharmacy  
## 427 64.33 19.20 61.05 52.52 20.00 42 pharmacy  
## 434 67.96 9.13 53.04 56.72 30.48 49 pharmacy  
## 438 63.92 14.81 56.70 48.64 15.83 53 pharmacy  
## 444 46.32 28.61 58.05 45.13 20.00 59 pharmacy  
## 446 61.49 4.37 62.24 47.08 27.27 61 pharmacy  
## 449 52.07 10.70 63.41 44.91 27.27 64 pharmacy  
## 457 56.49 8.58 60.49 40.97 15.83 72 pharmacy

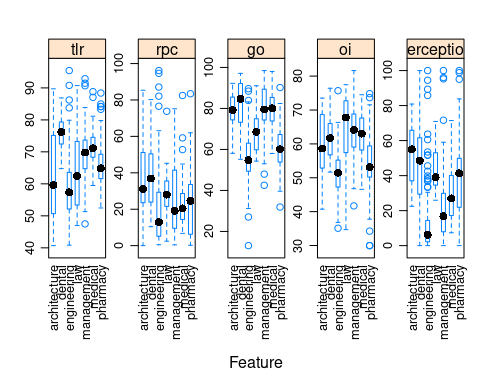
trainu$category <- as.factor(trainu$category)  
testu$category <- as.factor(testu$category)

testu$tlr <- as.numeric(testu$tlr)  
trainu$tlr <- as.numeric(trainu$tlr)  
testu$rpc <- as.numeric(testu$rpc)  
trainu$rpc <- as.numeric(trainu$rpc)  
testu$go <- as.numeric(testu$go)  
trainu$go <- as.numeric(trainu$go)  
testu$oi <- as.numeric(testu$oi)  
trainu$oi <- as.numeric(trainu$oi)  
testu$perception <- as.numeric(testu$perception)  
trainu$perception <- as.numeric(trainu$perception)

# Featureplot for density   
featurePlot(x=trainu[,1:5], y = trainu$category,  
 plot="density",  
 scales= list(x = list(relation = "free"),   
 y = list(relation = "free")),  
 adjust = 1.5,   
 pch = "|",  
 auto.key = list(columns = 3)  
 )



# Featureplot for boxplots  
featurePlot(x=trainu[,1:5],   
 y = trainu$category,  
 plot = "box",  
 scales = list(y = list(relation = "free"),  
 x = list(rot = 90)),  
 layout = c(5,1)  
 )



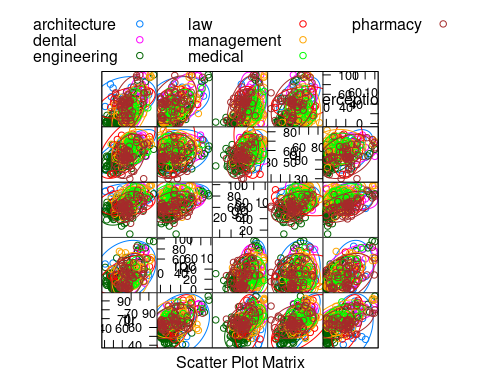
# install.packages("ellipse")  
library(ellipse)

##   
## Attaching package: 'ellipse'

## The following object is masked from 'package:car':  
##   
## ellipse

## The following object is masked from 'package:graphics':  
##   
## pairs

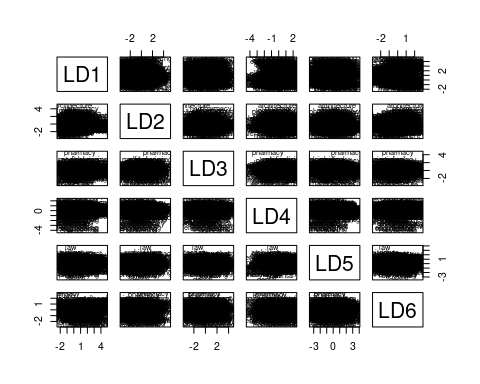
featurePlot(x = trainu[, 1:5],   
 y = trainu$category,  
 plot = "ellipse",  
 auto.key = list(columns = 3)  
 )



working on L.D.A

library(MASS)  
umodel\_lda = lda(category ~ ., data = trainu)  
#umodel\_lda

plot(umodel\_lda)



pred = predict(umodel\_lda,trainu)  
head(pred$class)

## [1] dental dental dental architecture engineering   
## [6] medical   
## Levels: architecture dental engineering law management medical pharmacy

