Assignment 2

```
Online_Retail <- read.csv("C:/Users/abinaya/Downloads/Online_Retail.csv")
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
```

```
library(zoo)
```

```
##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
library(readxl)
```

1)Show the breakdown of the number of transactions by countries i.e., how many transactions are in the dataset for each country.Show this in total number and also in percentage. Show only countries accounting for more than 1% of the total transactions.

```
set.seed(123)
Online_Retail %>% group_by(Country)%>% summarise(transactions = n())%>% mutate(percentage= (transactions
```

```
## # A tibble: 4 x 3
##   Country        transactions percentage
##   <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)Create a new variable 'TransactionValue' that is the product of the exising 'Quantity' and 'UnitPrice' variables.Add this variable to the dataframe

```
Online_Retail<- mutate(Online_Retail, "TransactionValue"=TransactionValue<- Online_Retail$Quantity * Onl
colnames(Online_Retail)
```

```
## [1] "InvoiceNo"        "StockCode"        "Description"      "Quantity"
## [5] "InvoiceDate"      "UnitPrice"        "CustomerID"       "Country"
## [9] "TransactionValue"
```

3)Using the newly created variable, TransactionValue,show the breakdown of transaction valuesby countries. Show this in total sum of transaction values. Show only countries with total transaction exceeding 130,000 British Pound.

```
Online_Retail%>% group_by(Country)%>% summarise(total.sum.of.transaction.values = sum(TransactionValue)
```

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

This is an optional question which carries additional marks (golden questions). In this question, we are dealing with the InvoiceDate variable. The variable is read as a categorical when you read data from the file. Now we need to explicitly instruct R to interpret this as a Date variable.

“POSIXlt” and “POSIXct” are two powerful object classes in R to deal with date and time. Click here for more information. First let’s convert ‘InvoiceDate’ into a POSIXlt object:

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

Check the variable using, head(Temp). Now, let’s separate date, day of the week and hour components dataframe with names as New_Invoice_Date, Invoice_Day_Week and New_Invoice_Hour:

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:

Online_Retail$New_{I}nvoice_{D}ate[20000] - Online_{R}etail$New_Invoice_Date[10]

Also we can convert dates to days of the week. Let’s define a new variable for that

Online_Retail$Invoice_{D}ay_{W}eek = weekdays(Online_{R}etail$New_Invoice_Date)

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

Online_Retail$New_Invoice_Hour = as.numeric(format(Temp, “%H”))

Finally, lets define the month as a separate numeric variable too:

Online_Retail$New_Invoice_Month = as.numeric(format(Temp, “%m”))

```
#let’s convert ‘InvoiceDate’ into a POSIXltobject:
Temp=strptime(Online_Retail$InvoiceDate,format='%m/%d/%Y %H:%M',tz='GMT')
#Now, let’s separate date,  day  of  the  week  and  hour components dataframe with names as
#New_Invoice_Date,Invoice_Day_Weekand New_Invoice_Hour:
```

```
Online_Retail$New_Invoice_Date<-as.Date(Temp)
#knowing two date values,the object allows you to know the difference between the two dates in terms of
Online_Retail$New_Invoice_Date[20000]-Online_Retail$New_Invoice_Date[10]
```

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

```
#Also we can convert dates to days of the week. Let's define a new variable for that
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 v
Online_Retail$New_Invoice_Hour =as.numeric(format(Temp,"%H"))
#Finally, lets define the month as a separate numeric variable too:
Online_Retail$New_Invoice_Month = as.numeric(format(Temp, "%m"))
```

Now answer the flowing questions.

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

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

4.c)Show the percentage of transactions (by transaction volume) by month of the year

4.d)What was the date with the highest number of transactions from Australia

4.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.

```
# 4.a)
Online_Retail%>% group_by(Invoice_Day_Week)%>% summarise(Number.of.transaction=(n()))%>% mutate(Number.o
```

```
## # A tibble: 6 x 3
##   Invoice_Day_Week Number.of.transaction percent
##   <chr>                            <int>   <dbl>
## 1 Friday                           82193    15.2
## 2 Monday                           95111    17.6
## 3 Sunday                           64375    11.9
## 4 Thursday                        103857    19.2
## 5 Tuesday                         101808    18.8
## 6 Wednesday                        94565    17.5
```

```
# 4.b)
Online_Retail%>% group_by(Invoice_Day_Week)%>% summarise(Volume.of.transaction=(sum(TransactionValue)))%
```

