FinalExam

Sandeep More

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Final Exam

Segmenting Consumers of Bath Soap

Data preprocessing

Load given data

Data preprocessing

- Clean the data by removing % symbols

Split the data

Split the data into two categories

- Demographics & Posession - updated annualy
- Purchase summary - Update monthly

Problem 1

Use k-means clustering to identify clusters of households based on given criteria

Purchase behavior (including brand loyalty)

For this problem the data we need is available as Variable Type = "Purchase summary over the period", which contins detaila about number of brands and how the consumer habits were regarding a specific brand and other brands.

Now, to measure brand loyalty we need to consider:

- Number of different brands purchased by a customer, no. of consecutive instances of brand purchase, number of transactions etc.
- How much percent of a brand (any brand since we are only measuring loyalty) does a consumer buy. We can create a derived variable that looks at all the "Brandwise purchase" and gets the max value. We call this variable as `brand.vol.max` - the presumption here would be that if a customer buys more of brand A they are loyal to that brand (which might or might not be true). We also conside other brands which indicates consumer's likelyhood to choose other brands.

K - Means Let's calcualte K-Means

Find the optimum value of k using

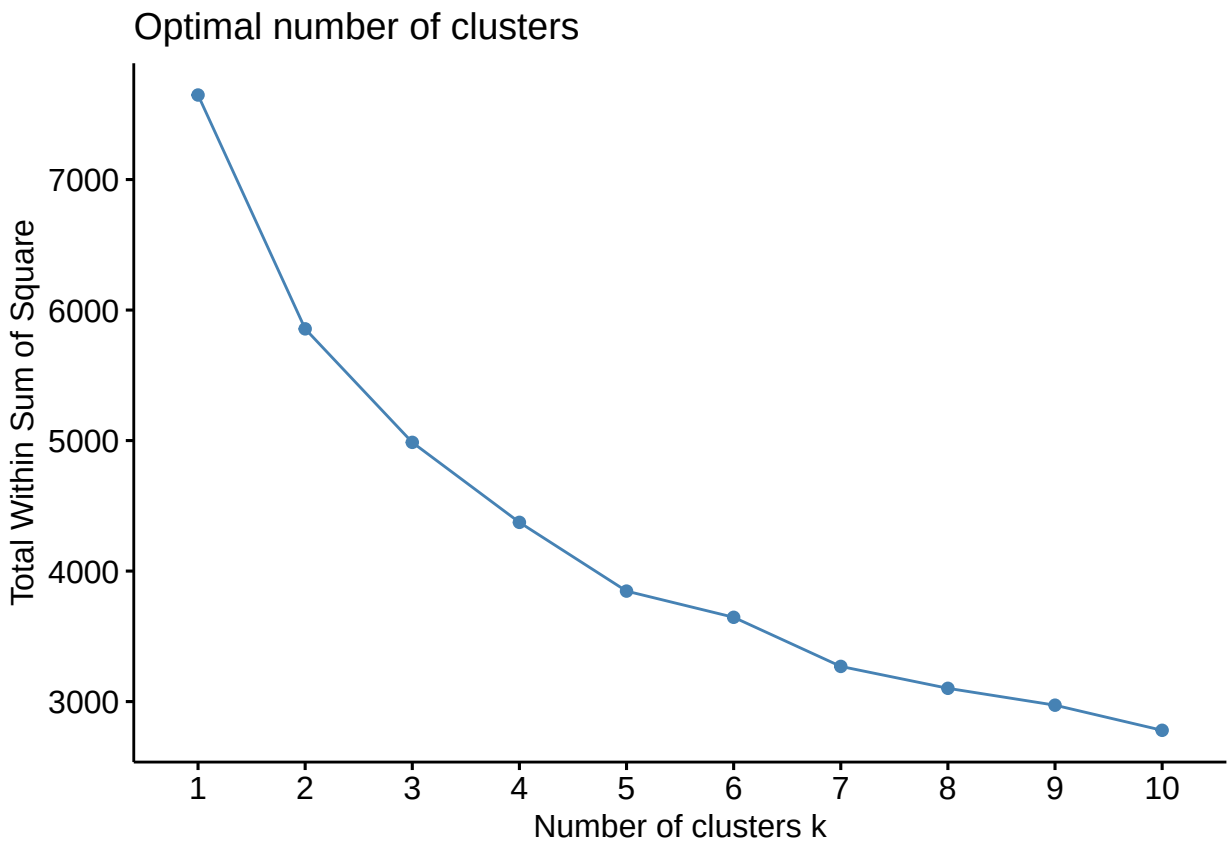
Elbow Chart

```
library(factoextra)
```

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

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

```
library(NbClust)
set.seed(13)
fviz_nbclust(data.df.brand, kmeans, method = "wss")
```



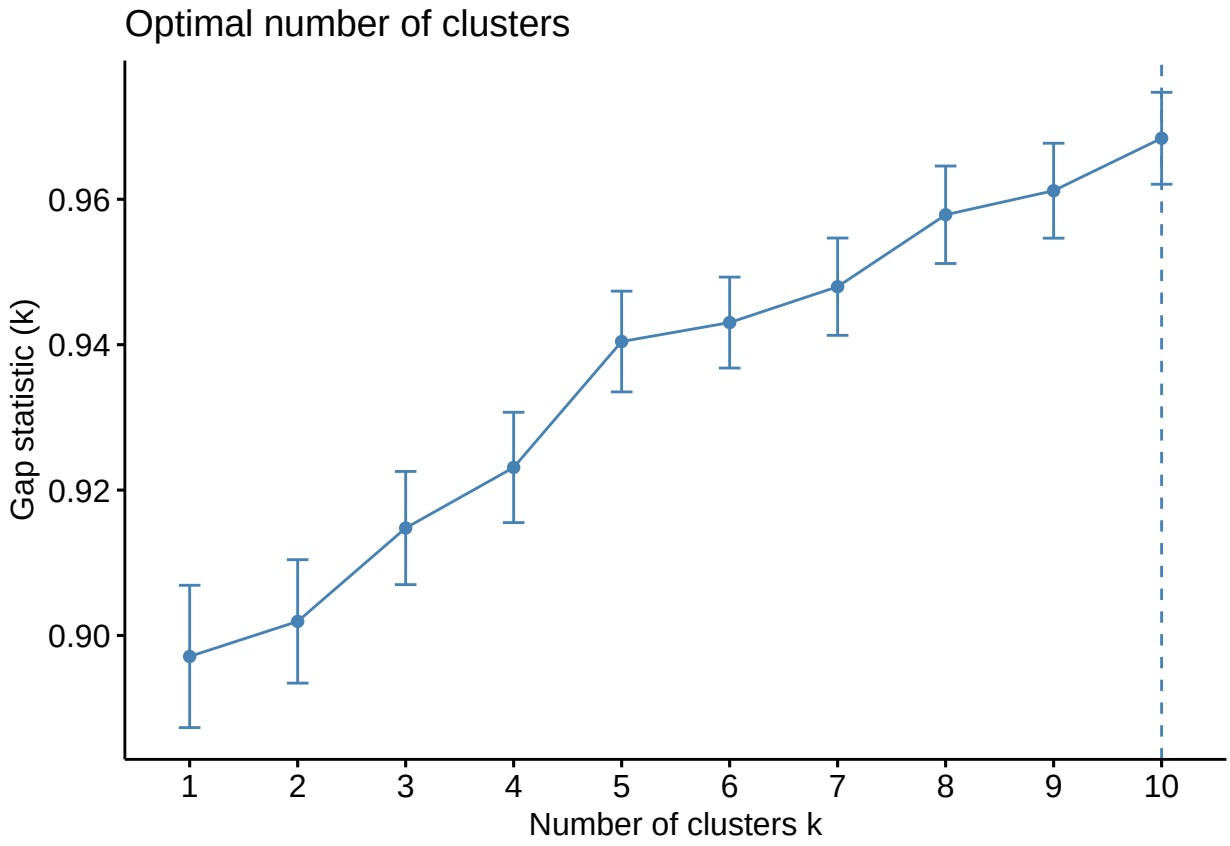
Using Gap Statistic Method

```
library(cluster)
set.seed(13)
gap_stat <- clusGap(data.df.brand, FUN = kmeans, nstart = 25,
                    K.max = 10, B = 100)
```

```
## Warning: did not converge in 10 iterations
```

```
## Warning: did not converge in 10 iterations
```

```
fviz_gap_stat(gap_stat)
```



Looking at the Elbow chart we can see that number of K should be around 5 and with the Gap stat method it shows us 8. We tried using k=5,4,3 and the value that we think is the base is k = 3 looking at the final clustering (and the visualization)

```
set.seed(13)
# Compute k-means clustering with k = 3
data.df.brand.kmeans.3 <- kmeans(data.df.brand, 3, nstart = 50)
print(data.df.brand.kmeans.3)
```

