LCA(Latent Class Analysis) with variables age, admission type (elective or emergency) and morbiditiy composition of each patient

```
library(RPostgreSQL)
```

```
## Loading required package: DBI
```

```
library(poLCA)
```

```
## Loading required package: scatterplot3d
```

```
## Loading required package: MASS
```

Establish connection to database in PostgreSQL

```
#Establish connection to database in PostgreSQL
conn <- dbConnect(drv="PostgreSQL",
                  dbname="mimic",
                  host= "localhost",
                  user="postgres")
```

Query* to select necessary variables -

Assuming create_elixhauser, create_patient_info, and create_elixhauser_final have been run in database already,

```
# *Assuming create_elixhauser and #create_patient_info
# *and create_elixhauser_final
# *have been run in database already
# Query* to select elixhauser_final -

query <- "SELECT age, admission_type_encoded, congestive_heart_failure,
                    cardiac_arrhythmias, valvular_disease,
                    pulmonary_circulation,
                    peripheral_vascular, hypertension,
                    paralysis,
                    other_neurological,
                    chronic_pulmonary,
                    diabetes_uncomplicated,
                    diabetes_complicated, hypothyroidism,
                    renal_failure,
                    liver_disease,
                    peptic_ulcer,
                    aids,
                    lymphoma,
                    solid_tumor,
                    rheumatoid_arthritis,
                    coagulopathy,
                    obesity,
                    weight_loss,
                    fluid_electrolyte,
                    blood_loss_anemia,
```

```
                      deficiency_anemias,
                      alcohol_abuse,
                      drug_abuse,
                      psychoses,
                      depression FROM ELIXHAUSER_FINAL;"
```

Store query results

```
final_table <- dbGetQuery(conn, query)
```

Factor all variables for LCA (poLCA requires factored data)

```
final_table$age <- as.factor(final_table$age)
final_table$admission_type_encoded <- as.factor(

final_table$admission_type_encoded)
comorbidity_columns <- c(
  "congestive_heart_failure",
  "cardiac_arrhythmias",
  "valvular_disease",
  "pulmonary_circulation",
  "peripheral_vascular",
  "hypertension",
  "paralysis",
  "other_neurological",
  "chronic_pulmonary",
  "diabetes_uncomplicated",
  "diabetes_complicated",
  "hypothyroidism",
  "renal_failure",
  "liver_disease",
  "peptic_ulcer",
  "aids",
  "lymphoma",
  "solid_tumor",
  "rheumatoid_arthritis",
  "coagulopathy",
  "obesity",
  "weight_loss",
  "fluid_electrolyte",
  "blood_loss_anemia",
  "deficiency_anemias",
  "alcohol_abuse",
  "drug_abuse",
  "psychoses",
  "depression"
)


final_table[comorbidity_columns] <- lapply(
                              final_table[comorbidity_columns], as.factor)
```

Define formula for running LCA with poLCA, cbind creates matrix with observed variables, and "~1" indicates 1 latent class being created

```
lca_formula <- cbind(age, admission_type_encoded, congestive_heart_failure,
                     cardiac_arrhythmias, valvular_disease,
                     pulmonary_circulation,
                     peripheral_vascular, hypertension,
                     paralysis,
                     other_neurological,
                     chronic_pulmonary,
                     diabetes_uncomplicated,
                     diabetes_complicated, hypothyroidism,
                     renal_failure,
                     liver_disease,
                     peptic_ulcer,
                     aids,
                     lymphoma,
                     solid_tumor,
                     rheumatoid_arthritis,
                     coagulopathy,
                     obesity,
                     weight_loss,
                     fluid_electrolyte,
                     blood_loss_anemia,
                     deficiency_anemias,
                     alcohol_abuse,
                     drug_abuse,
                     psychoses,
                     depression) ~1
```

