Assignment 9

Concrete slump test data set to group the similar slump, flow and compressive strength values from the amount of ingredients.

There are 7 attributes in the dataset: (component kg in one cubic-meter [m³] concrete): Cement,Slag,Fly ash,Water,SP,Coarse Aggr,Fine Aggr.


SLUMP (cm)
FLOW (cm)
28-day Compressive Strength (Mpa)

→

```
> concrete_slump <- read.csv(file.choose(), header = TRUE, sep = ",")
> summary(concrete_slump)
      NO               Cement          Slag          Fly.ash          Water
SP
 Min.   :  1.0   Min.   :137.0   Min.   :  0.00   Min.   :  0.0   Min.   :160
.0   Min.   : 4.40
 1st Qu.: 26.5   1st Qu.:152.0   1st Qu.:  0.05   1st Qu.:115.5   1st Qu.:180
.0   1st Qu.: 6.00
 Median : 52.0   Median :248.0   Median :100.00   Median :164.0   Median :196
.0   Median : 8.00
 Mean   : 52.0   Mean   :229.9   Mean   : 77.97   Mean   :149.0   Mean   :197
.2   Mean   : 8.54
 3rd Qu.: 77.5   3rd Qu.:303.9   3rd Qu.:125.00   3rd Qu.:235.9   3rd Qu.:209
.5   3rd Qu.:10.00
 Max.   :103.0   Max.   :374.0   Max.   :193.00   Max.   :260.0   Max.   :240
.0   Max.   :19.00
  Coarse.Aggr.      Fine.Aggr.       SLUMP.cm.        FLOW.cm.       Compressive
.Strength..28.day..Mpa.
 Min.   : 708.0   Min.   :640.6   Min.   : 0.00   Min.   :20.00   Min.   :17.
19
 1st Qu.: 819.5   1st Qu.:684.5   1st Qu.:14.50   1st Qu.:38.50   1st Qu.:30.
90
 Median : 879.0   Median :742.7   Median :21.50   Median :54.00   Median :35.
52
 Mean   : 884.0   Mean   :739.6   Mean   :18.05   Mean   :49.61   Mean   :36.
04
 3rd Qu.: 952.8   3rd Qu.:788.0   3rd Qu.:24.00   3rd Qu.:63.75   3rd Qu.:41.
20
 Max.   :1049.9   Max.   :902.0   Max.   :29.00   Max.   :78.00   Max.   :58.
53
```

```
> X = concrete_slump[,c(2,3,4,5,6,7,8)]
> class.slump = concrete_slump[,c(9)]
> class.flow = concrete_slump[,c(10)]
> class.cmpstr = concrete_slump[,c(11)]
```



```
