Project Report

Contents

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Project Description

Getting and preparing the data set

importing the library we are going to use

```
library(dplyr)
library(ggplot2)
library(forcats)
library(arules)
library(hrbrthemes)
```

Reading the data and checking the frist 10 rows of it

```
dataPath <- readline("Enter the path to the data set : ")
grc <- as_tibble(read.csv(dataPath,stringsAsFactors = FALSE))
# displaying first 10 rows of our data
print(grc,n = 10, width = 80)
```

```
## # A tibble: 9,835 x 8
##    items                      count total   rnd customer   age city   paymentType
##    <chr>                      <int> <int> <int> <chr>    <int> <chr>  <chr>
##  1 citrus fruit,semi-finish~     4  1612     9 Maged       60 Hurgh~ Cash
##  2 tropical fruit,yogurt,co~     3   509    12 Eman        23 Aswan  Cash
##  3 whole milk                    1  2084     8 Rania       37 Dakah~ Cash
##  4 pip fruit,yogurt,cream c~     4   788     8 Rania       37 Dakah~ Cash
##  5 other vegetables,whole m~     4  1182    14 Magdy       36 Sohag  Cash
##  6 whole milk,butter,yogurt~     5  1771     3 Ahmed       30 Giza   Credit
##  7 rolls/buns                    1  2196     7 Huda        39 Gharb~ Cash
##  8 other vegetables,UHT-mil~     5  1657     6 Walaa       29 Cairo  Cash
##  9 pot plants                    1  2373     2 Mohamed     25 Alexa~ Credit
## 10 whole milk,cereals            2   343     5 Shimaa      55 Port ~ Cash
## # ... with 9,825 more rows
```

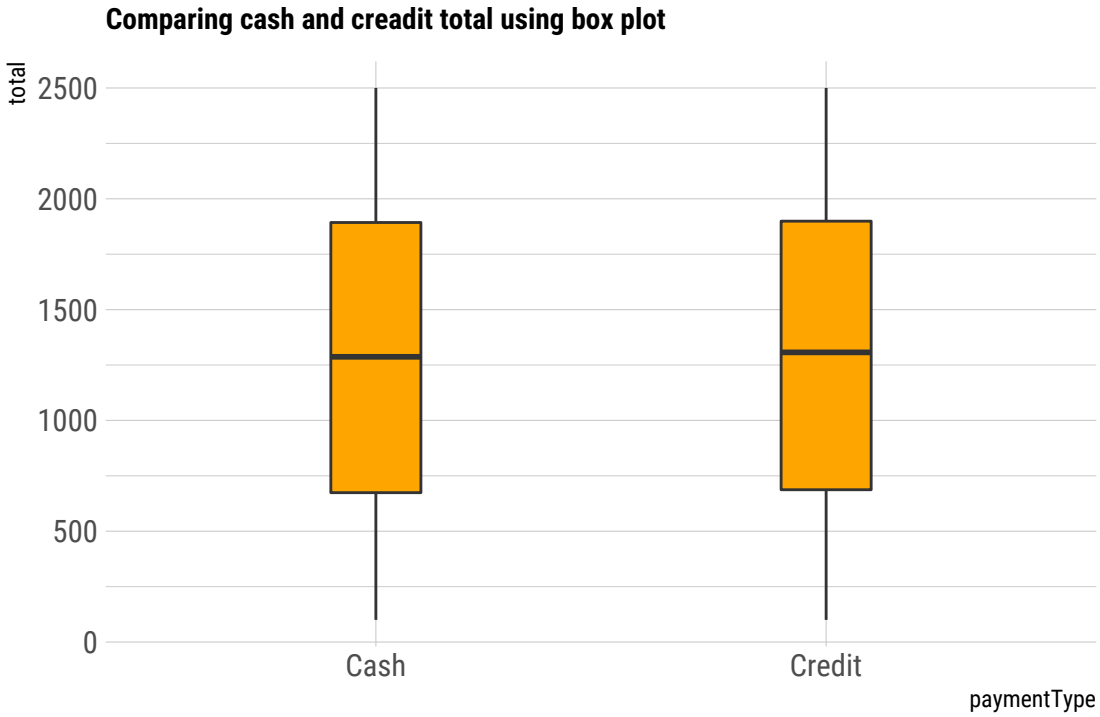
Preparing the data for k-means and apriori algorithms

```
grc_k <- grc %>%
  select(customer,age,total) %>%
  group_by(customer)%>%
  mutate(total = sum(total))%>%
  unique()
grc_k <- data.frame(grc_k[,2:3],row.names = grc_k$customer)
tdata <- strsplit(as.vector(grc$items), ',')
tdata <- transactions(tdata)
```