### Computing P.C.A

trainu

## tlr rpc go oi perception rank category  
## 1 78.58 79.73 91.80 71.71 75.54 1 architecture  
## 2 81.32 85.34 87.15 70.90 56.30 2 architecture  
## 3 89.70 27.93 75.96 66.96 58.79 3 architecture  
## 4 70.14 43.18 82.53 59.98 74.72 4 architecture  
## 6 71.68 62.31 74.67 52.88 37.00 6 architecture  
## 7 79.91 22.57 74.12 73.51 52.25 7 architecture  
## 8 49.63 52.10 83.90 59.37 73.03 8 architecture  
## 11 57.69 25.46 92.24 54.30 37.00 11 architecture  
## 12 61.52 0.00 79.85 70.35 54.99 12 architecture  
## 13 51.76 40.71 60.95 60.59 53.64 13 architecture  
## 14 63.40 0.01 77.67 57.88 54.99 14 architecture  
## 15 56.44 34.30 71.03 55.22 25.28 15 architecture  
## 16 40.68 50.18 88.25 40.73 34.91 16 architecture  
## 17 47.68 24.60 78.55 51.00 54.99 17 architecture  
## 18 46.60 25.50 58.10 52.83 80.87 18 architecture  
## 20 53.75 19.68 80.14 47.84 22.48 20 architecture  
## 21 86.86 75.47 92.13 53.76 100.00 1 dental  
## 22 83.05 79.41 71.63 76.42 74.72 2 dental  
## 23 79.92 80.24 81.41 57.36 63.00 3 dental  
## 24 82.66 60.57 74.93 63.38 80.44 4 dental  
## 26 78.72 55.20 73.87 72.41 65.62 6 dental  
## 27 78.27 55.21 71.42 59.28 60.20 7 dental  
## 28 71.10 45.00 92.13 52.56 60.20 8 dental  
## 29 73.92 45.61 95.99 56.37 37.72 9 dental  
## 31 78.67 44.21 88.53 63.18 19.29 11 dental  
## 32 79.84 37.00 97.12 63.62 19.29 12 dental  
## 34 73.65 44.38 84.45 54.45 32.43 14 dental  
## 36 73.33 41.46 68.72 60.36 60.20 16 dental  
## 37 77.27 33.07 77.48 65.81 50.45 17 dental  
## 38 85.39 12.11 92.16 59.45 46.63 18 dental  
## 39 78.86 36.28 55.20 73.84 50.45 19 dental  
## 41 73.69 36.70 74.06 60.48 32.43 21 dental  
## 42 74.23 24.35 91.54 55.54 26.38 22 dental  
## 43 70.73 17.36 86.58 67.18 46.63 23 dental  
## 44 76.43 17.89 85.12 70.85 26.38 24 dental  
## 46 75.98 10.38 84.85 57.14 57.20 26 dental  
## 47 67.82 32.71 93.44 51.67 0.00 27 dental  
## 48 71.58 24.15 72.61 66.19 32.43 28 dental  
## 49 69.84 23.70 92.17 63.83 0.00 29 dental  
## 50 64.76 20.21 72.47 62.87 63.00 30 dental  
## 51 95.42 94.64 83.90 61.31 100.00 1 engineering  
## 52 90.79 96.15 80.36 64.81 94.46 2 engineering  
## 54 86.22 82.08 88.44 54.21 85.78 4 engineering  
## 55 77.32 87.11 83.21 56.62 89.31 5 engineering  
## 56 77.21 76.57 89.65 61.71 60.55 6 engineering  
## 59 72.11 50.04 74.71 61.49 63.68 9 engineering  
## 60 79.89 53.31 72.09 57.76 27.15 10 engineering  
## 61 72.34 47.77 77.77 56.07 53.49 11 engineering  
## 62 64.02 63.12 72.11 55.07 39.78 12 engineering  
## 66 64.38 57.82 74.30 47.23 30.48 16 engineering  
## 67 53.73 62.04 76.45 40.45 51.61 17 engineering  
## 69 73.38 38.12 74.21 57.81 36.91 19 engineering  
## 70 65.77 56.76 59.00 60.07 28.01 20 engineering  
## 71 69.57 47.62 63.17 47.92 45.56 21 engineering  
## 73 71.05 31.30 78.29 63.87 38.04 23 engineering  
## 74 83.76 34.55 55.15 57.90 38.26 24 engineering  
## 77 67.70 45.19 69.73 53.77 15.56 27 engineering  
## 79 65.95 47.65 65.69 54.82 17.42 29 engineering  
## 80 61.95 34.87 77.36 56.26 42.47 30 engineering  
## 81 70.38 36.80 67.11 64.70 21.26 31 engineering  
## 82 71.22 50.11 51.01 56.94 8.05 32 engineering  
## 83 78.65 24.02 62.88 62.97 33.32 33 engineering  
## 84 74.73 29.41 68.18 64.26 10.70 34 engineering  
## 85 71.41 41.69 59.89 54.40 8.95 35 engineering  
## 86 63.36 31.12 73.21 53.07 36.91 36 engineering  
## 87 73.13 33.81 64.89 56.60 10.70 37 engineering  
## 89 70.58 45.83 56.57 40.89 10.70 39 engineering  
## 90 63.85 41.64 61.65 54.75 17.42 40 engineering  
## 91 61.27 41.96 63.57 61.06 11.55 41 engineering  
## 92 66.08 25.80 65.80 75.70 17.79 42 engineering  
## 93 53.01 36.66 73.92 52.91 24.77 43 engineering  
## 95 70.32 24.86 54.60 62.23 33.57 45 engineering  
## 96 61.63 35.41 62.30 51.68 19.21 46 engineering  
## 98 59.71 30.56 69.00 50.72 22.89 48 engineering  
## 99 69.35 19.73 52.14 48.69 51.77 49 engineering  
## 100 61.94 21.89 67.56 51.85 29.40 50 engineering  
## 101 59.06 31.77 64.14 64.20 2.69 51 engineering  
## 103 67.71 26.19 56.17 59.29 8.05 53 engineering  
## 104 57.49 31.20 62.46 55.13 9.84 54 engineering  
## 105 66.34 30.98 53.14 49.19 6.18 55 engineering  
## 106 55.18 29.80 67.58 41.15 18.86 56 engineering  
## 107 71.72 29.24 40.88 53.90 11.13 57 engineering  
## 109 65.53 13.98 62.74 55.31 18.15 59 engineering  
## 110 68.66 18.42 54.26 62.06 5.21 60 engineering  
## 111 66.27 20.64 54.64 59.35 7.59 61 engineering  
## 112 59.63 17.63 63.93 57.99 17.79 62 engineering  
## 113 64.43 32.96 44.38 47.56 2.69 63 engineering  
## 114 59.67 18.32 59.11 51.54 27.44 64 engineering  
## 115 52.55 28.36 64.27 47.33 3.20 65 engineering  
## 117 58.88 24.26 56.99 50.70 1.63 67 engineering  
## 119 65.32 10.04 63.72 54.35 5.69 69 engineering  
## 120 63.06 13.29 59.79 48.30 13.20 70 engineering  
## 121 57.29 11.04 68.16 52.93 11.55 71 engineering  
## 122 40.82 43.55 51.63 40.27 7.59 72 engineering  
## 123 62.07 11.92 55.53 52.58 17.79 73 engineering  
## 124 70.18 5.41 53.50 58.94 9.84 74 engineering  
## 125 57.69 21.55 48.22 55.37 10.27 75 engineering  
## 126 49.60 22.68 62.41 44.55 13.60 76 engineering  
## 127 57.39 18.33 52.11 56.77 11.13 77 engineering  
## 128 69.41 18.63 41.79 48.00 1.10 78 engineering  
## 129 56.64 12.85 64.87 45.15 11.13 79 engineering  
## 130 56.50 20.50 50.75 54.83 6.65 80 engineering  
## 131 45.42 30.89 59.40 43.47 1.63 81 engineering  
## 132 63.11 11.35 54.41 45.37 14.79 82 engineering  
## 133 62.69 4.26 63.05 48.54 12.79 83 engineering  
## 135 59.37 10.39 55.58 49.98 16.31 85 engineering  
## 136 46.40 32.31 49.33 47.61 3.71 86 engineering  
## 138 60.88 4.28 65.20 53.66 4.72 88 engineering  
## 139 58.70 12.89 48.00 58.38 14.00 89 engineering  
## 141 60.33 13.44 54.58 50.17 1.63 91 engineering  
## 142 52.49 16.60 59.09 43.42 13.20 92 engineering  
## 143 59.49 5.07 58.70 57.65 10.70 93 engineering  
## 144 57.56 12.20 55.31 49.22 10.27 93 engineering  
## 145 57.70 24.09 36.36 59.88 0.55 95 engineering  
## 146 50.85 19.39 53.38 50.64 9.84 96 engineering  
## 147 58.25 10.41 59.54 50.97 1.63 97 engineering  
## 149 54.62 3.35 65.40 66.06 6.18 99 engineering  
## 150 45.99 17.51 62.35 53.20 7.59 100 engineering  
## 151 49.72 18.31 52.51 47.18 18.86 101 engineering  
## 153 42.80 15.69 68.87 44.19 16.69 103 engineering  
## 154 68.53 31.00 13.06 43.60 2.69 