

Quantium Virtual Internship - Retail Strategy and Analytics - Task 1

Usman Derek Yahaya

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Conducting analysis on client's transaction dataset and identifying customer purchasing behaviours to generate insights and provide commercial recommendations.

Background information for the task

We need to present a strategic recommendation to Julia that is supported by data which she can then use for the upcoming category review however to do so we need to analyse the data to understand the current purchasing trends and behaviours. The client is particularly interested in customer segments and their chip purchasing behaviour. Consider what metrics would help describe the customers' purchasing behaviour.

Main goals of this task are :

Examine transaction data - check for missing data, anomalies, outliers and clean them
Examine customer data - similar to above transaction data
Data analysis and customer segments - create charts and graphs, note trends and insights
Deep dive into customer segments - determine which segments should be targetted

Load required libraries and datasets

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

```
## Warning: package 'ggplot2' was built under R version 4.3.1
```

```
library(ggmosaic)
```

```
## Warning: package 'ggmosaic' was built under R version 4.3.1
```

```
library(readr)
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.3.1
```

```
## Warning: package 'lubridate' was built under R version 4.3.1
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.2      v stringr  1.5.0
## v forcats    1.0.0      v tibble   3.2.1
## v lubridate  1.9.3      v tidyr    1.3.0
## v purrr      1.0.1
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::between()      masks data.table::between()
## x dplyr::filter()       masks stats::filter()
## x dplyr::first()        masks data.table::first()
## x lubridate::hour()     masks data.table::hour()
## x lubridate::isoweek()  masks data.table::isoweek()
## x dplyr::lag()          masks stats::lag()
## x dplyr::last()         masks data.table::last()
## x lubridate::mday()     masks data.table::mday()
## x lubridate::minute()   masks data.table::minute()
## x lubridate::month()    masks data.table::month()
## x lubridate::quarter()  masks data.table::quarter()
## x lubridate::second()   masks data.table::second()
## x purrr::transpose()    masks data.table::transpose()
## x lubridate::wday()     masks data.table::wday()
## x lubridate::week()     masks data.table::week()
## x lubridate::yday()     masks data.table::yday()
## x lubridate::year()     masks data.table::year()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
#### Point the filePath to where you have downloaded the datasets to and
#### assign the data files to data.tables
```

```
file.path <- "C:/Users/OK/OneDrive/Desktop/Quantium/"
```

```
transactionData <- fread(paste0(file.path, "QVI_transaction_data.csv"))
```

```
customerData <- fread(paste0(file.path, "QVI_purchase_behaviour.csv"))
```

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.

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 6 rows.

Let's check if columns we would expect to be numeric are in numeric form and date columns are in date format.

```
#### Examine transaction data
str(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 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>
```

```
#### Examine customer data
str(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>
```

```
#### Examine first 6 variables of transaction data
head(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
## 6: 43604         4         4074    2982         57
##
##      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
## 6: Old El Paso Salsa Dip Tomato Mild 300g      1      5.1
```

```
#### Examine first 6 variables of customer data
head(customerData)
```

```
##      LYLTY_CARD_NBR      LIFESTAGE PREMIUM_CUSTOMER
## 1:         1000 YOUNG SINGLES/COUPLES      Premium
## 2:         1002 YOUNG SINGLES/COUPLES      Mainstream
## 3:         1003      YOUNG FAMILIES      Budget
## 4:         1004 OLDER SINGLES/COUPLES      Mainstream
## 5:         1005 MIDAGE SINGLES/COUPLES      Mainstream
## 6:         1007 YOUNG SINGLES/COUPLES      Budget
```

We can see that the date column is in an integer format. Let's change this to a date format.

```
#### Convert DATE column to a date format
#### A quick search online tells us that CSV and Excel integer dates begin on
#### 30 Dec 1899
transactionData$DATE <- as.Date(transactionData$DATE, origin = "1899-12-30")
head(transactionData)
```

```
##          DATE STORE_NBR LYLTY_CARD_NBR TXN_ID PROD_NBR
## 1: 2018-10-17          1           1000      1        5
## 2: 2019-05-14          1           1307     348       66
## 3: 2019-05-20          1           1343     383       61
## 4: 2018-08-17          2           2373     974       69
## 5: 2018-08-18          2           2426    1038      108
## 6: 2019-05-19          4           4074    2982       57
##
##          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
## 6: Old El Paso Salsa   Dip Tomato Mild 300g      1      5.1
```

We should check that we are looking at the right products by examining PROD_NAME.

```
#### Examine PROD_NAME
summary(transactionData$PROD_NAME)
```

```
##      Length      Class      Mode
##      264836 character character
```

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 summarizing the individual words in the product name.

```
#### Examine the words in PROD_NAME to see if there are any incorrect entries
#### such as products that are not chips
productWords <- data.table(unlist(strsplit(unique(transactionData[, PROD_NAME]), " ")))
setnames(productWords, 'words')
```

As we are only interested in words that will tell us if the product is chips or not, let's remove all words with digits and special characters such as '&' from our set of product words. We can do this using `grepl()`

```
#### Removing digits
productWords[, SPECIAL := grepl("[[:digit:]]", words)]
productWords <- productWords[SPECIAL == FALSE,][, SPECIAL := NULL]
#### Removing special characters
#### Removing punctuation
productWords[, SPECIAL := grepl("[[:punct:]]", words)]
productWords <- productWords[SPECIAL == FALSE,][, SPECIAL := NULL]
#### changing empty string to NA
productWords[words == ""] <- NA
#### removing all empty cells
productWords <- productWords[complete.cases(productWords),]
#### Let's look at the most common words by counting the number of times a word
#### appears and sorting them by this frequency in order of highest to lowest frequency
#### creating a frequency table for our set of words, sorted.
productWords <- data.frame(sort(table(productWords), decreasing = TRUE))
```

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

```
#### Remove salsa products
transactionData<- data.table(transactionData)
transactionData[, SALSA := grepl("salsa", tolower(PROD_NAME))]
transactionData <- transactionData[SALSA == FALSE, ][, SALSA := NULL]
```

Next, we can use `summary()` to check summary statistics such as mean, min and max values for each feature to see if there are any obvious outliers in the data and if there are any nulls in any of the columns (NA's : number of nulls will appear in the output if there are any nulls).

```
#### Summarise the data to check for nulls and possible outliers
summary(transactionData)
```

```
##      DATE      STORE_NBR      LYLTY_CARD_NBR      TXN_ID
## Min.   :2018-07-01   Min.    : 1.0         Min.    : 1000   Min.    :    1
## 1st Qu.:2018-09-30   1st Qu.: 70.0        1st Qu.: 70015   1st Qu.: 67569
## Median :2018-12-30   Median :130.0        Median : 130367   Median : 135183
## Mean   :2018-12-30   Mean   :135.1        Mean   : 135531   Mean   : 135131
## 3rd Qu.:2019-03-31   3rd Qu.:203.0        3rd Qu.: 203084   3rd Qu.: 202654
## Max.   :2019-06-30   Max.    :272.0        Max.    :2373711   Max.    :2415841
##      PROD_NBR      PROD_NAME      PROD_QTY      TOT_SALES
## Min.    : 1.00   Length:246742   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    : 1.908   Mean    : 7.321
## 3rd Qu.: 87.00                      3rd Qu.: 2.000   3rd Qu.: 8.800
## Max.    :114.00                      Max.    :200.000   Max.    :650.000
```

```
sum(is.na(transactionData))
```

```
## [1] 0
```

There are no nulls in the columns but product quantity appears to have an outlier which we should investigate further. Let's investigate further the case where 200 packets of chips are bought in one transaction.

```
#### Filter the dataset to find the outlier
outlier <- transactionData[PROD_QTY == 200,]
```

There are two transactions where 200 packets of chips are bought in one transaction and both of these transactions were by the same customer. It looks like this customer has only had the two transactions over the year and is not an ordinary retail customer. The customer might be buying chips for commercial purposes instead. We'll remove this loyalty card number from further analysis.

```
#### Filter out the customer based on the loyalty card number
outlierTransactions <- transactionData[LYLTY_CARD_NBR == 226000,]
```

```
#### Re-examine transaction data
```

```
numberOfTransactionsByDate <- data.frame(sort(table(transactionData$DATE),decreasing = TRUE ))
setnames(numberOfTransactionsByDate,c('date','freq'))
numberOfTransactionsByDate<-numberOfTransactionsByDate[order(as.Date(numberOfTransactionsByDate$date)),]
```