Visualizing our Data

Comparison between cash and creadit total spending using box plot

```
ggplot(
  grc,
  aes(x = paymentType, y = total, fill = paymentType)
) +
  geom_boxplot(width = .2,
               fill = "orange",
               outlier.color = "orange",
               outlier.size = 2)+
  theme_ipsum_rc() +
  theme(
    legend.position="none",
    plot.title = element_text(size=11)
  ) +
  ggtitle("Comparing cash and creadit total using box plot")
```



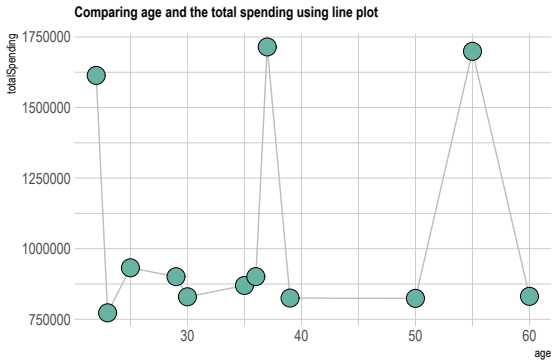
Observations

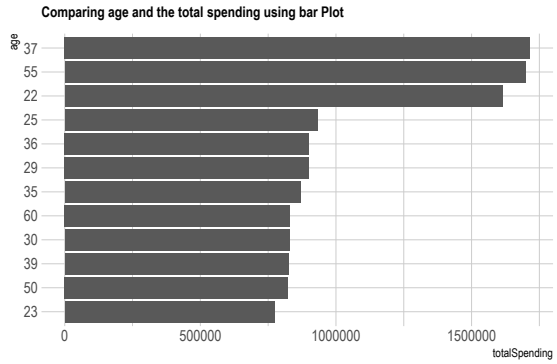
After brief moments of seeing the figure, it is quite easy to see that people nearly equally pay with Cash or credit money.

Compare each age and sum of total spending.

```
grc_age <- select(grc,age,total)
grc_age <- grc_age %>%
  group_by(age) %>%
  summarise(totalSpending = sum(total))
ggplot(
  grc_age,
  aes(x = age, y = totalSpending)) +
  geom_line( color="gray") +
  geom_point(shape=21, color="black", fill="#69b3a2", size=6) +
  theme_ipsum() +
  theme(
    plot.title = element_text(size=11)
  )+
  ggtitle("Comparing age and the total spending using line plot")
grc_age <- mutate(grc_age,age = fct_reorder(as.factor(age),totalSpending))
ggplot(
  grc_age,
  aes(x = age, y = totalSpending)) +
  geom_col() +
```

```
  coord_flip() +
  theme_ipsum() +
  theme(
    plot.title = element_text(size=11)
  )+
  ggtitle("Comparing age and the total spending using bar Plot")
```





Observations

After seeing both figures, it is easy to conclude that total spending of people aged (37,55 and 22) is higher than the rest of age groups. However, we cannot come to a reasonable explanation for this behavior.

Generating of association rules

Brief explanition of Apriori algorithm for generating the rules

Apriori algorithm is an iterative approach for discovering the most frequent item sets. The frequent item sets generated by the algorithm can be used to determine association rules that highlight general trends in the data-set, it is especially useful in the analysis of super-market items in our data set

Implementing the alogrithm

Reading both minimum support and minimum confidance from the user

```
min_support <- as.numeric(readline("Enter the minimum Support : "))
min_conf <- as.numeric(readline("Enter the minimum Confidance : "))
```