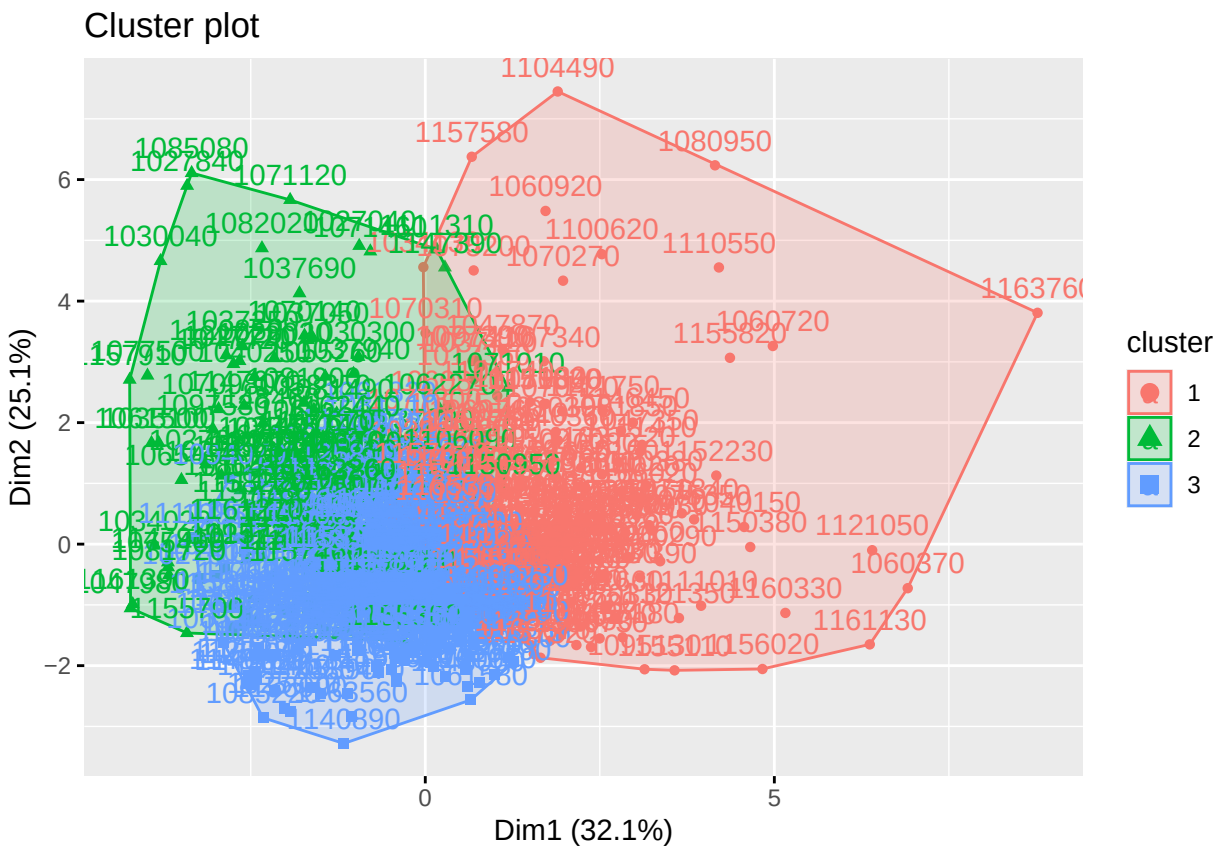
```
## K-means clustering with 3 clusters of sizes 183, 102, 315
##
## Cluster means:
##   No..of.Brands Brand.Runs Total.Volume No..of..Trans      Value
## 1     0.7730896  0.9189979   0.85363953     0.9284306  0.9114185
## 2    -0.6140370 -0.9228896  -0.02107873    -0.4937273 -0.2381902
## 3    -0.2502972 -0.2350536  -0.48909843    -0.3795004 -0.4523625
##   Trans...Brand.Runs   Vol.Tran  Avg..Price Others.999 brand.vol.max
## 1         -0.2218248  0.1755094  0.04255520  0.2047511      1.218621
## 2          1.0843822  0.4463582 -0.35797842 -1.3384059      4.808923
## 3         -0.2222636 -0.2464976  0.09119428  0.3144380      1.074950
##
## Clustering vector:
## 1010010 1010020 1014020 1014030 1014190 1017020 1017110 1017160 1017360 1017460
##       3       1       1       3       3       1       3       3       1       2
## 1017490 1020070 1020210 1024050 1024100 1024120 1024220 1024400 1024630 1025070
##       1       1       3       3       3       1       1       3       3       3
## 1025140 1025210 1027040 1027160 1027210 1027390 1027480 1027540 1027580 1027680
##       2       2       2       3       2       1       2       3       3       2
```

```
## 1027720 1027750 1027810 1027840 1028020 1028050 1028110 1028230 1030040 1030150
##       2       3       3       2       2       3       3       3       2       3
## 1030200 1030280 1030300 1034020 1034130 1034220 1034350 1035020 1035100 1035150
##       3       2       2       2       1       2       3       2       2       1
## 1037050 1037120 1037190 1037220 1037250 1037290 1037420 1037630 1037690 1037720
##       2       3       3       1       2       2       1       1       2       3
## 1037850 1037890 1037940 1038000 1038080 1038110 1040080 1040150 1040190 1040250
##       1       1       2       2       1       2       1       1       3       2
## 1040340 1040370 1044010 1044140 1044370 1045030 1045060 1045100 1045120 1047210
##       3       3       2       3       3       3       3       2       1       3
## 1047220 1047350 1047420 1047610 1047650 1047750 1047760 1047870 1047980 1050050
##       3       1       2       3       3       1       3       1       2       2
## 1050210 1054110 1054270 1054310 1055060 1055160 1055260 1055330 1057150 1057280
##       1       1       2       3       1       1       2       1       3       2
## 1057410 1057500 1057510 1057550 1057580 1057800 1057930 1058000 1058010 1058190
##       3       3       1       1       3       1       1       3       1       3
## 1058350 1058370 1060050 1060130 1060150 1060230 1060260 1060330 1060370 1060420
##       2       3       3       1       1       3       1       2       1       3
## 1060590 1060640 1060650 1060720 1060760 1060810 1060920 1060980 1061080 1061130
##       3       1       2       1       1       1       1       3       3       1
## 1061180 1061310 1061380 1061400 1061500 1061580 1061660 1061700 1061730 1061820
##       1       1       2       3       2       3       3       3       2       3
## 1061830 1061940 1062120 1062220 1062270 1062310 1065040 1065080 1065100 1065160
##       3       3       3       3       2       3       3       3       1       2
## 1065340 1065370 1065450 1065510 1065600 1065650 1065660 1065710 1065780 1070040
##       3       3       2       3       1       3       3       2       3       1
## 1070070 1070140 1070270 1070300 1070310 1070330 1070420 1070500 1070600 1070660
##       3       2       1       1       1       1       1       3       1       3
## 1070670 1070790 1070880 1070980 1071010 1071090 1071120 1071340 1071460 1071500
##       1       3       3       2       2       3       2       2       2       3
## 1071560 1071640 1071780 1071800 1071840 1071910 1075060 1075130 1075200 1075220
##       3       1       1       3       1       2       1       1       1       3
## 1075280 1075350 1075400 1075420 1075520 1075610 1075630 1075690 1075730 1077110
##       3       1       2       3       1       3       1       3       1       2
## 1077200 1077300 1077390 1077480 1077500 1077570 1080020 1080080 1080180 1080220
##       3       1       1       3       2       3       3       1       2       1
## 1080230 1080250 1080330 1080380 1080390 1080470 1080570 1080590 1080690 1080750
##       3       3       1       3       1       3       3       3       3       1
## 1080820 1080950 1081110 1081140 1081260 1081410 1081490 1081530 1081640 1081720
##       3       1       3       3       3       2       2       1       3       2
## 1081820 1081850 1081900 1082020 1082110 1082190 1082210 1082260 1085080 1085220
##       3       1       2       2       3       1       1       2       2       3
## 1085230 1085290 1085340 1085460 1085480 1085530 1085590 1085630 1090040 1094030
##       1       1       3       3       3       3       3       3       3       3
## 1094070 1095130 1095140 1095150 1095220 1095330 1097180 1097370 1097410 1097450
##       3       1       3       1       3       3       1       3       1       3
## 1097530 1097540 1100100 1100120 1100290 1100420 1100460 1100470 1100490 1100510
##       2       3       1       1       1       2       3       3       3       1
## 1100620 1100790 1100860 1100910 1101030 1101070 1101080 1104070 1104230 1104380
##       1       1       3       3       3       2       1       1       3       3
## 1104490 1104510 1104630 1104740 1105040 1105100 1105130 1105150 1105250 1105370
##       1       3       3       1       1       3       3       3       1       3
## 1105400 1105580 1105630 1105830 1105890 1105900 1106020 1106040 1106090 1106180
##       3       3       3       3       3       3       3       1       2       3
```

```
## 1106290 1106360 1106440 1106550 1106570 1106630 1106730 1106800 1106810 1110140
##       3       3       3       1       3       2       1       3       3       3
## 1110290 1110370 1110380 1110540 1110550 1110680 1110890 1110970 1111010 1111100
##       3       1       1       3       1       1       3       3       1       2
## 1111180 1111280 1111310 1111410 1111500 1111710 1111750 1115100 1115200 1115320
##       1       1       2       1       3       3       1       2       1       3
## 1115330 1115620 1115710 1115800 1115970 1116000 1116050 1116130 1116200 1116250
##       1       3       3       3       3       3       1       3       2       3
## 1116380 1116470 1116570 1116580 1116630 1116730 1120150 1120250 1120440 1120450
##       2       3       3       3       1       3       1       3       1       3
## 1120550 1120560 1120690 1120850 1120870 1120960 1121050 1121170 1121270 1121350
##       3       3       3       2       1       3       1       1       1       1
## 1121440 1121450 1121570 1121660 1121760 1121780 1125100 1125140 1125190 1125280
##       3       3       1       1       1       3       3       1       3       3
## 1125470 1125480 1125510 1125790 1125840 1125910 1130020 1134090 1135050 1135150
##       3       3       3       3       3       3       3       3       1       3
## 1135240 1135320 1137070 1137150 1137510 1137580 1137610 1140060 1140070 1140180
##       3       3       1       3       1       3       3       1       1       3
## 1140360 1140480 1140500 1140570 1140670 1140890 1141020 1141110 1141130 1144060
##       1       1       3       3       1       3       3       3       3       2
## 1145010 1145120 1145270 1145330 1145380 1145390 1145440 1145470 1145620 1145690
##       3       1       1       3       3       3       3       3       1       1
## 1145750 1145780 1145960 1145980 1146030 1146060 1146140 1146240 1146340 1146370
##       3       3       3       3       3       3       1       3       3       3
## 1146450 1146510 1146620 1146670 1146710 1146760 1146840 1146930 1146970 1147250
##       1       3       3       2       3       1       2       3       3       2
## 1147390 1147430 1147500 1147580 1147590 1147670 1147700 1147740 1147820 1147850
##       2       3       3       3       3       2       3       1       3       3
## 1147910 1147940 1147960 1148010 1148070 1148140 1148150 1148180 1148250 1148280
##       2       3       3       3       3       3       2       3       3       3
## 1148330 1148380 1148460 1148480 1150090 1150100 1150350 1150380 1150400 1150490
##       3       2       2       3       2       3       3       1       1       3
## 1150620 1150720 1150750 1150910 1150950 1150970 1151040 1151170 1151190 1151290
##       3       3       2       1       2       1       3       3       3       3
## 1151420 1151460 1151510 1151600 1151760 1151830 1152040 1152050 1152170 1152230
##       3       3       3       3       1       1       1       1       3       1
## 1152360 1155080 1155110 1155150 1155250 1155270 1155360 1155380 1155460 1155550
##       3       3       1       3       3       3       2       3       3       3
## 1155580 1155680 1155700 1155740 1155820 1155870 1155960 1156020 1156100 1156150
##       2       3       2       2       1       1       3       1       1       1
## 1156220 1156240 1156290 1156520 1156690 1156770 1156780 1156840 1156880 1156970
##       3       1       3       3       3       3       3       3       1       1
## 1156990 1157070 1157120 1157180 1157190 1157250 1157310 1157320 1157360 1157420
##       3       3       3       1       3       3       2       1       3       1
## 1157460 1157490 1157500 1157580 1157610 1157640 1157670 1157700 1157730 1157780
##       2       2       3       1       3       1       3       3       1       2
## 1157830 1157860 1157870 1157910 1157950 1158030 1158080 1158120 1158130 1158220
##       3       3       1       2       3       3       3       3       3       2
## 1160050 1160140 1160280 1160330 1160540 1160600 1160660 1160890 1161010 1161130
##       3       1       1       1       1       3       3       3       1       1
## 1161270 1161340 1161390 1161500 1161750 1161780 1161880 1161920 1162150 1162260
##       2       3       2       1       1       3       3       3       3       2
## 1162360 1162440 1162580 1162600 1162660 1162680 1162890 1162960 1163000 1163230
##       3       2       1       1       1       3       3       3       3       3
```

```
## 1163300 1163410 1163560 1163670 1163760 1163830 1165010 1165070 1165090 1165100
##       3       1       3       1       1       3       1       3       3       3
## 1165160 1165310 1165330 1165390 1165460 1165720 1166020 1166080 1166340 1166460
##       3       3       1       3       3       1       1       3       3       1
## 1166470 1166740 1166870 1166960 1166980 1167090 1167230 1167340 1167350 1167670
##       3       3       2       3       3       2       3       1       3       2
##
## Within cluster sum of squares by cluster:
## [1] 1731.601 1489.026 1765.025
##  (between_SS / total_SS =  34.8 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
#data.df.brand.kmeans.3
# visualize
fviz_cluster(data.df.brand.kmeans.3, data = data.df.brand)
```




```
# Compute k-means clustering with k = 5
data.df.brand.kmeans.5 <- kmeans(data.df.brand, 5, nstart = 50)
print(data.df.brand.kmeans.5)
```

