tyeruva BA Assignment 2

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```
## Loading the required package
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

loading the Online_Retail file using the command 'read.csv'

```
getwd()
```

```
## [1] "C:/Users/tejar/OneDrive/Desktop/BA Assignment 1"
```

```
setwd("C:/Users/tejar/OneDrive/Documents")
Online_Retail <- read.csv("C:/Users/tejar/Downloads/Online_Retail.csv")
```

Setting echo= TRUE

1.The breakdown of the number of transactions by countries i.e. number of transactions are in the dataset for each country (considering all the records including cancelled transactions) along with total number and also in percentage are shown below.In addition the countries accounting for more than 1% of the total transactions are also derived.

Grouping the data frame by country and then summarising transactions by count and percentage.

Filtering out all the countries that represent less than 1% of the total transactions.

```
Online_Retail %>%
  group_by(Country) %>%
  summarise(n_transactions = n(), percent_total = 100*(n()/nrow(Online_Retail))) %>%
  filter(percent_total > 1.0) %>%
  arrange(desc(percent_total))
```

```
## # A tibble: 4 x 3
##   Country        n_transactions percent_total
##   <chr>                   <int>         <dbl>
## 1 United Kingdom         495478         91.4 
## 2 Germany                  9495          1.75
## 3 France                   8557          1.58
## 4 EIRE                     8196          1.51
```

2.Creating a new variable 'TransactionValue' that is the product of the exising 'Quantity' and 'UnitPrice' variables and Adding this variable to the dataframe.

With the below command creating a new column as "TransactionValue" and binding it to the original dataframe.

using head function to display the first six rows of new data frame.

```
Online_Retail <- cbind(Online_Retail, TransactionValue = Online_Retail$Quantity * Online_Retail$UnitPri
head(Online_Retail)
```

```
##   InvoiceNo StockCode                         Description Quantity
## 1    536365    85123A  WHITE HANGING HEART T-LIGHT HOLDER        6
## 2    536365     71053                 WHITE METAL LANTERN        6
## 3    536365    84406B      CREAM CUPID HEARTS COAT HANGER        8
## 4    536365    84029G KNITTED UNION FLAG HOT WATER BOTTLE        6
## 5    536365    84029E      RED WOOLLY HOTTIE WHITE HEART.        6
## 6    536365     22752        SET 7 BABUSHKA NESTING BOXES        2
##      InvoiceDate UnitPrice CustomerID        Country TransactionValue
## 1 12/1/2010 8:26      2.55      17850 United Kingdom            15.30
## 2 12/1/2010 8:26      3.39      17850 United Kingdom            20.34
## 3 12/1/2010 8:26      2.75      17850 United Kingdom            22.00
## 4 12/1/2010 8:26      3.39      17850 United Kingdom            20.34
## 5 12/1/2010 8:26      3.39      17850 United Kingdom            20.34
## 6 12/1/2010 8:26      7.65      17850 United Kingdom            15.30
```

3.Using the newly created variable, TransactionValue, showing the breakdown of transaction values by countries i.e. how much money in total has been spent each country. Showing this in total sum of transaction values. Sowing the countries with total transaction exceeding 130,000 British Pound.

Grouping transactions by country and then summarising it by the sum of the "TransactionValue" column. Filtering out the countries with spend less than 130,000 and arranging them in descending order.

```
Online_Retail %>%
  group_by(Country) %>%
  summarise(Total_Spend = sum(TransactionValue)) %>%
  filter(Total_Spend > 130000) %>%
  arrange(desc(Total_Spend))
```

```
## # A tibble: 6 x 2
##   Country        Total_Spend
##   <chr>                <dbl>
## 1 United Kingdom    8187806.
## 2 Netherlands        284662.
## 3 EIRE               263277.
## 4 Germany            221698.
## 5 France             197404.
## 6 Australia          137077.
```