```
## # A tibble: 6 x 3
##   Invoice_Day_Week Volume.of.transaction percent
##   <chr>                            <dbl>   <dbl>
## 1 Friday                        1540611.   15.8
## 2 Monday                        1588609.   16.3
## 3 Sunday                         805679.    8.27
## 4 Thursday                      2112519    21.7
## 5 Tuesday                       1966183.   20.2
## 6 Wednesday                     1734147.   17.8
```

```
# 4.c)
Online_Retail%>% group_by(New_Invoice_Month)%>%
summarise(Volume.By.Month=sum(TransactionValue))%>% mutate(Volume.By.Month,'Percent'=(Volume.By.Month*1
```

```
## # A tibble: 12 x 3
##    New_Invoice_Month Volume.By.Month Percent
##                <dbl>           <dbl>   <dbl>
##  1                 1         560000.    5.74
##  2                 2         498063.    5.11
##  3                 3         683267.    7.01
##  4                 4         493207.    5.06
##  5                 5         723334.    7.42
##  6                 6         691123.    7.09
##  7                 7         681300.    6.99
##  8                 8         682681.    7.00
##  9                 9        1019688.   10.5
## 10                10        1070705.   11.0
## 11                11        1461756.   15.0
## 12                12        1182625.   12.1
```

```
# 4.d
b<-Online_Retail%>% group_by(New_Invoice_Date,Country)%>%
filter(Country=='Australia')%>% summarise(Number=sum(Quantity),amount=sum(TransactionValue))%>% arrange
```

```
## `summarise()` has grouped output by 'New_Invoice_Date'. You can override using
## the `.groups` argument.
```

```
b<-b[b['Number']==max(b['Number']),]
print(paste('The Date with the highest number of transactions from Australia is', b['New_Invoice_Date']
```

```
## [1] "The Date with the highest number of transactions from Australia is 15140 which is $ 23426.81"
```

```
# 4.e)
f=Online_Retail%>% group_by(New_Invoice_Hour)%>% summarise(Total.transaction= n())
n<-rollapply(f['Total.transaction'],2,sum)
index(min(n))
```

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

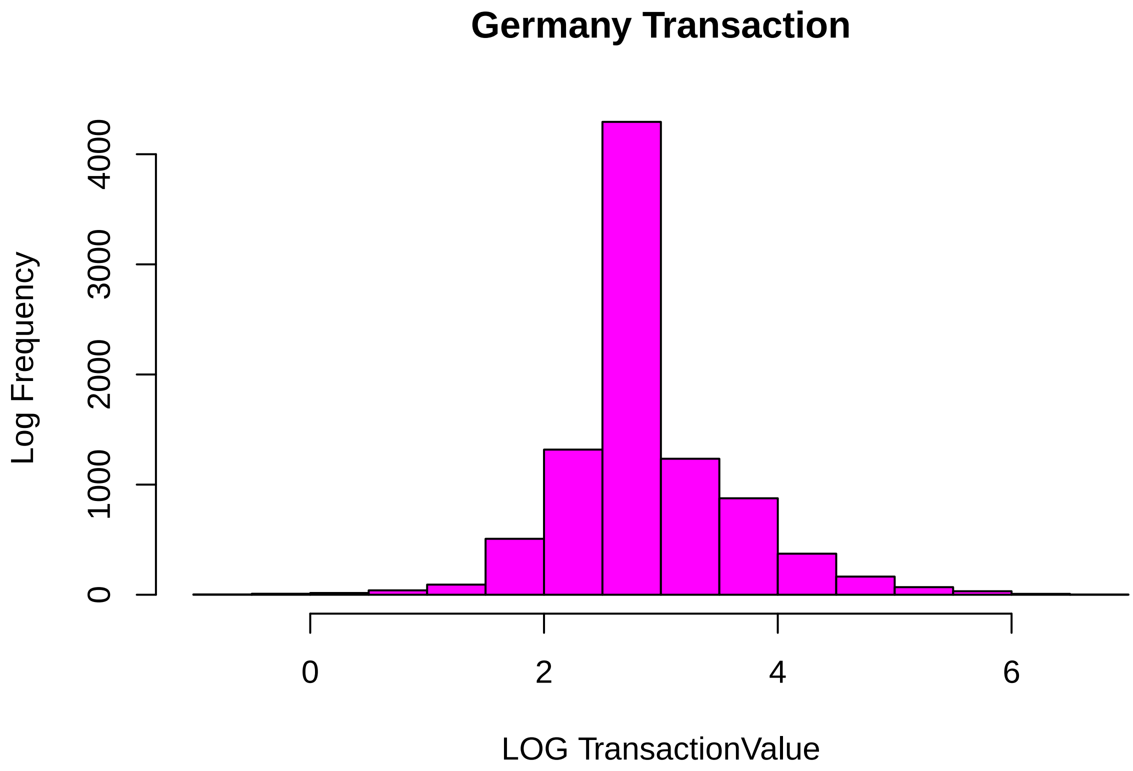
```
print('According to the data, the ideal time to shut down a website for two hours straight for maintenan
```