That's better. Now, let's look at the number of transaction lines over time to see if there are any obvious data issues such as missing data.

```
#### Count the number of transactions by date
unique(transactionData$DATE)
```

```
## [1] "2018-10-17" "2019-05-14" "2019-05-20" "2018-08-17" "2018-08-18"
## [6] "2019-05-16" "2018-08-20" "2019-05-17" "2019-05-18" "2019-05-15"
## [11] "2019-05-19" "2018-08-14" "2018-08-16" "2018-08-19" "2018-08-15"
## [16] "2019-06-17" "2018-09-05" "2018-09-27" "2019-02-27" "2019-03-19"
## [21] "2018-11-25" "2018-11-10" "2019-03-09" "2018-11-01" "2019-03-13"
## [26] "2019-04-06" "2018-07-30" "2018-10-18" "2018-11-05" "2019-03-04"
## [31] "2019-03-11" "2019-04-21" "2019-01-03" "2018-09-23" "2018-12-14"
## [36] "2019-05-02" "2019-01-09" "2019-04-11" "2019-03-05" "2018-09-26"
## [41] "2019-03-30" "2019-02-23" "2018-12-17" "2019-04-08" "2018-10-09"
## [46] "2018-11-03" "2019-01-24" "2019-02-14" "2019-06-11" "2018-07-03"
## [51] "2018-07-18" "2018-07-28" "2019-03-28" "2019-05-08" "2019-05-26"
## [56] "2019-03-02" "2019-04-23" "2019-04-29" "2018-09-14" "2019-01-29"
## [61] "2019-03-23" "2019-03-26" "2018-08-06" "2019-01-02" "2019-03-31"
## [66] "2018-07-13" "2018-10-13" "2019-01-31" "2019-02-08" "2019-02-24"
## [71] "2019-04-28" "2018-08-09" "2018-12-12" "2019-04-13" "2019-06-27"
## [76] "2019-06-30" "2018-07-06" "2019-04-07" "2018-11-30" "2019-01-14"
## [81] "2018-08-21" "2019-06-18" "2018-12-02" "2018-12-24" "2018-12-29"
## [86] "2019-04-24" "2019-06-04" "2019-06-06" "2018-09-02" "2018-09-18"
## [91] "2019-01-17" "2019-06-01" "2018-07-07" "2018-09-09" "2018-09-17"
## [96] "2018-10-31" "2018-07-09" "2018-08-11" "2018-09-20" "2018-10-26"
## [101] "2018-10-29" "2019-04-01" "2018-09-24" "2018-11-19" "2018-12-05"
## [106] "2019-02-22" "2019-03-15" "2019-06-23" "2018-07-11" "2018-10-22"
## [111] "2018-12-16" "2018-12-28" "2019-02-07" "2018-08-24" "2018-10-02"
## [116] "2018-10-08" "2019-03-10" "2019-06-28" "2018-07-14" "2019-06-16"
## [121] "2019-02-13" "2018-08-13" "2018-10-27" "2018-12-09" "2018-09-22"
## [126] "2019-02-06" "2019-05-22" "2018-07-21" "2018-10-14" "2018-11-08"
## [131] "2019-03-12" "2018-11-20" "2019-02-03" "2019-02-19" "2019-05-23"
## [136] "2018-07-27" "2018-11-24" "2019-01-19" "2018-08-04" "2019-01-05"
## [141] "2019-04-17" "2018-09-12" "2019-01-16" "2019-04-16" "2018-09-01"
## [146] "2019-05-05" "2019-01-10" "2019-02-11" "2019-06-25" "2019-03-07"
## [151] "2018-11-26" "2018-10-16" "2018-12-04" "2018-07-25" "2018-11-04"
## [156] "2018-11-15" "2019-05-30" "2018-07-20" "2018-08-05" "2018-08-01"
## [161] "2018-12-18" "2019-05-21" "2018-12-20" "2019-01-20" "2019-06-21"
## [166] "2018-08-07" "2018-09-06" "2018-09-07" "2018-12-11" "2019-04-27"
## [171] "2019-06-08" "2018-07-17" "2018-09-08" "2018-12-23" "2019-03-08"
## [176] "2019-03-27" "2018-07-02" "2018-08-28" "2018-12-21" "2019-02-01"
## [181] "2019-03-16" "2019-06-15" "2018-12-03" "2018-07-22" "2018-10-01"
## [186] "2019-05-04" "2019-05-06" "2018-12-22" "2019-03-14" "2018-07-04"
## [191] "2018-12-01" "2019-01-12" "2019-06-03" "2018-08-10" "2018-10-03"
## [196] "2018-09-15" "2018-12-30" "2018-11-14" "2019-03-29" "2019-04-14"
## [201] "2018-10-21" "2018-11-16" "2018-07-12" "2018-10-11" "2019-02-10"
## [206] "2019-05-28" "2018-08-03" "2019-04-10" "2019-06-29" "2019-01-18"
## [211] "2019-05-24" "2019-04-12" "2018-08-25" "2018-11-18" "2019-06-19"
## [216] "2019-03-18" "2019-05-09" "2018-11-29" "2018-11-22" "2019-03-01"
## [221] "2019-04-30" "2019-04-18" "2019-05-12" "2018-10-12" "2018-11-09"
## [226] "2019-03-22" "2018-12-07" "2019-01-13" "2018-08-30" "2018-09-21"
## [231] "2019-01-07" "2019-06-02" "2018-09-30" "2018-12-15" "2018-11-11"
## [236] "2018-10-23" "2018-11-12" "2018-11-06" "2019-02-02" "2019-03-24"
## [241] "2018-10-25" "2019-01-15" "2018-08-27" "2018-10-05" "2019-02-04"
## [246] "2019-05-25" "2019-05-03" "2019-03-06" "2019-06-05" "2019-01-26"
```

```
## [251] "2018-07-26" "2018-07-19" "2019-04-26" "2018-10-19" "2018-11-02"
## [256] "2019-05-11" "2019-01-25" "2018-09-10" "2018-11-27" "2019-04-09"
## [261] "2019-02-26" "2018-07-31" "2018-11-23" "2019-01-22" "2019-04-04"
## [266] "2018-10-10" "2019-01-01" "2019-05-31" "2018-12-19" "2019-02-20"
## [271] "2018-09-16" "2019-06-09" "2019-02-25" "2019-06-12" "2018-10-20"
## [276] "2018-08-12" "2019-02-05" "2019-03-20" "2018-11-17" "2018-10-30"
## [281] "2018-07-23" "2018-09-04" "2019-03-17" "2018-12-13" "2018-10-24"
## [286] "2018-07-16" "2018-12-27" "2019-03-21" "2019-01-04" "2018-07-24"
## [291] "2019-04-20" "2018-08-22" "2018-08-02" "2019-02-28" "2019-02-18"
## [296] "2018-09-13" "2019-04-19" "2018-11-07" "2018-12-10" "2019-06-10"
## [301] "2019-03-25" "2019-06-24" "2018-12-06" "2019-01-27" "2019-02-21"
## [306] "2019-04-15" "2018-07-29" "2019-04-03" "2019-06-07" "2018-09-25"
## [311] "2018-07-01" "2018-08-29" "2018-08-23" "2018-10-28" "2018-07-08"
## [316] "2018-10-06" "2019-02-17" "2018-09-28" "2018-10-15" "2019-01-06"
## [321] "2019-06-22" "2019-01-21" "2019-05-29" "2019-06-13" "2019-04-02"
## [326] "2019-05-07" "2018-08-26" "2019-02-15" "2018-11-28" "2019-01-28"
## [331] "2019-05-13" "2018-10-07" "2019-06-26" "2018-11-13" "2019-01-08"
## [336] "2018-07-10" "2019-05-27" "2018-08-08" "2019-05-01" "2018-09-11"
## [341] "2019-03-03" "2019-04-25" "2018-07-15" "2018-07-05" "2019-06-20"
## [346] "2019-02-16" "2018-10-04" "2018-09-19" "2018-09-29" "2019-04-05"
## [351] "2018-12-31" "2019-01-23" "2019-04-22" "2019-06-14" "2019-01-11"
## [356] "2018-09-03" "2018-11-21" "2018-12-26" "2019-05-10" "2018-12-08"
## [361] "2019-01-30" "2019-02-09" "2018-08-31" "2019-02-12"
```

```
summary(transactionData$DATE)
```

```
## Min. 1st Qu. Median Mean 3rd Qu. Max.
## "2018-07-01" "2018-09-30" "2018-12-30" "2018-12-30" "2019-03-31"
## "2019-06-30"
```

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 overtime to find the missing date.

```
#### Create a sequence of dates and join this the count of transactions by date Over to you - create a
#### 30 Jun 2019, and join it onto the data to fill in the missing day.
```

```
seqOfDates <- data.table(seq(as.Date('2018-07-01'),as.Date('2019-06-30'),by = 1))
setnames(seqOfDates,"date")
seqOfDates$date <- as.factor(seqOfDates$date)
class(seqOfDates$date)
```

```
## [1] "factor"
```

```
class(numberOfTransactionsByDate$date)
```

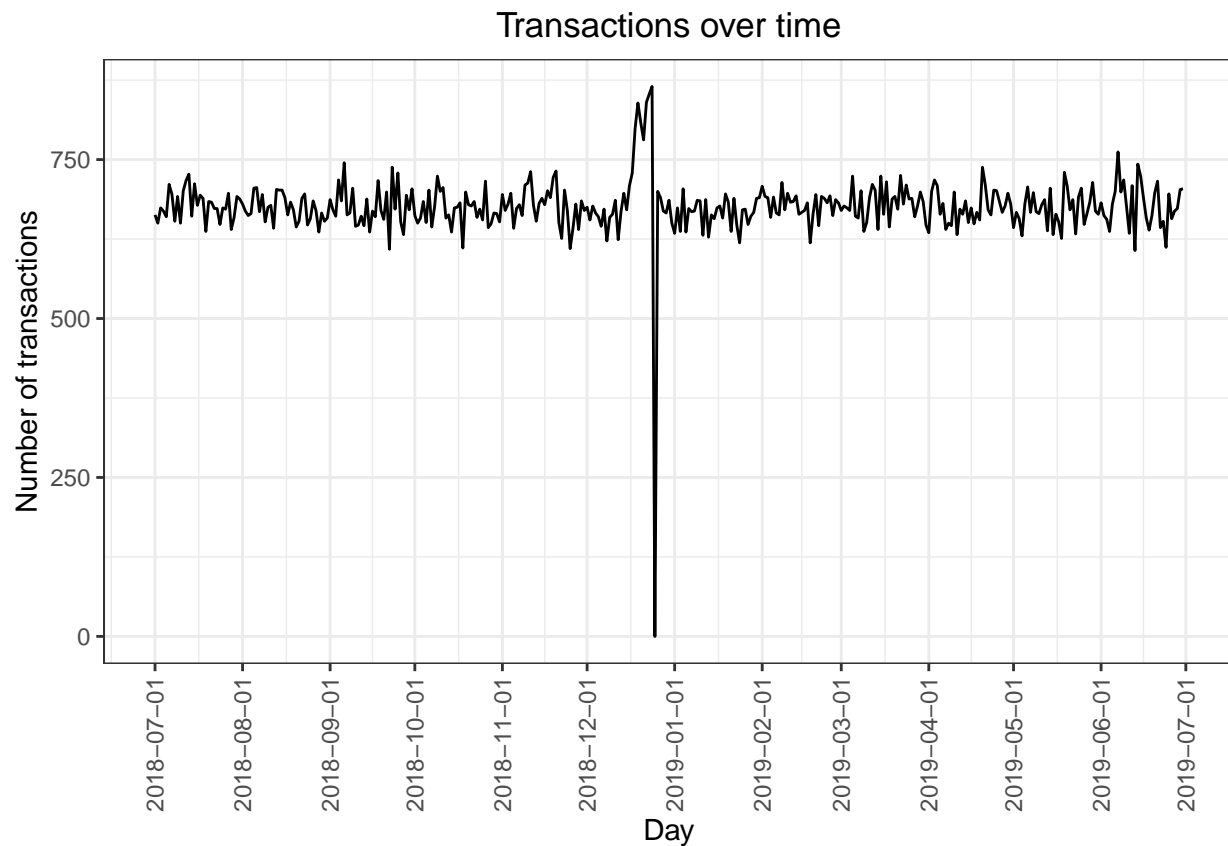
```
## [1] "factor"
```

```
transactions_by_day <- merge (x = seqOfDates, y = numberOfTransactionsByDate, by="date", all.x = TRUE)
transactions_by_day[is.na(transactions_by_day)] <- 0
transactions_by_day$date <- as.Date(transactions_by_day$date)
#### Setting plot themes to format graphs
```

```

theme_set(theme_bw())
theme_update(plot.title = element_text(hjust = 0.5))
#### Plot transactions over time
ggplot(transactions_by_day, aes(x = date, y = freq)) +
  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))