4.Optional question

Using the head command to verify the format and it is creating the temporary variable that is formatting transacation date into mm/dd/yyyy format.

```
Temp=strptime(Online_Retail$InvoiceDate,format='%m/%d/%Y %H:%M',tz='GMT')
head(Temp)
```

```
## [1] "2010-12-01 08:26:00 GMT" "2010-12-01 08:26:00 GMT"
## [3] "2010-12-01 08:26:00 GMT" "2010-12-01 08:26:00 GMT"
## [5] "2010-12-01 08:26:00 GMT" "2010-12-01 08:26:00 GMT"
```

Checking the variable using, head(Temp). Separating date, day of the week and hour components dataframe with names as New_Invoice_Date, Invoice_Day_Week and New_Invoice_Hour:

Here I am formatting the New_Invoice_Date column into a date format from the Temp variable

echo=TRUE

```
Online_Retail$New_Invoice_Date <- as.Date(Temp)
```

The Date objects have a lot of flexible functions. For example knowing two date values, the object allows you to know the difference between the two dates in terms of the number days. Try this:

This command shows us how dates can be subtracted from each other and returning the differences in values.

```
Online_Retail$New_Invoice_Date[20000]- Online_Retail$New_Invoice_Date[10]
```

```
## Time difference of 8 days
```

Now converting dates to days of week and assigning column title to Invoice_Day_Week

```
Online_Retail$Invoice_Day_Week= weekdays(Online_Retail$New_Invoice_Date)
```

For the Hour, let's just take the hour (ignore the minute) and convert into a normal numerical

value:

# Now creating a new column with the transaction hour that is assigned to New_Invoice_Hour

```
Online_Retail$New_Invoice_Hour = as.numeric(format(Temp, "%H"))
```

lets define the month as a separate numeric variable too:

## Now creating a new column with the transaction month that is assigned to New_Invoice_Hour

```
Online_Retail$New_Invoice_Month = as.numeric(format(Temp, "%m"))
```

a) Show the percentage of transactions (by numbers) by days of the week

Grouping the data frame by the day of week, Calculating the percentage of transactions (by number) by day, and returning the values in the descending order of percentages.

```
Online_Retail %>%
  group_by(Invoice_Day_Week) %>%
  summarise(percent_of_transactions = 100*(n()/nrow(Online_Retail))) %>%
  arrange(desc(percent_of_transactions))
```

```
## # A tibble: 6 x 2
##   Invoice_Day_Week percent_of_transactions
##   <chr>                              <dbl>
## 1 Thursday                            19.2
## 2 Tuesday                                 18.8
## 3 Monday                                  17.6
## 4 Wednesday                               17.5
## 5 Friday                                  15.2
## 6 Sunday                                  11.9
```

b) Show the percentage of transactions (by transaction volume) by days of the week

Grouping the data frame by the day of week, Calculating the percentage of transactions (by transaction values) by day, and returning the values in the descending order of percentages.

```
Online_Retail %>%
  group_by(Invoice_Day_Week) %>%
  summarise(percent_of_transactions_by_volume = 100*(sum(TransactionValue)/sum(Online_Retail$Transactio
  arrange(desc(percent_of_transactions_by_volume))
```

```
## # A tibble: 6 x 2
##   Invoice_Day_Week percent_of_transactions_by_volume
##   <chr>                                        <dbl>
## 1 Thursday                                     21.7
## 2 Tuesday                                      20.2
## 3 Wednesday                                    17.8
## 4 Monday                                       16.3
## 5 Friday                                       15.8
## 6 Sunday                                        8.27
```

C) Show the percentage of transactions (by transaction volume) by month of the year

Grouping the data frame by the month of year, Calculating the percentage of transactions (by transaction values) by month, and returning the values in the descending order of percentages.

```
Online_Retail %>%
  group_by(New_Invoice_Month) %>%
  summarise(percent_of_transactions_by_volume = 100*(sum(TransactionValue)/sum(Online_Retail$Transactio
  arrange(desc(percent_of_transactions_by_volume))
```

```
## # A tibble: 12 x 2
##    New_Invoice_Month percent_of_transactions_by_volume
##                <dbl>                             <dbl>
##  1                11                             15.0
##  2                12                             12.1
##  3                10                             11.0
##  4                 9                             10.5
##  5                 5                              7.42
##  6                 6                              7.09
##  7                 3                              7.01
## 8                   8                              7.00
## 9                   7                              6.99
## 10                  1                              5.74
## 11                  2                              5.11
## 12                  4                              5.06
```

d) Date with the highest number of transactions from Australia?

