task1

January 6, 2024

1 Task 1

[ ]:

```
# set options for R markdown knitting
knitr::opts_chunk$set(echo = TRUE)
knitr::opts_chunk$set(linewidth=80)
```

[ ]:

```
# set up line wrapping in MD knit output
library(knitr)
hook_output = knit_hooks$get("output")
knit_hooks$set(output = function(x, options)
{
# this hook is used only when the linewidth option is not NULL
if (!is.null(n <- options$linewidth))
{
x = knitr:::split_lines(x)
# any lines wider than n should be wrapped
if (any(nchar(x) > n))
x = strwrap(x, width = n)
x = paste(x, collapse = "\n")
}
hook_output(x, options)
})
```

Load required libraries and datasets

[ ]:

```
#### Load required libraries
library(data.table)
library(ggplot2)
library(ggmosaic)
library(readr)
```

[ ]:

```
#file path  to read the data
filePath <- ""
transactionData <- fread(paste0(filePath,"QVI_transaction_data.csv"))
customerData <- fread(paste0(filePath,"QVI_purchase_behaviour.csv"))
```

[ ]:

```
head(data_behaiour)
```

```
Error in head(data_behaiour): object 'data_behaiour' not found
Traceback:

1. head(data_behaiour)
```

1.1 Exploratory data analysis

The first step in any analysis is to first understand the data. Let's take a look at each of the datasets provided.

1.1.1 Examining transaction data

We can use `str()` to look at the format of each column and see a sample of the data. As we have read in the dataset as a `data.table` object, we can also run `transactionData` in the console to see a sample of the data or use `head(transactionData)` to look at the first 10 rows.

[ ]:

```
str(transactionData)
head(transactionData)
```

```
Classes 'data.table' and 'data.frame':  264836 obs. of  8 variables:
 $ DATE          : int  43390 43599 43605 43329 43330 43604 43601 43601 43332
43330 …
 $ STORE_NBR     : int  1 1 1 2 2 4 4 4 5 7 …
 $ LYLTY_CARD_NBR: int  1000 1307 1343 2373 2426 4074 4149 4196 5026 7150 …
 $ TXN_ID        : int  1 348 383 974 1038 2982 3333 3539 4525 6900 …
 $ PROD_NBR      : int  5 66 61 69 108 57 16 24 42 52 …
 $ PROD_NAME     : chr  "Natural Chip        Compny SeaSalt175g" "CCs Nacho
Cheese    175g" "Smiths Crinkle Cut  Chips Chicken 170g" "Smiths Chip Thinly
S/Cream&Onion 175g" …
 $ PROD_QTY      : int  2 3 2 5 3 1 1 1 1 2 …
 $ TOT_SALES     : num  6 6.3 2.9 15 13.8 5.1 5.7 3.6 3.9 7.2 …
 - attr(*, ".internal.selfref")=<externalptr>
```

A data.table: 6 × 8

DATE <int>	STORE_NBR <int>	LYLTY_CARD_NBR <int>	TXN_ID <int>	PROD_NBR <int>	PROD_NAM <chr>
43390	1	1000	1	5	Natural Chip
43599	1	1307	348	66	CCs Nacho C
43605	1	1343	383	61	Smiths Crink
43329	2	2373	974	69	Smiths Chip
43330	2	2426	1038	108	Kettle Tortill
43604	4	4074	2982	57	Old El Paso S

[ ]:

```
str(customerData)
head(customerData)
```

```
Classes 'data.table' and 'data.frame':  72637 obs. of  3 variables:
 $ LYLTY_CARD_NBR  : int  1000 1002 1003 1004 1005 1007 1009 1010 1011 1012 …
 $ LIFESTAGE       : chr  "YOUNG SINGLES/COUPLES" "YOUNG SINGLES/COUPLES" "YOUNG
```

```
FAMILIES" "OLDER SINGLES/COUPLES" …
 $ PREMIUM_CUSTOMER: chr  "Premium" "Mainstream" "Budget" "Mainstream" …
 - attr(*, ".internal.selfref")=<externalptr>
```

A data.table: 6 × 3

LYLTY_CARD_NBR	LIFESTAGE	PREMIUM_CUSTOMER
<int>	<chr>	<chr>
1000	YOUNG SINGLES/COUPLES	Premium
1002	YOUNG SINGLES/COUPLES	Mainstream
1003	YOUNG FAMILIES	Budget
1004	OLDER SINGLES/COUPLES	Mainstream
1005	MIDAGE SINGLES/COUPLES	Mainstream
1007	YOUNG SINGLES/COUPLES	Budget

[ ]:

```r
#Convert DATE column to a date format
transactionData$DATE <- as.Date(transactionData$DATE, origin = "1899-12-30")
```

[ ]:

```r
productWords <- data.table(unlist(strsplit(unique(transactionData[,␣
  ↪PROD_NAME]), " ")))
setnames(productWords, 'words')
summary_prod_name <- table(transactionData$PROD_NAME)
print(summary_prod_name)
```

```
                       Burger Rings 220g
                                    1564
                CCs Nacho Cheese    175g
                                    1498
                       CCs Original 175g
                                    1514
                CCs Tasty Cheese    175g
                                    1539
          Cheetos Chs & Bacon Balls 190g
                                    1479
                      Cheetos Puffs 165g
                                    1448
                    Cheezels Cheese 330g
                                    3149
                Cheezels Cheese Box 125g
                                    1454
          Cobs Popd Sea Salt  Chips 110g
                                    3265
  Cobs Popd Sour Crm  &Chives Chips 110g
                                    3159
Cobs Popd Swt/Chlli &Sr/Cream Chips 110g
                                    3269
        Dorito Corn Chp     Supreme 380g
                                    3183
        Doritos Cheese      Supreme 330g
```

```
                                    3052
 Doritos Corn Chip Mexican Jalapeno 150g
                                    3204
 Doritos Corn Chip Southern Chicken 150g
                                    3172
 Doritos Corn Chips  Cheese Supreme 170g
                                    3217
   Doritos Corn Chips  Nacho Cheese 170g
                                    3160
       Doritos Corn Chips  Original 170g
                                    3121
                Doritos Mexicana    170g
                                    3115
          French Fries Potato Chips 175g
                                    1418
   Grain Waves         Sweet Chilli 210g
                                    3167
   Grain Waves Sour    Cream&Chives 210G
                                    3105
   GrnWves Plus Btroot & Chilli Jam 180g
                                    1468
 Infuzions BBQ Rib   Prawn Crackers 110g
                                    3174
 Infuzions Mango     Chutny Papadums 70g
                                    1507
Infuzions SourCream&Herbs Veg Strws 110g
                                    3134
Infuzions Thai SweetChili PotatoMix 110g
                                    3242
  Infzns Crn Crnchers Tangy Gcamole 110g
                                    3144
            Kettle 135g Swt Pot Sea Salt
                                    3257
                      Kettle Chilli 175g
                                    3038
        Kettle Honey Soy    Chicken 175g
                                    3148
  Kettle Mozzarella   Basil & Pesto 175g
                                    3304
                    Kettle Original 175g
                                    3159
    Kettle Sea Salt     And Vinegar 175g
                                    3173
      Kettle Sensations   BBQ&Maple 150g
                                    3083
Kettle Sensations   Camembert & Fig 150g
                                    3219
   Kettle Sensations   Siracha Lime 150g
```

```
                                    3127
 Kettle Sweet Chilli And Sour Cream 175g
                                    3200
 Kettle Tortilla ChpsBtroot&Ricotta 150g
                                    3146
    Kettle Tortilla ChpsFeta&Garlic 150g
                                    3138
Kettle Tortilla ChpsHny&Jlpno Chili 150g
                                    3296
  Natural Chip        Compny SeaSalt175g
                                    1468
 Natural Chip Co     Tmato Hrb&Spce 175g
                                    1572
  Natural ChipCo      Hony Soy Chckn175g
                                    1460
  Natural ChipCo Sea  Salt & Vinegr 175g
                                    1550
  NCC Sour Cream &    Garden Chives 175g
                                    1419
                Pringles Barbeque   134g
                                    3210
     Pringles Chicken    Salt Crips 134g
                                    3104
        Pringles Mystery    Flavour 134g
                                    3114
         Pringles Original   Crisps 134g
                                    3157
                Pringles Slt Vingar 134g
                                    3095
          Pringles SourCream  Onion 134g
                                    3162
        Pringles Sthrn FriedChicken 134g
                                    3083
            Pringles Sweet&Spcy BBQ 134g
                                    3177
   Red Rock Deli Chikn&Garlic Aioli 150g
                                    1434
 Red Rock Deli Sp    Salt & Truffle 150G
                                    1498
    Red Rock Deli Thai  Chilli&Lime 150g
                                    1495
        RRD Chilli&         Coconut 150g
                                    1506
        RRD Honey Soy       Chicken 165g
                                    1513
                RRD Lime & Pepper   165g
                                    1473
                RRD Pc Sea Salt     165g
```

```
                                    1431
                RRD Salt & Vinegar  165g
                                    1474
     RRD SR Slow Rst     Pork Belly 150g
                                    1526
    RRD Steak &         Chimuchurri 150g
                                    1455
     RRD Sweet Chilli &  Sour Cream 165g
                                    1516
      Smith Crinkle Cut   Bolognese 150g
                                    1451
   Smith Crinkle Cut   Mac N Cheese 150g
                                    1512
   Smiths Chip Thinly  Cut Original 175g
                                    1614
  Smiths Chip Thinly  CutSalt/Vinegr175g
                                    1440
  Smiths Chip Thinly  S/Cream&Onion 175g
                                    1473
       Smiths Crinkle      Original 330g
                                    3142
Smiths Crinkle Chips Salt & Vinegar 330g
                                    3197
 Smiths Crinkle Cut  Chips Barbecue 170g
                                    1489
  Smiths Crinkle Cut  Chips Chicken 170g
                                    1484
 Smiths Crinkle Cut  Chips Chs&Onion170g
                                    1481
 Smiths Crinkle Cut  Chips Original 170g
                                    1461
Smiths Crinkle Cut  French OnionDip 150g
                                    1438
 Smiths Crinkle Cut  Salt & Vinegar 170g
                                    1455
     Smiths Crinkle Cut  Snag&Sauce 150g
                                    1503
  Smiths Crnkle Chip  Orgnl Big Bag 380g
                                    3233
Smiths Thinly       Swt Chli&S/Cream175G
                                    1461
  Smiths Thinly Cut   Roast Chicken 175g
                                    1519
    Snbts Whlgrn Crisps Cheddr&Mstrd 90g
                                    1576
Sunbites Whlegrn    Crisps Frch/Onin 90g
                                    1432
  Thins Chips         Originl saltd 175g
```

```
                                    1441
          Thins Chips Light&  Tangy 175g
                                    3188
        Thins Chips Salt &  Vinegar 175g
                                    3103
        Thins Chips Seasonedchicken 175g
                                    3114
    Thins Potato Chips  Hot & Spicy 175g
                                    3229
         Tostitos Lightly    Salted 175g
                                    3074
       Tostitos Smoked     Chipotle 175g
                                    3145
           Tostitos Splash Of  Lime 175g
                                    3252
                Twisties Cheese     270g
                                    3115
         Twisties Cheese     Burger 250g
                                    3169
                    Twisties Chicken270g
                                    3170
  Tyrrells Crisps     Ched & Chives 165g
                                    3268
 Tyrrells Crisps     Lightly Salted 165g
                                    3174
          Woolworths Cheese   Rings 190g
                                    1516
        WW Crinkle Cut      Chicken 175g
                                    1467
       WW Crinkle Cut      Original 175g
                                    1410
       WW D/Style Chip     Sea Salt 200g
                                    1469
          WW Original Corn    Chips 200g
                                    1495
          WW Original Stacked Chips 160g
                                    1487
  WW Sour Cream &OnionStacked Chips 160g
                                    1483
     WW Supreme Cheese   Corn Chips 200g
                                    1509
```

Looks like we are definitely looking at potato chips but how can we check that these are all chips? We can do some basic text analysis by summarising the individual words in the product name.