```

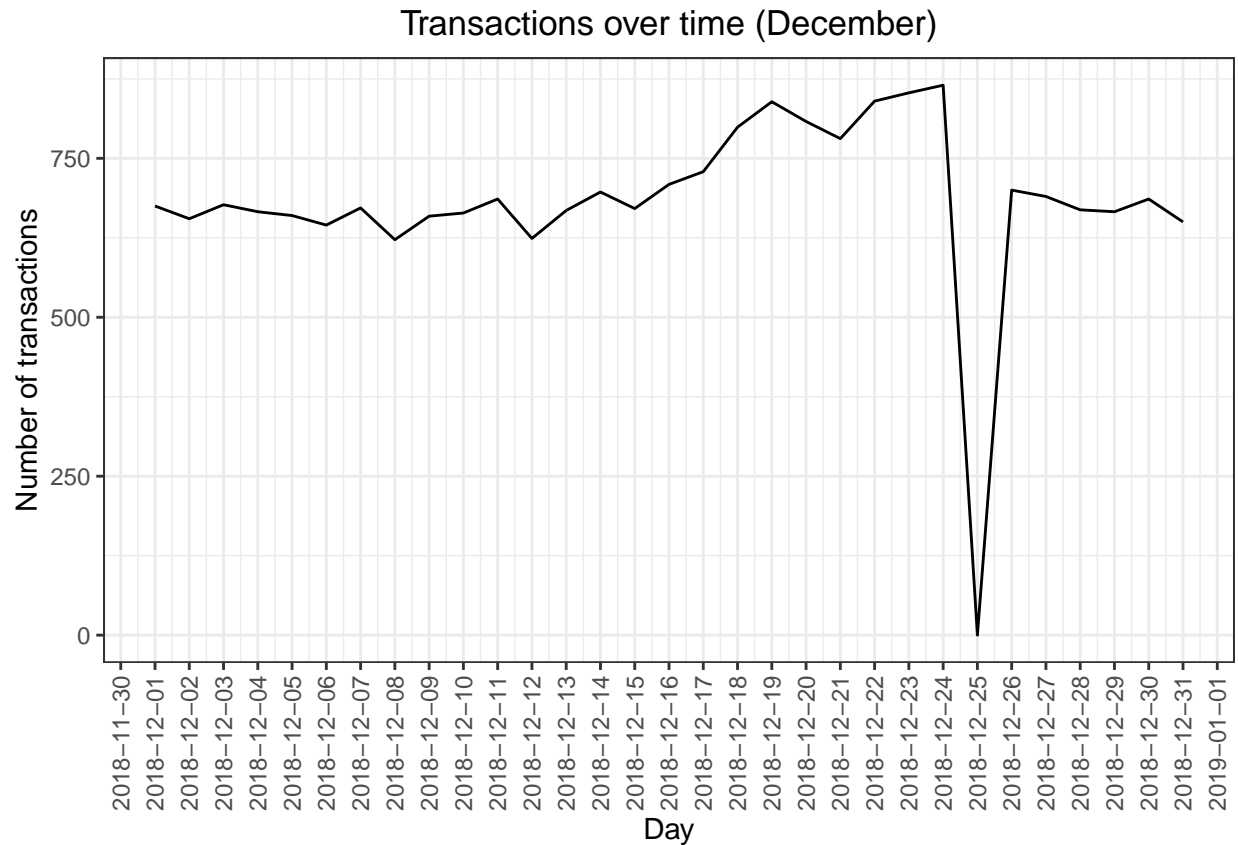


We can see that there is an increase in purchases in December and a break in late December. Let's zoom in on this.

```

#### Filter to December and look at individual days
december <- transactions_by_day[transactions_by_day$date >= as.Date("2018-12-01") & transactions_by_day]
#### plotting transactions over december
ggplot(december, aes(x=date, y= freq)) +
  geom_line() +
  labs(x = "Day", y = "Number of transactions", title = "Transactions over time (December)") +
  scale_x_date(breaks = "1 day") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))

```

We can see that the increase in sales occurs in the lead-up to Christmas and that there are zero sales on Christmas day itself. This is due to shops being closed on Christmas day. Now that we are satisfied that the data no longer has outliers, we can move on to creating other features such as brand of chips or pack size from `PROD_NAME`. We will start with pack size.

```
#### Pack size
#### We can work this out by taking the digits that are in PROD_NAME
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)]
```

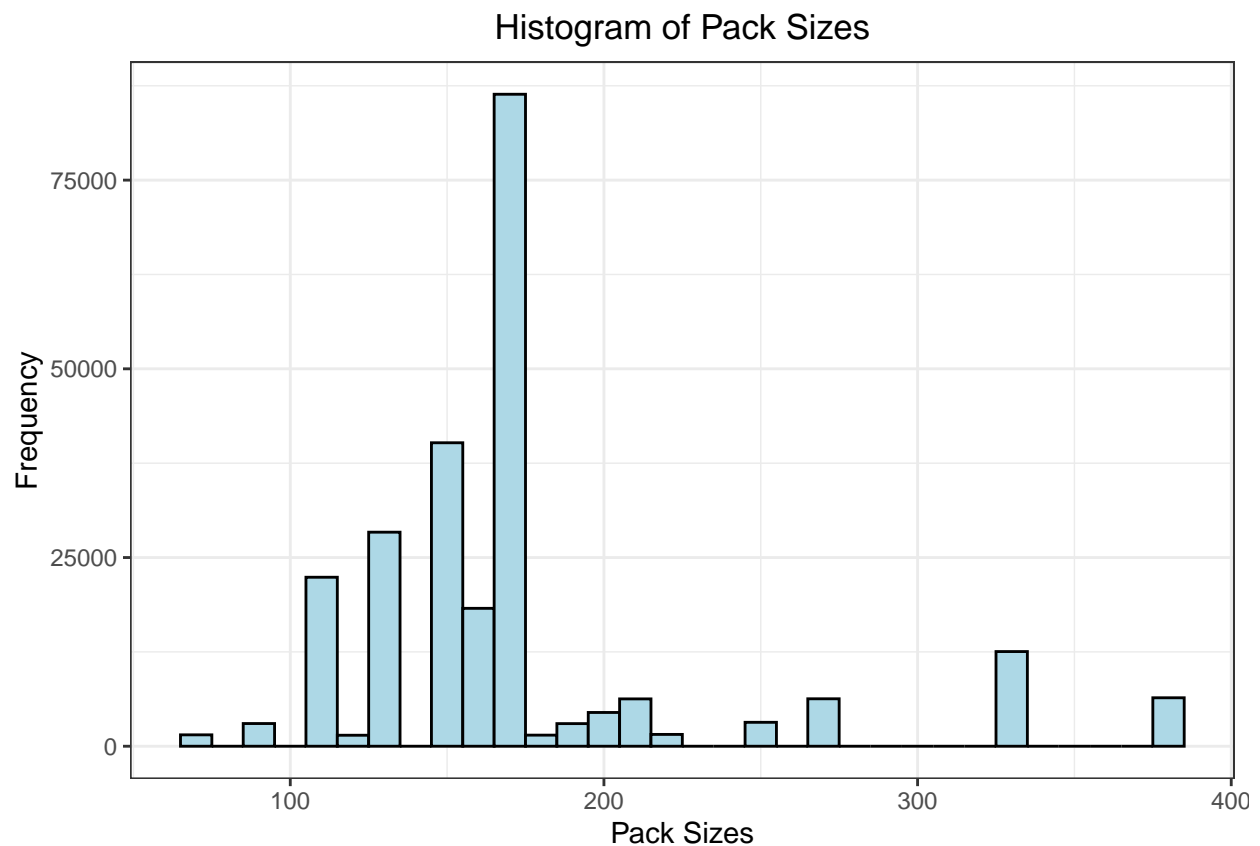
```
##      PACK_SIZE      N
## 1:         70  1507
## 2:         90  3008
## 3:        110 22387
## 4:        125  1454
## 5:        134 25102
## 6:        135  3257
## 7:        150 40203
## 8:        160  2970
## 9:        165 15297
## 10:       170 19983
## 11:       175 66390
## 12:       180  1468
```

```
## 13:      190  2995
## 14:      200  4473
## 15:      210  6272
## 16:      220  1564
## 17:      250  3169
## 18:      270  6285
## 19:      330 12540
## 20:      380  6418
```

The largest size is 380g and the smallest size is 70g - seems sensible!

```
#### Let's plot a histogram of PACK_SIZE since we know that it is a categorical
#### variable and not a continuous variable even though it is numeric.
```

```
ggplot(transactionData,aes(x=PACK_SIZE) )+
  geom_histogram(binwidth = 10,color="black",fill="lightblue") +
  labs(x = "Pack Sizes", y ="Frequency",title="Histogram of Pack Sizes")
```



```
#### mean and standard deviation of pack sizes
```

```
mean(transactionData$PACK_SIZE)
```

```
## [1] 175.5852
```

```
sd(transactionData$PACK_SIZE)
```

```
## [1] 59.43473
```

Pack sizes created look reasonable.

Now to create brands, we can use the first word in PROD_NAME to work out the brand name...

Brands

```
transactionData$BRAND_NAME <- sub('^\\w+\\s+', '\\1', transactionData$PROD_NAME)
```