Creating a subset of data for Australian transactions and grouping by the date of invoice, and returning the top values for the year.

```
subset(Online_Retail, Country == "Australia") %>%
  group_by(New_Invoice_Date) %>%
  summarise(n_transactions = n()) %>%
  top_n(3)
```

```
## Selecting by n_transactions
```

```
## # A tibble: 3 x 2
##   New_Invoice_Date n_transactions
##   <date>                    <int>
## 1 2011-06-15                  139
## 2 2011-07-19                  137
## 3 2011-08-18                   97
```

e) The company needs to shut down the website for two consecutive hours for maintenance. What would be the hour of the day to start this so that the distribution is at minimum for the customers? The responsible IT team is available from 7:00 to 20:00 every day.

Grouping the data frame by hours for transactions and summarising the data to return the percent of transactions by number and then returning the values in ascending order.

```
Online_Retail %>%
  group_by(New_Invoice_Hour) %>%
  summarise(percent_of_transactions = 100*(n()/nrow(Online_Retail))) %>%
  arrange(percent_of_transactions)
```

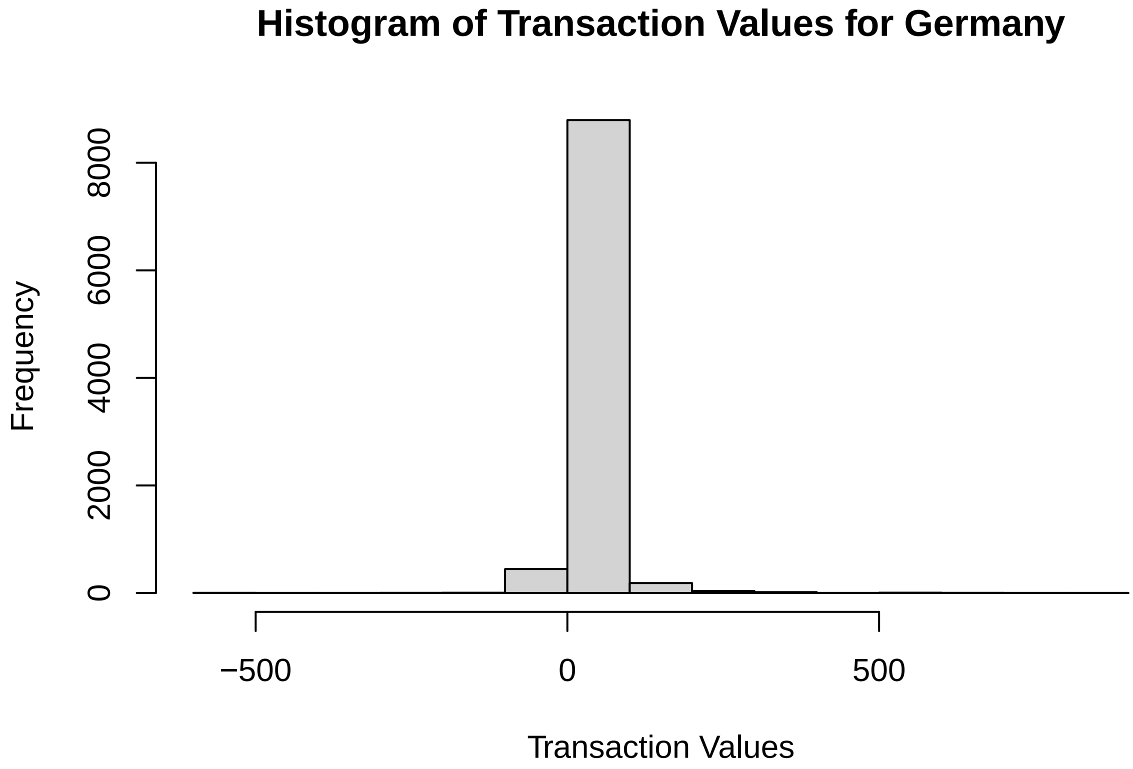
```
## # A tibble: 15 x 2
##    New_Invoice_Hour percent_of_transactions
##               <dbl>                   <dbl>
##  1                6                 0.00757
##  2                7                 0.0707
##  3               20                 0.161
##  4               19                 0.684
##  5               18                 1.47
##  6                8                 1.64
##  7               17                 5.26
##  8                9                  6.34
##  9               10                  9.05
## 10               16                 10.1
## 11               11                 10.6
## 12               14                 12.5
## 13               13                 13.3
## 14               15                 14.3
## 15               12                 14.5
```