implementing the algorithm using the built-in function

```
apriori_rules <- apriori(
  tdata,
  parameter = list(supp = min_support, conf = min_conf, minlen = 2))
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen maxlen target  ext
##         0.5    0.1    1 none FALSE            TRUE       5   0.001      2     10  rules TRUE
##
```

```
## Algorithmic control:
##  filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 9
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.00s].
## sorting and recoding items ... [157 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 done [0.01s].
## writing ... [5668 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].
```

```
# Displaying at most 100 rows of the rules
as_tibble(DATAFRAME(apriori_rules,separate = TRUE, setStart = "", setEnd = "")) %>%
  print(n = 100, width = 90)
```

```
## # A tibble: 5,668 x 7
##     LHS                                RHS           support confidence coverage  lift count
##     <fct>                              <fct>           <dbl>      <dbl>    <dbl> <dbl> <int>
##   1 honey                              whole milk    0.00112      0.733  0.00153  2.87    11
##   2 tidbits                            rolls/buns    0.00122      0.522  0.00234  2.84    12
##   3 cocoa drinks                       whole milk    0.00132      0.591  0.00224  2.31    13
##   4 pudding powder                     whole milk    0.00132      0.565  0.00234  2.21    13
##   5 cooking chocolate                  whole milk    0.00132      0.52   0.00254  2.04    13
##   6 cereals                            whole milk    0.00366      0.643  0.00569  2.52    36
##   7 jam                                whole milk    0.00295      0.547  0.00539  2.14    29
##   8 specialty cheese                   other vegeta~ 0.00427      0.5    0.00854  2.58    42
##   9 rice                               other vegeta~ 0.00397      0.52   0.00763  2.69    39
##  10 rice                               whole milk    0.00468      0.613  0.00763  2.40    46
##  11 baking powder                      whole milk    0.00925      0.523  0.0177   2.05    91
##  12 liver loaf,yogurt                  whole milk    0.00102      0.667  0.00153  2.61    10
##  13 curd cheese,tropical fruit         other vegeta~ 0.00102      0.667  0.00153  3.45    10
##  14 curd cheese,rolls/buns             whole milk    0.00102      0.625  0.00163  2.45    10
##  15 curd cheese,other vegetables       whole milk    0.00122      0.571  0.00214  2.24    12
##  16 curd cheese,whole milk             other vegeta~ 0.00122      0.522  0.00234  2.70    12
##  17 cleaner,other vegetables           whole milk    0.00102      0.625  0.00163  2.45    10
##  18 liquor,red/blush wine              bottled beer  0.00193      0.905  0.00214 11.2     19
##  19 liquor,soda                        bottled beer  0.00122      0.571  0.00214  7.10    12
##  20 cereals,curd                       whole milk    0.00102      0.909  0.00112  3.56    10
##  21 cereals,root vegetables            whole milk    0.00102      0.769  0.00132  3.01    10
##  22 cereals,yogurt                     whole milk    0.00173      0.810  0.00214  3.17    17
##  23 cereals,other vegetables           whole milk    0.00132      0.65   0.00203  2.54    13
##  24 butter,jam                         whole milk    0.00102      0.833  0.00122  3.26    10
##  25 jam,root vegetables                other vegeta~ 0.00102      0.526  0.00193  2.72    10
##  26 jam,other vegetables               root vegetab~ 0.00102      0.556  0.00183  5.10    10
##  27 jam,root vegetables                whole milk    0.00132      0.684  0.00193  2.68    13
##  28 jam,other vegetables               whole milk    0.00132      0.722  0.00183  2.83    13
##  29 instant coffee,whipped/sour cre~   other vegeta~ 0.00102      0.769  0.00132  3.98    10
##  30 instant coffee,other vegetables    whipped/sour~ 0.00102      0.526  0.00193  7.34    10
##  31 instant coffee,other vegetables    soda          0.00102      0.526  0.00193  3.02    10
##  32 instant coffee,other vegetables    whole milk    0.00102      0.526  0.00193  2.06    10
##  33 vinegar,yogurt                     other vegeta~ 0.00102      0.556  0.00183  2.87    10
##  34 other vegetables,vinegar           whole milk    0.00132      0.542  0.00244  2.12    13
```

```
##  35 vinegar,whole milk                whole milk     0.00132      0.5    0.00264  2.58    13
##  36 popcorn,salty snack               soda           0.00122      0.545  0.00224  3.13    12
##  37 popcorn,soda                      salty snack    0.00122      0.632  0.00193 16.7     12
##  38 candles,tropical fruit            whole milk     0.00102      0.667  0.00153  2.61    10
##  39 candles,root vegetables           other vegeta~  0.00102      0.588  0.00173  3.04    10
##  40 bottled beer,soups                whole milk     0.00112      0.917  0.00122  3.59    11
##  41 soups,whipped/sour cream          other vegeta~  0.00102      0.667  0.00153  3.45    10
##  42 pip fruit,soups                   other vegeta~  0.00102      0.714  0.00142  3.69    10
##  43 root vegetables,soups             other vegeta~  0.00122      0.706  0.00173  3.65    12
##  44 root vegetables,soups             whole milk     0.00112      0.647  0.00173  2.53    11
##  45 other vegetables,soups            