```
## [1] "According to the data, the ideal time to shut down a website for two hours straight for maintena
```

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

```
hist(x=log(Online_Retail$TransactionValue[Online_Retail$Country=="Germany"]),xlab = "LOG TransactionValu
```

```
## Warning in log(Online_Retail$TransactionValue[Online_Retail$Country ==
## "Germany"]): NaNs produced
```



6)Which customer had the highest number of transactions? Which customer is most valuable

```
data_1<- Online_Retail %>% group_by(CustomerID)%>%
summarise(CustomerTransaction = n())%>% filter(CustomerID != "NA")%>% filter(CustomerTransaction ==max(C
print(paste('The customerID had the highest number of transactions is',data_1$CustomerID,'with max trans
```

```
## [1] "The customerID had the highest number of transactions is 17841 with max transaction of  7983"
```

```
data_2<- Online_Retail%>% group_by(CustomerID)%>%
summarise(total.transaction.by.each.customer = sum(TransactionValue))%>% arrange(desc(total.transaction
filter(CustomerID != "NA")%>% filter(total.transaction.by.each.customer ==max(total.transaction.by.each
print(paste('Most valuable customerID is',data_2$CustomerID,'with total transaction Amount $',data_2$tot
```

```
## [1] "Most valuable customerID is 14646 with total transaction Amount $ 279489.02"
```

7)Calculate the percentage of missing values for each variable in the dataset. Hint colMeans():

```
Null_Value<-colMeans(is.na(Online_Retail))
print(paste('Online customerID column has missing values in dataset and  i.e.',Null_Value['CustomerID']
```

```
## [1] "Online customerID column has missing values in dataset and  i.e. 24.9266943342886 % of whole da
```

8)What are the number of transactions with missing CustomerID records by countries

```
Online_Retail%>% group_by(Country)%>% filter(is.na(CustomerID))%>% summarise(No.of.missing.CustomerID=n
```

```
## # A tibble: 9 x 2
##   Country        No.of.missing.CustomerID
##   <chr>                             <int>
## 1 Bahrain                               2
## 2 EIRE                                711
## 3 France                               66
## 4 Hong Kong                           288
## 5 Israel                               47
## 6 Portugal                             39
## 7 Switzerland                         125
## 8 United Kingdom                   133600
## 9 Unspecified                         202
```

9)On average, how often the costumers comeback to the website for their next shopping Hint: 1. A close approximation is also acceptable and you may find diff() function useful.

```
Averg<-Online_Retail%>% group_by(CustomerID)%>%
summarise(difference.in.consecutivedays= diff(New_Invoice_Date))%>%
filter(difference.in.consecutivedays>0)
```

```
## ‘summarise()‘ has grouped output by ’CustomerID’. You can override using the
## ‘.groups‘ argument.
```

```
print(paste('The average  number  of  days  between  consecutive  shopping is',mean(Averg$difference.in
```

```
## [1] "The average  number  of  days  between  consecutive  shopping is 38.4875"
```

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 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.

```
Return_value<-nrow(Online_Retail%>% group_by(CustomerID)%>% filter((Country=='France')&(TransactionValu
total_french_customer<-nrow(Online_Retail%>%
group_by(CustomerID)%>% filter((Country=='France')&(CustomerID != 'Na')))

print(paste('Return rate for french customer is given as',((Return_value)/(total_french_customer))*100,
```

```
## [1] "Return rate for french customer is given as 1.75479919915204 percent"
```

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

```
Total_customer1<-Online_Retail%>%
group_by(Description,StockCode)%>%
summarise(n=sum(TransactionValue))%>%
arrange(desc(n))
```

```
## ‘summarise()‘ has grouped output by ’Description’. You can override using the
## ‘.groups‘ argument.
```

```
x<- Total_customer1[Total_customer1['n']==max(Total_customer1['n']),]
print(paste('The highest revenue generated product is', x$Description,'with stock code',x$StockCode))
```

```
## [1] "The highest revenue generated product is DOTCOM POSTAGE with stock code DOT"
```

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

```
print(paste('Total no. of customers with valid customer id are ',length(unique(Online_Retail$CustomerID
```

```
## [1] "Total no. of customers with valid customer id are  4372 . This does not include null CustomerID
```