[ ]:
```
productWords <- data.table(unlist(strsplit(unique(transactionData[,␣
  ↪PROD_NAME]), " ")))
setnames(productWords, 'words')
```

Removing digits

[ ]:
```
containsDigitsOrSpecial <- grepl("[0-9&]", productWords$words)
productWords <- productWords[!containsDigitsOrSpecial]
```

[ ]:
```
wordFrequency <- table(productWords$words)
sortedWordFrequency <- data.table(words = names(wordFrequency), frequency = as.
 ↪integer(wordFrequency))

# Remove rows with empty strings in the 'words' column
sortedWordFrequency <- sortedWordFrequency[words != ""]

# Sort by frequency in descending order
sortedWordFrequency <- sortedWordFrequency[order(-frequency)]

# Print or inspect the sorted word frequency
print(sortedWordFrequency)
```

```
       words frequency
  1:   Chips        21
  2:  Smiths        16
  3: Crinkle        14
  4:     Cut        14
  5:  Kettle        13
 ---
167:     Veg         1
168:  Vinegr         1
169:  Vingar         1
170: Whlegrn         1
171:  Whlgrn         1
```

There are salsa products in the dataset but we are only interested in the chips category, so let's remove these.

[ ]:
```
transactionData[, SALSA := grepl("salsa", tolower(PROD_NAME))]
transactionData <- transactionData[SALSA == FALSE, ][, SALSA := NULL]
```

[ ]:
```
summary(transactionData)
```

```
      DATE          STORE_NBR     LYLTY_CARD_NBR        TXN_ID
 Min.   :43282   Min.   :  1.0   Min.   :   1000   Min.   :      1
 1st Qu.:43373   1st Qu.: 70.0   1st Qu.:  70015   1st Qu.:  67569
 Median :43464   Median :130.0   Median : 130367   Median : 135182
 Mean   :43464   Mean   :135.1   Mean   : 135530   Mean   : 135130
 3rd Qu.:43555   3rd Qu.:203.0   3rd Qu.: 203083   3rd Qu.: 202652
 Max.   :43646   Max.   :272.0   Max.   :2373711   Max.   :2415841
    PROD_NBR       PROD_NAME             PROD_QTY        TOT_SALES
 Min.   :  1.00   Length:246740      Min.   :1.000   Min.   : 1.700
 1st Qu.: 26.00   Class :character   1st Qu.:2.000   1st Qu.: 5.800
 Median : 53.00   Mode  :character   Median :2.000   Median : 7.400
 Mean   : 56.35                      Mean   :1.906   Mean   : 7.316
 3rd Qu.: 87.00                      3rd Qu.:2.000   3rd Qu.: 8.800
 Max.   :114.00                      Max.   :5.000   Max.   :29.500
```

[ ]:

```
outlier <- transactionData[PROD_QTY == 200,]
outlier
```

A data.table: 0 × 8

DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAM
<int>	<int>	<int>	<int>	<int>	<chr>

[ ]:

```
outlierTransactions <- transactionData[LYLTY_CARD_NBR == 226000,] # this is the␣
 ↪outliers customer
outlierTransactions
```

A data.table: 0 × 8

DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_NAM
<int>	<int>	<int>	<int>	<int>	<chr>

[ ]:

```
transactionData <- transactionData[LYLTY_CARD_NBR != 226000]
```

[ ]:

```
print(transactionData)
```

```
         DATE STORE_NBR LYLTY_CARD_NBR TXN_ID PROD_NBR
     1: 43390         1           1000      1        5
     2: 43599         1           1307    348       66
     3: 43605         1           1343    383       61
     4: 43329         2           2373    974       69
     5: 43330         2           2426   1038      108
    ---
246736: 43533       272         272319 270088       89
246737: 43325       272         272358 270154       74
246738: 43410       272         272379 270187       51
246739: 43461       272         272379 270188       42
246740: 43365       272         272380 270189       74
                                       PROD_NAME PROD_QTY TOT_SALES
     1:   Natural Chip        Compny SeaSalt175g        2       6.0
     2:                 CCs Nacho Cheese    175g        3       6.3
     3:   Smiths Crinkle Cut  Chips Chicken 170g        2       2.9
     4:   Smiths Chip Thinly  S/Cream&Onion 175g        5      15.0
     5: Kettle Tortilla ChpsHny&Jlpno Chili 150g        3      13.8
    ---
246736:  Kettle Sweet Chilli And Sour Cream 175g        2      10.8
246737:            Tostitos Splash Of  Lime 175g        1       4.4
246738:                 Doritos Mexicana    170g        2       8.8
246739:  Doritos Corn Chip Mexican Jalapeno 150g        2       7.8
246740:            Tostitos Splash Of  Lime 175g        2       8.8
```

[ ]:

```
productWords <- data.table(unlist(strsplit(unique(transactionData[,␣
 ↪PROD_NAME]), " ")))
```

```
setnames(productWords, 'words')
containsDigitsOrSpecial <- grepl("[0-9&]", productWords$words)
productWords <- productWords[!containsDigitsOrSpecial]
wordFrequency <- table(productWords$words)
sortedWordFrequency <- data.table(words = names(wordFrequency), frequency = as.
 ↪integer(wordFrequency))

sortedWordFrequency <- sortedWordFrequency[words != ""]

sortedWordFrequency <- sortedWordFrequency[order(-frequency)]

print(sortedWordFrequency)
```

```
         words frequency
  1:     Chips        21
  2:    Smiths        15
  3:   Crinkle        13
  4:       Cut        13
  5:    Kettle        13
 ---
155:    Vinegr         1
156:    Vingar         1
157:   Whlegrn         1
158:    Whlgrn         1
159: Woolworths        1
```

[ ]:
```
transactions_by_date <- transactionData[, .N, by = DATE]
print(transactions_by_date)
```

```
           DATE   N
  1: 2018-10-17 682
  2: 2019-05-14 705
  3: 2019-05-20 707
  4: 2018-08-17 663
  5: 2018-08-18 683
 ---
360: 2018-12-08 622
361: 2019-01-30 689
362: 2019-02-09 671
363: 2018-08-31 658
364: 2019-02-12 684
```

[ ]:
```
summary(transactions_by_date)
```

```
      DATE                  N
 Min.   :2018-07-01   Min.   :607.0
 1st Qu.:2018-09-29   1st Qu.:658.0
 Median :2018-12-30   Median :674.0
 Mean   :2018-12-30   Mean   :677.9
 3rd Qu.:2019-03-31   3rd Qu.:694.2
 Max.   :2019-06-30   Max.   :865.0
```

There's only 364 rows, meaning only 364 dates which indicates a missing date. Let's create a sequence of dates from 1 Jul 2018 to 30 Jun 2019 and use this to create a chart of number of transactions over time to find the missing date.

[ ]:

```
date_sequence <- data.table(DATE = seq(as.Date("2018-07-01"), as.
 ↪Date("2019-06-30"), by = "days"))
transactions_by_day <- merge(date_sequence, transactions_by_date, by = "DATE",␣
 ↪all.x = TRUE)
transactions_by_day[is.na(N), N := 0]
print(transactions_by_day)
```