> clPairs(X, class.slump)
Warning message:
In clPairs(X, class.slump) : more colors needed
> clPairs(X, class.flow)
Warning message:
In clPairs(X, class.flow) : more colors needed
```

```
> clPairs(X, class.cmpstr)
Warning message:
In clPairs(X, class.cmpstr) : more colors needed
```
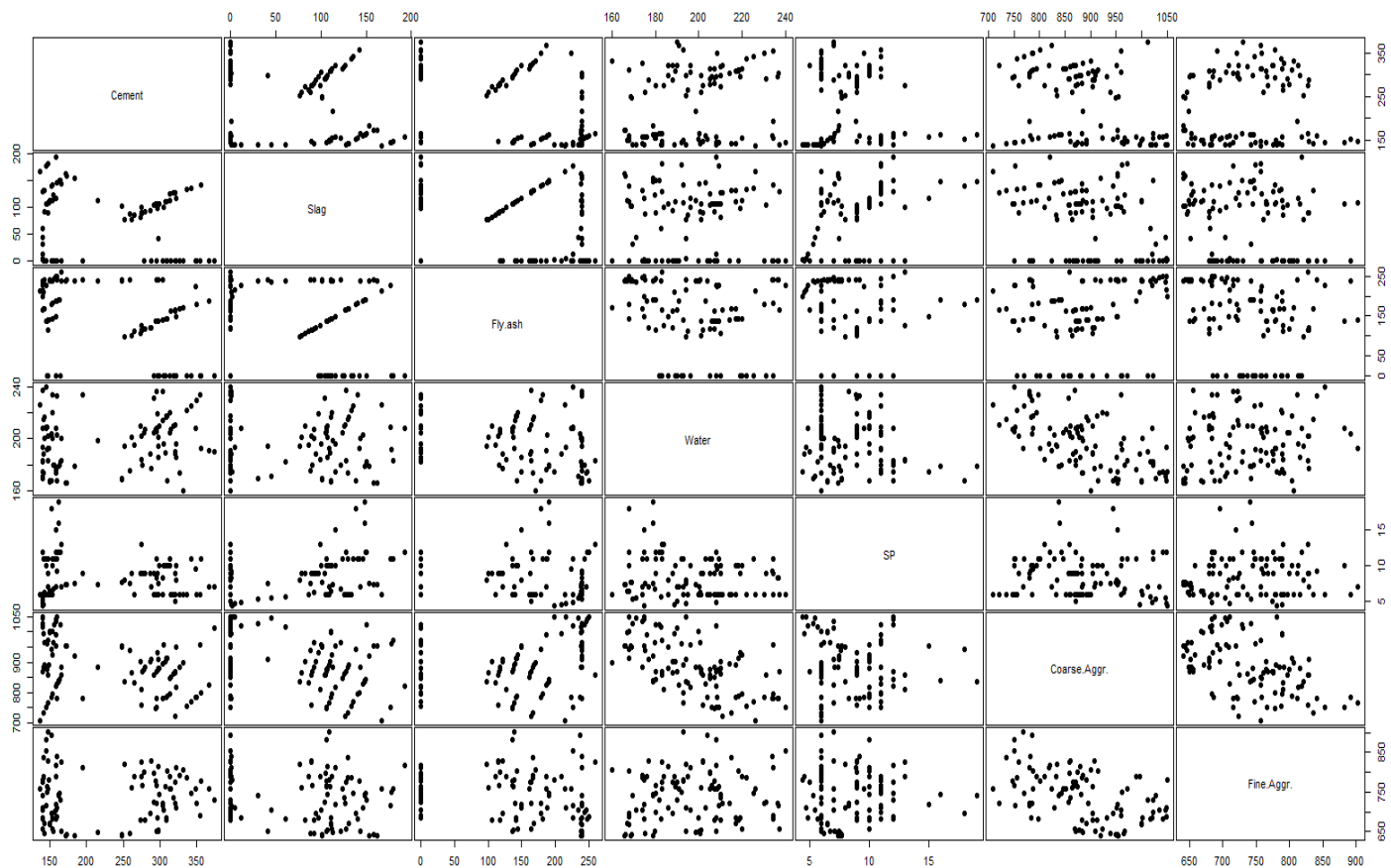


```
> fit <- Mclust(X)
fitting ...
  |===============================================================
====================| 100%
> fit
'Mclust' model object:
 best model: ellipsoidal, equal shape (VEV) with 8 components


> summary(fit)
----------------------------------------------------------
Gaussian finite mixture model fitted by EM algorithm
----------------------------------------------------------

Mclust VEV (ellipsoidal, equal shape) model with 8 components:

 log.likelihood    n  df      BIC       ICL
      -2237.736  103 245  -5610.98  -5610.982

Clustering table:
  1  2  3  4  5  6  7  8