104 engineering  
## 156 62.19 4.51 57.76 51.77 2.69 106 engineering  
## 157 59.79 11.96 46.62 56.11 5.21 107 engineering  
## 160 54.88 13.94 56.91 48.16 0.00 110 engineering  
## 161 47.25 10.86 68.33 49.81 7.12 111 engineering  
## 162 53.75 22.22 46.02 47.26 0.00 112 engineering  
## 164 55.94 5.26 63.07 55.65 0.55 114 engineering  
## 165 48.53 18.76 54.81 46.44 7.59 115 engineering  
## 166 57.31 13.41 51.16 47.33 3.71 116 engineering  
## 167 49.08 23.49 46.44 53.20 1.10 117 engineering  
## 169 51.53 19.97 47.54 46.54 5.21 119 engineering  
## 170 60.17 6.39 55.19 47.37 1.63 120 engineering  
## 171 53.96 3.72 59.10 64.06 1.10 121 engineering  
## 174 57.82 2.01 57.52 50.22 8.50 124 engineering  
## 175 53.58 7.74 59.93 46.69 2.16 125 engineering  
## 176 51.56 6.69 57.99 54.63 5.69 126 engineering  
## 177 62.78 6.38 44.97 50.33 2.16 127 engineering  
## 178 58.44 6.10 49.40 53.09 4.22 128 engineering  
## 179 58.78 7.54 43.77 59.09 3.71 129 engineering  
## 181 53.90 10.82 50.60 46.14 7.12 131 engineering  
## 182 55.76 3.86 54.88 51.44 8.05 132 engineering  
## 183 58.73 5.43 50.17 48.85 5.69 133 engineering  
## 184 56.16 7.55 56.28 42.16 0.00 134 engineering  
## 185 58.13 5.76 46.86 44.25 14.79 135 engineering  
## 186 56.85 8.11 48.85 49.29 1.63 136 engineering  
## 187 59.28 17.63 27.04 55.09 2.69 137 engineering  
## 188 60.56 4.32 47.57 48.17 3.71 138 engineering  
## 190 51.75 8.58 53.65 52.42 0.00 139 engineering  
## 191 57.68 1.21 54.84 51.32 1.10 141 engineering  
## 192 54.46 5.15 53.30 46.28 6.18 142 engineering  
## 193 57.23 4.18 52.41 48.49 0.00 143 engineering  
## 194 41.84 24.72 48.59 39.99 0.00 144 engineering  
## 195 64.04 9.76 33.30 43.05 5.69 145 engineering  
## 196 42.33 8.13 63.06 53.96 5.21 145 engineering  
## 197 59.25 0.71 51.11 54.45 0.00 147 engineering  
## 198 54.46 2.27 58.68 41.41 6.65 148 engineering  
## 199 49.09 12.43 41.93 66.36 0.55 149 engineering  
## 200 53.05 6.12 52.87 46.82 5.21 150 engineering  
## 201 56.06 5.17 48.62 51.89 2.16 151 engineering  
## 202 51.06 4.37 58.86 46.60 3.71 152 engineering  
## 203 42.43 27.73 38.00 42.67 3.71 153 engineering  
## 204 52.26 4.90 50.40 54.15 6.18 154 engineering  
## 205 54.27 2.25 54.24 53.21 1.10 155 engineering  
## 206 55.02 5.36 47.11 53.23 2.69 156 engineering  
## 207 41.49 16.75 52.96 47.42 2.69 157 engineering  
## 208 54.89 8.29 42.86 53.25 1.63 158 engineering  
## 209 47.89 1.88 63.26 53.12 1.10 159 engineering  
## 210 53.65 6.81 52.88 42.44 0.00 160 engineering  
## 211 62.29 1.91 31.20 62.13 12.38 160 engineering  
## 214 57.13 2.86 49.94 45.99 2.16 164 engineering  
## 215 47.21 6.45 59.26 44.53 3.20 165 engineering  
## 216 59.15 2.31 46.82 42.34 6.65 166 engineering  
## 219 48.02 4.04 51.43 53.36 11.13 169 engineering  
## 220 50.61 7.28 45.04 54.16 4.72 170 engineering  
## 221 51.95 2.84 59.03 39.37 0.55 171 engineering  
## 222 53.11 2.72 52.44 48.87 1.10 172 engineering  
## 223 50.80 2.95 52.51 53.89 2.16 173 engineering  
## 224 51.95 4.10 51.73 49.28 1.10 174 engineering  
## 225 51.97 2.65 51.05 50.57 5.21 175 engineering  
## 226 56.18 4.91 48.74 38.31 2.16 176 engineering  
## 228 50.08 14.19 38.55 44.77 5.69 178 engineering  
## 229 52.90 2.66 47.20 56.20 2.69 179 engineering  
## 231 48.34 7.56 47.86 53.83 0.00 181 engineering  
## 233 47.49 15.84 44.10 35.10 2.69 183 engineering  
## 234 54.06 1.24 50.93 47.58 0.00 184 engineering  
## 235 55.12 3.96 48.19 36.84 4.72 185 engineering  
## 236 55.66 1.11 46.87 50.80 0.00 186 engineering  
## 237 48.80 0.75 56.58 50.47 2.16 187 engineering  
## 238 54.28 1.69 45.48 48.12 6.65 188 engineering  
## 239 53.98 5.99 42.90 46.85 1.10 189 engineering  
## 240 53.11 1.15 48.27 51.60 2.69 190 engineering  
## 241 43.74 7.80 51.73 52.96 2.16 191 engineering  
## 242 48.89 2.80 54.08 47.67 2.16 192 engineering  
## 243 49.40 2.29 59.12 36.87 2.69 193 engineering  
## 244 41.95 12.14 53.25 43.08 0.55 194 engineering  
## 246 49.69 1.66 53.63 48.50 1.63 196 engineering  
## 247 46.11 7.36 50.73 48.76 0.55 197 engineering  
## 248 53.60 3.82 45.75 47.25 0.00 198 engineering  
## 249 49.16 0.46 53.74 52.98 1.63 199 engineering  
## 250 50.56 9.06 39.36 46.21 7.12 200 engineering  
## 252 90.73 45.21 67.77 74.67 65.36 2 law  
## 253 83.28 39.74 77.73 73.22 70.96 3 law  
## 254 81.00 73.78 69.16 67.68 39.07 4 law  
## 255 74.48 26.85 78.05 65.16 44.35 5 law  
## 256 70.52 35.19 68.59 69.75 57.09 6 law  
## 257 69.67 35.83 68.56 67.92 36.15 7 law  
## 258 72.00 16.72 67.48 77.47 36.15 8 law  
## 259 59.24 35.00 72.20 76.31 33.01 9 law  
## 260 62.14 29.23 59.13 72.22 29.62 10 law  
## 261 62.79 2.46 78.65 48.12 36.15 11 law  
## 263 46.95 26.48 91.05 34.70 33.01 13 law  
## 265 54.42 29.60 60.50 71.80 25.93 15 law  
## 267 54.39 24.98 58.53 55.54 39.07 17 law  
## 268 52.36 15.06 57.02 59.29 60.60 18 law  
## 269 50.08 24.79 70.81 35.39 41.79 19 law  
## 270 50.51 18.36 54.32 65.82 49.04 20 law  
## 271 92.87 63.06 98.46 66.78 95.99 1 management  
## 272 91.46 57.43 98.48 69.45 100.00 2 management  
## 273 90.68 56.79 97.18 71.85 95.26 3 management  
## 275 63.67 72.34 89.66 68.45 48.63 5 management  
## 276 81.27 44.07 94.41 63.24 71.63 6 management  
## 277 83.18 43.42 93.74 67.49 55.67 7 management  
## 278 58.85 72.08 81.33 62.55 53.97 8 management  
## 280 79.56 46.04 94.54 69.12 24.51 10 management  
## 281 74.93 51.74 86.46 59.65 45.02 11 management  
## 282 56.75 75.17 76.86 59.00 20.34 12 management  
## 283 77.51 43.86 92.77 66.83 12.30 12 management  
## 284 67.19 48.90 79.17 59.09 51.96 14 management  
## 285 77.93 23.77 89.15 65.37 59.08 15 management  
## 286 70.79 49.79 79.81 58.94 24.95 16 management  
## 288 73.32 21.80 97.99 71.12 16.78 18 management  
## 289 70.51 28.83 90.07 67.91 15.15 19 management  
## 290 70.40 18.91 92.07 68.82 38.92 20 management  
## 292 79.78 14.76 94.56 66.62 18.85 22 management  
## 293 83.89 16.46 84.14 68.75 19.85 23 management  
## 294 77.88 18.05 90.20 69.48 16.78 24 management  
## 295 70.70 34.08 72.38 76.20 16.78 25 management  
## 296 74.90 18.22 86.23 58.00 40.15 26 management  
## 298 70.75 27.85 85.77 66.38 12.88 28 management  
## 299 72.92 44.32 53.02 56.63 22.71 29 management  
## 300 72.49 12.46 91.82 58.51 38.61 30 management  
## 301 67.49 18.62 91.76 52.95 30.66 31 management  
## 302 72.68 17.87 77.97 74.64 