Run LCA model, we are using 5 Latent classes to model the data here

```
lca_out <- poLCA(lca_formula, data=final_table, nclass=5, graph=TRUE)
```


```
## Conditional item response (column) probabilities,
##  by outcome variable, for each class (row)
##
## $age
##               16     17     18     19     20     21     22     23     24     25
## class 1:  0.0000 0.0000 0.0000 0.0011 0.0014 0.0000 0.0021 0.0013 0.0026 0.0031
## class 2:  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0002 0.0007 0.0002
## class 3:  0.0000 0.0000 0.0000 0.0002 0.0008 0.0000 0.0003 0.0000 0.0003 0.0004
## class 4:  0.0037 0.0106 0.0206 0.0223 0.0242 0.0273 0.0273 0.0262 0.0213 0.0238
## class 5:  0.0000 0.0000 0.0000 0.0000 0.0000 0.0013 0.0000 0.0005 0.0000 0.0005
##               26     27     28     29     30     31     32     33     34     35
## class 1:  0.0019 0.0020 0.0040 0.0043 0.0060 0.0041 0.0030 0.0049 0.0062 0.0071
## class 2:  0.0002 0.0003 0.0006 0.0003 0.0005 0.0009 0.0017 0.0017 0.0024 0.0023
## class 3:  0.0003 0.0000 0.0011 0.0000 0.0000 0.0000 0.0000 0.0004 0.0014 0.0009
## class 4:  0.0236 0.0201 0.0210 0.0214 0.0184 0.0179 0.0235 0.0234 0.0181 0.0171
## class 5:  0.0005 0.0000 0.0000 0.0003 0.0000 0.0000 0.0000 0.0005 0.0000 0.0006
##               36     37     38     39     40     41     42     43     44     45
## class 1:  0.0093 0.0081 0.0146 0.0168 0.0132 0.0160 0.0226 0.0176 0.0268 0.0259
## class 2:  0.0016 0.0040 0.0031 0.0045 0.0050 0.0059 0.0059 0.0075 0.0091 0.0089
## class 3:  0.0012 0.0008 0.0014 0.0019 0.0014 0.0020 0.0014 0.0010 0.0039 0.0030
## class 4:  0.0211 0.0227 0.0205 0.0212 0.0276 0.0236 0.0207 0.0247 0.0246 0.0284
## class 5:  0.0000 0.0008 0.0000 0.0001 0.0000 0.0000 0.0008 0.0008 0.0000 0.0000
##               46     47     48     49     50     51     52     53     54     55
## class 1:  0.0259 0.0258 0.0310 0.0314 0.0337 0.0412 0.0335 0.0357 0.0334 0.0377
## class 2:  0.0097 0.0120 0.0134 0.0158 0.0159 0.0168 0.0186 0.0215 0.0246 0.0240
## class 3:  0.0036 0.0050 0.0052 0.0053 0.0052 0.0067 0.0052 0.0122 0.0119 0.0099
```

```
## class 4:  0.0265 0.0247 0.0230 0.0222 0.0265 0.0204 0.0262 0.0199 0.0150 0.0192
## class 5:  0.0022 0.0000 0.0004 0.0000 0.0000 0.0000 0.0017 0.0010 0.0005 0.0009
##               56     57     58     59     60     61     62     63     64     65
## class 1:  0.0318 0.0289 0.0328 0.0302 0.0352 0.0263 0.0276 0.0256 0.0214 0.0195
## class 2:  0.0254 0.0292 0.0332 0.0321 0.0325 0.0335 0.0311 0.0331 0.0345 0.0332
## class 3:  0.0105 0.0154 0.0124 0.0143 0.0170 0.0169 0.0200 0.0168 0.0189 0.0255
## class 4:  0.0155 0.0168 0.0120 0.0100 0.0124 0.0086 0.0068 0.0064 0.0006 0.0089
## class 5:  0.0053 0.0047 0.0039 0.0060 0.0047 0.0072 0.0102 0.0103 0.0130 0.0083
##               66     67     68     69     70     71     72     73     74     75
## class 1:  0.0178 0.0178 0.0196 0.0204 0.0124 0.0080 0.0129 0.0076 0.0093 0.0049
## class 2:  0.0349 0.0328 0.0316 0.0337 0.0296 0.0276 0.0299 0.0249 0.0239 0.0243
## class 3:  0.0234 0.0215 0.0310 0.0263 0.0278 0.0270 0.0305 0.0314 0.0281 0.0339
## class 4:  0.0066 0.0042 0.0000 0.0003 0.0019 0.0009 0.0006 0.0024 0.0000 0.0013
## class 5:  0.0126 0.0121 0.0182 0.0158 0.0145 0.0252 0.0207 0.0208 0.0289 0.0292
##               76     77     78     79     80     81     82     83     84     85
## class 1:  0.0048 0.0029 0.0051 0.0070 0.0058 0.0029 0.0006 0.0014 0.0018 0.0000
## class 2:  0.0249 0.0246 