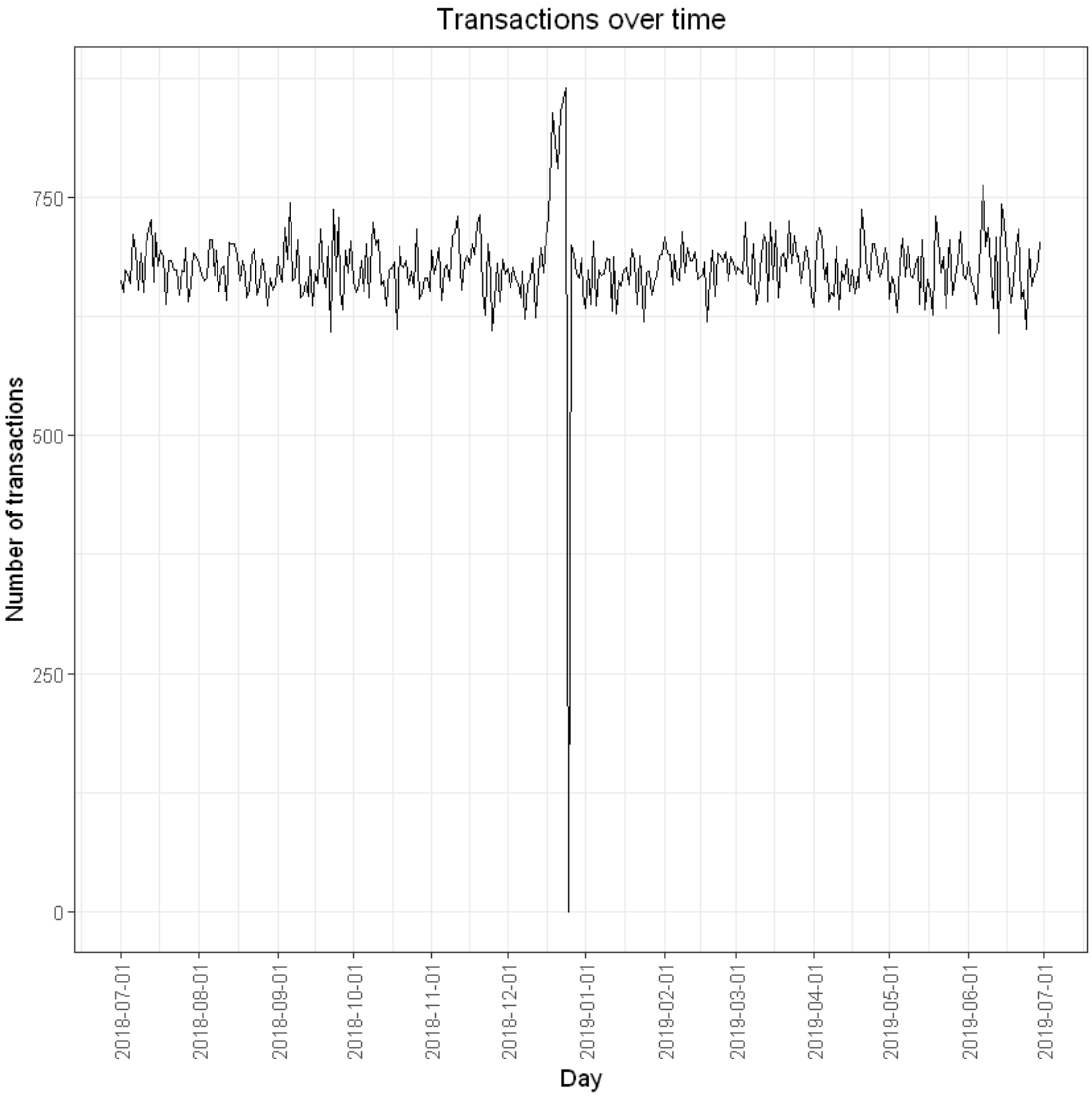
```
           DATE   N
  1: 2018-07-01 663
  2: 2018-07-02 650
  3: 2018-07-03 674
  4: 2018-07-04 669
  5: 2018-07-05 660
 ---
361: 2019-06-26 657
362: 2019-06-27 669
363: 2019-06-28 673
364: 2019-06-29 703
365: 2019-06-30 704
```

[ ]:

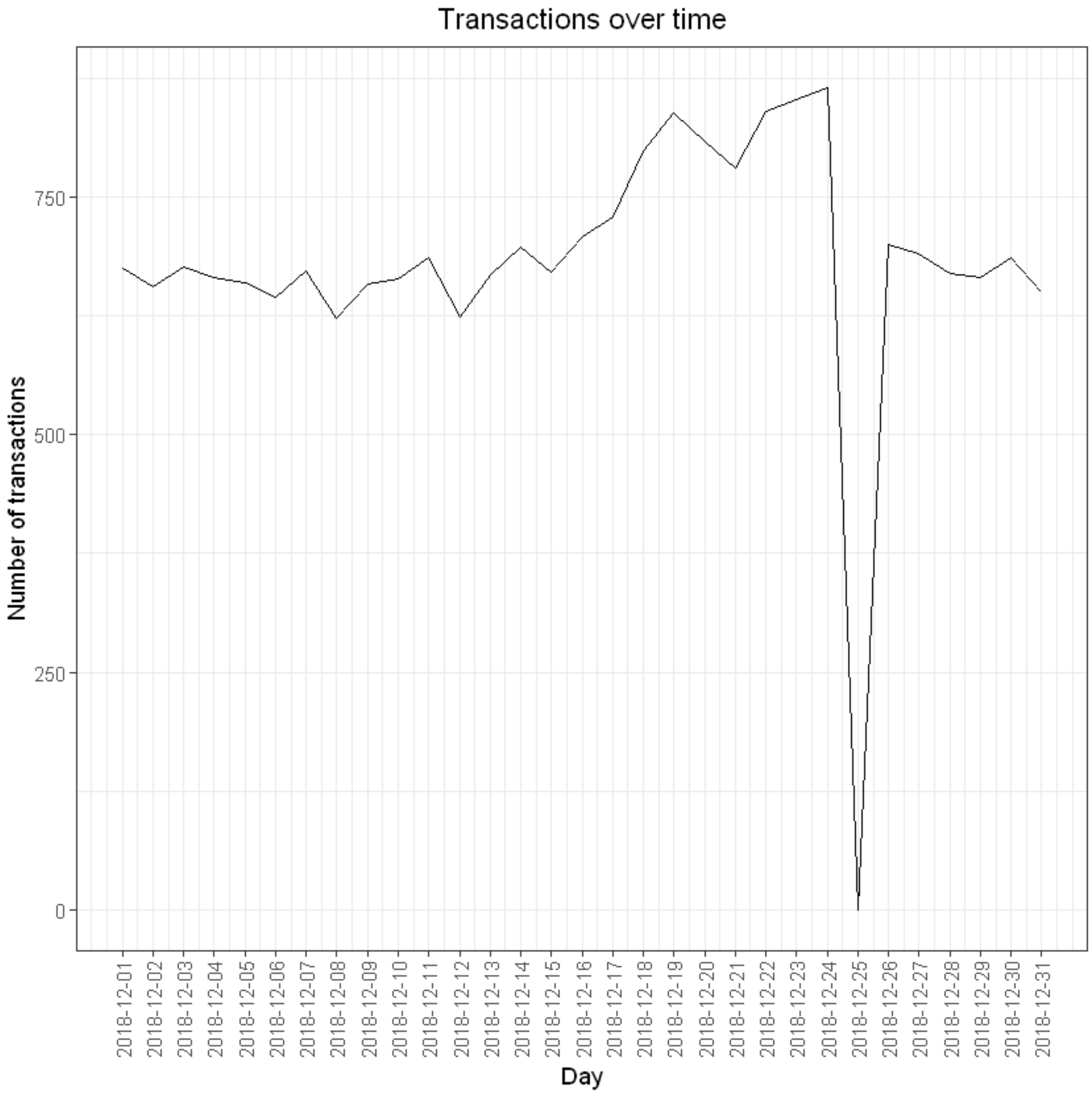
```
theme_set(theme_bw())
theme_update(plot.title = element_text(hjust = 0.5))
```

[ ]:

```
ggplot(transactions_by_day, aes(x = DATE, y = N)) + geom_line() + labs(x =␣
 ↪"Day", y = "Number of transactions", title = "Transactions over time") +␣
 ↪scale_x_date(breaks = "1 month") + theme(axis.text.x = element_text(angle =␣
 ↪90, vjust = 0.5))
```



```
[ ]: december_data <- transactions_by_day[month(DATE) == 12]

     # Plot transactions over time with denser auxiliary lines
     ggplot(december_data, aes(x = DATE, y = N)) +
       geom_line() +
       labs(x = "Day", y = "Number of transactions", title = "Transactions over␣
      ↪time") +
       scale_x_date(breaks = seq(as.Date("2018-12-01"), as.Date("2018-12-31"), by =␣
      ↪"1 day")) +
       theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```



[ ]:

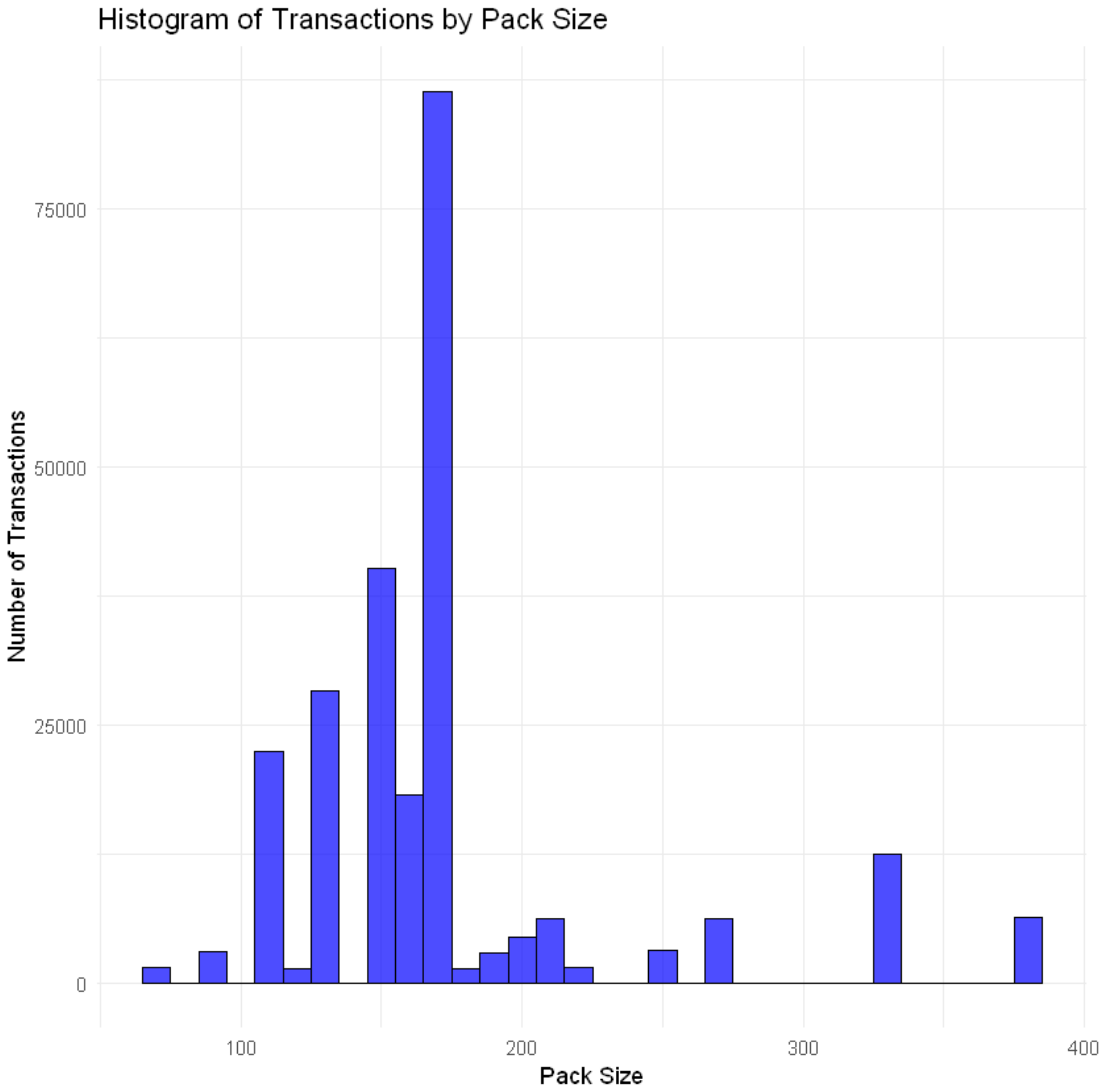
```
transactionData[, PACK_SIZE := parse_number(PROD_NAME)]

#### Always check your output
#### Let's check if the pack sizes look sensible
transactionData[, .N, PACK_SIZE][order(PACK_SIZE)]
```

A data.table: 20 × 2

PACK_SIZE <dbl>	N <int>
70	1507
90	3008
110	22387
125	1454
134	25102
135	3257
150	40203
160	2970
165	15297
170	19983
175	66390
180	1468
190	2995
200	4473
210	6272
220	1564
250	3169
270	6285
330	12540
380	6416

Plot a histogram showing the number of transactions by pack size.