19.35 32 management  
## 303 67.09 24.88 84.06 60.48 16.24 33 management  
## 304 65.78 27.65 75.45 73.76 9.23 34 management  
## 305 47.47 40.13 75.43 66.73 24.51 35 management  
## 306 65.41 20.94 77.96 59.88 20.34 36 management  
## 307 65.00 19.31 78.25 62.15 11.10 37 management  
## 308 69.74 19.34 75.13 64.43 0.79 37 management  
## 309 70.01 9.44 81.67 65.23 7.93 39 management  
## 310 66.35 3.15 86.44 63.33 29.10 40 management  
## 312 64.89 19.59 74.96 60.93 7.93 42 management  
## 314 74.60 9.04 72.37 63.32 8.59 44 management  
## 315 61.42 28.82 69.89 47.94 8.59 45 management  
## 317 65.03 9.69 81.75 70.85 7.93 47 management  
## 318 66.07 12.54 74.21 68.63 13.46 48 management  
## 319 71.79 21.32 57.99 70.53 0.00 49 management  
## 320 63.56 6.59 85.92 56.10 26.66 50 management  
## 321 71.79 5.85 73.89 81.64 1.56 51 management  
## 322 69.83 9.60 75.77 63.17 9.23 52 management  
## 323 63.66 7.36 84.69 73.93 5.22 53 management  
## 325 60.46 42.81 42.50 46.78 17.31 55 management  
## 326 68.65 4.55 84.19 60.30 6.60 56 management  
## 327 63.78 17.77 74.51 51.30 7.27 57 management  
## 329 51.32 36.21 47.94 51.29 38.29 59 management  
## 332 70.70 6.76 70.23 63.05 6.60 62 management  
## 333 68.25 8.24 69.69 62.18 9.23 63 management  
## 334 67.27 0.43 73.06 74.17 16.78 63 management  
## 337 64.57 4.71 79.07 67.76 0.79 67 management  
## 338 68.54 4.45 77.35 56.63 3.79 68 management  
## 339 63.55 6.81 77.91 63.85 3.06 69 management  
## 340 74.06 6.77 58.93 68.82 3.79 70 management  
## 341 70.14 10.34 65.77 54.97 4.51 71 management  
## 342 54.41 10.55 81.69 53.54 15.15 72 management  
## 344 59.21 17.50 75.31 41.70 2.32 74 management  
## 345 61.69 6.61 73.95 70.31 0.00 75 management  
## 347 81.14 82.46 86.16 66.08 71.44 2 medical  
## 349 87.05 59.18 78.39 58.07 59.80 4 medical  
## 351 72.09 52.73 89.09 57.44 37.07 6 medical  
## 352 75.74 44.82 84.59 70.59 42.39 7 medical  
## 356 88.82 34.60 77.57 58.31 32.06 11 medical  
## 357 72.68 17.49 98.06 55.61 66.14 12 medical  
## 358 72.29 27.29 83.30 66.91 46.73 13 medical  
## 359 72.22 29.16 84.98 65.68 38.47 14 medical  
## 361 74.25 25.25 89.28 59.03 25.12 16 medical  
## 362 69.43 26.43 80.40 55.08 49.62 17 medical  
## 363 74.87 20.34 85.79 65.89 26.97 18 medical  
## 364 65.59 37.94 74.63 61.41 28.73 19 medical  
## 365 67.75 18.25 85.80 68.37 45.20 20 medical  
## 366 66.91 21.12 82.32 69.77 39.81 21 medical  
## 367 65.91 41.49 60.00 68.94 17.55 22 medical  
## 368 71.83 18.65 83.40 63.20 25.75 23 medical  
## 369 71.73 20.49 78.60 69.79 16.80 24 medical  
## 370 69.66 19.06 84.00 58.92 26.97 25 medical  
## 371 77.05 15.27 87.32 53.00 12.77 26 medical  
## 372 74.89 12.31 88.67 49.49 16.02 27 medical  
## 373 72.58 8.00 79.75 62.86 40.25 27 medical  
## 374 70.47 15.11 82.59 68.35 11.91 29 medical  
## 375 75.28 10.16 74.57 60.71 34.14 30 medical  
## 376 68.90 28.13 61.80 59.90 16.02 31 medical  
## 377 67.66 15.80 68.10 65.88 29.31 32 medical  
## 379 69.69 20.51 58.00 66.40 11.91 34 medical  
## 380 59.48 23.66 73.12 46.60 22.53 35 medical  
## 381 69.62 7.71 67.45 69.19 26.97 36 medical  
## 382 70.04 13.65 68.86 63.93 7.35 37 medical  
## 383 69.83 6.74 78.12 52.19 21.17 38 medical  
## 384 66.34 7.88 76.22 59.17 25.12 38 medical  
## 385 67.64 10.50 67.26 74.49 12.77 40 medical  
## 387 76.05 83.43 76.47 71.53 95.05 2 pharmacy  
## 388 79.78 61.99 79.53 62.88 100.00 3 pharmacy  
## 391 88.39 60.82 74.71 67.95 64.47 6 pharmacy  
## 393 84.97 39.56 76.69 66.33 63.08 8 pharmacy  
## 394 77.54 28.53 90.20 73.65 83.81 9 pharmacy  
## 395 76.16 28.41 82.33 68.59 98.82 10 pharmacy  
## 396 84.16 30.80 70.57 66.68 51.78 11 pharmacy  
## 397 72.88 52.84 67.02 37.78 49.89 12 pharmacy  
## 399 66.72 42.86 77.34 52.01 41.30 14 pharmacy  
## 400 58.11 53.78 66.30 63.83 36.24 15 pharmacy  
## 401 66.30 42.30 59.38 60.42 60.15 16 pharmacy  
## 402 62.01 41.58 69.74 52.36 47.90 17 pharmacy  
## 403 83.31 30.27 53.00 59.59 43.62 18 pharmacy  
## 404 59.20 57.11 51.76 50.28 45.82 19 pharmacy  
## 405 70.47 26.18 82.42 74.82 15.83 20 pharmacy  
## 406 67.88 53.39 44.28 59.01 33.46 21 pharmacy  
## 407 64.87 28.05 72.51 54.85 65.82 22 pharmacy  
## 408 60.10 47.00 68.05 39.71 45.82 23 pharmacy  
## 409 72.89 22.54 59.30 53.51 75.25 24 pharmacy  
## 411 68.36 28.66 64.27 52.00 43.62 26 pharmacy  
## 412 84.16 15.25 61.81 29.98 63.08 27 pharmacy  
## 413 61.05 33.46 62.92 51.91 49.89 28 pharmacy  
## 414 62.85 42.93 50.95 58.07 27.27 29 pharmacy  
## 415 71.55 23.01 70.38 52.48 23.79 30 pharmacy  
## 416 69.08 29.60 54.62 46.26 45.82 31 pharmacy  
## 418 63.38 27.92 70.05 48.98 23.79 33 pharmacy  
## 419 52.45 29.77 65.83 45.03 63.08 34 pharmacy  
## 420 68.54 33.57 58.84 29.97 30.48 35 pharmacy  
## 422 68.06 13.55 63.24 64.67 41.30 37 pharmacy  
## 423 62.88 18.18 64.92 61.89 38.85 38 pharmacy  
## 424 61.66 29.75 66.24 50.11 0.00 39 pharmacy  
## 425 61.95 18.71 55.00 55.61 43.62 40 pharmacy  
## 426 67.23 7.42 63.01 53.20 45.82 41 pharmacy  
## 428 63.09 37.93 45.40 49.60 0.00 43 pharmacy  
## 429 70.73 32.84 46.52 37.95 0.00 44 pharmacy  
## 430 67.11 7.91 52.61 52.29 58.61 45 pharmacy  
## 431 61.61 33.56 44.13 44.07 20.00 46 pharmacy  
## 432 67.07 1.12 64.68 52.04 41.30 47 pharmacy  
## 433 65.28 4.86 61.75 53.39 38.85 48 pharmacy  
## 435 60.62 2.28 67.33 57.50 43.62 49 pharmacy  
## 436 57.47 10.50 59.59 53.19 45.82 51 pharmacy  
## 437 64.83 13.29 39.61 60.23 43.62 52 pharmacy  
## 439 58.63 3.56 67.27 50.72 41.30 54 pharmacy  
## 440 62.47 3.32 61.68 57.14 33.46 55 pharmacy  
## 441 69.43 27.04 31.87 51.44 5.97 56 pharmacy  
## 442 63.83 0.81 56.13 53.24 49.89 57 pharmacy  
## 443 64.11 10.93 45.05 52.27 38.85 58 pharmacy  
## 445 59.80 5.95 57.80 64.33 27.27 60 pharmacy  
## 447 54.41 9.56 58.14 41.94 45.82 62 pharmacy  
## 448 63.89 10.99 56.35 50.72 5.97 63 pharmacy  
## 450 63.19 4.34 59.34 52.15 11.19 65 pharmacy  
## 451 65.50 0.18 44.39 44.12 51.78 66 pharmacy  
## 452 62.96 2.95 59.31 46.89 15.83 67 pharmacy  
## 453 67.49 1.35 51.43 53.30 15.83 68 pharmacy  
## 454 64.49 1.59 56.86 59.21 5.97 69 pharmacy  
## 455 57.42 3.19 51.62 58.36 33.46 70 pharmacy  
## 456 60.10 1.52 60.56 53.10 15.83 71 pharmacy  
## 458 57.24 6.55 58.13 54.12 11.19 73 pharmacy  
## 459 68.68 1.95 48.93 51.96 11.19 73 pharmacy  
## 460 59.77 14.22 55.01 34.25 5.97 75 pharmacy