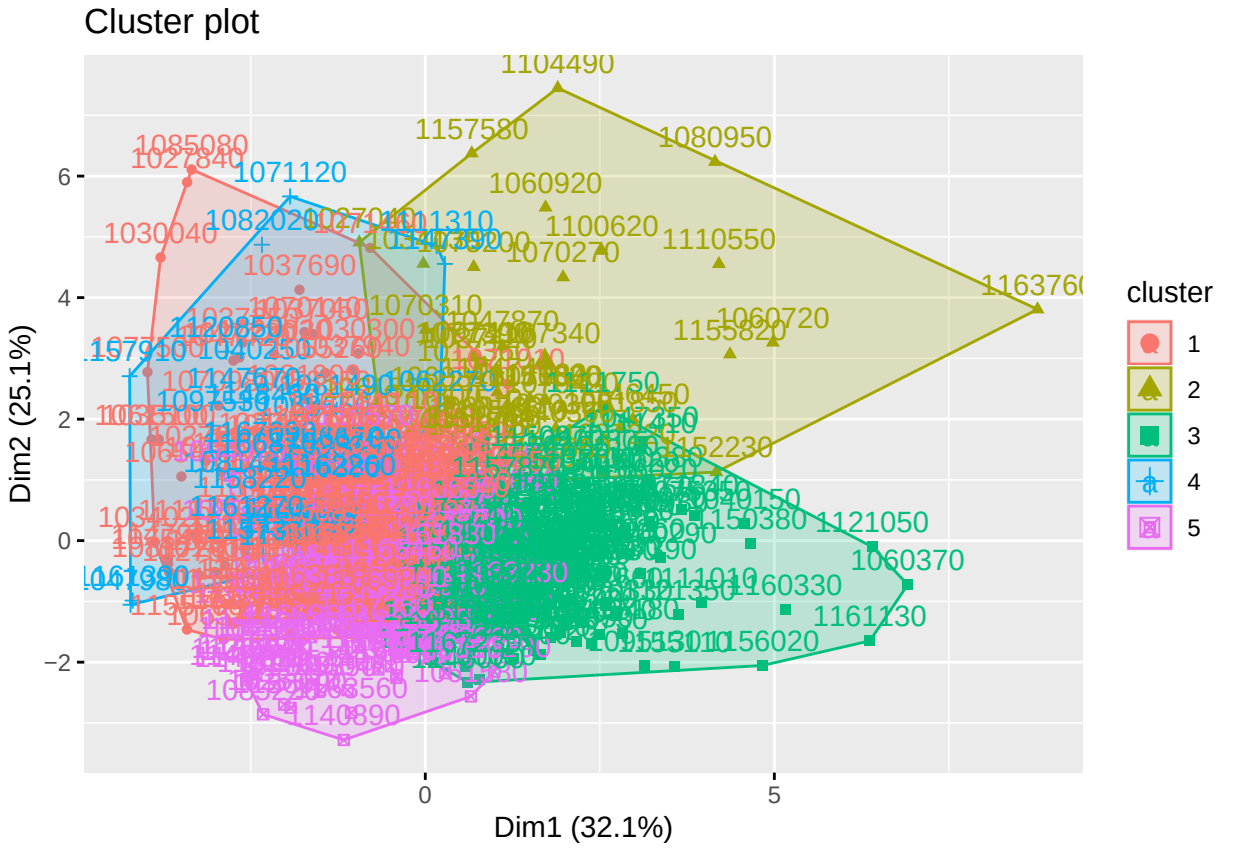
```
## K-means clustering with 5 clusters of sizes 176, 43, 182, 33, 166
##
## Cluster means:
##   No..of.Brands Brand.Runs Total.Volume No..of..Trans       Value
```

```
## 1   -0.35267326 -0.6024183  -0.22231841    -0.4668714 -0.39708508
## 2   -0.04970986  0.1245465   2.34182508     0.4062156  2.10774298
## 3    0.98824231  1.0528693   0.12752285     0.8951158  0.27591547
## 4   -0.53730639 -0.9234040  -0.09573038    -0.5200143  0.07225461
## 5   -0.58988537 -0.3643359  -0.49168973    -0.4882440 -0.44184936
##   Trans...Brand.Runs   Vol.Tran Avg..Price Others.999 brand.vol.max
## 1        0.329542257  0.1459040 -0.4175375 -0.9362052      2.593037
## 2       -0.007631009  1.9818628 -0.3452454  0.1517275      1.153866
## 3       -0.301816021 -0.5075117  0.2163928  0.2434275      1.186758
## 4        0.801157886  0.3302924  0.5031527 -1.3007581      7.828451
## 5       -0.175777098 -0.1772995  0.1948471  0.9449942      0.432574
##
## Clustering vector:
## 1010010 1010020 1014020 1014030 1014190 1017020 1017110 1017160 1017360 1017460
##       5       3       3       1       5       3       5       1       2       4
## 1017490 1020070 1020210 1024050 1024100 1024120 1024220 1024400 1024630 1025070
##       3       3       5       1       5       3       3       1       5       5
## 1025140 1025210 1027040 1027160 1027210 1027390 1027480 1027540 1027580 1027680
##       1       1       2       1       1       3       1       1       5       1
## 1027720 1027750 1027810 1027840 1028020 1028050 1028110 1028230 1030040 1030150
##       1       5       1       1       1       5       5       5       1       1
## 1030200 1030280 1030300 1034020 1034130 1034220 1034350 1035020 1035100 1035150
##       5       1       1       1       2       4       5       1       1       3
## 1037050 1037120 1037190 1037220 1037250 1037290 1037420 1037630 1037690 1037720
##       1       1       1       2       1       1       2       3       1       1
## 1037850 1037890 1037940 1038000 1038080 1038110 1040080 1040150 1040190 1040250
##       3       1       1       1       3       1       3       3       5       4
## 1040340 1040370 1044010 1044140 1044370 1045030 1045060 1045100 1045120 1047210
##       1       3       1       5       3       5       5       1       2       5
## 1047220 1047350 1047420 1047610 1047650 1047750 1047760 1047870 1047980 1050050
##       5       3       1       5       5       3       5       2       4       1
## 1050210 1054110 1054270 1054310 1055060 1055160 1055260 1055330 1057150 1057280
##       3       2       1       5       3       3       1       3       1       4
## 1057410 1057500 1057510 1057550 1057580 1057800 1057930 1058000 1058010 1058190
##       5       5       2       3       5       3       3       5       3       5
## 1058350 1058370 1060050 1060130 1060150 1060230 1060260 1060330 1060370 1060420
##       1       5       1       5       2       3       3       1       3       3
## 1060590 1060640 1060650 1060720 1060760 1060810 1060920 1060980 1061080 1061130
##       5       3       4       2       2       2       2       1       1       5
## 1061180 1061310 1061380 1061400 1061500 1061580 1061660 1061700 1061730 1061820
##       3       3       1       5       1       5       5       3       1       2
## 1061830 1061940 1062120 1062220 1062270 1062310 1065040 1065080 1065100 1065160
##       5       1       5       1       4       1       3       5       3       1
## 1065340 1065370 1065450 1065510 1065600 1065650 1065660 1065710 1065780 1070040
##       1       1       1       1       3       3       1       1       1       2
## 1070070 1070140 1070270 1070300 1070310 1070330 1070420 1070500 1070600 1070660
##       1       1       2       3       2       1       2       5       3       5
## 1070670 1070790 1070880 1070980 1071010 1071090 1071120 1071340 1071460 1071500
##       3       1       1       1       1       1       4       1       1       5
## 1071560 1071640 1071780 1071800 1071840 1071910 1075060 1075130 1075200 1075220
##       5       5       3       3       3       1       5       3       2       5
## 1075280 1075350 1075400 1075420 1075520 1075610 1075630 1075690 1075730 1077110
##       5       3       1       1       1       3       3       3       3       1
## 1077200 1077300 1077390 1077480 1077500 1077570 1080020 1080080 1080180 1080220
```

```
##       1       2       2       5       1       5       5       2       1       3
## 1080230 1080250 1080330 1080380 1080390 1080470 1080570 1080590 1080690 1080750
##       1       5       3       1       2       5       1       3       1       3
## 1080820 1080950 1081110 1081140 1081260 1081410 1081490 1081530 1081640 1081720
##       5       2       1       1       5       4       4       3       5       1
## 1081820 1081850 1081900 1082020 1082110 1082190 1082210 1082260 1085080 1085220
##       1       2       1       4       1       1       3       1       1       5
## 1085230 1085290 1085340 1085460 1085480 1085530 1085590 1085630 1090040 1094030
##       3       3       5       1       1       1       5       5       5       5
## 1094070 1095130 1095140 1095150 1095220 1095330 1097180 1097370 1097410 1097450
##       5       3       5       3       5       1       3       1       2       3
## 1097530 1097540 1100100 1100120 1100290 1100420 1100460 1100470 1100490 1100510
##       4       5       3       1       3       1       1       1       3       3
## 1100620 1100790 1100860 1100910 1101030 1101070 1101080 1104070 1104230 1104380
##       2       2       5       3       1       1       3       3       1       5
## 1104490 1104510 1104630 1104740 1105040 1105100 1105130 1105150 1105250 1105370
##       2       5       3       2       5       3       3       1       3       5
## 1105400 1105580 1105630 1105830 1105890 1105900 1106020 1106040 1106090 1106180
##       5       5       1       5       1       5       1       3       1       3
## 1106290 1106360 1106440 1106550 1106570 1106630 1106730 1106800 1106810 1110140
##       3       1       5       3       5       4       3       5       5       5
## 1110290 1110370 1110380 1110540 1110550 1110680 1110890 1110970 1111010 1111100
##       5       3       3       3       2       3       5       5       3       4
## 1111180 1111280 1111310 1111410 1111500 1111710 1111750 1115100 1115200 1115320
##       2       3       4       3       5       1       3       1       3       5
## 1115330 1115620 1115710 1115800 1115970 1116000 1116050 1116130 1116200 1116250
##       3       1       3       5       1       5       3       3       4       5
## 1116380 1116470 1116570 1116580 1116630 1116730 1120150 1120250 1120440 1120450
##       4       1       5       5       3       5       3       5       3       1
## 1120550 1120560 1120690 1120850 1120870 1120960 1121050 1121170 1121270 1121350
##       1       5       5       4       3       3       3       3       3       3
## 1121440 1121450 1121570 1121660 1121760 1121780 1125100 1125140 1125190 1125280
##       5       1       3       2       3       5       5       3       3       5
## 1125470 1125480 1125510 1125790 1125840 1125910 1130020 1134090 1135050 1135150
##       5       5       1       1       1       5       5       5       3       3
## 1135240 1135320 1137070 1137150 1137510 1137580 1137610 1140060 1140070 1140180
##       5       5       3       5       3       3       1       3       3       3
## 1140360 1140480 1140500 1140570 1140670 1140890 1141020 1141110 1141130 1144060
##       2       3       5       1       3       5       5       1       5       1
## 1145010 1145120 1145270 1145330 1145380 1145390 1145440 1145470 1145620 1145690
##       5       3       1       3       5       5       5       5       3       3
## 1145750 1145780 1145960 1145980 1146030 1146060 1146140 1146240 1146340 1146370
##       5       5       3       1       5       3       3       5       1       3
## 1146450 1146510 1146620 1146670 1146710 1146760 1146840 1146930 1146970 1147250
##       2       5       5       4       5       3       4       1       3       1
## 1147390 1147430 1147500 1147580 1147590 1147670 1147700 1147740 1147820 1147850
##       4       5       5       5       5       4       5       3       1       5
## 1147910 1147940 1147960 1148010 1148070 1148140 1148150 1148180 1148250 1148280
##       1       5       3       5       5       5       1       3       1       5
## 1148330 1148380 1148460 1148480 1150090 1150100 1150350 1150380 1150400 1150490
##       5       1       4       5       4       3       5       3       3       3
## 1150620 1150720 1150750 1150910 1150950 1150970 1151040 1151170 1151190 1151290
##       5       5       1       1       1       3       3       1       1       5
## 1151420 1151460 1151510 1151600 1151760 1151830 1152040 1152050 1152170 1152230
```

```
##       5       5       3       3       2       2       3       3       1       2
## 1152360 1155080 1155110 1155150 1155250 1155270 1155360 1155380 1155460 1155550
##       1       3       3       5       5       1       1       3       3       3
## 1155580 1155680 1155700 1155740 1155820 1155870 1155960 1156020 1156100 1156150
##       1       5       1       1       2       3       5       3       3       3
## 1156220 1156240 1156290 1156520 1156690 1156770 1156780 1156840 1156880 1156970
##       1       3       1       3       5       5       1       1       3       3
## 1156990 1157070 1157120 1157180 1157190 1157250 1157310 1157320 1157360 1157420
##       5       5       1       3       1       1       4       3       1       3
## 1157460 1157490 1157500 1157580 1157610 1157640 1157670 1157700 1157730 1157780
##       1       4       1       2       1       1       3       5       3       1
## 1157830 1157860 1157870 1157910 1157950 1158030 1158080 1158120 1158130 1158220
##       1       1       3       4       3       1       1       1       1       4
## 1160050 1160140 1160280 1160330 1160540 1160600 1160660 1160890 1161010 1161130
##       3       3       3       3       1       5       5       1       3       3
## 1161270 1161340 1161390 1161500 1161750 1161780 1161880 1161920 1162150 1162260
##       4       5       4       3       3       1       5       1       3       4
## 1162360 1162440 1162580 1162600 1162660 1162680 1162890 1162960 1163000 1163230
##       3       1       3       3       3       5       3       5       1       5
## 1163300 1163410 1163560 1163670 1163760 1163830 1165010 1165070 1165090 1165100
##       5       3       5       3       2       1       3       5       5       3
## 1165160 1165310 1165330 1165390 1165460 1165720 1166020 1166080 1166340 1166460
##       3       5       1       3       5       3       3       3       1       3
## 1166470 1166740 1166870 1166960 1166980 1167090 1167230 1167340 1167350 1167670
##       5       5       4       5       1       4       3       2       5       1
##
## Within cluster sum of squares by cluster:
## [1] 1214.8849  485.3760  943.0511  381.3592  821.8262
##  (between_SS / total_SS =  49.7 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
#data.df.brand.kmeans.5
# visualize
fviz_cluster(data.df.brand.kmeans.5, data = data.df.brand)
```



Analysis Here we only analyr cluster with k=3 we think k=3 is segmented more meaningfully then k=5 for purposes of the study (marketing to consumers) K-means clustering with 3 clusters of sizes 102, 315, 183

Cluster means: No..of.Brands Brand.Runs Total.Volume No..of..Trans Value Trans. . . Brand.Runs Vol.Tran Avg..Price Others.999 brand.vol.max 1 -0.6140370 -0.9228896 -0.02107873 -0.4937273 -0.2381902 1.0843822 0.4463582 -0.35797842 -1.3384059 4.808923 2 -0.2502972 -0.2350536 -0.48909843 -0.3795004 -0.4523625 -0.2222636 -0.2464976 0.09119428 0.3144380 1.074950 3 0.7730896 0.9189979 0.85363953 0.9284306 0.9114185 -0.2218248 0.1755094 0.04255520 0.2047511 1.218621

Here we can see that Cluster 1 has following properties

- Lowest number of brands purchased
- Lowest Brand runs
- Highest average transaction/brand
- Lowest other brand purchase
- Highest volume purchase per brand

Cluster 3 has following properties

- Highest number of brands purchased
- Highest brand runs
- Highest sum of volumes purchased
- Highest number of transactions
- Low average transaction/brand
- Lowest volume purchase per brand

Cluster 2 lies somewhere in between Cluster 1 and Cluster 3. We can see that cluster 2 also has the highest number (n=315) than cluster 1 (n=102) and cluster 3 (n=183) We can safely conclude that Cluster 1 has the most loyal customers and Cluster 3 has the least loyal customers and Cluster 2 is where most of the

customers are which like to try out different brands and they experiment with brands.

Basis for Purchase

For the basis of purchase we will try to see if promotions affect the consumer purchase habits. As as result we will use the following variables

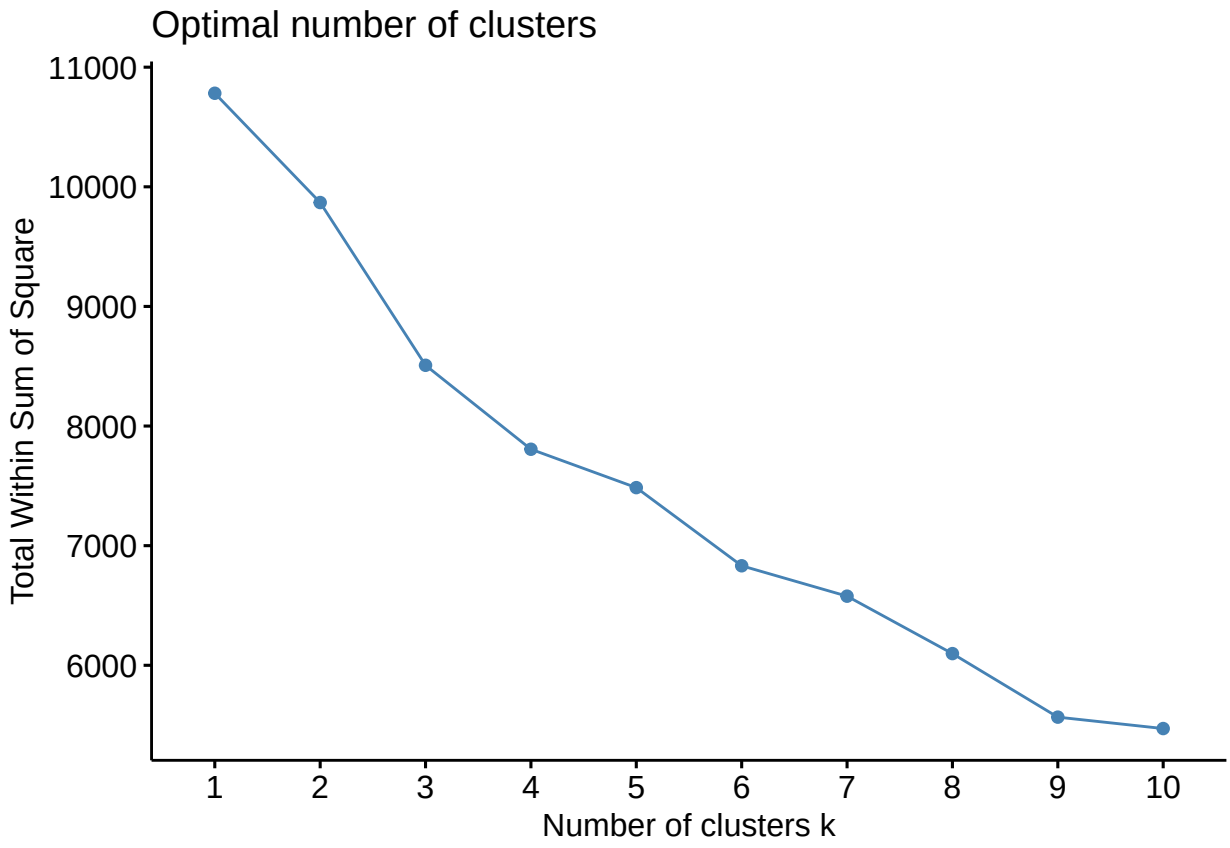
- Pur Vol
- No of Promo %
- Pur Vol Promo 6%
- Pur Vol Other Promo %
- Price cat 1-4
- Produce proposition/Promise

K - Means Let's calcualte K-Means

Find the optimum value of k using

Elbow Chart

```
library(factoextra)
library(NbClust)
set.seed(13)
fviz_nbclust(data.df.pur, kmeans, method = "wss")
```

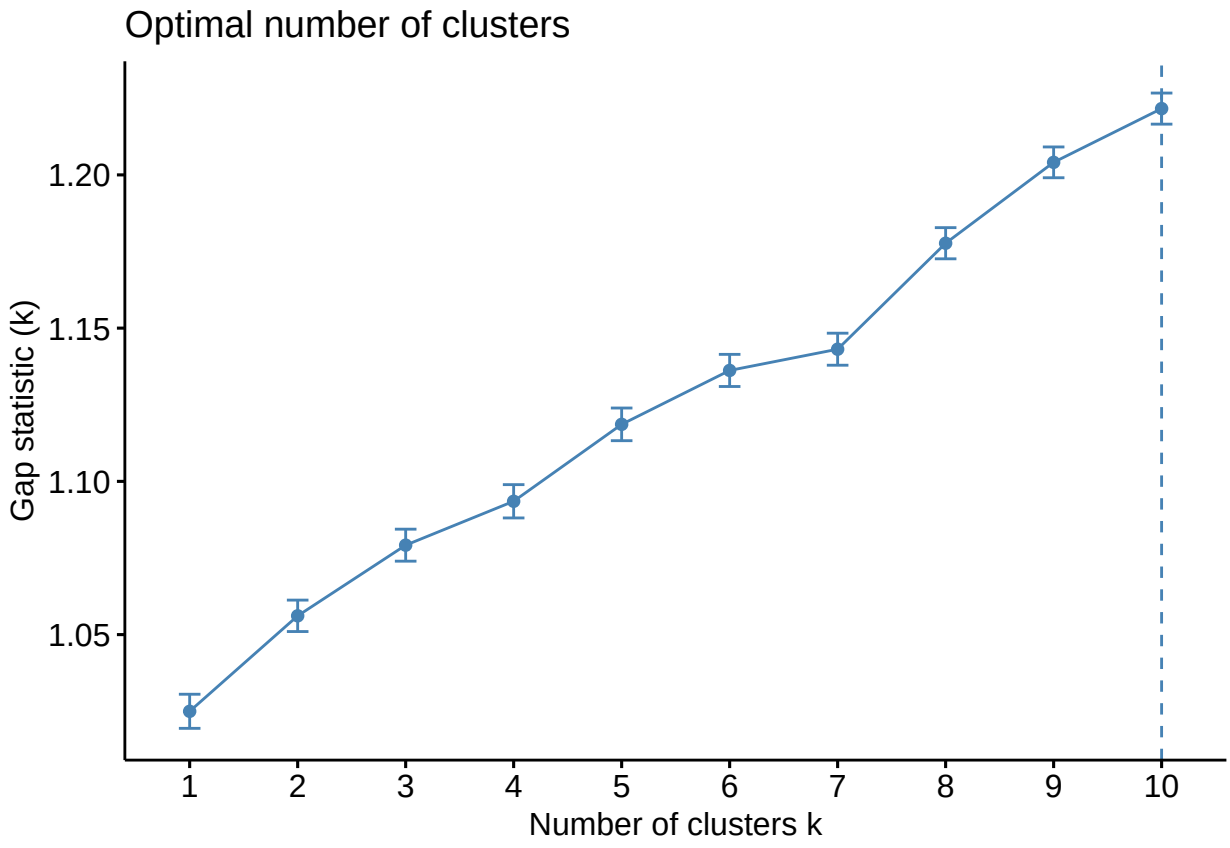


Using Gap Statistic Method

```
set.seed(13)
gap_stat <- clusGap(data.df.pur, FUN = kmeans, nstart = 25,
                    K.max = 10, B = 100)
```

```
## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations
```

```
fviz_gap_stat(gap_stat)
```