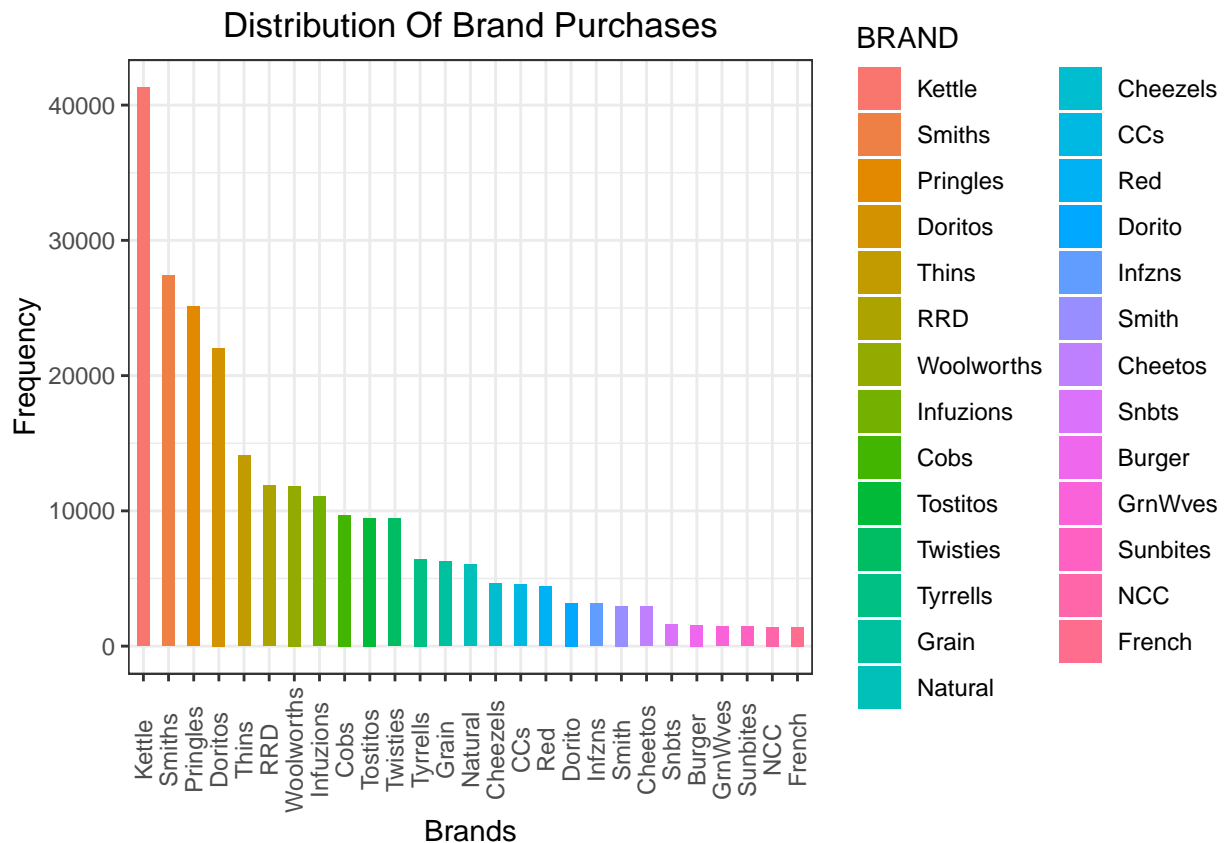
Some of the brand names look like they are of the same brands - such as RED and RRD, which are both Red Rock Deli chips. Let's combine these together.

Clean brand names

```
transactionData[BRAND_NAME == "RED", BRAND_NAME := "RRD"]
transactionData[BRAND_NAME == "GRAIN", BRAND_NAME := "GrnWves"]
transactionData[BRAND_NAME == "INFZNS", BRAND_NAME := "Infuzions"]
transactionData[BRAND_NAME == "WW", BRAND_NAME := "Woolworths"]
transactionData[BRAND_NAME == "SNBTS", BRAND_NAME := "Sunbites"]
# Over to you! Add any additional brand adjustments you think may be required.
#### Check again
brands <- data.frame(sort(table(transactionData$BRAND_NAME), decreasing = TRUE))
```

```
setnames(brands, c("BRAND", "freq"))
```

```
ggplot(brands, aes(x=BRAND, y=freq, fill=BRAND)) +
  geom_bar(stat="identity", width = 0.5) +
  labs(x = "Brands", y = "Frequency", title="Distribution Of Brand Purchases") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```



Examining customer data

Now that we are happy with the transaction dataset, let's have a look at the customer dataset.

```
#### Examining customer data
```

```
#### Over to you! Do some basic summaries of the dataset, including distributions #### of any key column
```

```
summary(customerData)
```

```
##  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
```

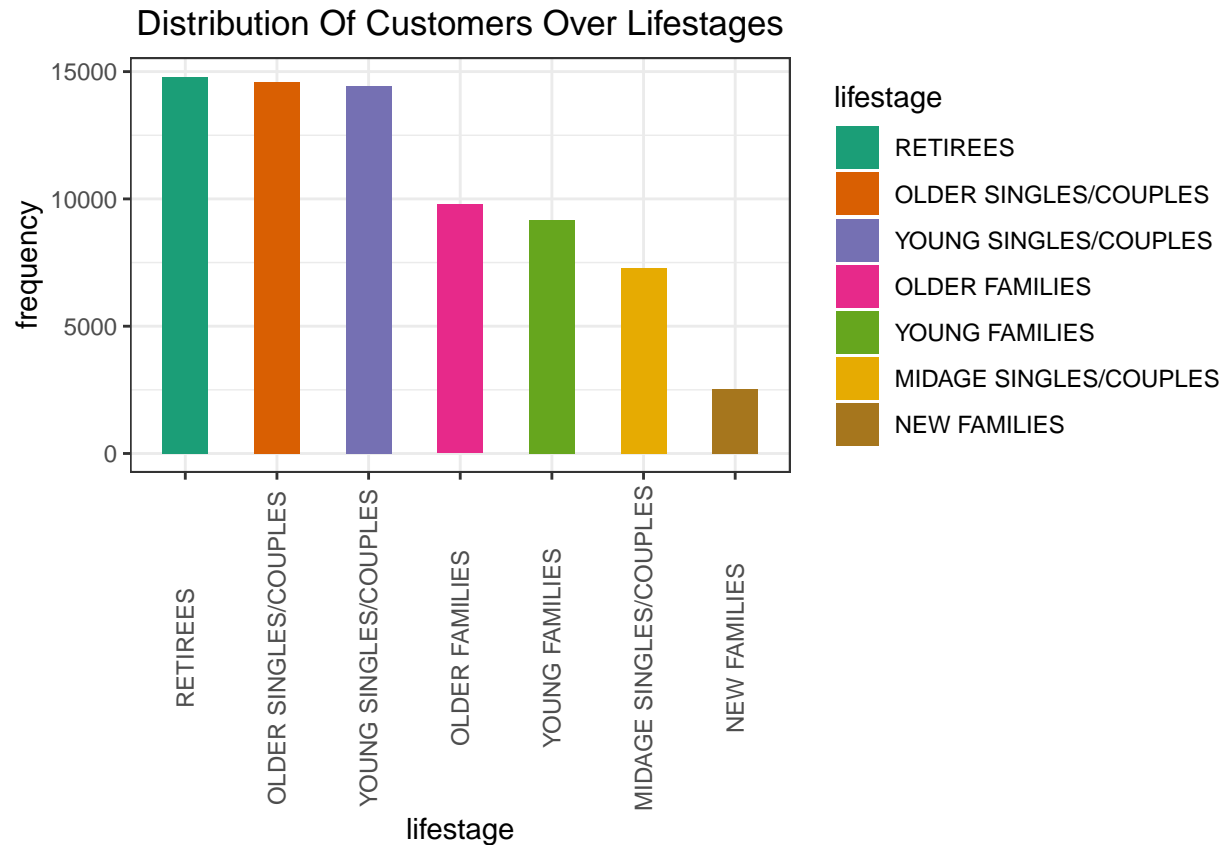
```
sum(is.na(customerData))
```

```
## [1] 0
```

```
lifestageCategory <- data.frame(sort(table(customerData$LIFESTAGE),decreasing = TRUE ))
```

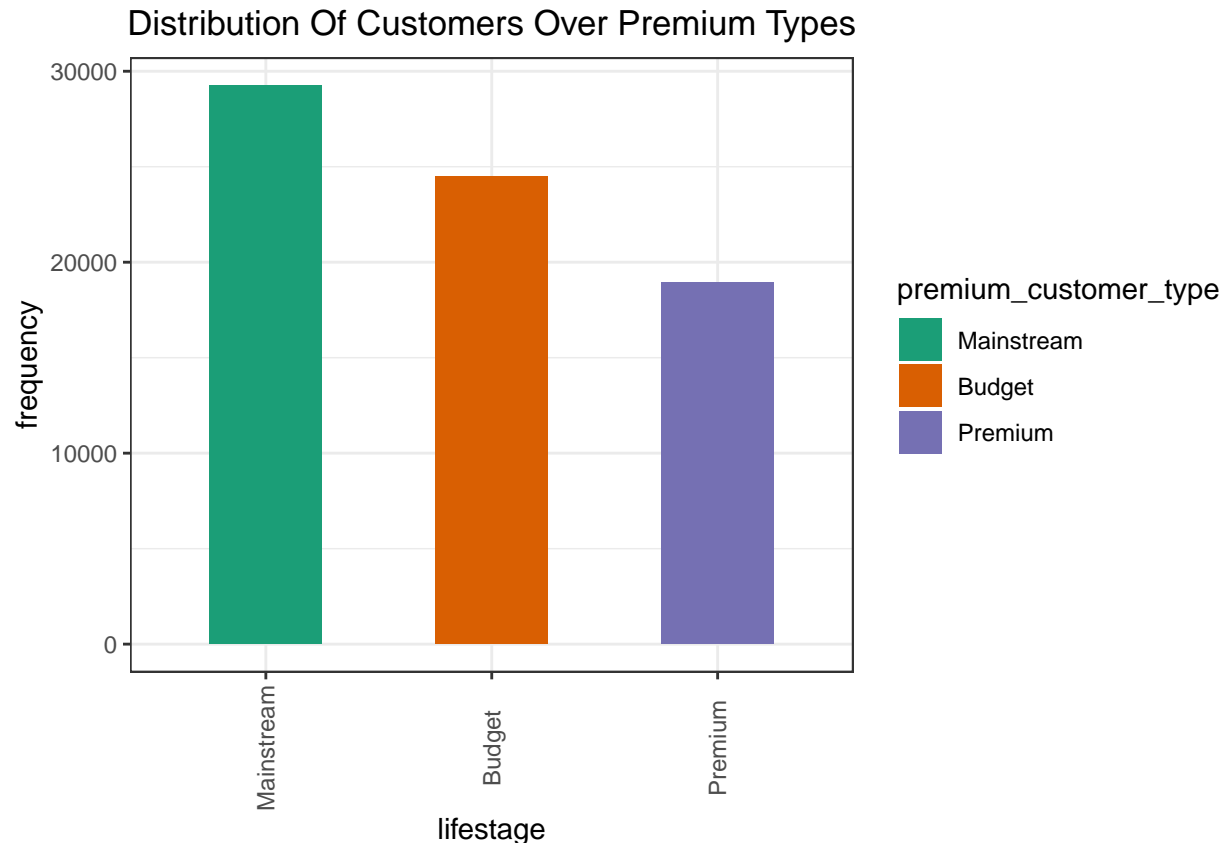
```
setnames(lifestageCategory,c("lifestage","freq"))
```

```
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")
```



```
#### Merge transaction data to customer data
data <- merge(transactionData, customerData, all.x = TRUE)
```

As the number of rows in `data` is the same as that of `transactionData`, we can be sure that no duplicates were created. This is because we created `data` by setting `all.x = TRUE` (in other words, a left join) which means take all the rows in `transactionData` and find rows with matching values in shared columns and then joining the details in these rows to the `x` or the first mentioned table.

Let's also check if some customers were not matched on by checking for nulls.

```
sum(is.na(data))
```

```
## [1] 0
```

Great, there are no nulls! So all our customers in the transaction data has been accounted for in the customer dataset. Note that if you are continuing with Task 2, you may want to retain this dataset which you can write out as a csv

```
fwrite(data, paste0("QVI_data.csv"))
```

****Deep Dive into specific customer segments for insights**

we have found a few interesting insights that we can dive deep into.