```
[ ]: ggplot(transactionData, aes(x = PACK_SIZE)) +
       geom_histogram(binwidth = 10, fill = "blue", color = "black", alpha = 0.7) +
       labs(x = "Pack Size", y = "Number of Transactions", title = "Histogram of Transactions by Pack Size") +
       theme_minimal()
```



```
[ ]: transactionData[, BRAND := gsub("^(\\w+).*", "\\1", PROD_NAME)]

     # Checking the results
     head(transactionData)
```

A data.table: 6 × 10

DATE	STORE_NBR	LYLTY_CARD_NBR	TXN_ID	PROD_NBR	PROD_
<date>	<int>	<int>	<int>	<int>	<chr>
2018-10-17	1	1000	1	5	Natural
2019-05-14	1	1307	348	66	CCs Na
2019-05-20	1	1343	383	61	Smiths (
2018-08-17	2	2373	974	69	Smiths (
2018-08-18	2	2426	1038	108	Kettle T
2019-05-16	4	4149	3333	16	Smiths (

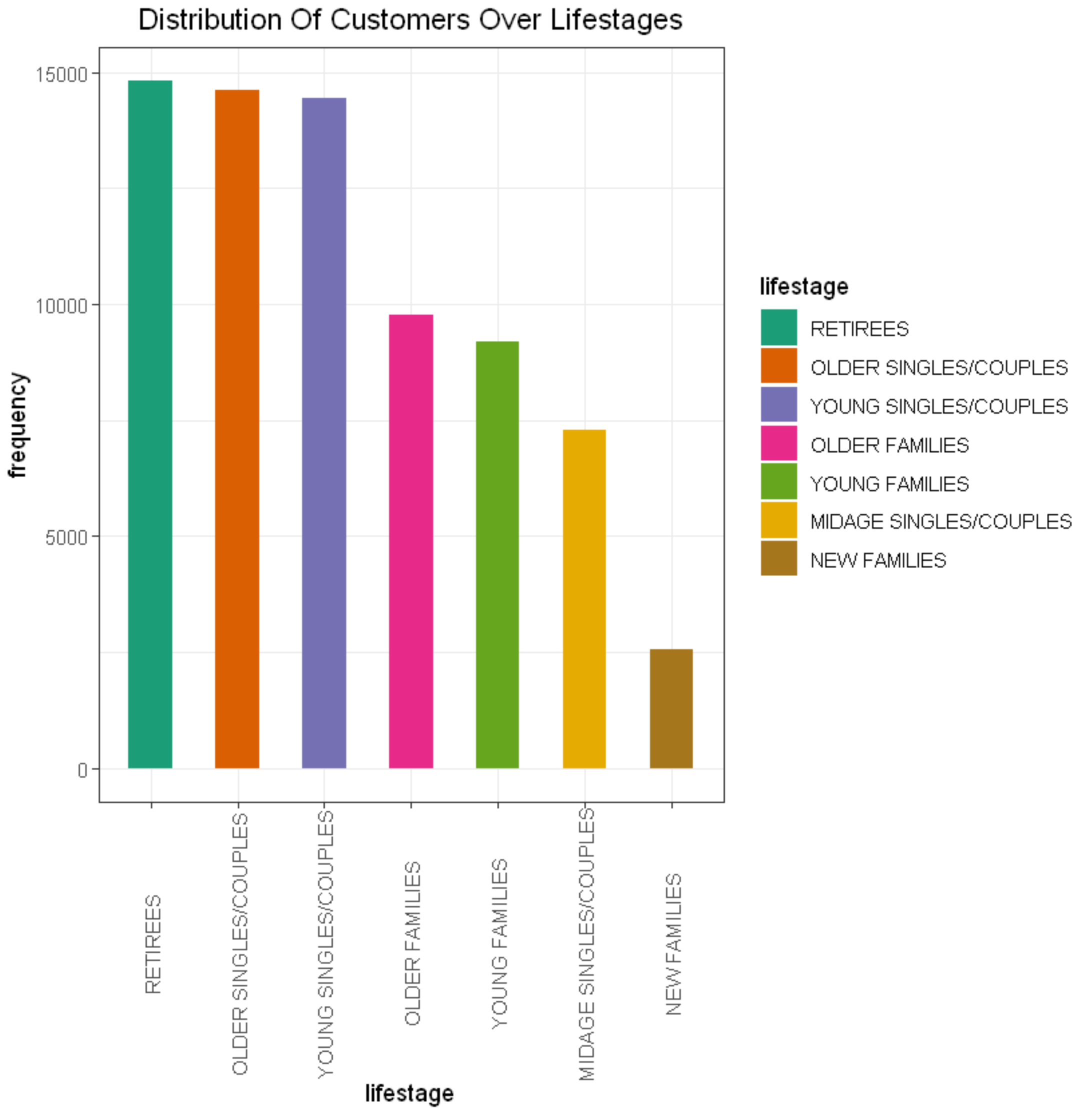
1.1.2 Examining customer data

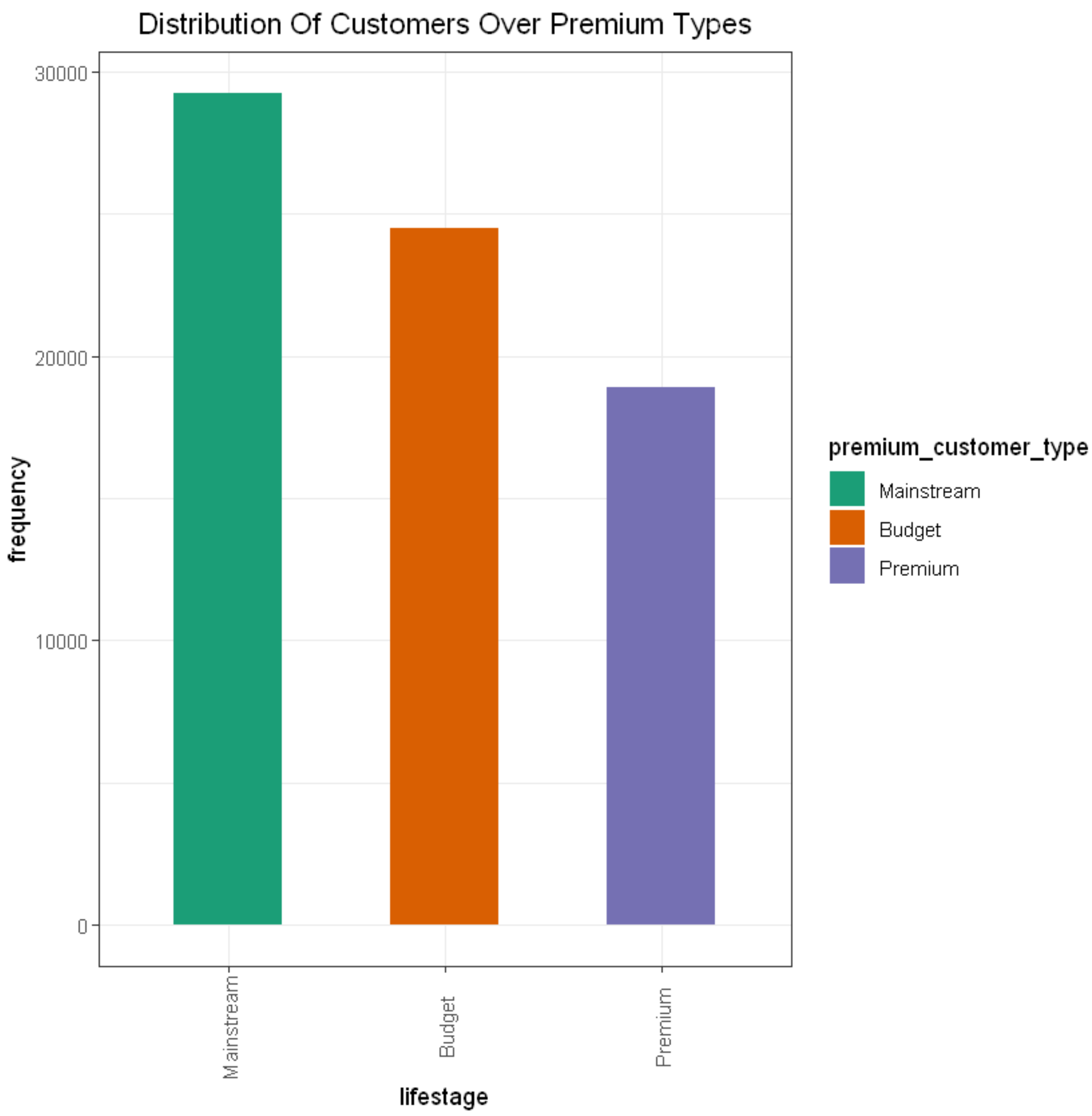
[ ]:

```
summary(customerData)
sum(is.na(customerData))
lifestageCategory <- data.frame(sort(table(customerData$LIFESTAGE),decreasing =␣
 ↪TRUE ))

setnames(lifestageCategory,c("lifestage","freq"))

ggplot(lifestageCategory,aes(x=lifestage,y= freq,fill=lifestage)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "lifestage", y ="frequency",title="Distribution Of Customers Over␣
 ↪Lifestages")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.
 ↪5))+scale_fill_brewer(palette="Dark2")



premiumCustomerType <- data.
 ↪frame(sort(table(customerData$PREMIUM_CUSTOMER),decreasing = TRUE ))

setnames(premiumCustomerType,c("premium_customer_type","freq"))

ggplot(premiumCustomerType,aes(x=premium_customer_type,y=␣
 ↪freq,fill=premium_customer_type)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "lifestage", y ="frequency",title="Distribution Of Customers Over␣
 ↪Premium Types")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.
 ↪5))+scale_fill_brewer(palette="Dark2")
```