Looking at the charts we can see that K=3 is perhaps a good number

```
set.seed(13)
# Compute k-means clustering with k = 3
data.df.pur.kmeans.3 <- kmeans(data.df.pur, 3, nstart = 50)
print(data.df.pur.kmeans.3)
```

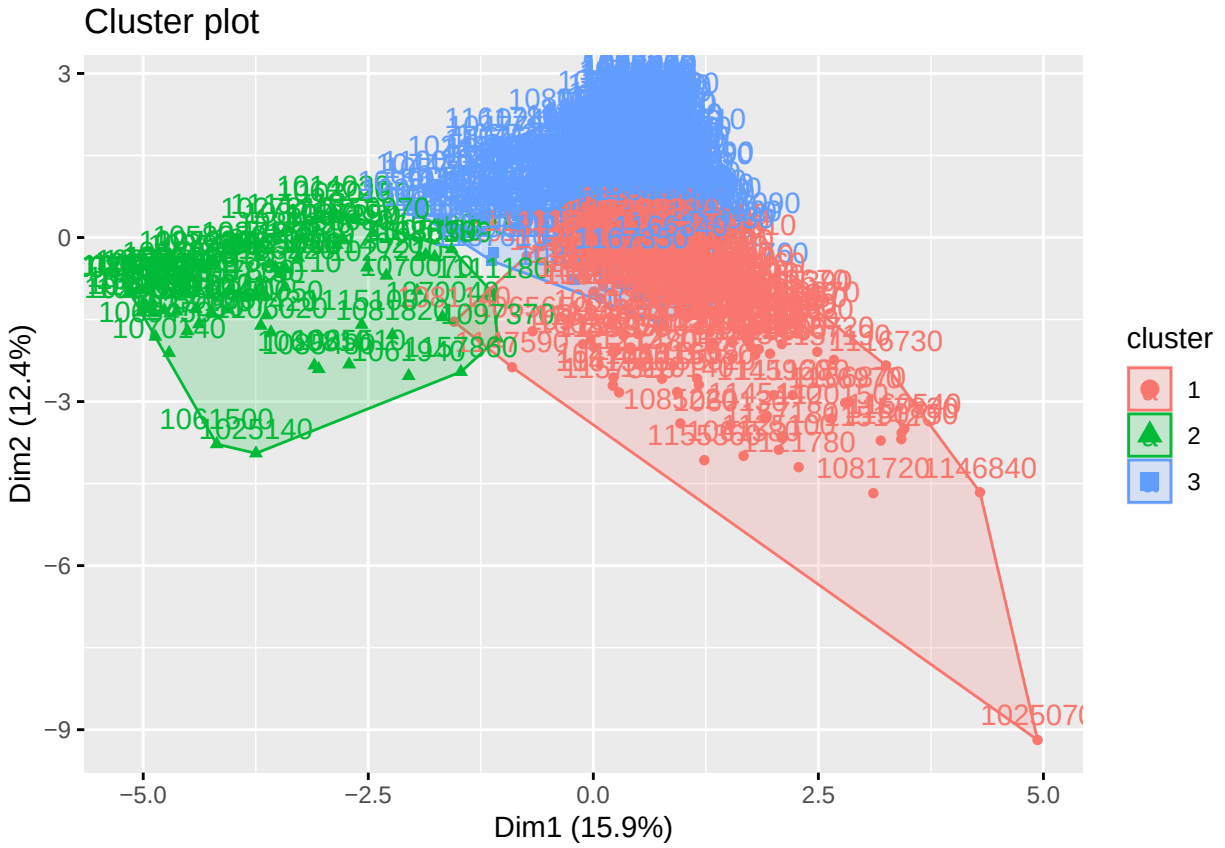
```
## K-means clustering with 3 clusters of sizes 193, 78, 329
##
## Cluster means:
##   Pur.Vol.No.Promo.... Pur.Vol.Promo.6.. Pur.Vol.Other.Promo..   Pr.Cat.1
```

```
## 1           -0.5626809         0.5576736             0.2131738  1.1091649
## 2            0.1856666        -0.3842112             0.1912587 -0.7825205
## 3            0.2860651        -0.2360563            -0.1703973 -0.4651435
##     Pr.Cat.2   Pr.Cat.3   Pr.Cat.4  PropCat.5   PropCat.6   PropCat.7
## 1 -0.4708722 -0.4653448 -0.2106562 -0.3516447  0.11719213  0.24917427
## 2 -1.1334328  2.3701003 -0.3204763 -1.0914607 -0.17089192 -0.44919415
## 3  0.5449425 -0.2889248  0.1995556  0.4650497 -0.02823256 -0.03967626
##    PropCat.8   PropCat.9 PropCat.10  PropCat.11  PropCat.12 PropCat.13
## 1  0.5131099  0.13143273  0.3787795 -0.01931633  0.23567662  0.4408922
## 2 -0.4629703 -0.16226455 -0.2570818 -0.22953559 -0.16301187 -0.2325107
## 3 -0.1912417 -0.03863186 -0.1612525  0.06575023 -0.09960688 -0.2035148
##   PropCat.14  PropCat.15
## 1 -0.4620933  0.04781956
## 2  2.3724613 -0.22967026
## 3 -0.2913920  0.02639850
##
## Clustering vector:
## 1010010 1010020 1014020 1014030 1014190 1017020 1017110 1017160 1017360 1017460
##       3       3       2       2       3       3       3       2       3       1
## 1017490 1020070 1020210 1024050 1024100 1024120 1024220 1024400 1024630 1025070
##       3       3       3       3       3       3       3       3       3       1
## 1025140 1025210 1027040 1027160 1027210 1027390 1027480 1027540 1027580 1027680
##       2       2       2       2       2       1       3       3       3       2
## 1027720 1027750 1027810 1027840 1028020 1028050 1028110 1028230 1030040 1030150
##       2       3       2       2       2       3       3       3       2       2
## 1030200 1030280 1030300 1034020 1034130 1034220 1034350 1035020 1035100 1035150
##       3       2       2       2       3       3       3       3       2       1
## 1037050 1037120 1037190 1037220 1037250 1037290 1037420 1037630 1037690 1037720
##       2       3       2       3       2       3       2       3       2       3
## 1037850 1037890 1037940 1038000 1038080 1038110 1040080 1040150 1040190 1040250
##       3       2       2       3       3       2       2       1       3       3
## 1040340 1040370 1044010 1044140 1044370 1045030 1045060 1045100 1045120 1047210
##       3       3       2       3       3       1       3       2       3       3
## 1047220 1047350 1047420 1047610 1047650 1047750 1047760 1047870 1047980 1050050
##       3       2       2       1       1       3       3       3       1       2
## 1050210 1054110 1054270 1054310 1055060 1055160 1055260 1055330 1057150 1057280
##       1       3       2       1       3       3       2       3       2       3
## 1057410 1057500 1057510 1057550 1057580 1057800 1057930 1058000 1058010 1058190
##       3       3       3       3       3       3       1       3       3       3
## 1058350 1058370 1060050 1060130 1060150 1060230 1060260 1060330 1060370 1060420
##       2       3       3       1       1       1       3       2       3       3
## 1060590 1060640 1060650 1060720 1060760 1060810 1060920 1060980 1061080 1061130
##       1       1       3       1       3       2       3       3       3       1
## 1061180 1061310 1061380 1061400 1061500 1061580 1061660 1061700 1061730 1061820
##       3       3       1       3       2       1       3       3       3       3
## 1061830 1061940 1062120 1062220 1062270 1062310 1065040 1065080 1065100 1065160
##       3       2       3       2       1       2       2       1       3       1
## 1065340 1065370 1065450 1065510 1065600 1065650 1065660 1065710 1065780 1070040
##       3       3       2       2       3       1       1       2       3       2
## 1070070 1070140 1070270 1070300 1070310 1070330 1070420 1070500 1070600 1070660
##       2       2       3       3       3       3       3       3       3       3
## 1070670 1070790 1070880 1070980 1071010 1071090 1071120 1071340 1071460 1071500
##       3       3       3       2       3       3       3       2       2       3
## 1071560 1071640 1071780 1071800 1071840 1071910 1075060 1075130 1075200 1075220
```

```
##       3       3       3       1       3       3       3       3       3       1
## 1075280 1075350 1075400 1075420 1075520 1075610 1075630 1075690 1075730 1077110
##       3       1       3       3       3       3       3       3       1       3
## 1077200 1077300 1077390 1077480 1077500 1077570 1080020 1080080 1080180 1080220
##       3       3       3       3       2       3       3       3       2       1
## 1080230 1080250 1080330 1080380 1080390 1080470 1080570 1080590 1080690 1080750
##       3       3       1       3       3       1       3       1       2       1
## 1080820 1080950 1081110 1081140 1081260 1081410 1081490 1081530 1081640 1081720
##       3       3       2       1       3       3       3       3       1       1
## 1081820 1081850 1081900 1082020 1082110 1082190 1082210 1082260 1085080 1085220
##       2       3       2       3       2       2       2       2       2       1
## 1085230 1085290 1085340 1085460 1085480 1085530 1085590 1085630 1090040 1094030
##       3       3       3       3       2       3       2       1       1       3
## 1094070 1095130 1095140 1095150 1095220 1095330 1097180 1097370 1097410 1097450
##       3       1       3       3       3       3       3       2       3       3
## 1097530 1097540 1100100 1100120 1100290 1100420 1100460 1100470 1100490 1100510
##       1       3       1       3       3       3       3       3       3       1
## 1100620 1100790 1100860 1100910 1101030 1101070 1101080 1104070 1104230 1104380
##       3       3       3       3       3       1       1       3       3       3
## 1104490 1104510 1104630 1104740 1105040 1105100 1105130 1105150 1105250 1105370
##       3       3       3       3       3       3       2       3       3       1
## 1105400 1105580 1105630 1105830 1105890 1105900 1106020 1106040 1106090 1106180
##       1       1       3       1       3       3       2       3       3       1
## 1106290 1106360 1106440 1106550 1106570 1106630 1106730 1106800 1106810 1110140
##       3       3       3       3       1       3       1       3       1       1
## 1110290 1110370 1110380 1110540 1110550 1110680 1110890 1110970 1111010 1111100
##       1       1       3       1       3       3       3       3       3       1
## 1111180 1111280 1111310 1111410 1111500 1111710 1111750 1115100 1115200 1115320
##       2       1       3       3       1       2       3       2       3       3
## 1115330 1115620 1115710 1115800 1115970 1116000 1116050 1116130 1116200 1116250
##       3       3       3       1       3       1       1       1       1       3
## 1116380 1116470 1116570 1116580 1116630 1116730 1120150 1120250 1120440 1120450
##       3       3       3       1       3       1       1       1       3       3
## 1120550 1120560 1120690 1120850 1120870 1120960 1121050 1121170 1121270 1121350
##       3       3       1       3       1       3       1       3       1       1
## 1121440 1121450 1121570 1121660 1121760 1121780 1125100 1125140 1125190 1125280
##       3       3       3       1       1       1       1       1       1       3
## 1125470 1125480 1125510 1125790 1125840 1125910 1130020 1134090 1135050 1135150
##       3       1       3       3       2       1       3       1       3       3
## 1135240 1135320 1137070 1137150 1137510 1137580 1137610 1140060 1140070 1140180
##       1       1       1       1       3       1       3       3       3       3
## 1140360 1140480 1140500 1140570 1140670 1140890 1141020 1141110 1141130 1144060
##       1       1       1       1       1       1       1       1       1       3
## 1145010 1145120 1145270 1145330 1145380 1145390 1145440 1145470 1145620 1145690
##       1       1       3       1       1       1       1       3       1       3
## 1145750 1145780 1145960 1145980 1146030 1146060 1146140 1146240 1146340 1146370
##       3       1       1       3       1       1       3       1       3       3
## 1146450 1146510 1146620 1146670 1146710 1146760 1146840 1146930 1146970 1147250
##       3       3       1       3       3       3       1       1       1       3
## 1147390 1147430 1147500 1147580 1147590 1147670 1147700 1147740 1147820 1147850
##       3       3       3       1       1       3       1       3       3       3
## 1147910 1147940 1147960 1148010 1148070 1148140 1148150 1148180 1148250 1148280
##       3       1       3       1       1       3       3       3       3       3
## 1148330 1148380 1148460 1148480 1150090 1150100 1150350 1150380 1150400 1150490
```

```
##       1       3       3       3       3       3       1       1       1       1
## 1150620 1150720 1150750 1150910 1150950 1150970 1151040 1151170 1151190 1151290
##       1       1       1       1       1       2       3       3       1       1
## 1151420 1151460 1151510 1151600 1151760 1151830 1152040 1152050 1152170 1152230
##       1       1       1       3       3       3       3       1       1       1
## 1152360 1155080 1155110 1155150 1155250 1155270 1155360 1155380 1155460 1155550
##       1       1       3       1       1       3       1       3       1       1
## 1155580 1155680 1155700 1155740 1155820 1155870 1155960 1156020 1156100 1156150
##       1       3       1       3       1       1       1       1       3       3
## 1156220 1156240 1156290 1156520 1156690 1156770 1156780 1156840 1156880 1156970
##       2       1       3       3       1       1       3       3       3       1
## 1156990 1157070 1157120 1157180 1157190 1157250 1157310 1157320 1157360 1157420
##       1       3       3       1       1       3       1       1       1       3
## 1157460 1157490 1157500 1157580 1157610 1157640 1157670 1157700 1157730 1157780
##       3       1       3       3       3       3       3       3       3       3
## 1157830 1157860 1157870 1157910 1157950 1158030 1158080 1158120 1158130 1158220
##       1       2       3       3       1       3       2       3       3       3
## 1160050 1160140 1160280 1160330 1160540 1160600 1160660 1160890 1161010 1161130
##       3       1       3       1       1       3       3       3       3       1
## 1161270 1161340 1161390 1161500 1161750 1161780 1161880 1161920 1162150 1162260
##       3       1       1       3       3       3       3       3       1       1
## 1162360 1162440 1162580 1162600 1162660 1162680 1162890 1162960 1163000 1163230
##       1       3       1       3       1       1       3       1       3       1
## 1163300 1163410 1163560 1163670 1163760 1163830 1165010 1165070 1165090 1165100
##       3       3       1       1       3       2       1       1       1       1
## 1165160 1165310 1165330 1165390 1165460 1165720 1166020 1166080 1166340 1166460
##       1       1       1       1       3       1       3       3       3       3
## 1166470 1166740 1166870 1166960 1166980 1167090 1167230 1167340 1167350 1167670
##       3       1       1       3       3       3       1       3       3       3
##
## Within cluster sum of squares by cluster:
## [1] 4584.9542  405.8688 3517.0510
##  (between_SS / total_SS =  21.1 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
#data.df.pur.kmeans.3
# visualize
fviz_cluster(data.df.pur.kmeans.3, data = data.df.pur)
```