 35  5 11 20  7  6  6 13
```
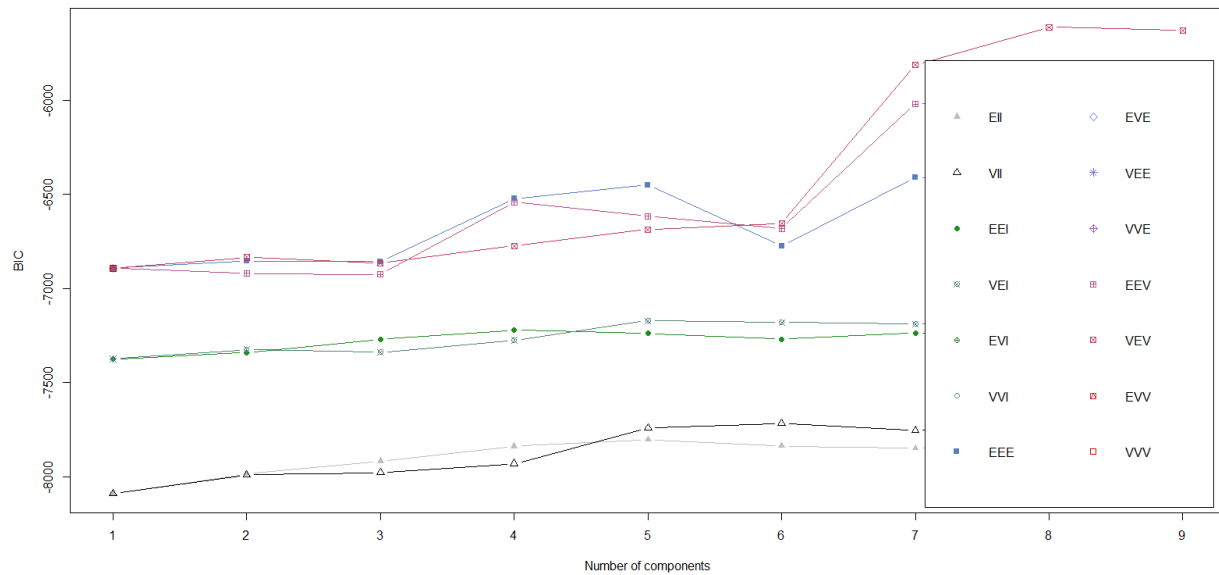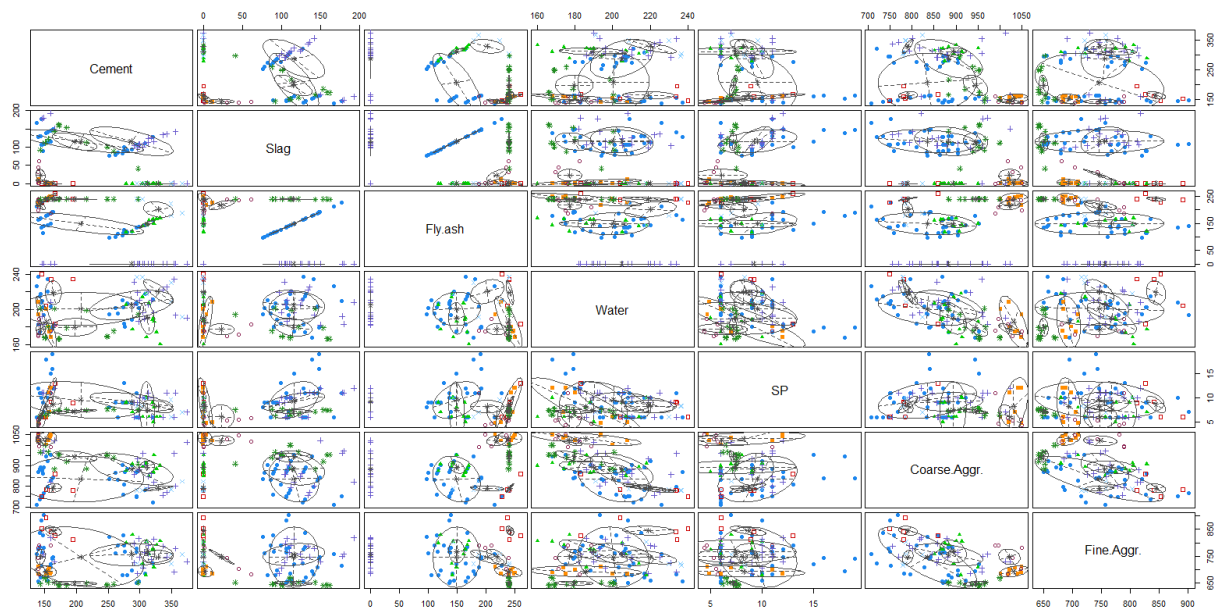
BIC Value is low, which is good indicator for model fit. Also from the result we can see that there are 8 cluster present in the data.
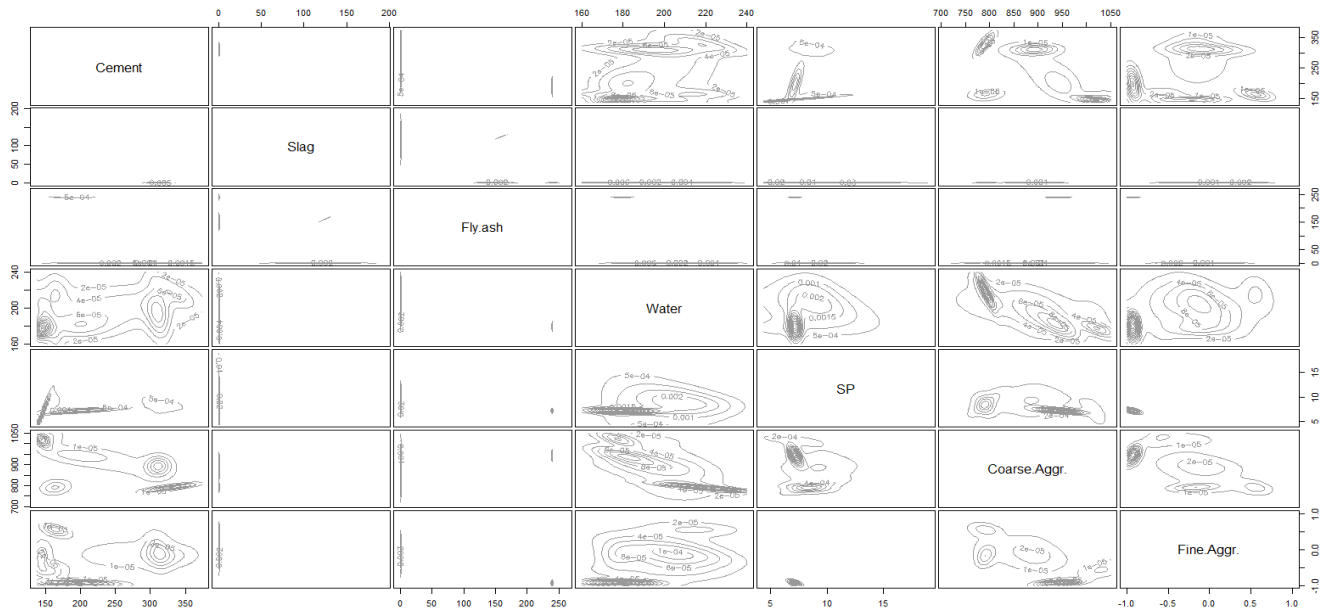
```
> plot(fit, what = "BIC")
```



```
> plot(fit, what = "classification")
```
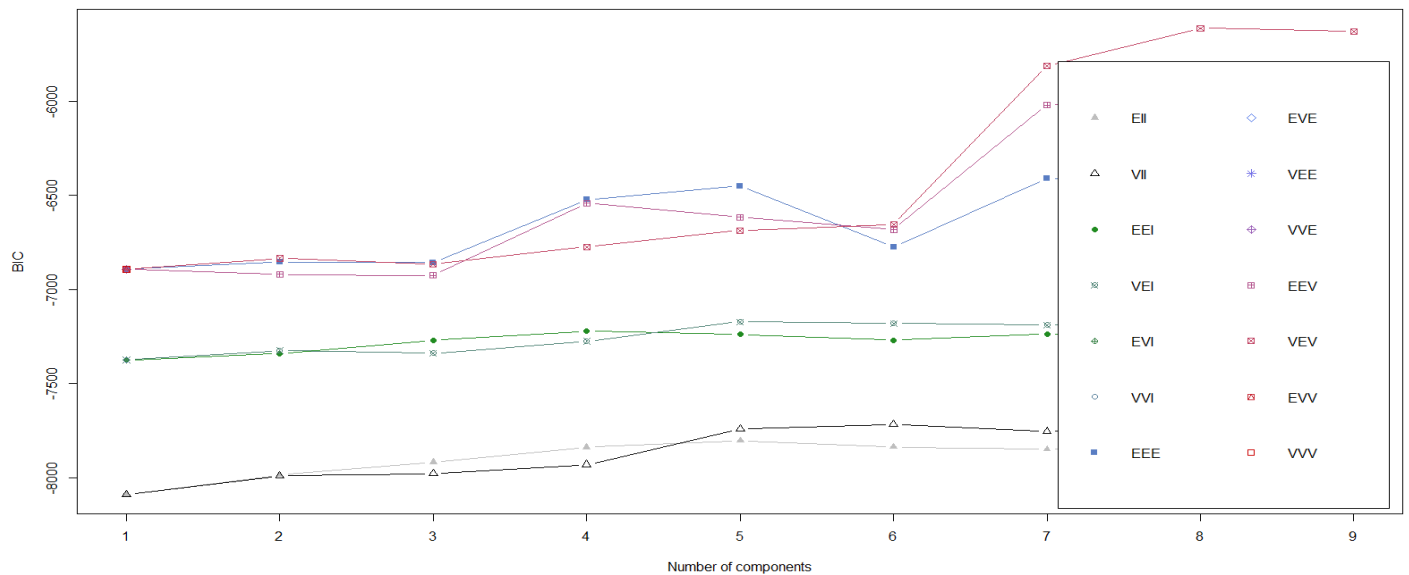


```
> plot(fit, what = "density")
```

```
> BIC = mclustBIC(X)
fitting ...
  |================================================================
====================| 100%
>
> summary(BIC)
Best BIC values:
            VEV,8        VEV,9        VEV,7
BIC      -5610.98 -5628.63526 -5813.4516
BIC diff     0.00   -17.65503  -202.4714

> plot(BIC)
```

```
> summary(ICL)
Best ICL values:
                VEV,8        VEV,9        VEV,7
ICL        -5610.982 -5628.64047 -5813.4564
ICL diff       0.000   -17.65851  -202.4745
```