```
 LYLTY_CARD_NBR      LIFESTAGE          PREMIUM_CUSTOMER
Min.    :   1000   Length:72637       Length:72637
1st Qu.:  66202   Class :character   Class :character
Median : 134040   Mode  :character   Mode  :character
Mean   : 136186
3rd Qu.: 203375
Max.   :2373711
```

0


Distribution Of Customers Over Lifestages
frequency
15000
10000
5000
0
RETIREES
OLDER SINGLES/COUPLES
YOUNG SINGLES/COUPLES
OLDER FAMILIES
YOUNG FAMILIES
MIDAGE SINGLES/COUPLES
NEW FAMILIES
lifestage
lifestage
RETIREES
OLDER SINGLES/COUPLES
YOUNG SINGLES/COUPLES
OLDER FAMILIES
YOUNG FAMILIES
MIDAGE SINGLES/COUPLES
NEW FAMILIES



[ ]:
```
data <- merge(transactionData, customerData, all.x = TRUE)
sum(is.na(data))
```

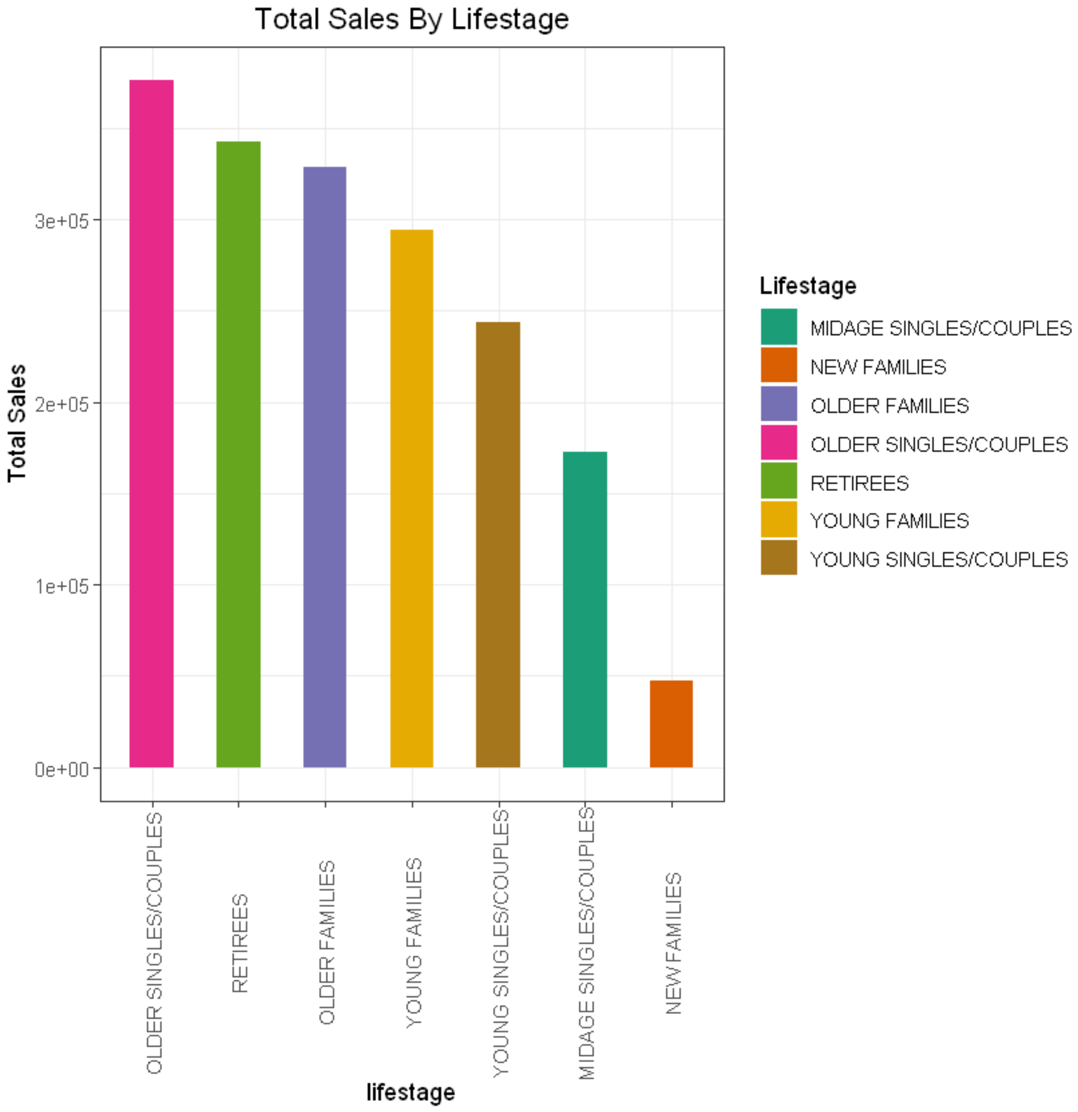
```
0
```

[ ]:
```
fwrite(data, paste0(filePath,"QVI_data.csv"))
```

1.2 Data analysis on customer segments

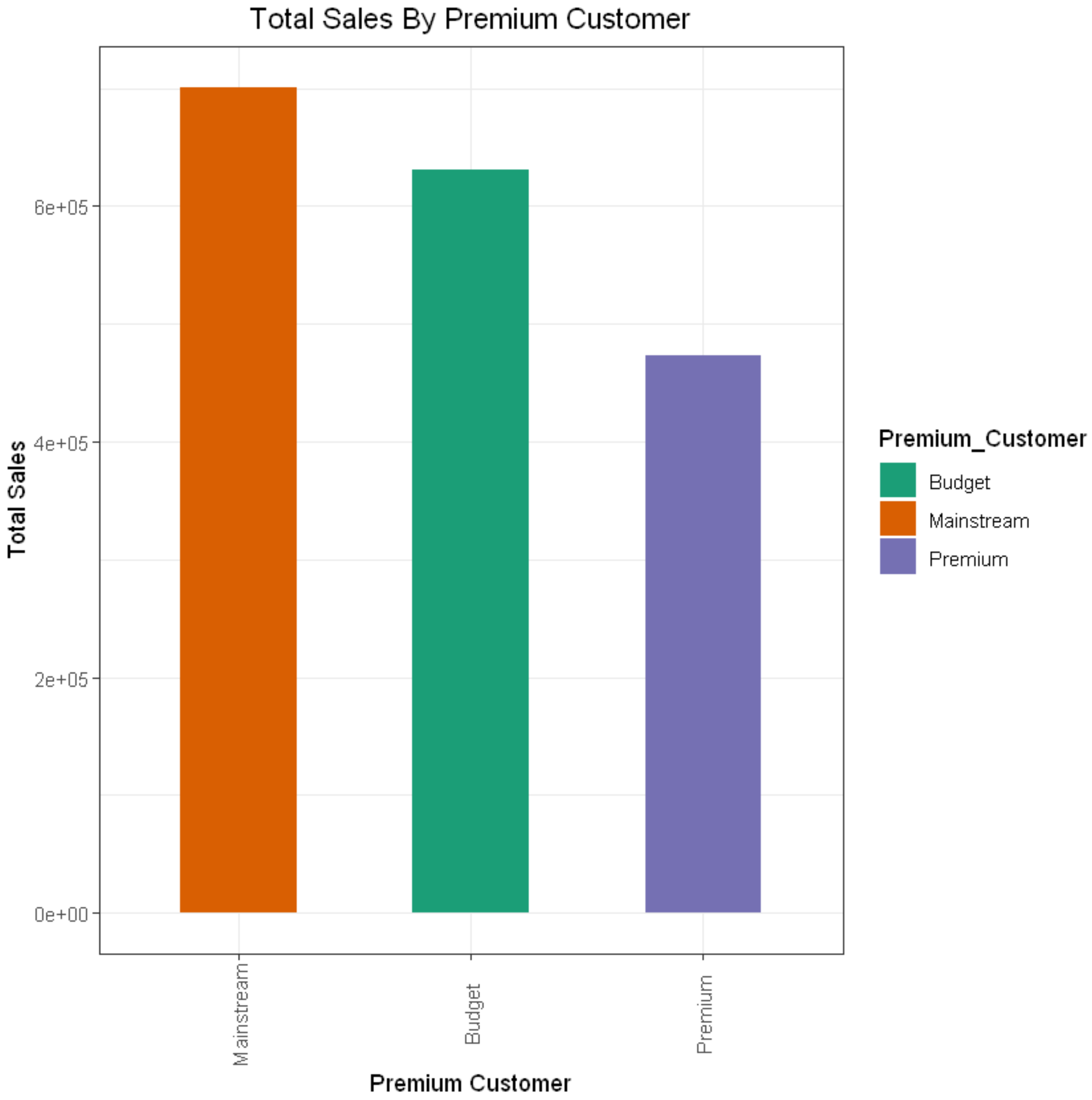
[ ]:
```
totalSalesByLifestage <- aggregate(data$TOT_SALES,␣
 ↪by=list(LIFESTAGE=data$LIFESTAGE),FUN=sum)

setnames(totalSalesByLifestage,c("Lifestage","Total_Sales"))
```

```
totalSalesByLifestage<-totalSalesByLifestage[order(totalSalesByLifestage$Total_Sales,decreasin
 ↪= FALSE),]