5. Plot the histogram of transaction values from Germany. Use the hist() function to plot.

echo=TRUE

creating a new variable for Germany and I am plotting the transaction values on histogram

```
Germany_Transactions <- subset(Online_Retail, Country == "Germany")
hist(Germany_Transactions$TransactionValue, main = "Histogram of Transaction Values for Germany", xlab =
```



6. Which customer had the highest number of transactions? Which customer is most valuable (i.e. highest total sum of transactions)?

Grouping the data by customer and then Summarzing the data based on count and returning the top three values that are displayed in the decreasing value.

```
Online_Retail %>%
  group_by(CustomerID) %>%
  summarise(n_transactions = n()) %>%
  top_n(3) %>%
  arrange(desc(n_transactions))
```

```
## Selecting by n_transactions
```

```
## # A tibble: 3 x 2
##   CustomerID n_transactions
##        <int>          <int>
## 1         NA         135080
## 2      17841           7983
## 3      14911           5903
```

Grouping the data by customer and then Summarzing the data based on transaction values and returning the top three values that are displayed in the decreasing value.

```
Online_Retail %>%
  group_by(CustomerID) %>%
  summarise(transaction_sum = sum(TransactionValue)) %>%
  top_n(3) %>%
  arrange(desc(transaction_sum))
```

```
## Selecting by transaction_sum
```

```
## # A tibble: 3 x 2
##   CustomerID transaction_sum
##        <int>           <dbl>
## 1         NA        1447682.
## 2      14646         279489.
## 3      18102         256438.
```

7. Calculate the percentage of missing values for each variable in the dataset

Calculating the percentage of missing values for each variable in the data frame using ColMeans command

```
colMeans(is.na(Online_Retail))
```

```
##         InvoiceNo         StockCode       Description          Quantity 
##         0.0000000         0.0000000         0.0000000         0.0000000 
##       InvoiceDate         UnitPrice        CustomerID           Country 
##         0.0000000         0.0000000         0.2492669         0.0000000 
##  TransactionValue  New_Invoice_Date  Invoice_Day_Week  New_Invoice_Hour 
##         0.0000000         0.0000000         0.0000000         0.0000000 
## New_Invoice_Month 
##         0.0000000
```

8. Number of transactions with missing CustomerID records by countries?

Filtering out values that are not NA, group by country, and summarise by total count

```
Online_Retail %>%
  filter(is.na(Online_Retail$CustomerID)) %>%
  group_by(Country) %>%
  summarise(n_missing_ID = n()) %>%
  arrange(desc(n_missing_ID))
```

```
## # A tibble: 9 x 2
##   Country        n_missing_ID
##   <chr>                 <int>
## 1 United Kingdom       133600
## 2 EIRE                    711
## 3 Hong Kong               288
## 4 Unspecified             202
## 5 Switzerland             125
## 6 France                   66
## 7 Israel                   47
## 8 Portugal                 39
## 9 Bahrain                   2
```