# Computing PCA  
pca\_u <- prcomp(trainu[,-7], center = TRUE, scale.=TRUE)  
pca\_u

## Standard deviations (1, .., p=6):  
## [1] 1.9142771 0.9352523 0.7080737 0.6205608 0.5914262 0.4739170  
##   
## Rotation (n x k) = (6 x 6):  
## PC1 PC2 PC3 PC4 PC5  
## tlr -0.4304886 0.16475710 -0.32089010 0.59641882 -0.52639653  
## rpc -0.3776698 -0.55811460 -0.26361619 -0.58508201 -0.25411231  
## go -0.4038491 0.22208813 0.80435186 -0.12306161 -0.08095638  
## oi -0.3361743 0.68488097 -0.40421343 -0.37528517 0.33310446  
## perception -0.4158839 -0.37461304 -0.02808566 0.38016187 0.72499542  
## rank 0.4722060 0.05141193 -0.12797202 0.03817683 0.12329938  
## PC6  
## tlr 0.22749841  
## rpc 0.26360223  
## go 0.34482278  
## oi 0.05233388  
## perception 0.12560035  
## rank 0.86101179

# Proportion pca  
prop.pca\_u <- pca\_u$sdev^2/sum(pca\_u$sdev^2)  
prop.pca\_u

## [1] 0.61074282 0.14578280 0.08356139 0.06418262 0.05829749 0.03743288

# Proportion lda  
prop.lda <- umodel\_lda$svd^2/sum(umodel\_lda$svd^2)  
prop.lda

## [1] 5.766940e-01 3.303096e-01 5.783794e-02 2.890036e-02 6.258151e-03  
## [6] 1.227610e-08

# Create Dataset  
dataset\_p\_l <- data.frame(category = trainu[,7],pca=pca\_u$x,lda=pred$x)  
head(dataset\_p\_l)

## category pca.PC1 pca.PC2 pca.PC3 pca.PC4 pca.PC5  
## 1 architecture -4.208016 -0.6797906 -0.377432762 -0.9205681 0.36797976  
## 2 architecture -3.933103 -0.6220629 -0.721228514 -1.1656642 -0.41378751  
## 3 architecture -2.782426 0.6228342 -0.635273137 1.2602013 -0.09453971  
## 4 architecture -2.482892 -0.7554049 0.363956989 0.2123548 0.86050563  
## 6 architecture -1.782165 -1.3079331 -0.002761993 -0.5084046 -0.78978785  
## 7 architecture -2.330117 1.1756367 -0.652376147 0.5334060 0.50252689  
## pca.PC6 lda.LD1 lda.LD2 lda.LD3 lda.LD4 lda.LD5  
## 1 1.00956634 -1.2226719 -1.2903801 -1.2619413 -2.5962773 -1.86078139  
## 2 0.94811094 -0.6910534 -2.1307864 -0.6909368 -2.2039807 -2.25712306  
## 3 0.12324737 -1.8074247 0.5282421 2.1895381 -0.3501643 -0.86482780  
## 4 0.12052262 -1.5871801 1.3484199 -0.6533690 -1.4624587 0.05735992  
## 6 0.02507708 -0.1799338 -0.2927196 0.1022083 -1.1865320 -0.33205491  
## 7 -0.12947172 -2.1110343 0.6192677 0.6100455 0.5076608 -1.15093236  
## lda.LD6  
## 1 0.07713504  
## 2 -0.95739192  
## 3 0.98945330  
## 4 0.68346516  
## 6 -1.92543529  
## 7 1.22488997

library(gridExtra)