```
# total sales by customer premium

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")
```



Sales are coming mainly from Mainstream

Let's see where in our customer segment that houses majority of our customers.

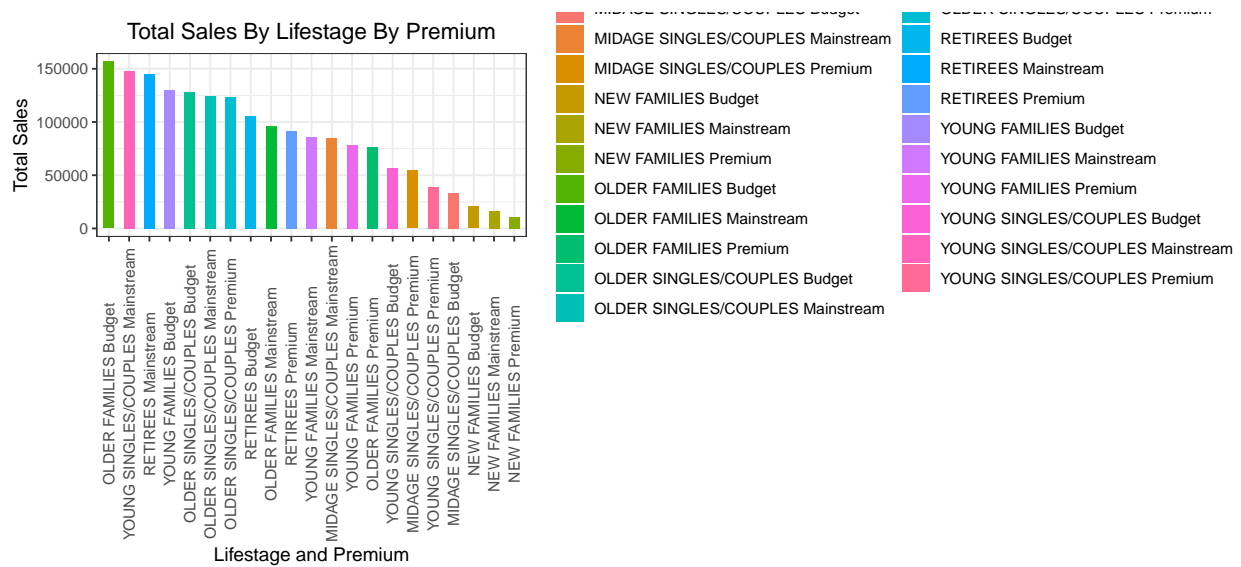
```
#total sales by customer premium and lifestage

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

totalSalesByPremiumAndLifestage$Lifestage_Premium <- paste(totalSalesByPremiumAndLifestage$LIFESTAGE,totalSalesByPremiumAndLifestage$PREMIUM_CUSTOMER)

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))
```



Sales are coming mainly from Budget - older families, Mainstream - young singles/couples, and Mainstream - retirees Let's see if the higher sales are due to there being more customers who buy chips.

```
#### Number of customers by LIFESTAGE and PREMIUM_CUSTOMER
```

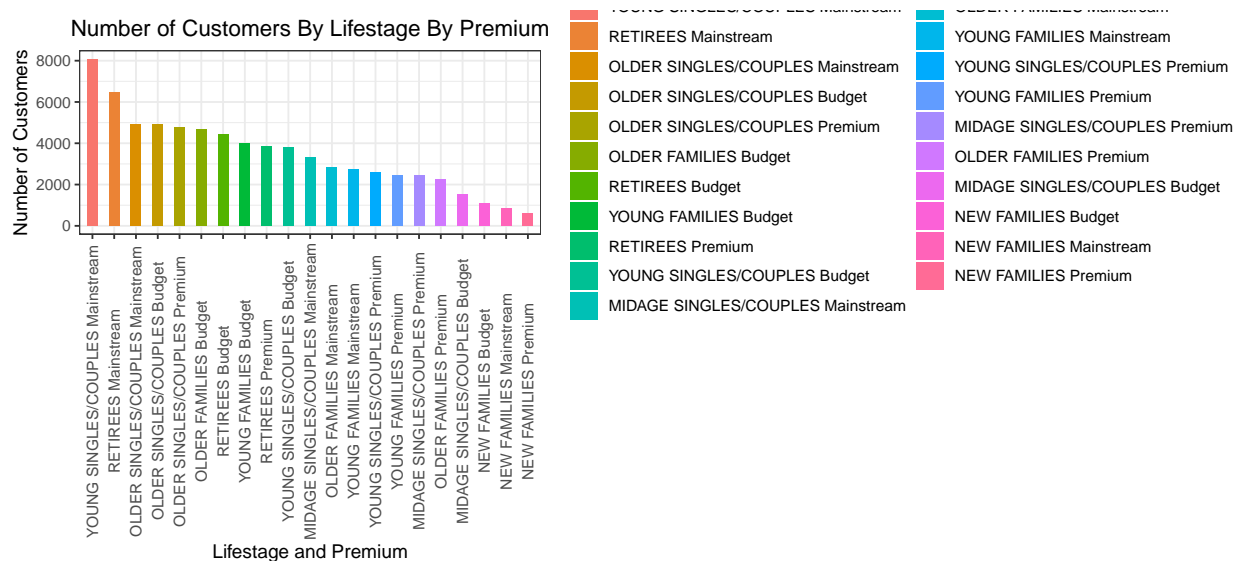
```
# Calculating the number of customers by Life-stage and Premium
```

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

```
numberOfCustomersByLifestageByPremium <- data.frame(sort(table(numberOfCustomersByLifestageByPremium),decreasing=T))
```

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

```
ggplot(numberOfCustomersByLifestageByPremium,aes(x=Lifestage_Premium,y = freq,fill=Lifestage_Premium)) +
  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))
```



There are more Mainstream - young singles/couples and Mainstream - retirees who buy chips. This contributes to there being more sales to these customer segments but this is not a major driver for the Budget - Older families segment.

Higher sales may also be driven by more units of chips being bought per customer.

Let's have a look at this next.

```
#### Average number of units per customer by LIFESTAGE and PREMIUM_CUSTOMER
averageNumberOfUnits <- data.table(data[,c("LIFESTAGE", "PREMIUM_CUSTOMER", "PROD_QTY")])

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

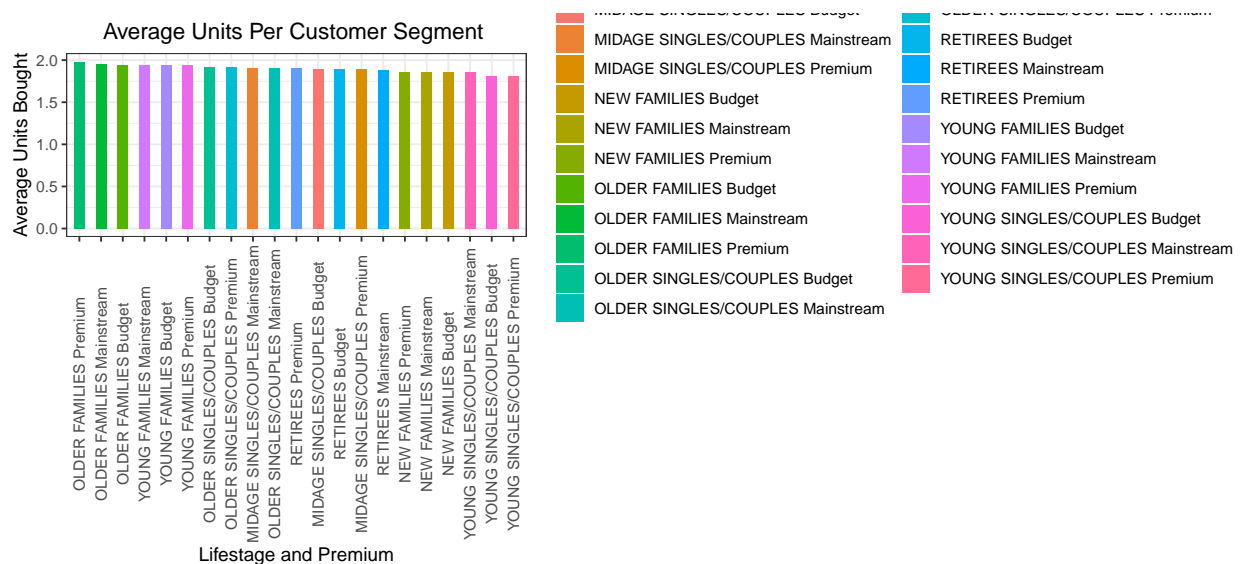
setnames(averageNumberOfUnits, c("Lifestage", "premium", "prod_qty", "Lifestage_Premium"))

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")],
  FUN = function(x) {sum(x)}, na.rm = TRUE)

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))
```



Older families and young families in general buy more chips per customer. Let's also investigate the average price per unit chips bought for each customer segment as this is also a driver of total sales.

```
#### Average price per unit by LIFESTAGE and PREMIUM_CUSTOMER
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"))

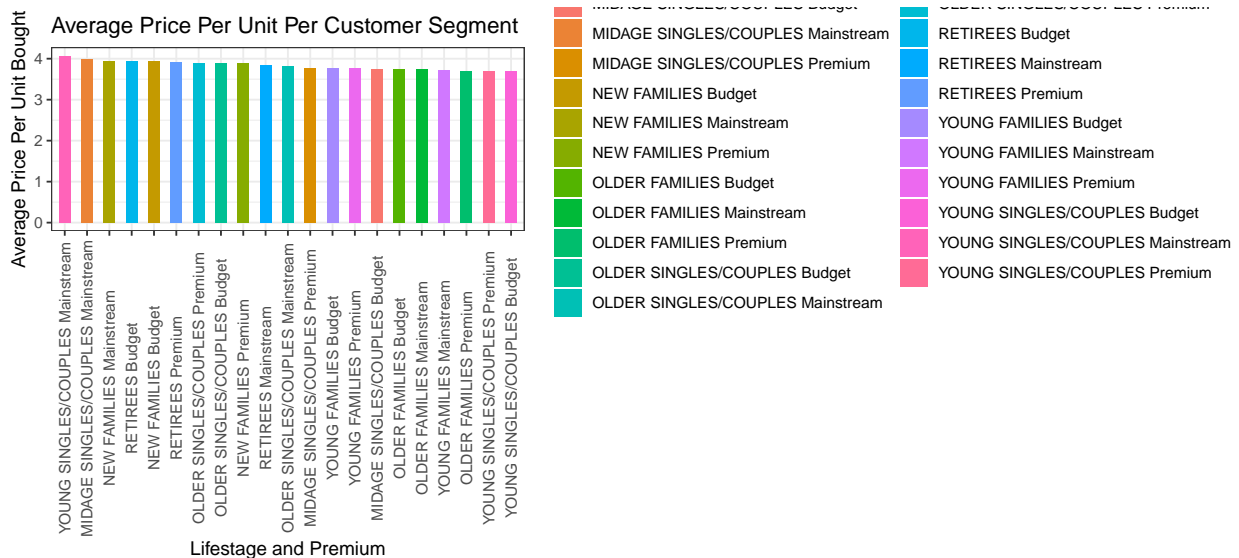
averagePrice<- averagePrice[,c("Lifestage_Premium","prod_qty","TOT_SALES")]

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 Bought",
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))

```



Mainstream mid age and young singles and couples are more willing to pay more per packet of chips compared to their budget and premium counterparts. This may be due to premium shoppers being more likely to buy healthy snacks and when they buy chips, this is mainly for entertainment purposes rather than their own consumption. This is also supported by there being fewer premium mid age and young singles and couples buying chips compared to their mainstream counterparts. As the difference in average price per unit isn't large, we have check if this difference is statistically different.