Analysis K-means clustering with 3 clusters of sizes 78, 193, 329

Cluster means: Pur.Vol.No.Promo.... Pur.Vol.Promo.6.. Pur.Vol.Other.Promo.. Pr.Cat.1 Pr.Cat.2 Pr.Cat.3 Pr.Cat.4 PropCat.5 PropCat.6 PropCat.7 PropCat.8 1 0.1856666 -0.3842112 0.1912587 -0.7825205 -1.1334328 2.3701003 -0.3204763 -1.0914607 -0.17089192 -0.44919415 -0.4629703 2 -0.5626809 0.5576736 0.2131738 1.1091649 -0.4708722 -0.4653448 -0.2106562 -0.3516447 0.11719213 0.24917427 0.5131099 3 0.2860651 -0.2360563 -0.1703973 -0.4651435 0.5449425 -0.2889248 0.1995556 0.4650497 -0.02823256 -0.03967626 -0.1912417

`PropCat.9 PropCat.10 PropCat.11 PropCat.12 PropCat.13 PropCat.14 PropCat.15`

1 -0.16226455 -0.2570818 -0.22953559 -0.16301187 -0.2325107 2.3724613 -0.22967026 2 0.13143273 0.3787795 -0.01931633 0.23567662 0.4408922 -0.4620933 0.04781956 3 -0.03863186 -0.1612525 0.06575023 -0.09960688 -0.2035148 -0.2913920 0.02639850

- Cluster 1 is responding nicely to price category 3 and proposition category 14. It does not respond well to Price category 1,5 and any proposition category other than 14 which is interesting. Cluster 1 also has least number of observations (n=78)
- Cluster 2 responds well to promitions and as expected does not respond well to no promotions so we can assume that the customers in this cluster are highely motivated by discounts and propmotions. They also respond well to price category 1 and promotion categories 6-10,12,13,15 and do not respond well to other price category and purchase categories.
- Cluster 3 responds well to no promotions, looks like consumers in this cluster are not motivated by promitions. They respond well to price category 2, 4, 5 and promotion category 11. Intrestingly this cluster has the largest number of observations (n=329)

Purchase Behavior and Basis of Purchase

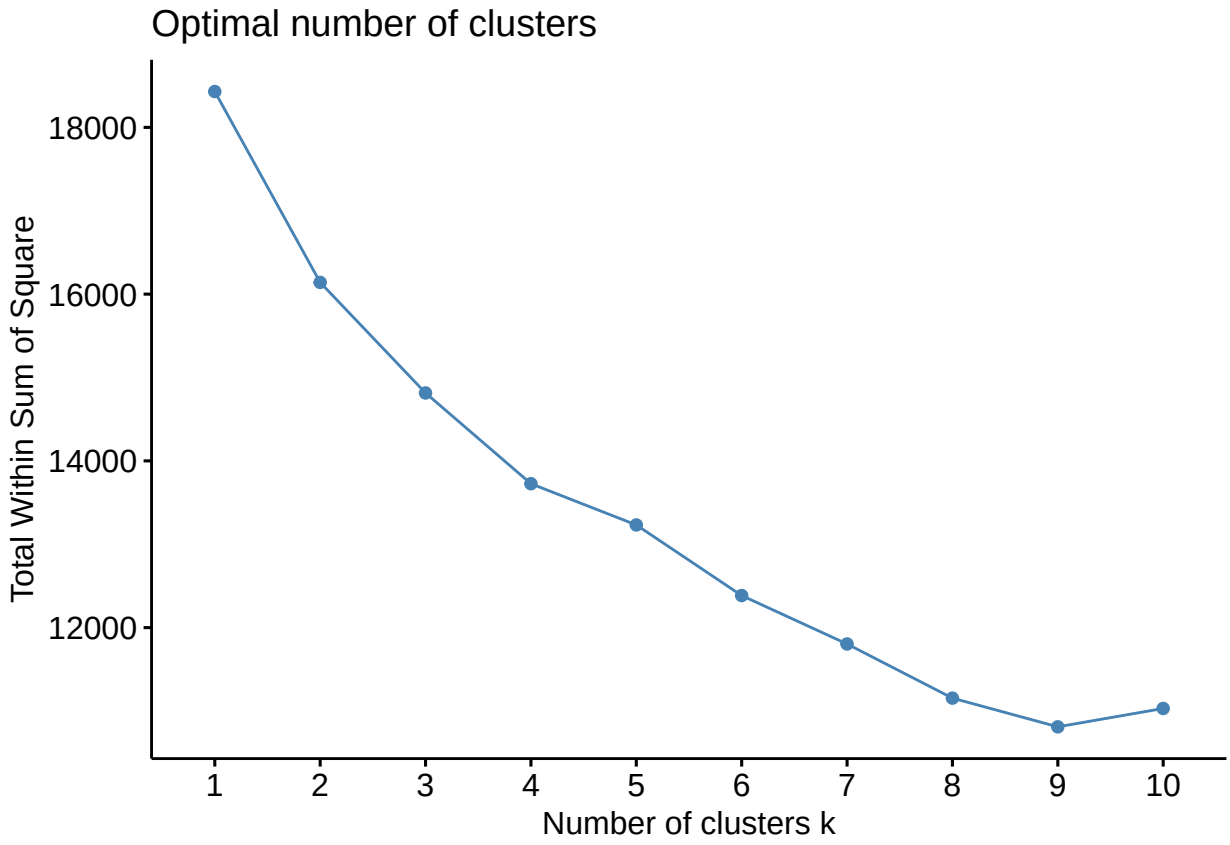
Here we consider all the above variables.

K - Means Let's calcualte K-Means

Find the optimum value of k using

Elbow Chart

```
library(factoextra)
library(NbClust)
set.seed(13)
fviz_nbclust(data.df.all, kmeans, method = "wss")
```



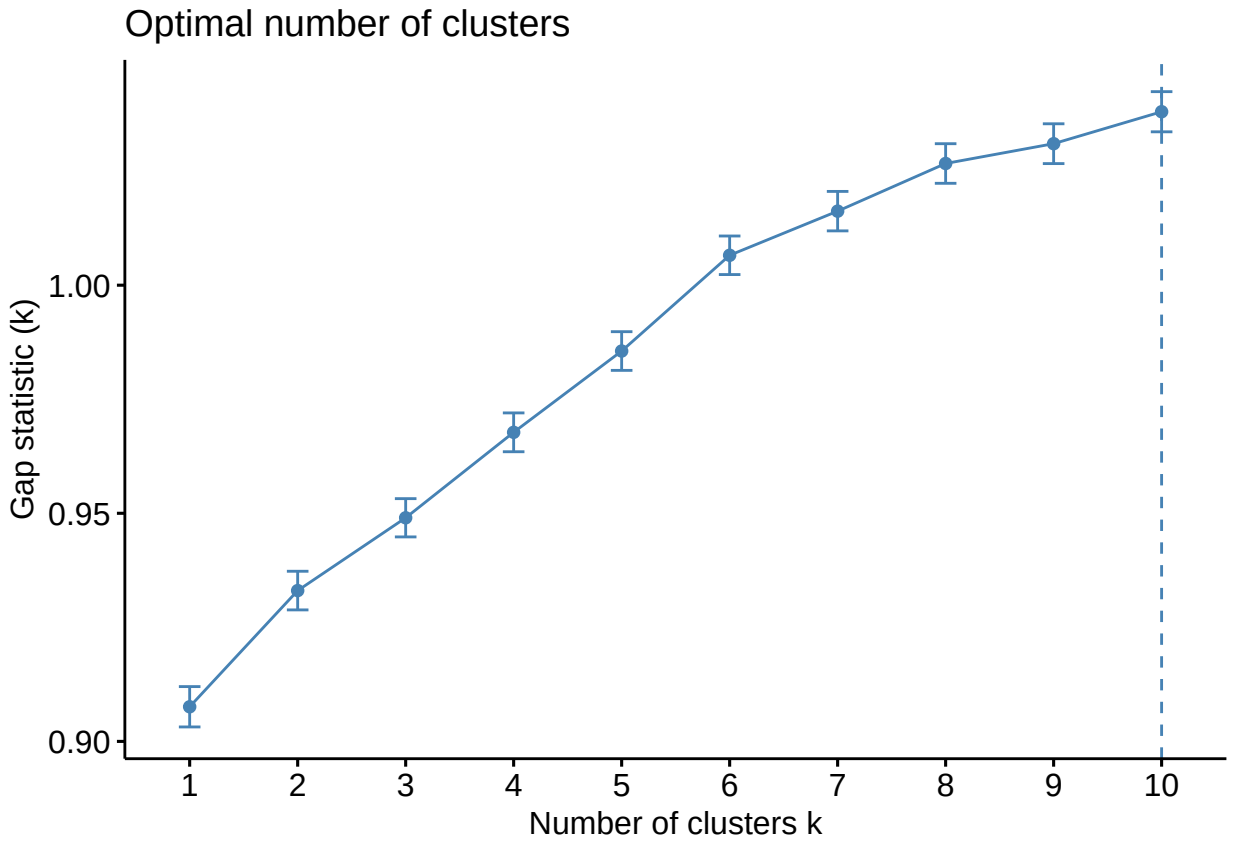
Using Gap Statistic Method

```
set.seed(13)
gap_stat <- clusGap(data.df.all, FUN = kmeans, nstart = 25,
                    K.max = 10, B = 100)
```

```
## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations
```

```
## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations
```

```
fviz_gap_stat(gap_stat)
```



Looking at the charts and considering that the marketing efforts would support two to five different promotional approaches, k=4 seems to be a good value.

```
set.seed(13)
# Compute k-means clustering with k = 4
data.df.all.kmeans.4 <- kmeans(data.df.all, 4, nstart = 50)
print(data.df.all.kmeans.4)
```