##   
## Attaching package: 'gridExtra'

## The following object is masked from 'package:dplyr':  
##   
## combine

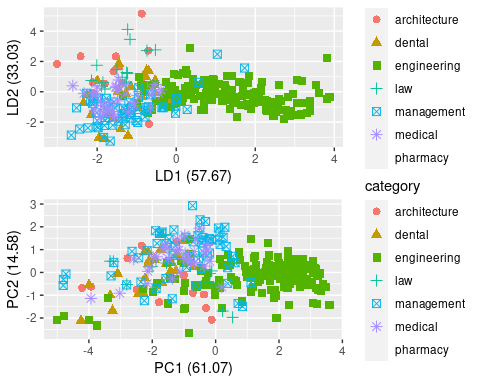
up1 <- ggplot(dataset\_p\_l)+  
 geom\_point(aes(lda.LD1, lda.LD2, colour = category, shape = category), size = 2.5) +   
 labs(x = paste("LD1 (", round(prop.lda[1]\*100,2), ")", sep=""),  
 y = paste("LD2 (", round(prop.lda[2]\*100,2), ")", sep=""))  
  
up2 <- ggplot(dataset\_p\_l) +   
 geom\_point(aes(pca.PC1, pca.PC2, colour = category, shape = category), size = 2.5) +  
 labs(x = paste("PC1 (", round(prop.pca\_u[1]\*100,2), ")", sep=""),  
 y = paste("PC2 (", round(prop.pca\_u[2]\*100,2), ")", sep=""))  
  
grid.arrange(up1, up2)

## Warning: The shape palette can deal with a maximum of 6 discrete values because  
## more than 6 becomes difficult to discriminate; you have 7. Consider  
## specifying shapes manually if you must have them.

## Warning: Removed 60 rows containing missing values (geom\_point).

## Warning: The shape palette can deal with a maximum of 6 discrete values because  
## more than 6 becomes difficult to discriminate; you have 7. Consider  
## specifying shapes manually if you must have them.

## Warning: Removed 60 rows containing missing values (geom\_point).



names(predict(umodel\_lda,trainu))

## [1] "class" "posterior" "x"

head(pred$posterior)

## architecture dental engineering law management medical  
## 1 0.033386155 0.6187214 0.030865620 0.0036124210 0.26530604 0.04644368  
## 2 0.002428615 0.4769854 0.074746619 0.0005215374 0.40513796 0.03967934  
## 3 0.003342475 0.3359865 0.008384560 0.0129884922 0.10138379 0.31296404  
## 4 0.450199868 0.1091861 0.011247908 0.1186098876 0.02624201 0.05583684  
## 6 0.015612796 0.2066689 0.457219951 0.0064874066 0.15250787 0.08796153  
## 7 0.025087853 0.1484475 0.006539798 0.1437978812 0.17717390 0.34187168  
## pharmacy  
## 1 0.0016646964  
## 2 0.0005004825  
## 3 0.2249501882  
## 4 0.2286774209  
## 6 0.0735415718  
## 7 0.1570814246

utrain\_pred <- predict(umodel\_lda,utrain)$class  
utest\_pred <- predict(umodel\_lda,utest)$class  
cal\_err <- function(actual,predicted){  
 mean(actual != predicted)  
}

# Error on train data  
cal\_err(predicted=utrain\_pred, actual=utrain$category)

## [1] 0.3592814

# Error on test data  
cal\_err(predicted=utest\_pred, actual=utest$category)

## [1] 0.3015873

pred\_tab\_1 <-table(predicted = utest\_pred, actual = utest$category)  
pred\_tab\_1

## actual  
## predicted architecture dental engineering law management medical pharmacy  
## architecture 3 0 1 0 1 0 1  
## dental 1 2 0 0 1 3 2  
## engineering 0 0 46 0 3 1 2  
## law 0 0 0 4 0 0 1  
## management 0 3 3 0 15 3 0  
## medical 0 2 0 0 0 3 0  
## pharmacy 2 2 4 2 0 0 15

u\_lda\_accuracy <- (pred\_tab\_1[1,1] +pred\_tab\_1[2, 2] + pred\_tab\_1[3,3] + pred\_tab\_1[4,4] +pred\_tab\_1[5,5]+pred\_tab\_1[6,6]+pred\_tab\_1[7,7]) / sum(pred\_tab\_1)  
u\_lda\_accuracy

## [1] 0.6984127

We got 69.8 % accuracy with the lda model to find the category of university by giving these parameters (tlr,rpc,go,oi,perception)

## PCA

### Correlation

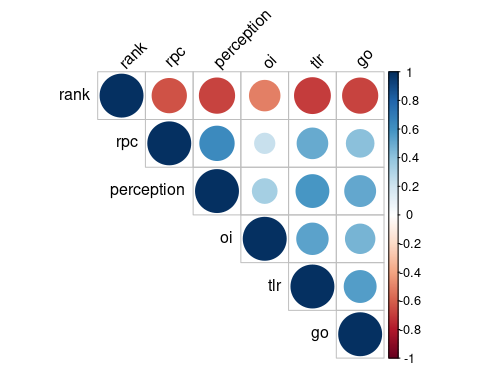
res\_pca = cor(univdata\_num)  
round(res\_pca,2)

## tlr rpc go oi perception rank  
## tlr 1.00 0.51 0.55 0.54 0.58 -0.70  
## rpc 0.51 1.00 0.42 0.22 0.64 -0.64  
## go 0.55 0.42 1.00 0.47 0.52 -0.67  
## oi 0.54 0.22 0.47 1.00 0.33 -0.50  
## perception 0.58 0.64 0.52 0.33 1.00 -0.67  
## rank -0.70 -0.64 -0.67 -0.50 -0.67 1.00

res\_pca

## tlr rpc go oi perception rank  
## tlr 1.0000000 0.5085836 0.5519768 0.5353762 0.5841083 -0.6971153  
## rpc 0.5085836 1.0000000 0.4151417 0.2234212 0.6398205 -0.6377772  
## go 0.5519768 0.4151417 1.0000000 0.4699512 0.5173559 -0.6715505  
## oi 0.5353762 0.2234212 0.4699512 1.0000000 0.3310690 -0.5046141  
## perception 0.5841083 0.6398205 0.5173559 0.3310690 1.0000000 -0.6735481  
## rank -0.6971153 -0.6377772 -0.6715505 -0.5046141 -0.6735481 1.0000000

corrplot(res\_pca, type = "upper", order = "hclust",   
 tl.col = "black", tl.srt = 45)



Compute the sample covariance matrix S

u\_cov.matrix <- cov(univdata\_num)  
sum(diag(u\_cov.matrix))

## [1] 4475.236

u\_cov.matrix

## tlr rpc go oi perception rank  
## tlr 122.72711 114.21422 93.50419 56.29662 163.94862 -421.2805  
## rpc 114.21422 410.93683 128.68382 42.98975 328.61686 -705.2660  
## go 93.50419 128.68382 233.81909 68.20964 200.43500 -560.1639  
## oi 56.29662 42.98975 68.20964 90.09611 79.61882 -261.2816  
## perception 163.94862 328.61686 200.43500 79.61882 641.93092 -930.9133  
## rank -421.28050 -705.26603 -560.16388 -261.28164 -930.91329 2975.7257