ggplot(totalSalesByLifestage,aes(x=reorder(Lifestage,-Total_Sales),y=␣
 ↪Total_Sales,fill=Lifestage)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "lifestage", y ="Total Sales",title="Total Sales By Lifestage")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.
 ↪5))+scale_fill_brewer(palette="Dark2")
```



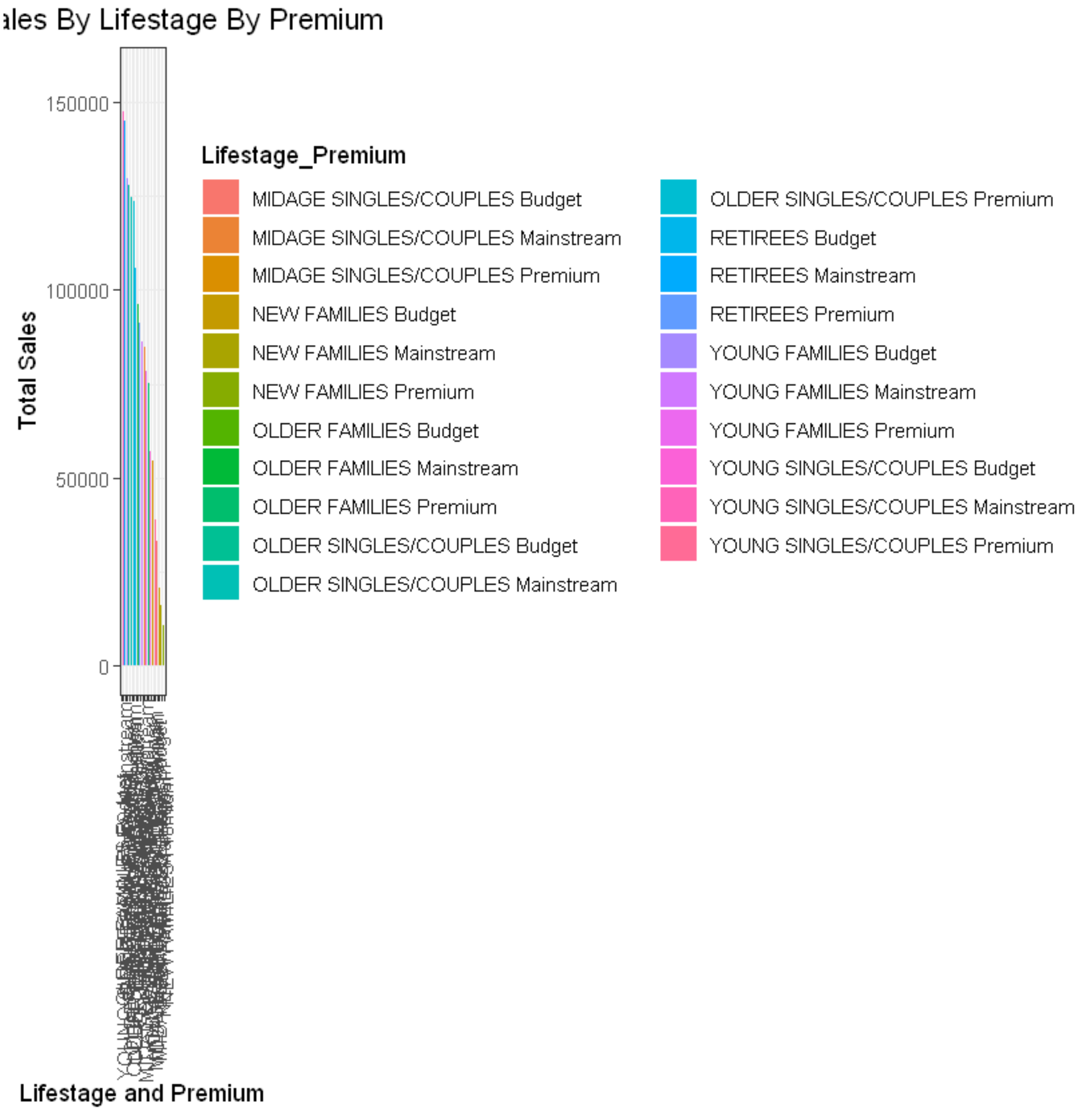
[ ]:

```
totalSalesByPremium <- aggregate(data$TOT_SALES,␣
 ↪by=list(LIFESTAGE=data$PREMIUM_CUSTOMER),FUN=sum)

setnames(totalSalesByPremium,c("Premium_Customer","Total_Sales"))

totalSalesByPremium<-totalSalesByPremium[order(totalSalesByPremium$Total_Sales,decreasing␣
 ↪= FALSE),]

ggplot(totalSalesByPremium,aes(x=reorder(Premium_Customer,-Total_Sales),y=␣
 ↪Total_Sales,fill=Premium_Customer)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "Premium Customer", y ="Total Sales",title="Total Sales By Premium␣
 ↪Customer")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.
 ↪5))+scale_fill_brewer(palette="Dark2")
```



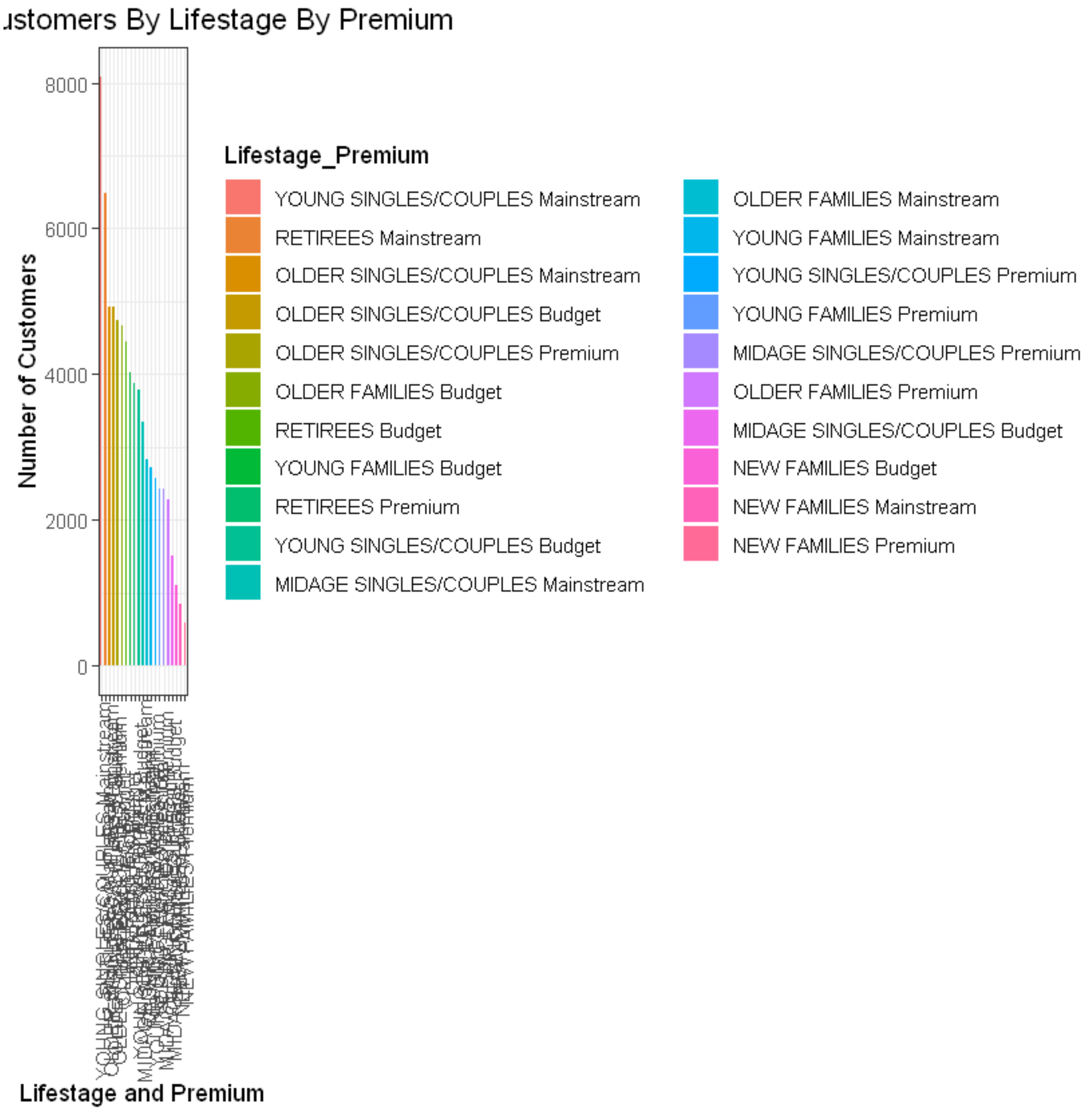
[ ]:

```
totalSalesByPremiumAndLifestage <- aggregate(.~LIFESTAGE+PREMIUM_CUSTOMER, data␣
 ↪= data[,c("LIFESTAGE","PREMIUM_CUSTOMER","TOT_SALES")] , sum)


totalSalesByPremiumAndLifestage$Lifestage_Premium <-␣
 ↪paste(totalSalesByPremiumAndLifestage$LIFESTAGE,totalSalesByPremiumAndLifestage$PREMIUM_CUS
totalSalesByPremiumAndLifestage <-␣
 ↪totalSalesByPremiumAndLifestage[,c("Lifestage_Premium","TOT_SALES")]

ggplot(totalSalesByPremiumAndLifestage,aes(x=reorder(Lifestage_Premium,-TOT_SALES),y=␣
 ↪TOT_SALES,fill=Lifestage_Premium)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "Lifestage and Premium", y ="Total Sales",title="Total Sales By␣
 ↪Lifestage By Premium")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```