```

#### Perform an independent t-test between mainstream vs premium and budget midage
#### and young singles and couples

```

Data exploration is now complete! ## Data analysis on customer segments Now that the data is ready for analysis, we can define some metrics of interest to the client: - Who spends the most on chips (total sales), describing customers by lifestage and how premium their general purchasing behaviour is

- How many customers are in each segment

- How many chips are bought per customer by segment
- What's the average chip price by customer segment.

We could also ask our data team for more information. Examples are: - The customer's total spend over the period and total spend for each transaction to understand what proportion of their grocery spend is on chips - Proportion of customers in each customer segment overall to compare against the mix of customers who purchase chips

Let's start with calculating total sales by LIFESTAGE and PREMIUM_CUSTOMER and plotting the split by these segments to describe which customer segment contribute most to chip sales.

```
#### Total sales by LIFESTAGE and PREMIUM_CUSTOMER
#total sales by life stages
```

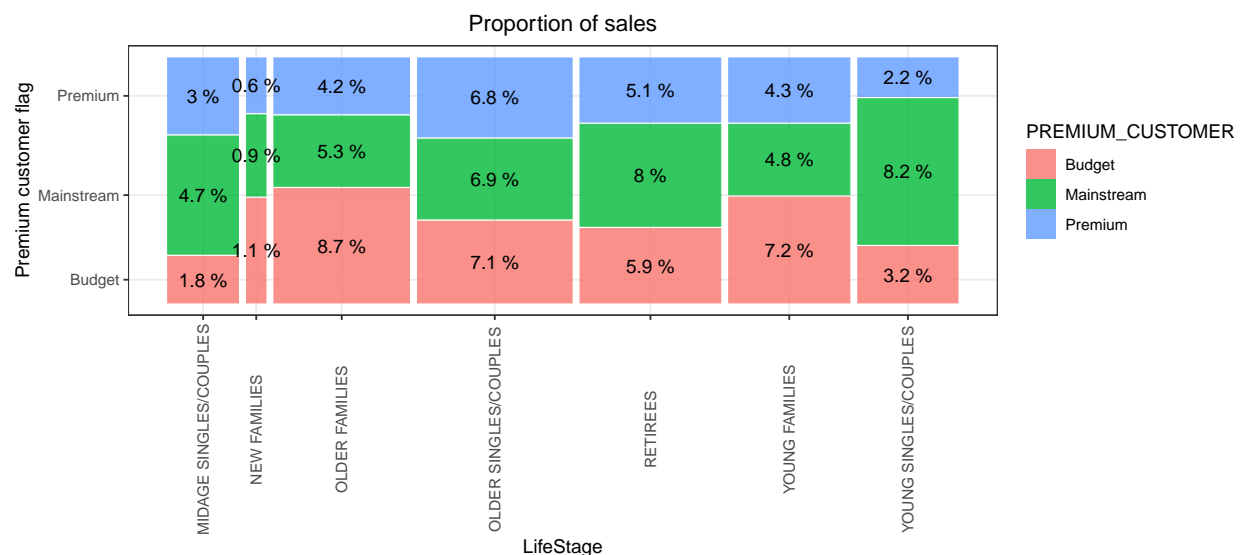
```
sales <- data[, .(SALES = sum(TOT_SALES)), .(LIFESTAGE, PREMIUM_CUSTOMER)]
```

```
####Create Plot
```

```
p <- ggplot(data = sales) +
  geom_mosaic(aes(weight = SALES, x = product(PREMIUM_CUSTOMER, LIFESTAGE),
    fill = PREMIUM_CUSTOMER)) +
  labs(x = "LifeStage", y = "Premium customer flag", title = "Proportion of sales") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```

```
p + geom_text(data = ggplot_build(p)$data[[1]], aes(x = (xmin + xmax)/2, y = (ymin + ymax)/2, label = a
```

```
## Warning: 'unite_()' was deprecated in tidyr 1.2.0.
## i Please use 'unite()' instead.
## i The deprecated feature was likely used in the ggmosaic package.
## Please report the issue at <https://github.com/haleyjeppson/ggmosaic>.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was
## generated.
```



Sales Revenue are mainly generated from budget - older families, mainstream - young single/couples, and Mainstream - retirees

Lets see if the higher sales are due to customers purchasing more chips.

```
####Number of customers by LIFESTAGE and PREMIUM_CUSTOMERS
```

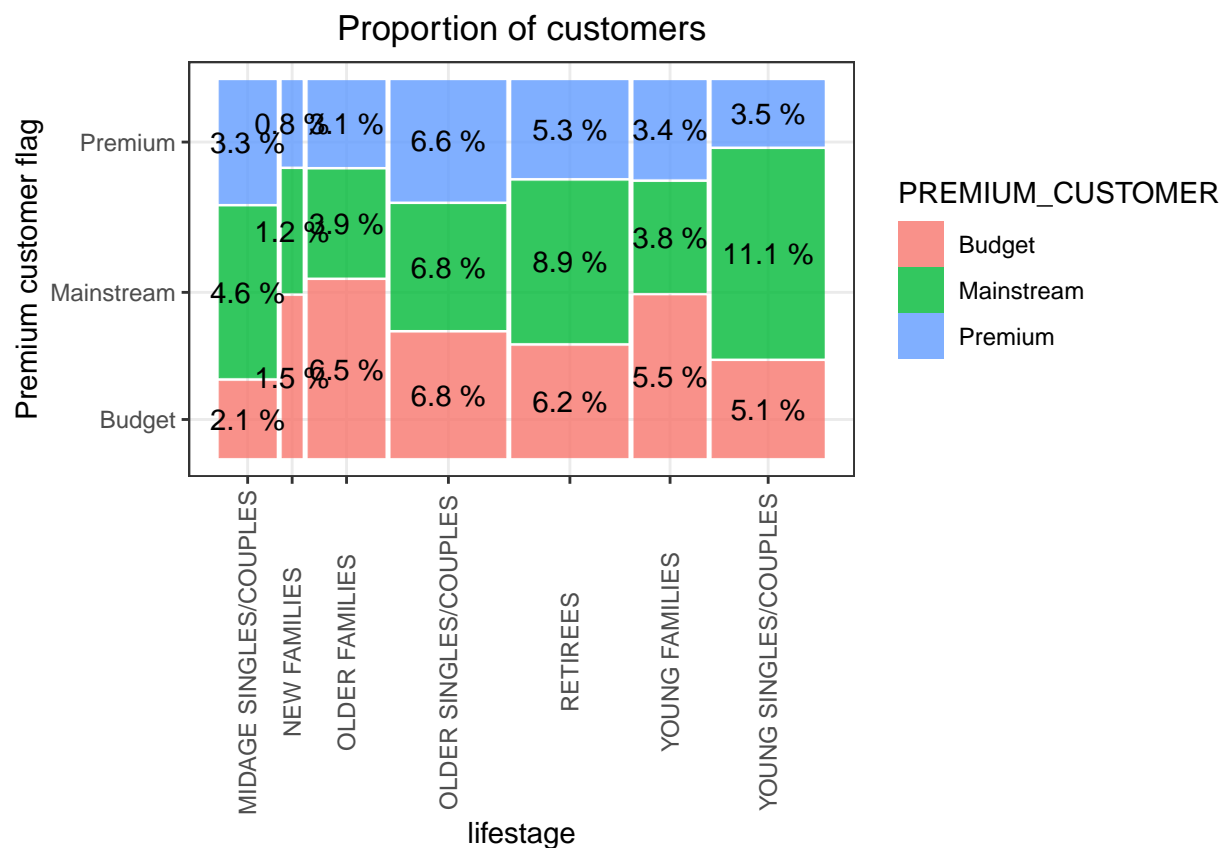
```
customers <- data[,.(CUSTOMERS = uniqueN(LYLTY_CARD_NBR)), .(LIFESTAGE, PREMIUM_CUSTOMER)][order(-CUSTOMERS)]
```

```
####Create Plot
```

```
p = ggplot(data = customers) +  
  geom_mosaic(aes(weight = CUSTOMERS, x = product(PREMIUM_CUSTOMER, LIFESTAGE), fill = PREMIUM_CUSTOMER,  
  labs(x = "lifestage", y = "Premium customer flag", title = "Proportion of customers") +  
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5))
```

```
####Plot and label with proportion of customers
```

```
p + geom_text(data = ggplot_build(p)$data[[1]], aes(x = (xmin + xmax)/2, y = (ymin + ymax)/2, label = a
```