# Computing Eigen Values and normalized eigen vectors  
u\_eig\_val <- eigen(u\_cov.matrix)  
u\_eig\_val$values# EIGEN VALUES

## [1] 3692.44136 358.74038 186.03252 122.56171 73.23953 42.22031

u\_eig\_val$vectors # EIGEN VECTORS

## [,1] [,2] [,3] [,4] [,5] [,6]  
## [1,] -0.13279544 0.03335027 0.08479980 0.1677323 -0.63454923 0.73707209  
## [2,] -0.23524800 0.46614576 -0.79595005 0.2893940 -0.05426678 -0.08447642  
## [3,] -0.17616249 -0.04216059 0.31315312 0.8631125 0.35017824 0.03919649  
## [4,] -0.07965636 -0.07907362 0.17526113 0.2224571 -0.67997651 -0.66695619  
## [5,] -0.31720382 0.78642866 0.47746279 -0.2177205 0.05084656 -0.05434499  
## [6,] 0.88827199 0.39382191 0.05020409 0.2150916 -0.08260855 0.01637574

names(univdata\_num)

## [1] "tlr" "rpc" "go" "oi" "perception"  
## [6] "rank"

eigen(cor(univdata\_num))$vectors

## [,1] [,2] [,3] [,4] [,5] [,6]  
## [1,] -0.4327566 0.13774047 -0.30408126 0.764413619 0.2431633 -0.24047307  
## [2,] -0.3821868 -0.55559474 -0.23608217 -0.446535965 0.4493462 -0.29699582  
## [3,] -0.4027919 0.20666812 0.82795103 -0.060424380 0.0792979 -0.31560226  
## [4,] -0.3278044 0.71166685 -0.39212309 -0.459281765 -0.1181817 -0.08606604  
## [5,] -0.4199881 -0.34902334 -0.06319306 0.040757255 -0.8309791 -0.07491250  
## [6,] 0.4696465 0.03665149 -0.09242843 0.005045033 -0.1678636 -0.86101229

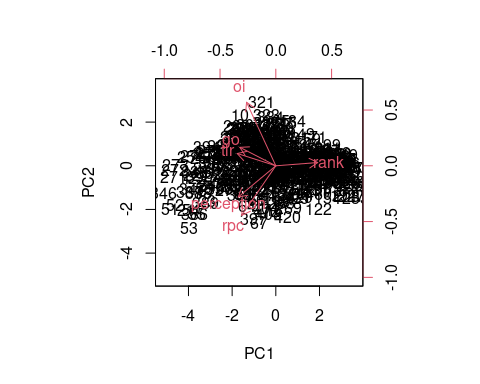
comp\_u <- prcomp(univdata\_num,scale=TRUE,center=TRUE)  
comp\_u

## Standard deviations (1, .., p=6):  
## [1] 1.9214217 0.9366513 0.7012929 0.6034482 0.5871554 0.4796978  
##   
## Rotation (n x k) = (6 x 6):  
## PC1 PC2 PC3 PC4 PC5  
## tlr -0.4327566 0.13774047 -0.30408126 0.764413619 -0.2431633  
## rpc -0.3821868 -0.55559474 -0.23608217 -0.446535965 -0.4493462  
## go -0.4027919 0.20666812 0.82795103 -0.060424380 -0.0792979  
## oi -0.3278044 0.71166685 -0.39212309 -0.459281765 0.1181817  
## perception -0.4199881 -0.34902334 -0.06319306 0.040757255 0.8309791  
## rank 0.4696465 0.03665149 -0.09242843 0.005045033 0.1678636  
## PC6  
## tlr -0.24047307  
## rpc -0.29699582  
## go -0.31560226  
## oi -0.08606604  
## perception -0.07491250  
## rank -0.86101229

summary(comp\_u)

## Importance of components:  
## PC1 PC2 PC3 PC4 PC5 PC6  
## Standard deviation 1.9214 0.9367 0.70129 0.60345 0.58716 0.47970  
## Proportion of Variance 0.6153 0.1462 0.08197 0.06069 0.05746 0.03835  
## Cumulative Proportion 0.6153 0.7615 0.84350 0.90419 0.96165 1.00000

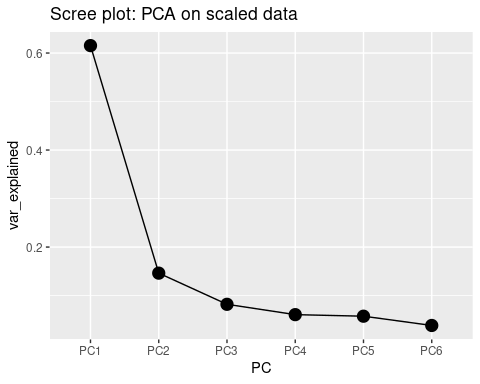
biplot(comp\_u, scale = 0)



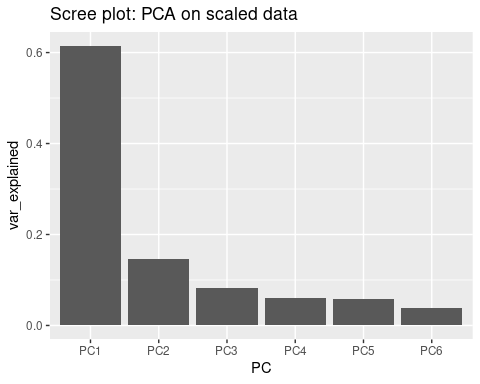
var\_explained\_df <- data.frame(PC= paste0("PC",1:6),  
 var\_explained=(comp\_u$sdev)^2/sum((comp\_u$sdev)^2))  
   
head(var\_explained\_df)

## PC var\_explained  
## 1 PC1 0.61531025  
## 2 PC2 0.14621927  
## 3 PC3 0.08196862  
## 4 PC4 0.06069163  
## 5 PC5 0.05745858  
## 6 PC6 0.03835166

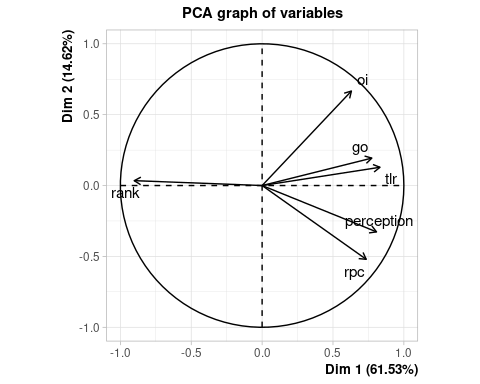
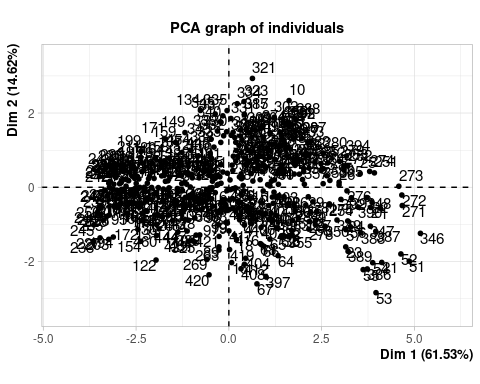
var\_explained\_df %>%  
 ggplot(aes(x=PC,y=var\_explained, group=1))+  
 geom\_point(size=4)+  
 geom\_line()+  
 labs(title="Scree plot: PCA on scaled data")



var\_explained\_df %>%  
 ggplot(aes(x=PC,y=var\_explained))+  
 geom\_col()+  
 labs(title="Scree plot: PCA on scaled data")

 the first two components covers around 76% of data

library("FactoMineR")  
comp\_u.pca <- PCA(univdata\_num, scale.unit = TRUE, ncp = 2, graph = TRUE)



library("factoextra")