9.On average, how often the costumers comeback to the website for their next shopping? (i.e. what is the average number of days between consecutive shopping) (Optional/Golden question: 18 additional marks!) Hint: 1. A close approximation is also acceptable and you may find diff() function useful.

```
## Creating a data frame by removing "NA" CustomerID's

Online_Retail_NA_Removed <- na.omit(Online_Retail)

## Creating a data frame by removing cancelled transactions

Online_Retail_NA_Neg_Removed <- subset(Online_Retail_NA_Removed, Quantity > 0)

## Creating a data frame that only have customerID and transaction date

Online_Retail_Subset <- Online_Retail_NA_Neg_Removed[,c("CustomerID","New_Invoice_Date")]

## creating a data frame that removes multiple invoices from same customer on same day
```

```
Online_Retail_Subset_Distinct <- distinct(Online_Retail_Subset)

## Grouping the data set by CustomerID and arranging them by date and finding the average time between

Online_Retail_Subset_Distinct %>%
  group_by(CustomerID) %>%
  arrange(New_Invoice_Date) %>%
  summarise(avg = mean(diff(New_Invoice_Date))) %>%
  na.omit() %>%
  summarise(avg_days_between_shopping = mean(avg))
```

```
## # A tibble: 1 x 1
##   avg_days_between_shopping
##   <drtn>
## 1 78.42025 days
```

10.In the retail sector, it is very important to understand the return rate of the goods purchased by customers. In this example, we can define this quantity, simply, as the ratio of the number of transactions cancelled (regardless of the transaction value) over the total number of transactions. With this definition, what is the return rate for the French customers? Consider the cancelled transactions as those where the 'Quantity' variable has a negative value.

Creating two new subsets that calculates the total number of returns and total number of transactions for France which are used to calulate the return rate.

```
France_Transactions_Cancelled <- subset(Online_Retail, Country == "France" & Quantity < 0)
France_Transactions <- subset(Online_Retail, Country == "France")
France_Return_Rate <- 100*(nrow(France_Transactions_Cancelled) / nrow(France_Transactions))
France_Return_Rate
```

```
## [1] 1.741264
```

11.What is the product that has generated the highest revenue for the retailer? (i.e. item with the highest total sum of 'TransactionValue')

Grouping data by StockCode, item description and then summarizing it based on transaction values and returning the values in decreasing value.

```
Online_Retail %>%
  group_by(StockCode, Description) %>%
  summarise(transaction_sum = sum(TransactionValue)) %>%
  arrange(desc(transaction_sum))
```

```
## `summarise()` has grouped output by 'StockCode'. You can override using the
## `.groups` argument.
## # A tibble: 5,752 x 3
## # Groups:   StockCode [4,070]
##    StockCode Description                          transaction_sum
##    <chr>     <chr>                                          <dbl>
##  1 DOT       "DOTCOM POSTAGE"                             206245.
##  2 22423     "REGENCY CAKESTAND 3 TIER"                   164762.
##  3 47566     "PARTY BUNTING"                               98303.
##  4 85123A    "WHITE HANGING HEART T-LIGHT HOLDER"          97716.
##  5 85099B    "JUMBO BAG RED RETROSPOT"                     92356.
##  6 23084     "RABBIT NIGHT LIGHT"                          66757.
##  7 POST      "POSTAGE"                                     66231.
##  8 22086     "PAPER CHAIN KIT 50'S CHRISTMAS "             63792.
##  9 84879     "ASSORTED COLOUR BIRD ORNAMENT"               58960.
## 10 79321     "CHILLI LIGHTS"                               53768.
## # ... with 5,742 more rows
```

12.How many unique customers are represented in the dataset? You can use unique() and length() functions

Returning the length of CustomerID vecto by removing the duplicate entries.

```
length(unique(Online_Retail$CustomerID))
```

```
## [1] 4373
```