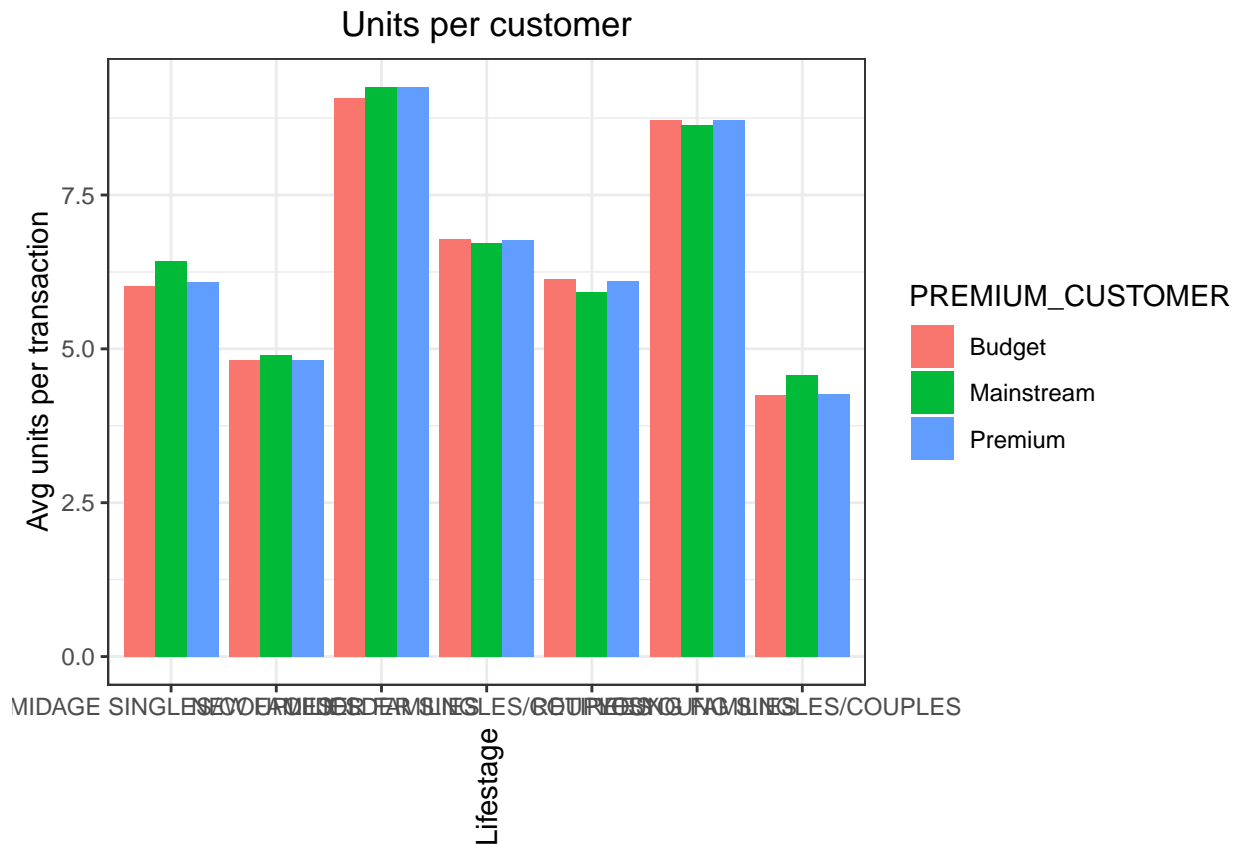
There seems to be more mainstream - young singles/couples and mainstream - retirees who buy chips. this contributes to there being more sales to these customer segments but this is not a major driver for the budget - older families segment.

Higher sales may also be driven by more units of chips being bought per customer. Lets have a look at this hypothesis.

```
#### Average number of units per customerby LIFESTAGE and PREMIUM_CUSTOMER
```

```
avg_units <- data[, .(AVG = sum(PROD_QTY)/uniqueN(LYLTY_CARD_NBR)), .(LIFESTAGE, PREMIUM_CUSTOMER)][order
```

```
####Create plot
ggplot(data = avg_units, aes(weight = AVG, x = LIFESTAGE, fill = PREMIUM_CUSTOMER)) +
  geom_bar(position = position_dodge()) +
  labs(x = "Lifestage", y = "Avg units per transaction", title = "Units per customer") +
  theme(axis.title.x = element_text(angle = 90, vjust = 0.5))
```

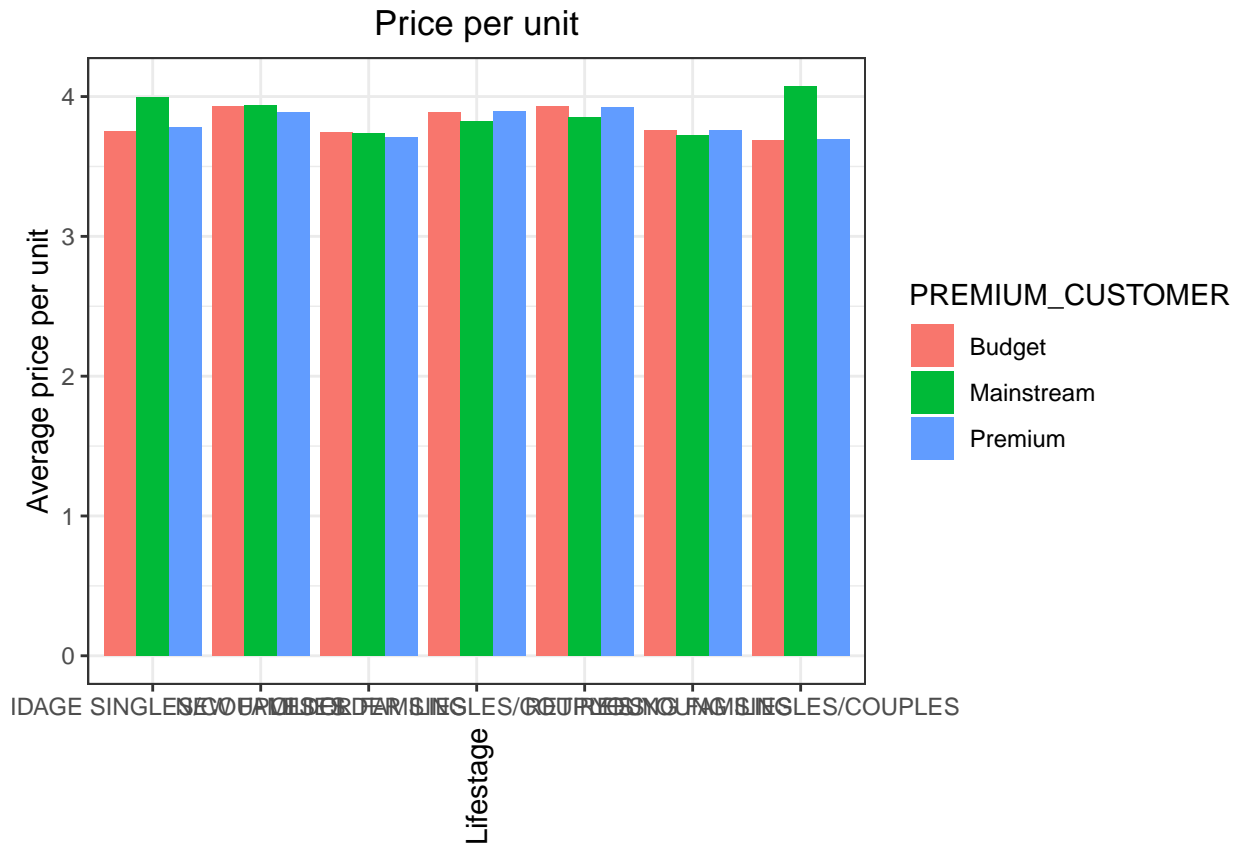


Older Families and young families in general buy more chips per customer.

Lets also investigate the average price per unit chips bought for each customer segment as this is also a driver for total sales.

```
####Average Price per unit by LIFESTAGE and PREMIUM_CUSTOMER
avg_price <- data[, .(AVG = sum(TOT_SALES)/sum(PROD_QTY)), .(LIFESTAGE, PREMIUM_CUSTOMER)][order(-AVG)]

#### Create plot
ggplot(data = avg_price, aes(weight = AVG, x = LIFESTAGE, fill = PREMIUM_CUSTOMER)) +
  geom_bar(position = position_dodge()) +
  labs(x = "Lifestage", y = "Average price per unit", title = "Price per unit") +
  theme(axis.title.x = element_text(angle = 90, vjust = 0.5))
```



Mainstream mid aged and young singles/couples are more willing to pay more per packets of chips compared to their budget and premium counterparts. this maybe due to premium shoppers being more likely to buy healthy snacks and when they buy chips, this is mainly for entertainment purposes rather than for their personal consumption. this is also supported by there being fewer premium mid aged and young singles/couples buying chips compared to their mainstream counterparts.

As the difference in average price per unit isn't large, we can use further insight to check the statistical difference.

Perform an Independent t-test between the mainstream vs premium and budget midage and young couple

```
pricePerUnit <- data[, price:= TOT_SALES/PROD_QTY]
t.test(data[LIFESTAGE %in% c("YOUNG_SINGLE/COUPLES", "MIDAGE SINGLES/COUPLES") & PREMIUM_CUSTOMER == "M", price],
data[LIFESTAGE %in% c("YOUNG_SINGLE/COUPLES", "MIDAGE SINGLES/COUPLES") & PREMIUM_CUSTOMER != "M", price])

##
## Welch Two Sample t-test
##
## data: data[LIFESTAGE %in% c("YOUNG_SINGLE/COUPLES", "MIDAGE SINGLES/COUPLES") & PREMIUM_CUSTOMER == "Mainstream", price] and data[LIFESTAGE %in% c("YOUNG_SINGLE/COUPLES", "MIDAGE SINGLES/COUPLES") & PREMIUM_CUSTOMER != "Mainstream", price]
## t = 16.864, df = 23345, p-value < 2.2e-16
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
## 0.2111567 Inf
## sample estimates:
## mean of x mean of y
```

```
## 3.994241 3.760262
```

The t-test results in a p-value $< 2.2e-16$, this means that, the unit price for mainstream, young and mid-aged singles and couples are significantly higher than that of budget or premium, young and mid aged singles/couples are significantly higher than that of budget or premium young and mid-aged singles/couples.