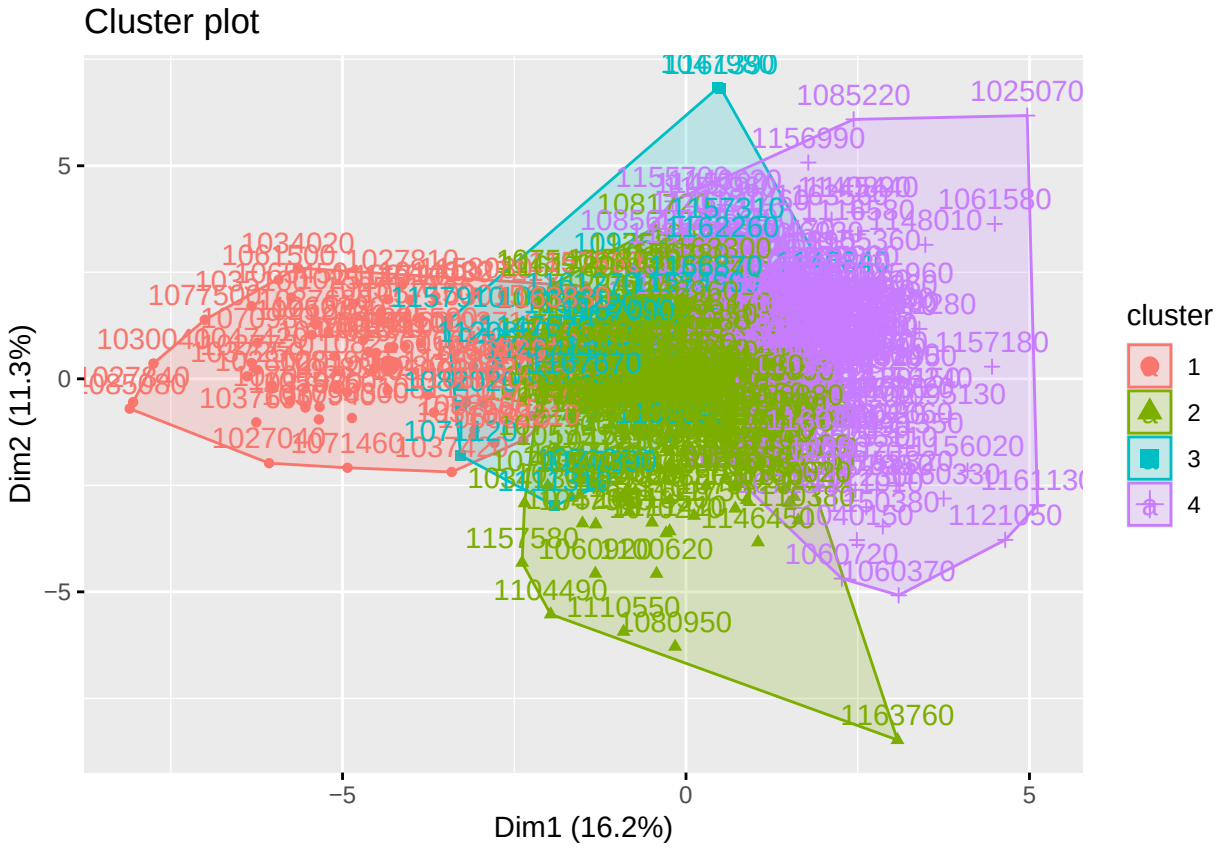
```
## K-means clustering with 4 clusters of sizes 70, 288, 40, 202
##
## Cluster means:
##   No..of.Brands  Brand.Runs Total.Volume No..of..Trans       Value
## 1   -0.57484960 -0.80331672   0.07589467   -0.42194435 -0.55565205
## 2    0.05196104 -0.02621079   0.21350378   -0.02752712  0.08913830
## 3   -0.40302775 -0.81534002  -0.05831701   -0.45780771  0.07909402
```

```
## 4    0.20492972  0.47720039  -0.31915363    0.27611992  0.04980224
##   Trans...Brand.Runs   Vol.Tran Avg..Price  Others.999 brand.vol.max
## 1          1.0474825  0.4965263 -1.3088637 -1.27596356      2.583395
## 2         -0.1604637  0.2104303 -0.3404089  0.09352442      1.190961
## 3          0.6362451  0.3190068  0.3941736 -1.27786148      7.302793
## 4         -0.2601982 -0.5352527  0.8608480  0.56186571      1.169212
##   Pur.Vol.No.Promo.... Pur.Vol.Promo.6.. Pur.Vol.Other.Promo..   Pr.Cat.1
## 1            0.2396606      -0.478972755            0.22251373 -0.7848684
## 2            0.1809100      -0.176891651           -0.07257201 -0.5075196
## 3            0.1082743       0.004476381           -0.18297411 -0.2029129
## 4           -0.3624222       0.417296204            0.06259279  1.0357572
##     Pr.Cat.2   Pr.Cat.3   Pr.Cat.4  PropCat.5   PropCat.6  PropCat.7  PropCat.8
## 1 -1.2090708  2.4892721 -0.3608966 -1.1445341 -0.22057973 -0.4563628 -0.4763799
## 2  0.4429335 -0.2220330  0.3336021  0.5689402 -0.02666001 -0.1852715 -0.2201183
## 3  0.8103512 -0.4364590 -0.4100657 -0.5836170  0.06386371  0.8079389  0.2792642
## 4 -0.3729898 -0.4596296 -0.2693664 -0.2989738  0.10180255  0.2623071  0.4236143
##     PropCat.9 PropCat.10   PropCat.11 PropCat.12 PropCat.13 PropCat.14
## 1 -0.13158214 -0.2561271 -0.249197062 -0.1655249 -0.2410929  2.4917854
## 2 -0.07035438 -0.1708574 -0.065248641 -0.1357292 -0.2155251 -0.2256394
## 3 -0.35126414 -0.2230794  0.954631305 -0.1410229  0.6087465 -0.4304315
## 4  0.21546226  0.3765297 -0.009652719  0.2788003  0.2702865 -0.4565524
##    PropCat.15
## 1 -0.25382822
## 2  0.02735269
## 3 -0.24117355
## 4  0.09671952
##
## Clustering vector:
## 1010010 1010020 1014020 1014030 1014190 1017020 1017110 1017160 1017360 1017460
##       2       2       2       1       2       2       2       1       2       3
## 1017490 1020070 1020210 1024050 1024100 1024120 1024220 1024400 1024630 1025070
##       2       2       2       2       2       2       2       2       2       4
## 1025140 1025210 1027040 1027160 1027210 1027390 1027480 1027540 1027580 1027680
##       1       1       1       1       1       4       2       2       2       1
## 1027720 1027750 1027810 1027840 1028020 1028050 1028110 1028230 1030040 1030150
##       1       2       1       1       1       2       2       2       1       1
## 1030200 1030280 1030300 1034020 1034130 1034220 1034350 1035020 1035100 1035150
##       2       1       1       1       2       3       2       2       1       4
## 1037050 1037120 1037190 1037220 1037250 1037290 1037420 1037630 1037690 1037720
##       1       2       1       2       1       2       1       2       1       2
## 1037850 1037890 1037940 1038000 1038080 1038110 1040080 1040150 1040190 1040250
##       2       1       1       2       4       1       2       4       2       3
## 1040340 1040370 1044010 1044140 1044370 1045030 1045060 1045100 1045120 1047210
##       2       2       1       2       2       4       2       1       2       2
## 1047220 1047350 1047420 1047610 1047650 1047750 1047760 1047870 1047980 1050050
##       2       2       1       4       2       2       2       2       3       1
## 1050210 1054110 1054270 1054310 1055060 1055160 1055260 1055330 1057150 1057280
##       4       2       1       4       4       2       1       2       1       3
## 1057410 1057500 1057510 1057550 1057580 1057800 1057930 1058000 1058010 1058190
##       2       2       2       2       2       2       4       2       2       2
## 1058350 1058370 1060050 1060130 1060150 1060230 1060260 1060330 1060370 1060420
##       1       2       2       4       2       4       4       1       4       2
## 1060590 1060640 1060650 1060720 1060760 1060810 1060920 1060980 1061080 1061130
##       2       4       3       4       2       1       2       2       2       4
```

```
## 1061180 1061310 1061380 1061400 1061500 1061580 1061660 1061700 1061730 1061820
##       2       2       4       2       1       4       2       2       3       2
## 1061830 1061940 1062120 1062220 1062270 1062310 1065040 1065080 1065100 1065160
##       2       1       2       1       3       1       1       2       2       3
## 1065340 1065370 1065450 1065510 1065600 1065650 1065660 1065710 1065780 1070040
##       2       2       1       1       2       4       4       1       2       2
## 1070070 1070140 1070270 1070300 1070310 1070330 1070420 1070500 1070600 1070660
##       1       1       2       2       2       2       2       2       2       2
## 1070670 1070790 1070880 1070980 1071010 1071090 1071120 1071340 1071460 1071500
##       2       4       2       1       3       2       3       1       1       2
## 1071560 1071640 1071780 1071800 1071840 1071910 1075060 1075130 1075200 1075220
##       2       2       4       4       4       2       2       2       2       4
## 1075280 1075350 1075400 1075420 1075520 1075610 1075630 1075690 1075730 1077110
##       2       4       2       2       2       2       2       2       4       2
## 1077200 1077300 1077390 1077480 1077500 1077570 1080020 1080080 1080180 1080220
##       2       2       2       2       1       2       2       2       1       4
## 1080230 1080250 1080330 1080380 1080390 1080470 1080570 1080590 1080690 1080750
##       2       2       4       2       2       4       2       4       1       4
## 1080820 1080950 1081110 1081140 1081260 1081410 1081490 1081530 1081640 1081720
##       2       2       1       4       2       3       3       2       4       2
## 1081820 1081850 1081900 1082020 1082110 1082190 1082210 1082260 1085080 1085220
##       1       2       1       3       1       1       1       1       1       4
## 1085230 1085290 1085340 1085460 1085480 1085530 1085590 1085630 1090040 1094030
##       2       4       2       2       1       2       1       4       4       2
## 1094070 1095130 1095140 1095150 1095220 1095330 1097180 1097370 1097410 1097450
##       2       4       2       2       2       2       2       2       2       2
## 1097530 1097540 1100100 1100120 1100290 1100420 1100460 1100470 1100490 1100510
##       3       2       4       2       4       2       2       2       2       4
## 1100620 1100790 1100860 1100910 1101030 1101070 1101080 1104070 1104230 1104380
##       2       2       2       2       2       4       4       4       2       2
## 1104490 1104510 1104630 1104740 1105040 1105100 1105130 1105150 1105250 1105370
##       2       2       2       2       2       2       2       2       2       4
## 1105400 1105580 1105630 1105830 1105890 1105900 1106020 1106040 1106090 1106180
##       4       4       2       2       2       2       1       2       3       4
## 1106290 1106360 1106440 1106550 1106570 1106630 1106730 1106800 1106810 1110140
##       4       2       2       2       4       3       4       2       2       4
## 1110290 1110370 1110380 1110540 1110550 1110680 1110890 1110970 1111010 1111100
##       4       4       2       4       2       4       2       2       4       3
## 1111180 1111280 1111310 1111410 1111500 1111710 1111750 1115100 1115200 1115320
##       2       4       3       2       4       1       2       1       2       2
## 1115330 1115620 1115710 1115800 1115970 1116000 1116050 1116130 1116200 1116250
##       2       2       2       4       2       4       4       4       3       2
## 1116380 1116470 1116570 1116580 1116630 1116730 1120150 1120250 1120440 1120450
##       3       2       2       4       2       4       4       4       2       2
## 1120550 1120560 1120690 1120850 1120870 1120960 1121050 1121170 1121270 1121350
##       2       4       4       3       4       2       4       2       4       4
## 1121440 1121450 1121570 1121660 1121760 1121780 1125100 1125140 1125190 1125280
##       4       4       2       4       4       4       4       4       4       2
## 1125470 1125480 1125510 1125790 1125840 1125910 1130020 1134090 1135050 1135150
##       2       4       2       2       1       4       2       4       2       2
## 1135240 1135320 1137070 1137150 1137510 1137580 1137610 1140060 1140070 1140180
##       4       4       4       4       2       4       2       4       2       4
## 1140360 1140480 1140500 1140570 1140670 1140890 1141020 1141110 1141130 1144060
##       4       4       4       4       4       4       4       4       4       2
```

```
## 1145010 1145120 1145270 1145330 1145380 1145390 1145440 1145470 1145620 1145690
##       4       4       2       4       4       4       4       2       4       2
## 1145750 1145780 1145960 1145980 1146030 1146060 1146140 1146240 1146340 1146370
##       2       4       4       2       4       4       4       4       2       2
## 1146450 1146510 1146620 1146670 1146710 1146760 1146840 1146930 1146970 1147250
##       2       2       4       3       4       2       3       4       4       2
## 1147390 1147430 1147500 1147580 1147590 1147670 1147700 1147740 1147820 1147850
##       3       2       2       4       4       3       4       4       2       4
## 1147910 1147940 1147960 1148010 1148070 1148140 1148150 1148180 1148250 1148280
##       2       4       2       4       4       2       3       2       2       2
## 1148330 1148380 1148460 1148480 1150090 1150100 1150350 1150380 1150400 1150490
##       4       2       3       4       3       2       4       4       4       4
## 1150620 1150720 1150750 1150910 1150950 1150970 1151040 1151170 1151190 1151290
##       4       4       4       4       4       2       2       2       4       4
## 1151420 1151460 1151510 1151600 1151760 1151830 1152040 1152050 1152170 1152230
##       4       4       4       4       2       2       2       4       4       4
## 1152360 1155080 1155110 1155150 1155250 1155270 1155360 1155380 1155460 1155550
##       4       4       4       4       4       2       4       4       4       4
## 1155580 1155680 1155700 1155740 1155820 1155870 1155960 1156020 1156100 1156150
##       3       4       4       2       4       4       4       4       2       2
## 1156220 1156240 1156290 1156520 1156690 1156770 1156780 1156840 1156880 1156970
##       1       4       2       2       4       4       2       2       2       4
## 1156990 1157070 1157120 1157180 1157190 1157250 1157310 1157320 1157360 1157420
##       4       2       2       4       4       2       3       4       4       2
## 1157460 1157490 1157500 1157580 1157610 1157640 1157670 1157700 1157730 1157780
##       2       3       2       2       2       2       2       2       2       2
## 1157830 1157860 1157870 1157910 1157950 1158030 1158080 1158120 1158130 1158220
##       4       1       2       3       4       2       1       2       2       3
## 1160050 1160140 1160280 1160330 1160540 1160600 1160660 1160890 1161010 1161130
##       4       4       2       4       4       2       2       2       2       4
## 1161270 1161340 1161390 1161500 1161750 1161780 1161880 1161920 1162150 1162260
##       3       4       3       2       2       2       2       4       4       3
## 1162360 1162440 1162580 1162600 1162660 1162680 1162890 1162960 1163000 1163230
##       4       2       4       2       4       4       2       4       2       4
## 1163300 1163410 1163560 1163670 1163760 1163830 1165010 1165070 1165090 1165100
##       2       2       4       4       2       1       4       4       4       4
## 1165160 1165310 1165330 1165390 1165460 1165720 1166020 1166080 1166340 1166460
##       4       4       2       4       2       4       2       2       4       4
## 1166470 1166740 1166870 1166960 1166980 1167090 1167230 1167340 1167350 1167670
##       2       4       3       2       2       3       4       2       2       3
##
## Within cluster sum of squares by cluster:
## [1]  931.7461 5401.4795 1689.3619 5699.3769
##  (between_SS / total_SS =  25.5 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
#data.df.all.kmeans.4
# visualize
fviz_cluster(data.df.all.kmeans.4, data = data.df.all)
```



Analysis K-means clustering with 4 clusters of sizes 40, 288, 70, 202

Cluster means: No..of.Brands Brand.Runs Total.Volume No..of..Trans Value Trans. . . Brand.Runs Vol.Tran Avg..Price Others.999 brand.vol.max Pur.Vol.No.Promo. . . . 1 -0.40302775 -0.81534002 -0.05831701 -0.45780771 0.07909402 0.6362451 0.3190068 0.3941736 -1.27786148 7.302793 0.1082743 2 0.05196104 -0.02621079 0.21350378 -0.02752712 0.08913830 -0.1604637 0.2104303 -0.3404089 0.09352442 1.190961 0.1809100 3 -0.57484960 -0.80331672 0.07589467 -0.42194435 -0.55565205 1.0474825 0.4965263 -1.3088637 -1.27596356 2.583395 0.2396606 4 0.20492972 0.47720039 -0.31915363 0.27611992 0.04980224 -0.2601982 -0.5352527 0.8608480 0.56186571 1.169212 -0.3624222

Pur.Vol.Promo.6.. Pur.Vol.Other.Promo.. Pr.Cat.1 Pr.Cat.2 Pr.Cat.3 Pr.Cat.4 PropCat.5 PropCat.6 PropCat.7 PropCat.8 PropCat.9 PropCat.10 1 0.004476381 -0.18297411 -0.2029129 0.8103512 -0.4364590 -0.4100657 -0.5836170 0.06386371 0.8079389 0.2792642 -0.35126414 -0.2230794 2 -0.176891651 -0.07257201 -0.5075196 0.4429335 -0.2220330 0.3336021 0.5689402 -0.02666001 -0.1852715 -0.2201183 -0.07035438 -0.1708574 3 -0.478972755 0.22251373 -0.7848684 -1.2090708 2.4892721 -0.3608966 -1.1445341 -0.22057973 -0.4563628 -0.4763799 -0.13158214 -0.2561271 4 0.417296204 0.06259279 1.0357572 -0.3729898 -0.4596296 -0.2693664 -0.2989738 0.10180255 0.2623071 0.4236143 0.21546226 0.3765297

`PropCat.11 PropCat.12 PropCat.13 PropCat.14 PropCat.15`

1 0.954631305 -0.1410229 0.6087465 -0.4304315 -0.24117355 2 -0.065248641 -0.1357292 -0.2155251 -0.2256394 0.02735269 3 -0.249197062 -0.1655249 -0.2410929 2.4917854 -0.25382822 4 -0.009652719 0.2788003 0.2702865 -0.4565524 0.09671952

Here we can see that two clusters (Cluster 1, Cluster 3) have less candidates (40, 70) than other two (Cluster 2, Cluster 4).