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

eig.val <- get\_eigenvalue(comp\_u.pca)  
eig.val

## eigenvalue variance.percent cumulative.variance.percent  
## Dim.1 3.6918615 61.531025 61.53102  
## Dim.2 0.8773156 14.621927 76.15295  
## Dim.3 0.4918117 8.196862 84.34981  
## Dim.4 0.3641498 6.069163 90.41898  
## Dim.5 0.3447515 5.745858 96.16483  
## Dim.6 0.2301100 3.835166 100.00000

ind <- get\_pca\_ind(comp\_u.pca)  
ind

## Principal Component Analysis Results for individuals  
## ===================================================  
## Name Description   
## 1 "$coord" "Coordinates for the individuals"   
## 2 "$cos2" "Cos2 for the individuals"   
## 3 "$contrib" "contributions of the individuals"

# Coordinates of individuals  
head(ind$coord,10)

## Dim.1 Dim.2  
## 1 4.083273 -0.5660386  
## 2 3.817784 -0.5435668  
## 3 2.663348 0.6551232  
## 4 2.373923 -0.6607819  
## 5 2.643267 0.3092898  
## 6 1.699283 -1.2842237  
## 7 2.214261 1.2399462  
## 8 1.692726 -1.1620634  
## 9 1.746095 1.3040965  
## 10 1.622337 2.3352756

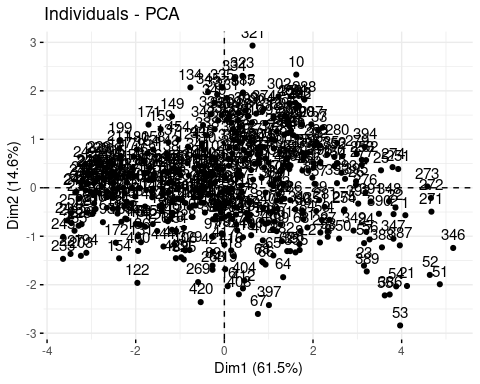
# Quality of individuals  
head(ind$cos2,10)

## Dim.1 Dim.2  
## 1 0.8746262 0.016807290  
## 2 0.8209100 0.016640973  
## 3 0.7579553 0.045859971  
## 4 0.8146303 0.063116620  
## 5 0.5632616 0.007711862  
## 6 0.5338836 0.304927522  
## 7 0.6767063 0.212201444  
## 8 0.3081801 0.145241483  
## 9 0.4707642 0.262595308  
## 10 0.2639801 0.546972445

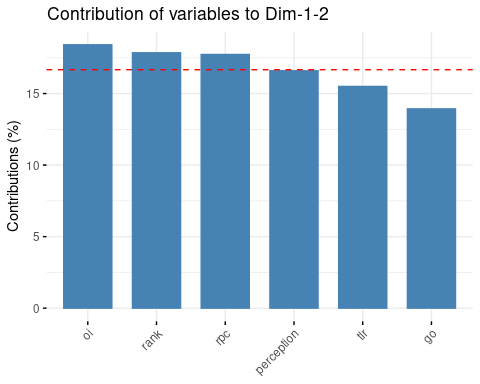
# Contributions of individuals  
head(ind$contrib,10)

## Dim.1 Dim.2  
## 1 0.9817789 0.07939231  
## 2 0.8582610 0.07321366  
## 3 0.4176885 0.10634872  
## 4 0.3318409 0.10819386  
## 5 0.4114137 0.02370377  
## 6 0.1700310 0.40866522  
## 7 0.2887050 0.38097107  
## 8 0.1687215 0.33461545  
## 9 0.1795282 0.42141092  
## 10 0.1549811 1.35133368

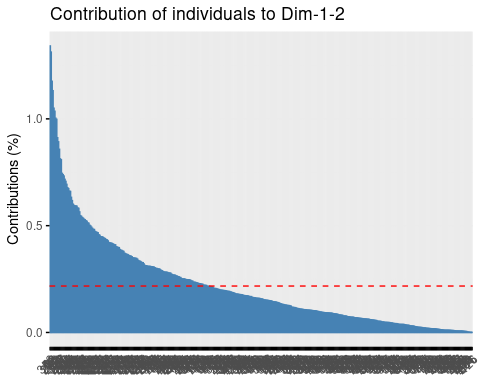
fviz\_pca\_ind(comp\_u.pca)



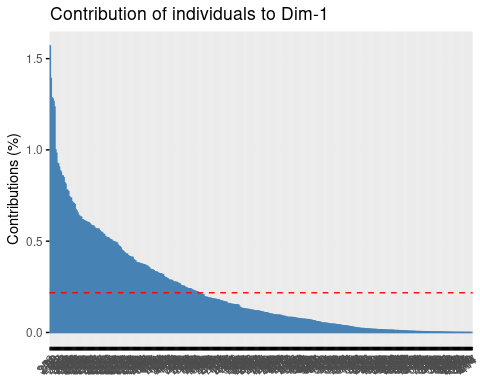
fviz\_contrib(comp\_u.pca,choice="var", axes = 1:2)



fviz\_contrib(comp\_u.pca,choice="ind", axes = 1:2)



fviz\_contrib(comp\_u.pca,choice="ind", axes = 1)



univdata$PC1Scores <- comp\_u$x[,1] #Adding the column to the main data frame  
final2 =univdata[order(univdata$PC1Scores),]#Arranging them in Descneding order  
head(final2)

## institute\_id name tlr rpc go  
## 346 IR-D-N-15 All India Institute of Medical Sciences 92.69 96.57 83.25  
## 51 IR-E-U-0456 Indian Institute of Technology Madras 95.42 94.64 83.90  
## 271 IR-M-S-8890 Indian Institute of Management Ahmedabad 92.87 63.06 98.46  
## 272 IR-M-S-8903 Indian Institute of Management Bangalore 91.46 57.43 98.48  
## 52 IR-E-I-1074 Indian Institute of Technology Delhi 90.79 96.15 80.36  
## 273 IR-M-S-8972 Indian Institute of Management Calcutta 90.68 56.79 97.18  
## oi perception city state rank category PC1Scores  
## 346 72.56 100.00 New Delhi Delhi 1 medical -5.157108  
## 51 61.31 100.00 Chennai Tamil Nadu 1 engineering -4.855966  
## 271 66.78 95.99 Ahmedabad Gujarat 1 management -4.666933  
## 272 69.45 100.00 Bengaluru Karnataka 2 management -4.656307  
## 52 64.81 94.46 New Delhi Delhi 2 engineering -4.630750  
## 273 71.85 95.26 Kolkata West Bengal 3 management -4.575230

#final2[,"name", drop=FALSE]

The new Rankings based on the pca score