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

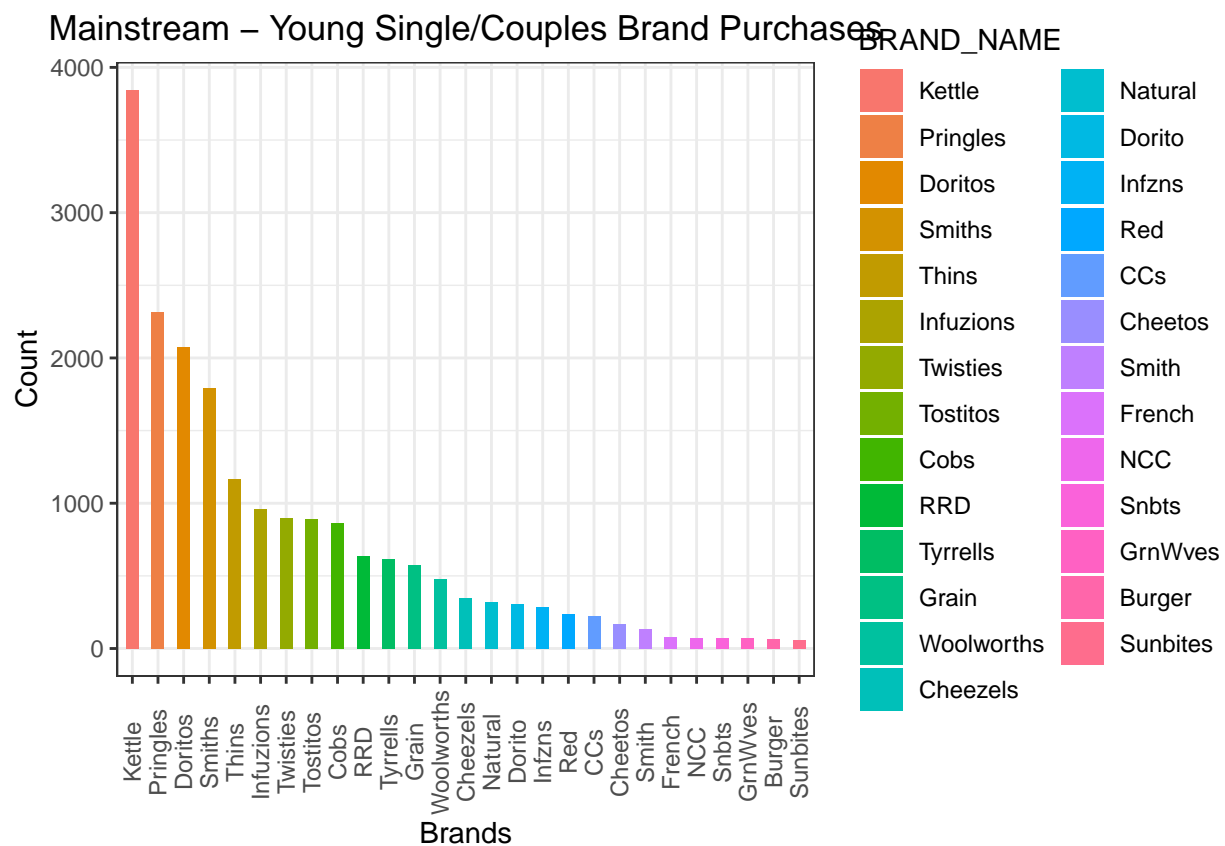
mainstreamYoungSingleCouples$Lifestage_Premium <- data.table(paste(data$LIFESTAGE,data$PREMIUM_CUSTOMER))

mainstreamYoungSingleCouples <- mainstreamYoungSingleCouples[Lifestage_Premium == 'YOUNG SINGLES/COUPLES',]

mainstreamYoungSingleCouplesBrandFreq <- data.frame(sort(table(mainstreamYoungSingleCouples$BRAND_NAME)))

setnames(mainstreamYoungSingleCouplesBrandFreq,c('BRAND_NAME','freq'))

ggplot(mainstreamYoungSingleCouplesBrandFreq,aes(x=BRAND_NAME ,y=freq ,fill=BRAND_NAME)) +
  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))
```



Deep dive into specific customer segments for insights

We have found quite a few interesting insights that we can dive deeper into. We might want to target customer segments that contribute the most to sales to retain them or further increase sales. Let's look at Mainstream - young singles/couples. For instance, let's find out if they tend to buy a particular brand of chips.

```
#### Deep dive into Mainstream, young singles/couples
# Now producing an histogram of PACK_SIZE to determine whether this segment buys larger chips.

is.na(mainstreamYoungSingleCouples)
```

##	LYLTY_CARD_NBR	DATE	STORE_NBR	TXN_ID	PROD_NBR	PROD_NAME	PROD_QTY
##	[1,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[2,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[3,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[4,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[5,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[6,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[7,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[8,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[9,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[10,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[11,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[12,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[13,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[14,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[15,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[16,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[17,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[18,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[19,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[20,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[21,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[22,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[23,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[24,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[25,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[26,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[27,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[28,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[29,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[30,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[31,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[32,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[33,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[34,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[35,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[36,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[37,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[38,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[39,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[40,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
##	[41,]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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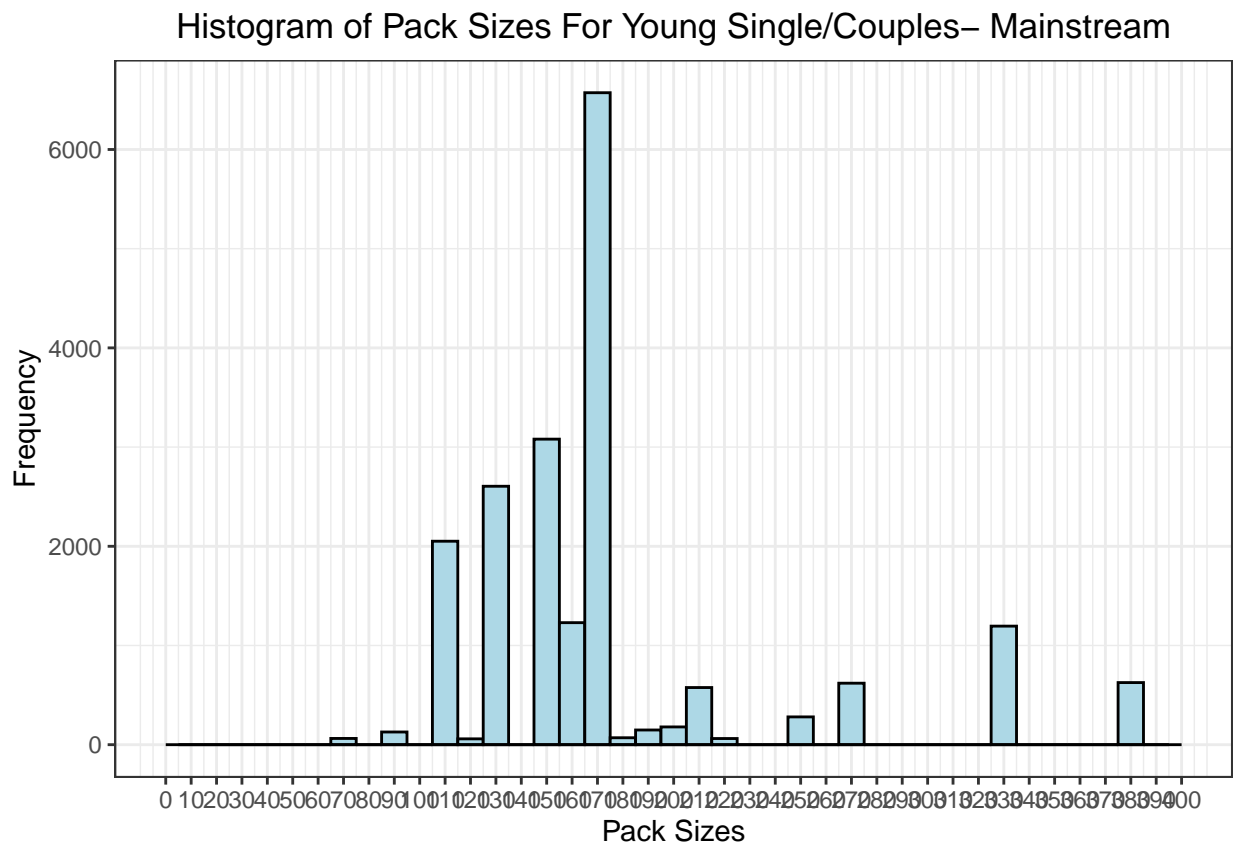
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## [ reached getOption("max.print") -- omitted 12402 rows ]
```

```
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_x_continuous(breaks = seq(0, 400, 10), limits = c(0,400))
```

```
## Warning: Removed 2 rows containing missing values ('geom_bar()').
```



```
# calculating mean and sd for pack size for this segment
mean(mainstreamYoungSingleCouples$PACK_SIZE)
```

```
## [1] 178.3442
```

```
sd(mainstreamYoungSingleCouples$PACK_SIZE)
```

```
## [1] 63.91625
```

- Mainstream young singles/couples are 23% more likely to purchase Tyrrells chips compared to the rest of the population
- Mainstream young singles/couples are 56% less likely to buy Burger Rings compared to the rest of the population

Let's also find out if our target segment tends to purchase larger packs of chips.

```
#### Preferred pack size compared to the rest of the population
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)]
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)]
```

##	PACK_SIZE	targetSegment	other	affinityToPack
## 1:	270	0.031828847	0.025072830	1.2694557
## 2:	330	0.061283644	0.050115746	1.2228421
## 3:	380	0.032160110	0.026481106	1.2144550
## 4:	134	0.119420290	0.100542140	1.1877636
## 5:	110	0.106280193	0.089708542	1.1847277
## 6:	210	0.029123533	0.025098142	1.1603860
## 7:	135	0.014768806	0.013063368	1.1305512
## 8:	250	0.014354727	0.012768826	1.1242010
## 9:	170	0.080772947	0.080911421	0.9982886
## 10:	150	0.157598344	0.163270237	0.9652607
## 11:	175	0.254989648	0.269758430	0.9452518
## 12:	165	0.055652174	0.062210349	0.8945806
## 13:	190	0.007481021	0.012430564	0.6018248
## 14:	180	0.003588682	0.006061108	0.5920835
## 15:	160	0.006404417	0.012361531	0.5180925
## 16:	90	0.006349206	0.012568630	0.5051629
## 17:	125	0.003008972	0.006031194	0.4989015
## 18:	200	0.008971705	0.018638943	0.4813419
## 19:	70	0.003036577	0.006316531	0.4807349
## 20:	220	0.002926156	0.006590362	0.4440053

It looks like mainstream young single/couples are 27% more likely to purchase a 270g pack of chips compared to the rest of the population but lets dive into what brands sell this packet size.

```
data[PACK_SIZE == 270, unique(PROD_NAME)]
```

```
## [1] "Twisties Cheese      270g" "Twisties Chicken270g"
```

Twisties are the only brand offering 270g packs and so this may instead be reflecting a higher likelihood of purchasing twisties.

1. Sales have mainly been due to Budget - older families, Mainstream - young singles/couples, and Mainstream- retirees shoppers.
2. We found that the high spending on chips for mainstream young singles/couples and retirees is due to more of them than other buyers.
3. Mainstream, mid-age, and young singles and couples are also more likely to pay more per packet of chips.

It is indicative of impulse buying behavior.

4. We've also found that Mainstream young singles and couples are 23% more likely to purchase Tyrrells chips than the rest of the population.
5. The Category Manager may want to increase the category's performance by off-locating some Tyrrells and smaller packs of chips in discretionary space near segments where young singles and couples frequent more often to increase visibility and impulse behavior

Conclusion

lets do a recap Sales have mainly been due to Budget - older families, Mainstream - young singles/couples, and Mainstream - retirees shoppers. We found that the high spend in chips for mainstream young singles/couples and retirees is due to there being more of them than other buyers. Mainstream, midage and young singles and couples are also more likely to pay more per packets of chips. this is indicative of impulse buying behavior.

we have also found from insights that mainstream young singles and couples are 23% more likely to purchase Tyrrells chips compared to the rest of the population. The category manager may want to increase the category performance by off-locating some Tyrrells and smaller packs of chips in discretionary space near segments where young singles and couples frequent more often to increase visibility and impulse behaviour.