- Cluster 1 consumers seems to be the most loyal customers who are not swayed by discounts and promotions. They do seem to care about promises that the products make (proposition). This cluster

also has the least number of members (n=40) looking at the data
  - Brand volume purchased per brand is the highest (way higher than other clusters)
  - They have low numbers in brands purchased
  - Brand runs are low
  - Number of transactions of distinct brands are lowest
  - Average transaction/ brand run is highest
  - High Proposition cat 2, 7
- Cluster 2 can primarily be defined by the proposition category, they care a lot about product proposition, higher values in Proposition cat 2,4,5. They also seem to experiment with other brands (high no. of brands and high other brand purchases). Cluster 2 has the highest number of members amongst all the clusters (n=288)
- Cluster 3 consumers can be classified as "frugal" given low "No. of brands", "No. of transactions" and "value". They have the most "Average transactions/brand run" and Volume per transaction. which indicates that they prefer to buy in bulk. They are inclined towards other promoitions and discounts (high Purchase volume under other promotion). They are also seem to care about promises that the products make (proposition) indicated by high Proposition category 14 and 2.
- Cluster 4 consumers are high spenders, they have high number of brands and the highest brand runs. They seem to buy less volume and more frequently paying the most (highest Average price per transaction). They also seem to experiment a lot (high other brand purchases). They are also inclined towards discounts and promotions (especially promo code 6), and appear to be most influenced by produce proposition 1, 6.8,9,10,12,13 and 15

Problem 2 (demographic, brand loyalty, and basis for purchase)

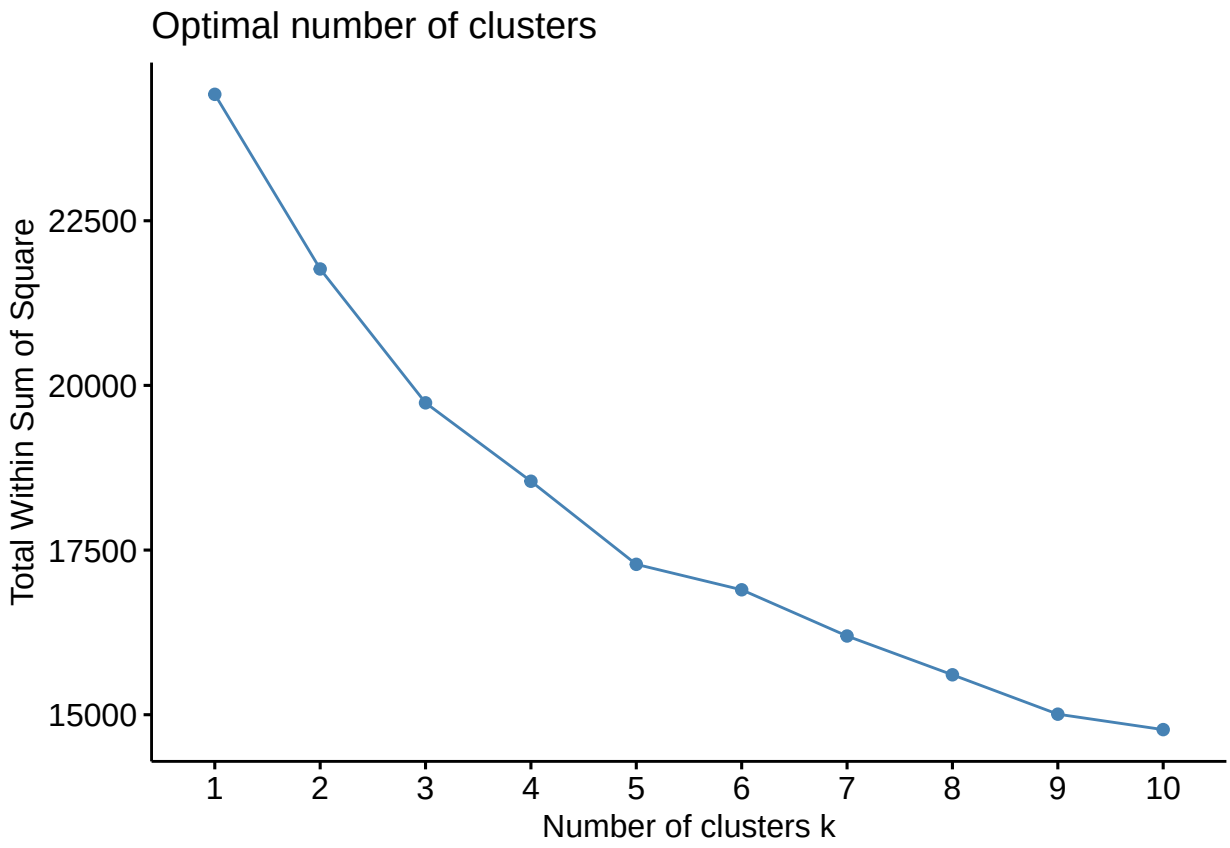
Here we include demographic info in the cluster creation.

K - Means Let's calcualte K-Means

Find the optimum value of k using

Elbow Chart

```
library(factoextra)
library(NbClust)
set.seed(13)
fviz_nbclust(data.df.all.demo, kmeans, method = "wss")
```



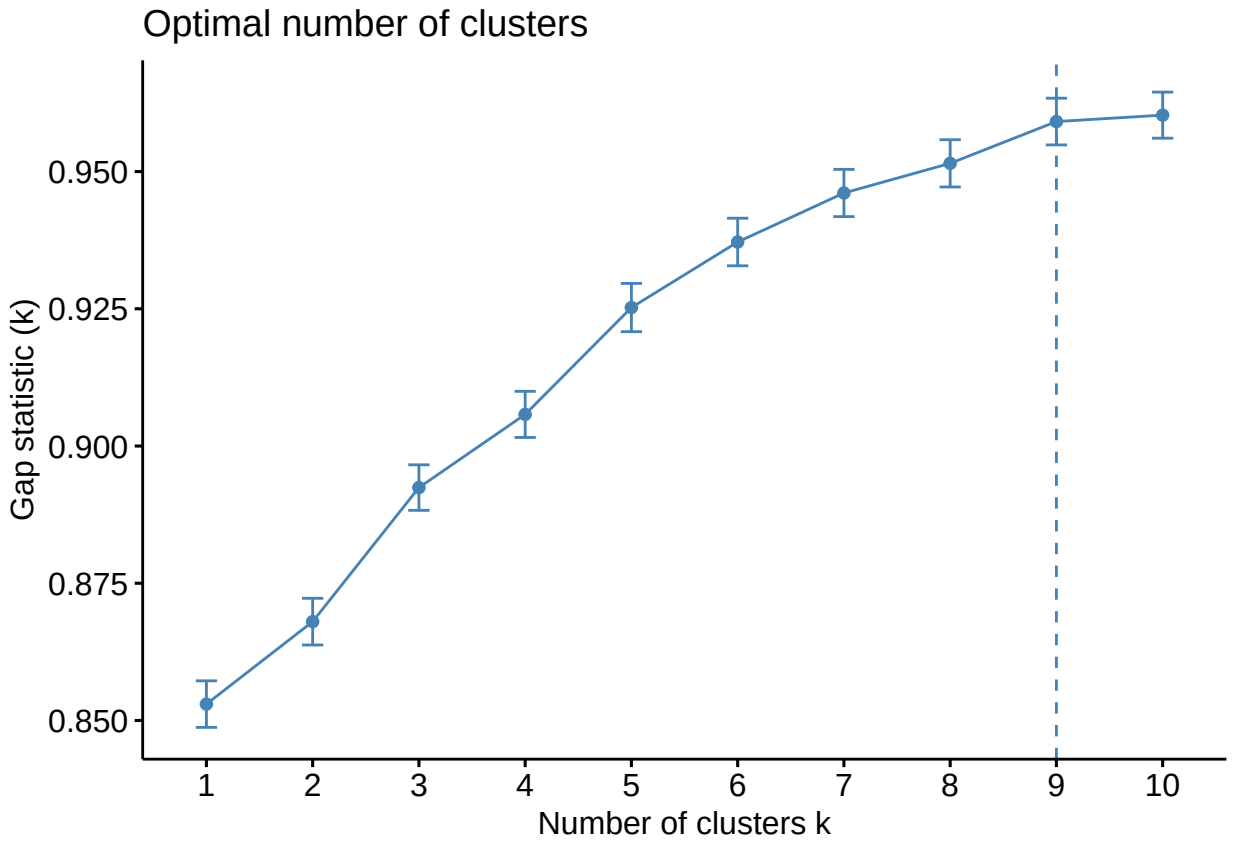
Using Gap Statistic Method

```
set.seed(13)
gap_stat <- clusGap(data.df.all.demo, FUN = kmeans, nstart = 25,
                    K.max = 10, B = 100)
```

```
## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations
```

```
## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations

## Warning: did not converge in 10 iterations
```

```
fviz_gap_stat(gap_stat)
```



Looking at the charts and considering that the marketing efforts would support two to five different promotional approaches, k=4 seems to be a good value.

```r
set.seed(13)
# Compute k-means clustering with k = 4
data.df.all.demo <- kmeans(data.df.all.demo, 4, nstart = 50)
print(data.df.all.demo)
```