whole milk     0.00183      0.581  0.00315  2.27    18
##  46 soups,whole milk                  other vegeta~  0.00183      0.621  0.00295  3.21    18
##  47 dog food,tropical fruit           yogurt         0.00102      0.625  0.00163  4.48    10
##  48 dog food,yogurt                   tropical fru~  0.00102      0.526  0.00193  5.02    10
##  49 dog food,tropical fruit           whole milk     0.00102      0.625  0.00163  2.45    10
##  50 dog food,root vegetables          whole milk     0.00102      0.714  0.00142  2.80    10
##  51 dog food,yogurt                   whole milk     0.00122      0.632  0.00193  2.47    12
##  52 dog food,other vegetables         whole milk     0.00112      0.5    0.00224  1.96    11
##  53 Instant food products,soda        hamburger me~  0.00122      0.632  0.00193 19.0     12
##  54 hamburger meat,Instant food pro~  whole milk     0.00153      0.5    0.00305  1.96    15
##  55 Instant food products,whole milk  hamburger me~  0.00153      0.5    0.00305 15.0     15
##  56 Instant food products,root vege~  other vegeta~  0.00102      0.526  0.00193  2.72    10
##  57 Instant food products,yogurt      whole milk     0.00112      0.786  0.00142  3.08    11
##  58 Instant food products,other veg~  whole milk     0.00153      0.556  0.00275  2.17    15
##  59 Instant food products,whole milk  other vegeta~  0.00153      0.5    0.00305  2.58    15
##  60 specialty cheese,whipped/sour c~  other vegeta~  0.00102      0.714  0.00142  3.69    10
##  61 citrus fruit,specialty cheese     whole milk     0.00102      0.714  0.00142  2.80    10
##  62 bottled water,specialty cheese    other vegeta~  0.00102      0.588  0.00173  3.04    10
##  63 root vegetables,specialty cheese  yogurt         0.00112      0.524  0.00214  3.75    11
##  64 root vegetables,specialty cheese  other vegeta~  0.00142      0.667  0.00214  3.45    14
##  65 root vegetables,specialty cheese  whole milk     0.00132      0.619  0.00214  2.42    13
##  66 specialty cheese,yogurt           other vegeta~  0.00163      0.571  0.00285  2.95    16
##  67 specialty cheese,yogurt           whole milk     0.00203      0.714  0.00285  2.80    20
##  68 specialty cheese,whole milk       yogurt         0.00203      0.541  0.00376  3.87    20
##  69 other vegetables,specialty chee~  whole milk     0.00224      0.524  0.00427  2.05    22
##  70 specialty cheese,whole milk       other vegeta~  0.00224      0.595  0.00376  3.07    22
##  71 butter,flower (seeds)             whole milk     0.00102      0.625  0.00163  2.45    10
##  72 flower (seeds),root vegetables    other vegeta~  0.00112      0.579  0.00193  2.99    11
##  73 flower (seeds),root vegetables    whole milk     0.00102      0.526  0.00193  2.06    10
##  74 frozen potato products,fruit/ve~  whole milk     0.00112      0.688  0.00163  2.69    11
##  75 frozen potato products,yogurt     whole milk     0.00153      0.682  0.00224  2.67    15
##  76 frozen potato products,rolls/bu~  whole milk     0.00112      0.55   0.00203  2.15    11
##  77 frozen potato products,other ve~  whole milk     0.00183      0.692  0.00264  2.71    18
##  78 frozen potato products,whole mi~  other vegeta~  0.00183      0.529  0.00346  2.74    18
##  79 house keeping products,napkins    whole milk     0.00132      0.812  0.00163  3.18    13
##  80 house keeping products,whipped/~  whole milk     0.00122      0.923  0.00132  3.61    12
##  81 house keeping products,sausage    whole milk     0.00112      0.688  0.00163  2.69    11
##  82 house keeping products,tropical~  whole milk     0.00112      0.688  0.00163  2.69    11
##  83 house keeping products,root veg~  whole milk     0.00132      0.765  0.00173  2.99    13
##  84 house keeping products,yogurt     other vegeta~  0.00102      0.556  0.00183  2.87    10
##  85 house keeping products,yogurt     whole milk     0.00102      0.556  0.00183  2.17    10
##  86 house keeping products,rolls/bu~  whole milk     0.00112      0.647  0.00173  2.53    11
##  87 house keeping products,other ve~  whole milk     0.00173      0.630  0.00275  2.46    17
##  88 sweet spreads,white bread         whole milk     0.00102      0.667  0.00153  2.61    10
```

```
##  89 pastry,sweet spreads            whole milk    0.00102      0.909  0.00112  3.56    10
##  90 root vegetables,sweet spreads   whole milk    0.00122      0.6    0.00203  2.35    12
##  91 sweet spreads,yogurt            soda          0.00122      0.545  0.00224  3.13    12
##  92 soda,sweet spreads              whole milk    0.00142      0.56   0.00254  2.19    14
##  93 sweet spreads,yogurt            whole milk    0.00122      0.545  0.00224  2.13    12
##  94 curd,turkey                     other vegeta~ 0.00122      0.8    0.00153  4.13    12
##  95 curd,turkey                     whole milk    0.00102      0.667  0.00153  2.61    10
##  96 butter,turkey                   whole milk    0.00102      0.667  0.00153  2.61    10
##  97 turkey,whipped/sour cream       other vegeta~ 0.00102      0.769  0.00132  3.98    10
##  98 pastry,turkey                   whole milk    0.00112      0.579  0.00193  2.27    11
##  99 bottled water,turkey            whole milk    0.00122      0.75   0.00163  2.94    12
## 100 tropical fruit,turkey           root vegetab~ 0.00153      0.577  0.00264  5.29    15
## # ... with 5,568 more rows
```