0.0214 0.0175 0.0152 0.0106 0.0101 0.0097 0.0038 0.0056
## class 3:  0.0318 0.0377 0.0286 0.0281 0.0377 0.0349 0.0328 0.0358 0.0321 0.0238
## class 4:  0.0000 0.0027 0.0008 0.0004 0.0000 0.0016 0.0003 0.0019 0.0005 0.0014
## class 5:  0.0350 0.0353 0.0439 0.0405 0.0429 0.0488 0.0446 0.0446 0.0516 0.0406
##               86     87     88    89     90
## class 1:  0.0000 0.0005 0.0000 0e+00 0.0017
## class 2:  0.0034 0.0012 0.0018 0e+00 0.0000
## class 3:  0.0222 0.0188 0.0153 2e-04 0.0779
## class 4:  0.0006 0.0004 0.0000 0e+00 0.0026
## class 5:  0.0470 0.0360 0.0366 0e+00 0.1676
##
## $admission_type_encoded
##                0      1
## class 1:  0.0332 0.9668
## class 2:  0.3444 0.6556
## class 3:  0.1523 0.8477
## class 4:  0.0875 0.9125
## class 5:  0.0663 0.9337
##
## $congestive_heart_failure
##                0      1
## class 1:  0.8839 0.1161
## class 2:  0.8992 0.1008
## class 3:  0.2927 0.7073
## class 4:  0.9754 0.0246
## class 5:  0.6429 0.3571
##
## $cardiac_arrhythmias
##                0      1
## class 1:  0.8453 0.1547
## class 2:  0.7394 0.2606
## class 3:  0.3719 0.6281
## class 4:  0.9194 0.0806
## class 5:  0.4518 0.5482
##
## $valvular_disease
##                0      1
## class 1:  0.9734 0.0266
```

```
## class 2:  0.9219 0.0781
## class 3:  0.6859 0.3141
## class 4:  0.9843 0.0157
## class 5:  0.8598 0.1402
##
## $pulmonary_circulation
##                0      1
## class 1:  0.9611 0.0389
## class 2:  0.9815 0.0185
## class 3:  0.6938 0.3062
## class 4:  0.9768 0.0232
## class 5:  0.9952 0.0048
##
## $peripheral_vascular
##                0      1
## class 1:  0.9710 0.0290
## class 2:  0.9212 0.0788
## class 3:  0.8242 0.1758
## class 4:  0.9883 0.0117
## class 5:  0.9168 0.0832
##
## $hypertension
##                0      1
## class 1:  0.5677 0.4323
## class 2:  0.3354 0.6646
## class 3:  0.3040 0.6960
## class 4:  0.9580 0.0420
## class 5:  0.3449 0.6551
##
## $paralysis
##                0      1
## class 1:  0.9695 0.0305
## class 2:  0.9791 0.0209
## class 3:  0.9882 0.0118
## class 4:  0.9719 0.0281
## class 5:  0.9593 0.0407
##
## $other_neurological
##                0      1
## class 1:  0.8201 0.1799
## class 2:  0.9399 0.0601
## class 3:  0.9266 0.0734
## class 4:  0.8844 0.1156
## class 5:  0.8749 0.1251
##
## $chronic_pulmonary
##                0      1
## class 1:  0.8304 0.1696
## class 2:  0.8360 0.1640
## class 3:  0.4252 0.5748
## class 4:  0.9235 0.0765
## class 5:  0.8687 0.1313
##
## $diabetes_uncomplicated
```

```
##                0      1
## class 1:  0.8327 0.1673
## class 2:  0.7490 0.2510
## class 3:  0.7469 0.2531
## class 4:  0.9899 0.0101
## class 5:  0.7864 0.2136
##
## $diabetes_complicated
##                0      1
## class 1:  0.9454 0.0546
## class 2:  0.9520 0.0480
## class 3:  0.8442 0.1558
## class 4:  0.9897 0.0103
## class 5:  0.9654 0.0346
##
## $hypothyroidism
##                0      1
## class 1:  0.9307 0.0693
## class 2:  0.9154 0.0846
## class 3:  0.8575 0.1425
## class 4:  0.9738 0.0262
## class 5:  0.8593 0.1407
##
## $renal_failure
##                0      1
## class 1:  0.8906 0.1094
## class 2:  0.9434 0.0566
## class 3:  0.6535 0.3465
## class 4:  0.9980 0.0020
## class 5:  0.8380 0.1620
##
## $liver_disease
##                0      1
## class 1:  0.5381 0.4619
## class 2:  0.9819 0.0181
## class 3:  0.9381 0.0619
## class 4:  0.9480 0.0520
## class 5:  0.9745 0.0255
##
## $peptic_ulcer
##                0      1
## class 1:  0.9823 0.0177
## class 2:  0.9942 0.0058
## class 3:  0.9935 0.0065
## class 4:  0.9976 0.0024
## class 5:  0.9888 0.0112
##
## $aids
##                0      1
## class 1:  0.9702 0.0298
## class 2:  0.9994 0.0006
## class 3:  0.9985 0.0015
## class 4:  0.9924 0.0076
## class 5:  1.0000 0.0000
```