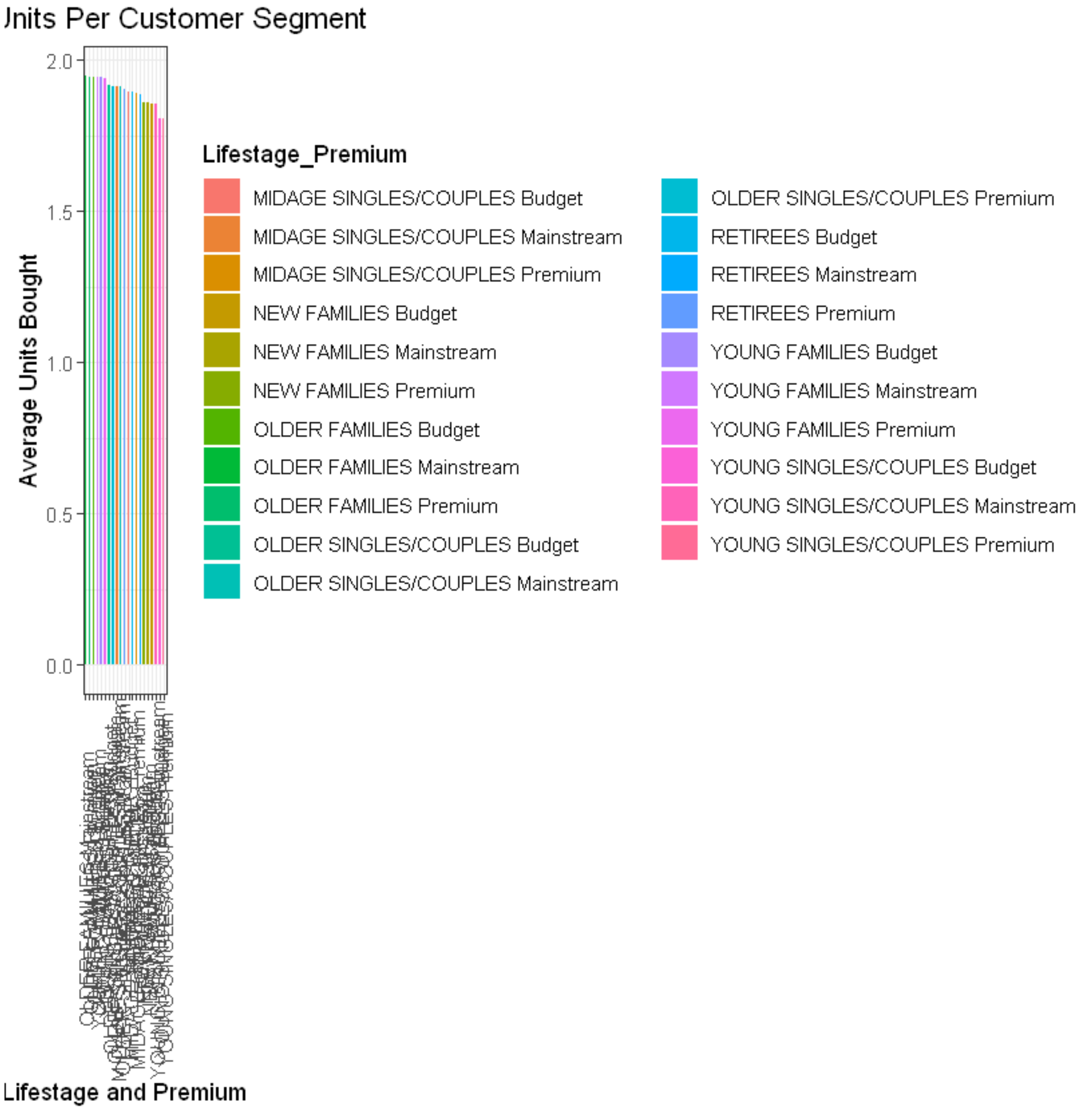
[ ]:

```
numberOfCustomersByLifestageByPremium <- data.
 ↪frame(paste(customerData$LIFESTAGE,customerData$PREMIUM_CUSTOMER))


numberOfCustomersByLifestageByPremium <- data.
 ↪frame(sort(table(numberOfCustomersByLifestageByPremium),decreasing = TRUE ))

setnames(numberOfCustomersByLifestageByPremium,c("Lifestage_Premium","freq"))

ggplot(numberOfCustomersByLifestageByPremium,aes(x=Lifestage_Premium,y =␣
 ↪freq,fill=Lifestage_Premium)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "Lifestage and Premium", y ="Number of Customers",title="Number of␣
 ↪Customers By Lifestage By Premium")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```

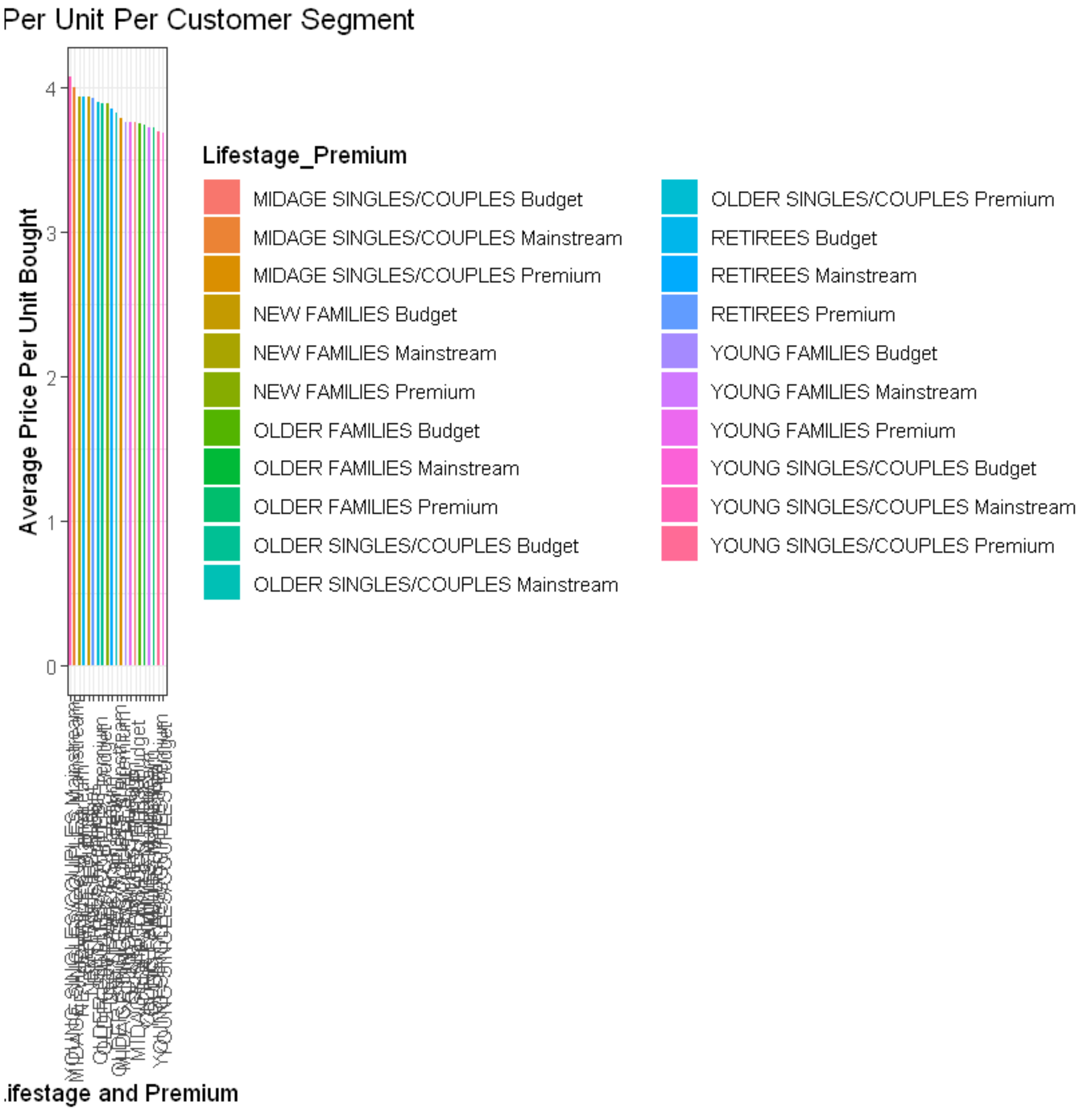


```
[ ]: averageNumberOfUnits <- data.
      ↪table(data[,c("LIFESTAGE","PREMIUM_CUSTOMER","PROD_QTY")])

     averageNumberOfUnits$Lifestage_Premium <-  data.
      ↪table(paste(data$LIFESTAGE,data$PREMIUM_CUSTOMER))

     setnames(averageNumberOfUnits,c("Lifestage","premium","prod_qty","Lifestage_Premium"))
```

```
averageNumberOfUnits<- averageNumberOfUnits[,c("Lifestage_Premium","prod_qty")]


setnames(averageNumberOfUnits,c("Lifestage_Premium","PROD_QTY"))

averageNumberOfUnits <- aggregate(.~Lifestage_Premium, data =␣
 ↪averageNumberOfUnits[,c("Lifestage_Premium","PROD_QTY")] , mean)

ggplot(averageNumberOfUnits,aes(x=reorder(Lifestage_Premium,-PROD_QTY),y=␣
 ↪PROD_QTY,fill=Lifestage_Premium)) +
  geom_bar(stat="identity",width = 0.5) +
  labs(x = "Lifestage and Premium", y ="Average Units Bought",title="Average␣
 ↪Units Per Customer Segment ")+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```



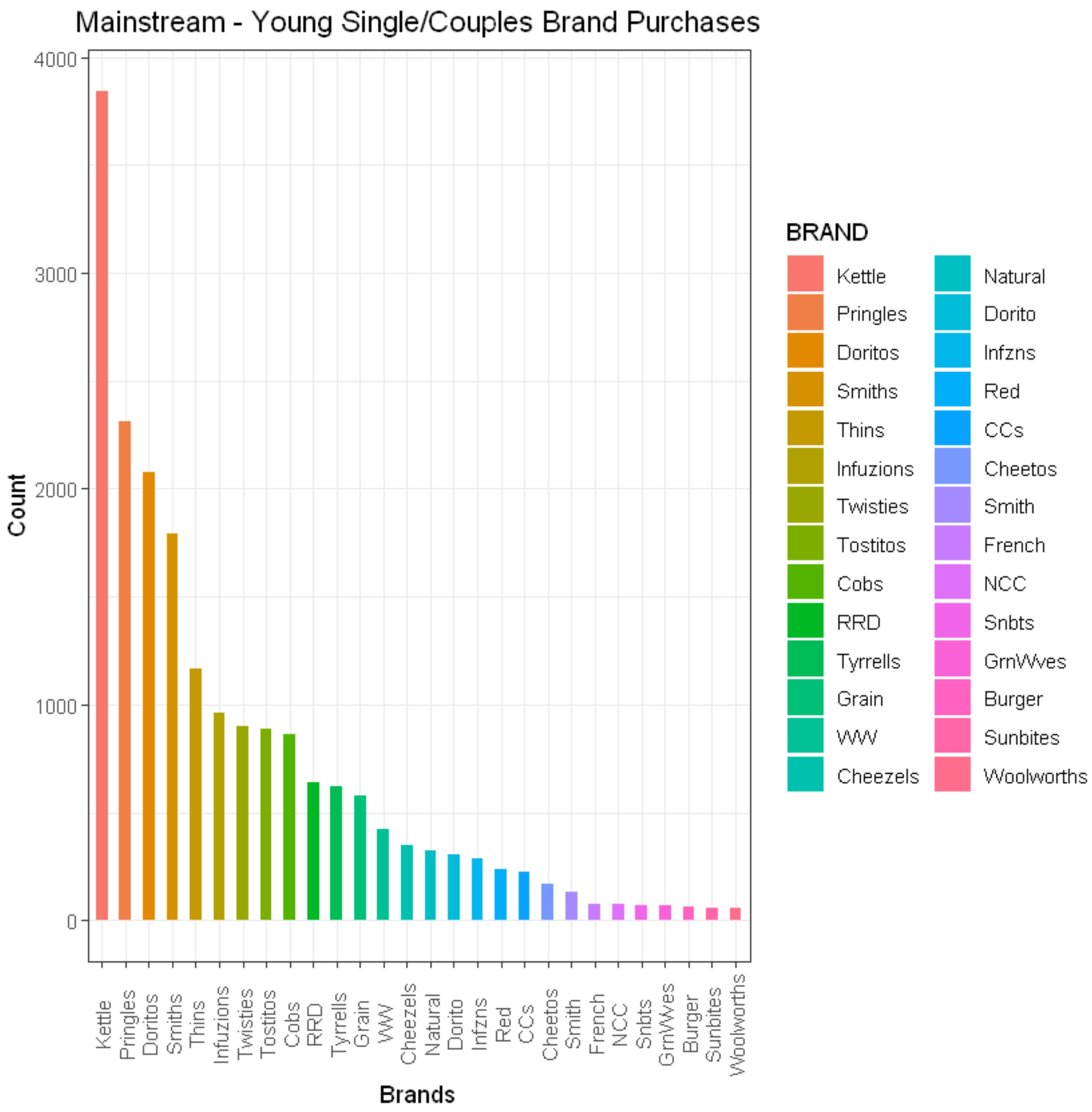
```
[ ]: averagePrice <- data.
      ↪table(data[,c("LIFESTAGE","PREMIUM_CUSTOMER","PROD_QTY","TOT_SALES")])

     averagePrice$Lifestage_Premium <-  data.
      ↪table(paste(data$LIFESTAGE,data$PREMIUM_CUSTOMER))

     setnames(averagePrice,c("Lifestage","premium","prod_qty","TOT_SALES","Lifestage_Premium"))


     averagePrice<- averagePrice[,c("Lifestage_Premium","prod_qty","TOT_SALES")]




     averagePrice <- aggregate(.~Lifestage_Premium, data = averagePrice , FUN= sum )

     averagePrice$averagePricePerUnit <- averagePrice$TOT_SALES /␣
      ↪averagePrice$prod_qty


     ggplot(averagePrice,aes(x=reorder(Lifestage_Premium,-averagePricePerUnit),y=␣
      ↪averagePricePerUnit,fill=Lifestage_Premium)) +
       geom_bar(stat="identity",width = 0.5) +
       labs(x = "Lifestage and Premium", y ="Average Price Per Unit␣
      ↪Bought",title="Average Price Per Unit Per Customer Segment ")+
       theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```



[ ]:

```
mainstreamYoungSingleCouples <- data.table(data)

mainstreamYoungSingleCouples$Lifestage_Premium <- data.
 ↪table(paste(data$LIFESTAGE, data$PREMIUM_CUSTOMER))

mainstreamYoungSingleCouples <- mainstreamYoungSingleCouples[Lifestage_Premium␣
 ↪== 'YOUNG SINGLES/COUPLES Mainstream']

mainstreamYoungSingleCouplesBrandFreq <- data.
 ↪frame(sort(table(mainstreamYoungSingleCouples$BRAND), decreasing = TRUE))

setnames(mainstreamYoungSingleCouplesBrandFreq, c('BRAND', 'freq'))
```

```
ggplot(mainstreamYoungSingleCouplesBrandFreq, aes(x = BRAND, y = freq, fill =␣
 ↪BRAND)) +
  geom_bar(stat = "identity", width = 0.5) +
  labs(x = "Brands", y = "Count", title = "Mainstream - Young Single/Couples␣
 ↪Brand Purchases") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```



[ ]:
```
is.na(mainstreamYoungSingleCouples)

ggplot(mainstreamYoungSingleCouples,aes(x=PACK_SIZE) )+
  geom_histogram(binwidth = 10,color="black",fill="lightblue") +
  labs(x = "Pack Sizes", y ="Frequency",title="Histogram of Pack Sizes For␣
 ↪Young Single/Couples-␣
 ↪Mainstream")+scale_color_brewer(palette="Dark2")+geom_density(alpha=.2,␣
 ↪fill="#FF6666")+
  scale_x_continuous(breaks = seq(0, 400, 10), limits = c(0,400))
# calculating mean and sd for pack size for this segment
mean(mainstreamYoungSingleCouples$PACK_SIZE)
sd(mainstreamYoungSingleCouples$PACK_SIZE)
```

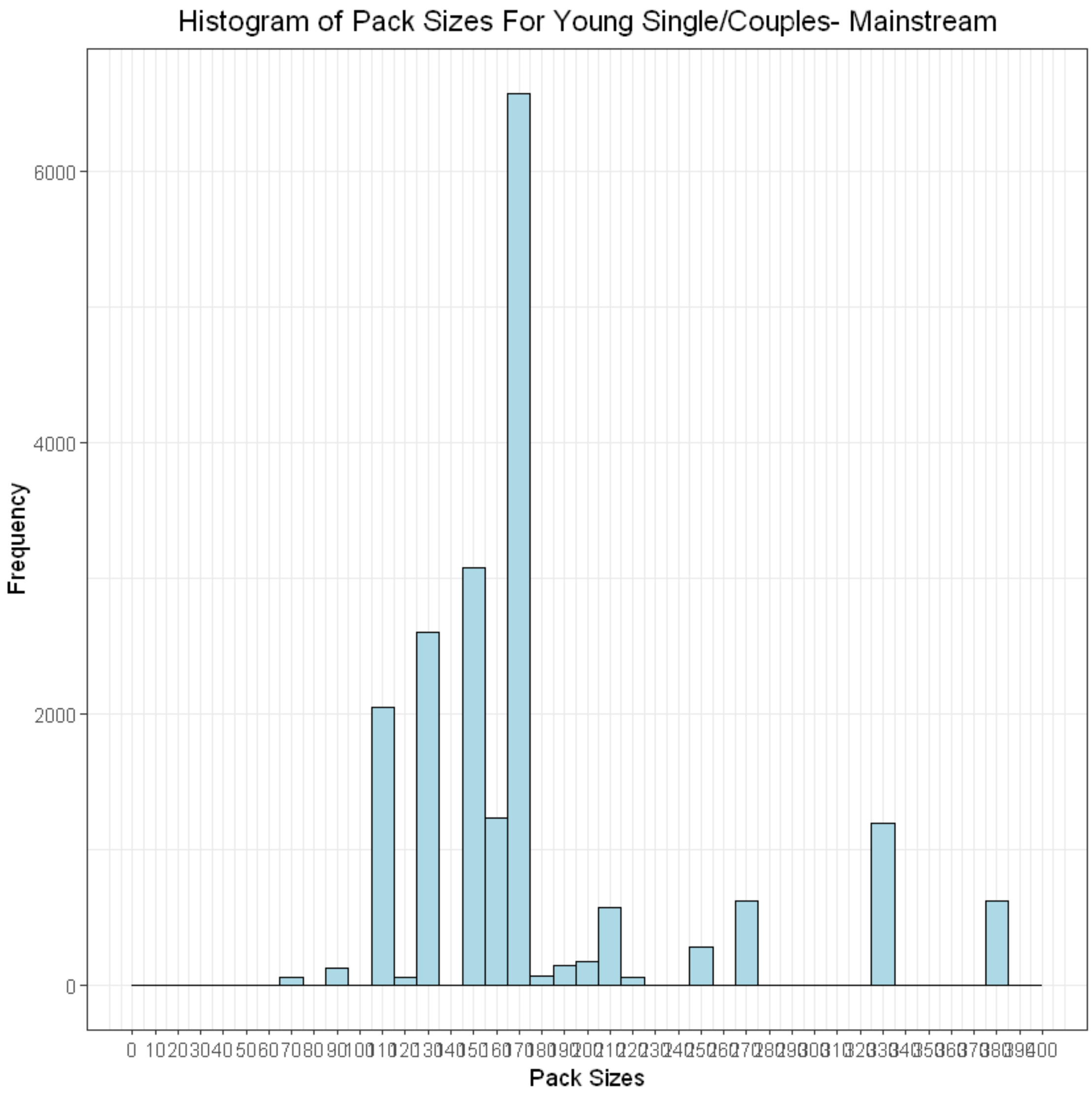
A matrix: 19544 × 13 of type lgl

LYLTY_CARD_NBR	DATE	STORE_NBR	TXN_ID	PROD_NBR
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
…	…	…	…	…
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	FALSE	FALSE	FALSE

```
Warning message:
"Removed 2 rows containing missing values (`geom_bar()`)."
```

178.344248874335

63.9162483099038



```
[ ]: segment1 <- data[LIFESTAGE == "YOUNG SINGLES/COUPLES" & PREMIUM_CUSTOMER == "Mainstream",]
     other <- data[!(LIFESTAGE == "YOUNG SINGLES/COUPLES" & PREMIUM_CUSTOMER == "Mainstream"),]
     quantity_segment1 <- segment1[, sum(PROD_QTY)]
     quantity_other <- other[, sum(PROD_QTY)]
```

```r
quantity_other_by_size <- other[, .(other = sum(PROD_QTY)/quantity_other), by = PACK_SIZE]

quantity_segment1_by_pack <- segment1[, .(targetSegment = sum(PROD_QTY)/quantity_segment1), by = PACK_SIZE]
quantity_other_by_pack <- other[, .(other = sum(PROD_QTY)/quantity_other), by = PACK_SIZE]
pack_proportions <- merge(quantity_segment1_by_pack, quantity_other_by_pack)[, affinityToPack := targetSegment/other]
pack_proportions[order(-affinityToPack)]
```

A data.table: 20 × 4

PACK_SIZE	targetSegment	other	affinityToPack
<dbl>	<dbl>	<dbl>	<dbl>
270	0.031828847	0.025095929	1.2682873
380	0.032160110	0.025584213	1.2570295
330	0.061283644	0.050161917	1.2217166
134	0.119420290	0.100634769	1.1866703
110	0.106280193	0.089791190	1.1836372
210	0.029123533	0.025121265	1.1593180
135	0.014768806	0.013075403	1.1295106
250	0.014354727	0.012780590	1.1231662
170	0.080772947	0.080985964	0.9973697
150	0.157598344	0.163420656	0.9643722
175	0.254989648	0.270006956	0.9443818
165	0.055652174	0.062267662	0.8937572
190	0.007481021	0.012442016	0.6012708
180	0.003588682	0.006066692	0.5915385
160	0.006404417	0.012372920	0.5176157
90	0.006349206	0.012580210	0.5046980
125	0.003008972	0.006036750	0.4984423
200	0.008971705	0.018656115	0.4808989
70	0.003036577	0.006322350	0.4802924
220	0.002926156	0.006596434	0.4435967

The main user groups of the sale are: budget shoppers and mainstream shoppers.

1. Budget shoppers are mainly older households: they are characterized by being more budget conscious. However, they buy more frequently and in larger quantities. Promotional activities can help to increase the purchasing power of this group.
2. Mainstream shoppers are mainly young people and retirees. These two groups had the highest total spending. This means that these groups are more willing to pay for crisps.
3. In all the products Kettle is the most popular brand.