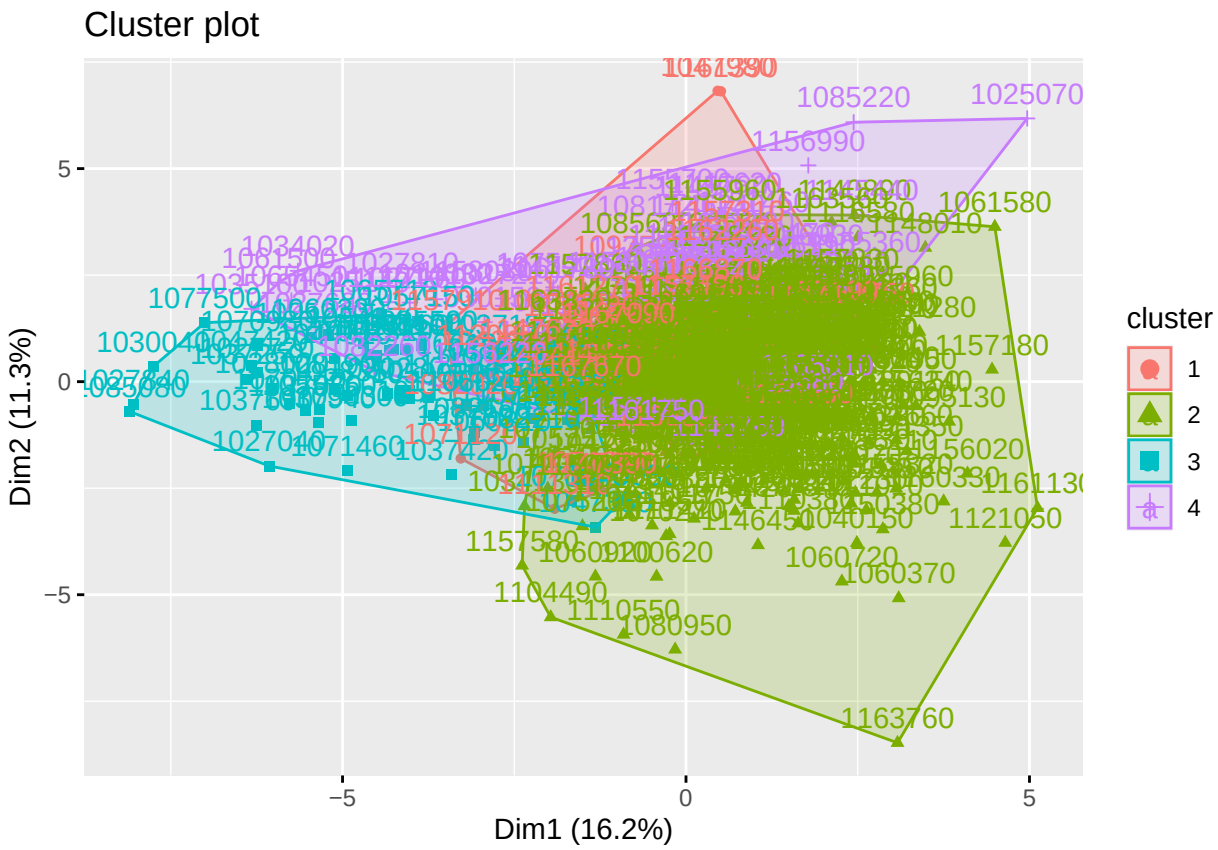
```
## K-means clustering with 4 clusters of sizes 44, 431, 59, 66
##
## Cluster means:
##           SEC         FEH          MT        SEX         AGE        EDU
## 1 -0.32497510  0.09758683  0.02197947  0.1932169  0.38373836  0.3434338
## 2 -0.04250689  0.19250649  0.23562435  0.3498234  0.07788562  0.3255918
## 3  0.84066652  0.53982630  0.39259944  0.2989470 -0.14857221 -0.5692790
## 4 -0.25727195 -1.80475562 -1.90431150 -2.6805048 -0.63162774 -1.8462679
##           HS      CHILD          CS Affluence.Index No..of.Brands Brand.Runs
## 1  0.1340527  0.2004250  0.08988684       0.1834901    -0.2879318 -0.7150001
## 2  0.1970988 -0.2279307  0.21699402       0.2912677     0.1888753  0.2892358
## 3  0.4988137 -0.1081565  0.40192716      -0.5959346    -0.3493813 -0.6184432
## 4 -1.8223924  1.4515254 -1.83625981      -1.4916636    -0.7291330 -0.8592797
##   Total.Volume No..of..Trans      Value Trans...Brand.Runs    Vol.Tran
## 1  -0.06291343   -0.34526198  0.1058201          0.5722869  0.22458798
## 2   0.09722397    0.22804946  0.1798034         -0.1695007 -0.08946189
## 3   0.50309197   -0.07493294 -0.2703163          1.1906898  0.58932409
## 4  -1.04269343   -1.19207192 -1.0030708         -0.3390380 -0.09233208
##    Avg..Price Others.999 brand.vol.max Pur.Vol.No.Promo.... Pur.Vol.Promo.6..
## 1  0.44214547 -1.2173356      7.002966           0.09611289        0.01766136
## 2  0.12093198  0.2993729      1.109575          -0.03578233        0.07641421
## 3 -1.30376457 -1.1477692      2.485438           0.23666440       -0.37172170
## 4  0.08100038 -0.1174025      1.804981          -0.04196942       -0.17848551
##   Pur.Vol.Other.Promo..    Pr.Cat.1   Pr.Cat.2   Pr.Cat.3   Pr.Cat.4  PropCat.5
## 1           -0.18328995 -0.15176518  0.7532476 -0.4423098 -0.3851764 -0.6015721
## 2           -0.03941985  0.08450512  0.1370934 -0.3226239  0.1039235  0.2298877
## 3            0.08677629 -0.78400616 -1.2074004  2.4260808 -0.2748316 -1.1148077
## 4            0.30204415  0.25018675 -0.3180835  0.2329356 -0.1761849 -0.1036176
##     PropCat.6    PropCat.7   PropCat.8   PropCat.9  PropCat.10  PropCat.11
## 1  0.03898175  0.761486517  0.36708717 -0.31333455 -0.20915792  0.94217859
## 2  0.03855987 -0.003162087  0.01112694  0.06577698  0.03090294 -0.03339647
## 3 -0.17542767 -0.457810355 -0.49714199 -0.14820766 -0.25439144 -0.24860743
## 4 -0.12097375 -0.077753582  0.12702773 -0.08816523  0.16504361 -0.18779002
##     PropCat.12  PropCat.13 PropCat.14  PropCat.15
## 1 -0.158347532  0.64844527 -0.4362395 -0.22221010
## 2 -0.001078873 -0.04796716 -0.3246806  0.08682974
## 3 -0.158787990 -0.22478307  2.4233292 -0.21032217
## 4  0.254557229  0.08188569  0.2447797 -0.23086921
##
## Clustering vector:
## 1010010 1010020 1014020 1014030 1014190 1017020 1017110 1017160 1017360 1017460
##       2       2       2       4       2       2       2       3       2       1
## 1017490 1020070 1020210 1024050 1024100 1024120 1024220 1024400 1024630 1025070
##       2       2       2       2       2       2       2       2       2       4
## 1025140 1025210 1027040 1027160 1027210 1027390 1027480 1027540 1027580 1027680
##       4       3       3       4       4       2       2       2       2       4
## 1027720 1027750 1027810 1027840 1028020 1028050 1028110 1028230 1030040 1030150
##       3       2       4       3       3       2       2       2       3       4
## 1030200 1030280 1030300 1034020 1034130 1034220 1034350 1035020 1035100 1035150
```

```
##       2       3       3       4       2       1       4       1       4       2
## 1037050 1037120 1037190 1037220 1037250 1037290 1037420 1037630 1037690 1037720
##       3       2       3       2       3       2       3       2       3       2
## 1037850 1037890 1037940 1038000 1038080 1038110 1040080 1040150 1040190 1040250
##       2       3       3       2       2       3       3       2       2       1
## 1040340 1040370 1044010 1044140 1044370 1045030 1045060 1045100 1045120 1047210
##       2       2       3       2       3       2       2       3       2       2
## 1047220 1047350 1047420 1047610 1047650 1047750 1047760 1047870 1047980 1050050
##       2       3       3       2       4       2       2       2       1       3
## 1050210 1054110 1054270 1054310 1055060 1055160 1055260 1055330 1057150 1057280
##       2       2       3       2       2       2       3       2       3       1
## 1057410 1057500 1057510 1057550 1057580 1057800 1057930 1058000 1058010 1058190
##       2       2       2       2       2       2       2       2       2       2
## 1058350 1058370 1060050 1060130 1060150 1060230 1060260 1060330 1060370 1060420
##       3       2       2       2       2       2       2       3       2       2
## 1060590 1060640 1060650 1060720 1060760 1060810 1060920 1060980 1061080 1061130
##       2       2       1       2       2       3       2       2       2       2
## 1061180 1061310 1061380 1061400 1061500 1061580 1061660 1061700 1061730 1061820
##       2       2       2       2       4       2       2       2       1       2
## 1061830 1061940 1062120 1062220 1062270 1062310 1065040 1065080 1065100 1065160
##       2       3       2       3       1       3       3       2       2       1
## 1065340 1065370 1065450 1065510 1065600 1065650 1065660 1065710 1065780 1070040
##       4       2       4       3       2       2       2       3       2       3
## 1070070 1070140 1070270 1070300 1070310 1070330 1070420 1070500 1070600 1070660
##       3       3       2       2       2       2       2       2       2       2
## 1070670 1070790 1070880 1070980 1071010 1071090 1071120 1071340 1071460 1071500
##       2       2       2       3       1       2       1       3       3       2
## 1071560 1071640 1071780 1071800 1071840 1071910 1075060 1075130 1075200 1075220
##       2       2       2       2       2       2       2       2       2       2
## 1075280 1075350 1075400 1075420 1075520 1075610 1075630 1075690 1075730 1077110
##       2       2       4       2       3       2       2       2       2       2
## 1077200 1077300 1077390 1077480 1077500 1077570 1080020 1080080 1080180 1080220
##       2       2       2       2       3       2       4       2       3       2
## 1080230 1080250 1080330 1080380 1080390 1080470 1080570 1080590 1080690 1080750
##       2       2       2       2       2       4       2       2       3       1
## 1080820 1080950 1081110 1081140 1081260 1081410 1081490 1081530 1081640 1081720
##       2       2       3       2       2       1       1       2       2       4
## 1081820 1081850 1081900 1082020 1082110 1082190 1082210 1082260 1085080 1085220
##       3       2       3       1       3       3       3       4       3       4
## 1085230 1085290 1085340 1085460 1085480 1085530 1085590 1085630 1090040 1094030
##       2       2       2       2       3       2       3       2       2       2
## 1094070 1095130 1095140 1095150 1095220 1095330 1097180 1097370 1097410 1097450
##       4       2       4       2       2       2       2       3       2       2
## 1097530 1097540 1100100 1100120 1100290 1100420 1100460 1100470 1100490 1100510
##       1       2       2       2       2       2       2       2       2       2
## 1100620 1100790 1100860 1100910 1101030 1101070 1101080 1104070 1104230 1104380
##       2       2       2       2       2       2       2       2       2       4
## 1104490 1104510 1104630 1104740 1105040 1105100 1105130 1105150 1105250 1105370
##       2       2       2       2       2       4       2       2       2       2
## 1105400 1105580 1105630 1105830 1105890 1105900 1106020 1106040 1106090 1106180
##       2       2       2       2       2       2       3       2       1       2
## 1106290 1106360 1106440 1106550 1106570 1106630 1106730 1106800 1106810 1110140
##       4       4       2       2       2       1       2       2       2       2
## 1110290 1110370 1110380 1110540 1110550 1110680 1110890 1110970 1111010 1111100
```

```
##       2       2       2       2       2       2       2       2       2       1
## 1111180 1111280 1111310 1111410 1111500 1111710 1111750 1115100 1115200 1115320
##       2       2       1       2       2       4       2       3       2       2
## 1115330 1115620 1115710 1115800 1115970 1116000 1116050 1116130 1116200 1116250
##       2       2       2       2       4       2       2       2       1       2
## 1116380 1116470 1116570 1116580 1116630 1116730 1120150 1120250 1120440 1120450
##       1       2       2       2       2       2       2       2       2       2
## 1120550 1120560 1120690 1120850 1120870 1120960 1121050 1121170 1121270 1121350
##       2       2       2       1       2       2       2       2       2       2
## 1121440 1121450 1121570 1121660 1121760 1121780 1125100 1125140 1125190 1125280
##       2       2       2       2       2       2       2       2       2       4
## 1125470 1125480 1125510 1125790 1125840 1125910 1130020 1134090 1135050 1135150
##       2       2       2       2       3       2       2       2       2       2
## 1135240 1135320 1137070 1137150 1137510 1137580 1137610 1140060 1140070 1140180
##       4       4       2       4       2       2       2       2       2       2
## 1140360 1140480 1140500 1140570 1140670 1140890 1141020 1141110 1141130 1144060
##       2       2       2       4       2       2       2       4       4       2
## 1145010 1145120 1145270 1145330 1145380 1145390 1145440 1145470 1145620 1145690
##       4       2       2       2       4       4       4       2       2       2
## 1145750 1145780 1145960 1145980 1146030 1146060 1146140 1146240 1146340 1146370
##       2       4       2       2       2       2       2       4       2       2
## 1146450 1146510 1146620 1146670 1146710 1146760 1146840 1146930 1146970 1147250
##       2       4       4       1       2       4       4       4       2       2
## 1147390 1147430 1147500 1147580 1147590 1147670 1147700 1147740 1147820 1147850
##       1       2       2       2       2       1       2       2       2       2
## 1147910 1147940 1147960 1148010 1148070 1148140 1148150 1148180 1148250 1148280
##       4       2       2       2       2       2       1       2       2       4
## 1148330 1148380 1148460 1148480 1150090 1150100 1150350 1150380 1150400 1150490
##       2       2       1       2       1       2       2       2       2       2
## 1150620 1150720 1150750 1150910 1150950 1150970 1151040 1151170 1151190 1151290
##       2       2       1       2       1       2       2       2       4       2
## 1151420 1151460 1151510 1151600 1151760 1151830 1152040 1152050 1152170 1152230
##       2       4       2       2       2       2       2       2       2       2
## 1152360 1155080 1155110 1155150 1155250 1155270 1155360 1155380 1155460 1155550
##       4       2       2       2       2       2       4       2       2       2
## 1155580 1155680 1155700 1155740 1155820 1155870 1155960 1156020 1156100 1156150
##       1       4       4       2       2       2       2       2       2       2
## 1156220 1156240 1156290 1156520 1156690 1156770 1156780 1156840 1156880 1156970
##       4       2       2       2       2       2       4       4       2       2
## 1156990 1157070 1157120 1157180 1157190 1157250 1157310 1157320 1157360 1157420
##       4       2       2       2       1       2       1       2       2       4
## 1157460 1157490 1157500 1157580 1157610 1157640 1157670 1157700 1157730 1157780
##       2       1       2       2       2       2       2       2       2       2
## 1157830 1157860 1157870 1157910 1157950 1158030 1158080 1158120 1158130 1158220
##       2       2       2       1       2       4       4       2       2       1
## 1160050 1160140 1160280 1160330 1160540 1160600 1160660 1160890 1161010 1161130
##       2       2       2       2       2       2       2       2       2       2
## 1161270 1161340 1161390 1161500 1161750 1161780 1161880 1161920 1162150 1162260
##       1       2       1       2       4       4       2       2       2       1
## 1162360 1162440 1162580 1162600 1162660 1162680 1162890 1162960 1163000 1163230
##       2       2       2       2       2       2       2       2       2       2
## 1163300 1163410 1163560 1163670 1163760 1163830 1165010 1165070 1165090 1165100
##       4       2       2       2       2       2       4       2       2       2
## 1165160 1165310 1165330 1165390 1165460 1165720 1166020 1166080 1166340 1166460
```

```
##       2       2       2       2       2       2       2       2       2       2
## 1166470 1166740 1166870 1166960 1166980 1167090 1167230 1167340 1167350 1167670
##       2       2       1       2       2       1       2       2       2       1
##
## Within cluster sum of squares by cluster:
## [1]  2110.079 12487.520  1172.561  2681.700
##  (between_SS / total_SS =  24.4 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
#data.df.all.kmeans.4
# visualize
fviz_cluster(data.df.all.demo, data = data.df.all)
```



Analysis K-means clustering with 4 clusters of sizes 66, 431, 44, 59

Cluster means: SEC FEH MT SEX AGE EDU HS CHILD CS Affluence.Index No..of.Brands Brand.Runs Total.Volume No..of..Trans Value Trans. . . Brand.Runs Vol.Tran Avg..Price Others.999 brand.vol.max Pur.Vol.No.Promo. . . . Pur.Vol.Promo.6.. Pur.Vol.Other.Promo.. 1 -0.25727195 -1.80475562 -1.90431150 -2.6805048 -0.63162774 -1.8462679 -1.8223924 1.4515254 -1.83625981 -1.4916636 -0.7291330 -0.8592797 -1.04269343 -1.19207192 -1.0030708 -0.3390380 -0.09233208 0.08100038 -0.1174025 1.804981 -0.04196942 -0.17848551 0.30204415 2 -0.04250689 0.19250649 0.23562435 0.3498234 0.07788562 0.3255918 0.1970988 -0.2279307 0.21699402 0.2912677 0.1888753 0.2892358 0.09722397 0.22804946 0.1798034 -0.1695007 -0.08946189 0.12093198 0.2993729 1.109575 -0.03578233 0.07641421 -0.03941985 3 -0.32497510 0.09758683 0.02197947 0.1932169 0.38373836 0.3434338 0.1340527 0.2004250 0.08988684 0.1834901 -0.2879318 -0.7150001 -0.06291343

-0.34526198 0.1058201 0.5722869 0.22458798 0.44214547 -1.2173356 7.002966 0.09611289 0.01766136 -0.18328995 4 0.84066652 0.53982630 0.39259944 0.2989470 -0.14857221 -0.5692790 0.4988137 -0.1081565 0.40192716 -0.5959346 -0.3493813 -0.6184432 0.50309197 -0.07493294 -0.2703163 1.1906898 0.58932409 -1.30376457 -1.1477692 2.485438 0.23666440 -0.37172170 0.08677629 Pr.Cat.1 Pr.Cat.2 Pr.Cat.3 Pr.Cat.4 PropCat.5 PropCat.6 PropCat.7 PropCat.8 PropCat.9 PropCat.10 PropCat.11 PropCat.12 PropCat.13 PropCat.14 PropCat.15 1 0.25018675 -0.3180835 0.2329356 -0.1761849 -0.1036176 -0.12097375 -0.077753582 0.12702773 -0.08816523 0.16504361 -0.18779002 0.254557229 0.08188569 0.2447797 -0.23086921 2 0.08450512 0.1370934 -0.3226239 0.1039235 0.2298877 0.03855987 -0.003162087 0.01112694 0.06577698 0.03090294 -0.03339647 -0.001078873 -0.04796716 -0.3246806 0.08682974 3 -0.15176518 0.7532476 -0.4423098 -0.3851764 -0.6015721 0.03898175 0.761486517 0.36708717 -0.31333455 -0.20915792 0.94217859 -0.158347532 0.64844527 -0.4362395 -0.22221010 4 -0.78400616 -1.2074004 2.4260808 -0.2748316 -1.1148077 -0.17542767 -0.457810355 -0.49714199 -0.14820766 -0.25439144 -0.24860743 -0.158787990 -0.22478307 2.4233292 -0.21032217

- Cluster 1 consumers seems to be ranked low in socialeconomic class have more childrean and are less affulant and are younger. They tend to have least number of brands, low brand runs and lowest total volume. They also seem to spend less and buy less on brands. They prefer other promotions (not promo code 6) prefer proposition category 1,10 and 12. Cluster 1 has the second lowest members (n=66)
- Cluster 2 has more females and well educated and lowest number of children and are most affluent. They tend to prefer more brands have more brand runs and more brand transactions with least volume, which makes us conclude that they experiment a lot. They also don't seem to be motivated by promotions. Cluster 2 has highest membership (n=431)
- Cluster 3 consumers seems to be ranked lowest in socialeconomic class. One thing that stands out is that they have the highest rate of volume purchase for any brand. They also seem to be moticated by some few brand propositions (2,7,6,11,13)
- Cluster 4 consumers are ranked the highest in socialeconomic class are the most educated. They can be classified as loyal consumers, they have low number of brands and low brand runs and buy bigger volumes. They also have highest brand runs which makes us think they experiment frequently. They appear to buy at the lower price and do not seem to take advantage of promotions. They have the most "Average transactions/brand run" and Volume per transaction. which indicates that they prefer to buy in bulk. One intresting thing that stands out is that they are driven by proposition category 3 and 14