```
##
## $lymphoma
##                0      1
## class 1:  0.9804 0.0196
## class 2:  0.9919 0.0081
## class 3:  0.9864 0.0136
## class 4:  0.9933 0.0067
## class 5:  0.9817 0.0183
##
## $solid_tumor
##                0      1
## class 1:  0.9468 0.0532
## class 2:  0.9765 0.0235
## class 3:  0.9818 0.0182
## class 4:  0.9937 0.0063
## class 5:  0.9596 0.0404
##
## $rheumatoid_arthritis
##                0      1
## class 1:  0.9705 0.0295
## class 2:  0.9744 0.0256
## class 3:  0.9493 0.0507
## class 4:  0.9900 0.0100
## class 5:  0.9606 0.0394
##
## $coagulopathy
##                0      1
## class 1:  0.6746 0.3254
## class 2:  0.9710 0.0290
## class 3:  0.8602 0.1398
## class 4:  0.9644 0.0356
## class 5:  0.8980 0.1020
##
## $obesity
##                0      1
## class 1:  0.9458 0.0542
## class 2:  0.9213 0.0787
## class 3:  0.8925 0.1075
## class 4:  0.9848 0.0152
## class 5:  1.0000 0.0000
##
## $weight_loss
##                0      1
## class 1:  0.8929 0.1071
## class 2:  0.9955 0.0045
## class 3:  0.9609 0.0391
## class 4:  0.9825 0.0175
## class 5:  0.9457 0.0543
##
## $fluid_electrolyte
##                0      1
## class 1:  0.4486 0.5514
## class 2:  0.8735 0.1265
## class 3:  0.6268 0.3732
```

```
## class 4:  0.8201 0.1799
## class 5:  0.6531 0.3469
##
## $blood_loss_anemia
##                0      1
## class 1:  0.9646 0.0354
## class 2:  0.9903 0.0097
## class 3:  0.9746 0.0254
## class 4:  0.9919 0.0081
## class 5:  0.9759 0.0241
##
## $deficiency_anemias
##                0      1
## class 1:  0.9628 0.0372
## class 2:  0.9909 0.0091
## class 3:  0.9512 0.0488
## class 4:  0.9787 0.0213
## class 5:  0.9711 0.0289
##
## $alcohol_abuse
##                0      1
## class 1:  0.6387 0.3613
## class 2:  0.9773 0.0227
## class 3:  0.9684 0.0316
## class 4:  0.8508 0.1492
## class 5:  0.9954 0.0046
##
## $drug_abuse
##                0      1
## class 1:  0.8727 0.1273
## class 2:  0.9917 0.0083
## class 3:  0.9828 0.0172
## class 4:  0.8860 0.1140
## class 5:  0.9960 0.0040
##
## $psychoses
##                0      1
## class 1:  0.9662 0.0338
## class 2:  0.9911 0.0089
## class 3:  0.9846 0.0154
## class 4:  0.9807 0.0193
## class 5:  0.9890 0.0110
##
## $depression
##                0      1
## class 1:  0.8211 0.1789
## class 2:  0.9391 0.0609
## class 3:  0.8966 0.1034
## class 4:  0.8845 0.1155
## class 5:  0.9383 0.0617
##
## Estimated class population shares
##  0.1314 0.3218 0.1377 0.1652 0.244
##
```

```
## Predicted class memberships (by modal posterior prob.)
##  0.1204 0.3396 0.1189 0.1687 0.2525
##
## =========================================================
## Fit for 5 latent classes:
## =========================================================
## number of observations: 37305
## number of estimated parameters: 524
## residual degrees of freedom: 36781
## maximum log-likelihood: -452518.6
##
## AIC(5): 906085.3
## BIC(5): 910553.4
## G^2(5): 184065.2 (Likelihood ratio/deviance statistic)
## X^2(5): 23106627763 (Chi-square goodness of fit)
##
## ALERT: iterations finished, MAXIMUM LIKELIHOOD NOT FOUND
##
```

```
dbDisconnect(conn)
```

```
## [1] TRUE
```