#1. Defining the question

1.1 Specifying the data analytic objective

Predict which individuals are most likely to click on ads from a cryptography course website

1.2 Defining the metric of success

For this study, we will perform conclusive Exploratory Data Analysis to enable us identify individuals who are most likely to click on ads

1.3 Understanding the context

A Kenyan entrepreneur has created an online cryptography course and would want to advertise it on her blog. She currently targets audiences originating from various countries. In the past, she ran ads to advertise a related course on the same blog and collected data in the process. Using the data previously collected, she is looking to do a study to identify which individuals are most likely to click on her ads.

1.4 Recording the Experimental Design

1. Loading the data
2. Checking the data
3. Tidying the data
4. Univariate Analysis
5. Bivariate Analysis
6. Challenging the solution
7. Recommendations
8. Follow up questions

2. Loading the data set

```
library(data.table)
advert <- fread('http://bit.ly/IPAdvertisingData')
advert
```

```
##       Daily Time Spent on Site Age Area Income Daily Internet Usage
##    1:                    68.95  35    61833.90                256.09
##    2:                    80.23  31    68441.85                193.77
##    3:                    69.47  26    59785.94                236.50
##    4:                    74.15  29    54806.18                245.89
##    5:                    68.37  35    73889.99                225.58
##   ---
##  996:                    72.97  30    71384.57                208.58
##  997:                    51.30  45    67782.17                134.42
##  998:                    51.63  51    42415.72                120.37
##  999:                    55.55  19    41920.79                187.95
```

```
## 1000:                    45.01  26    29875.80               178.35
##                              Ad Topic Line           City Male
##    1:    Cloned 5thgeneration orchestration    Wrightburgh    0
##    2:    Monitored national standardization      West Jodi    1
##    3:      Organic bottom-line service-desk       Davidton    0
##    4: Triple-buffered reciprocal time-frame West Terrifurt    1
##    5:         Robust logistical utilization   South Manuel    0
##   ---
##  996:         Fundamental modular algorithm      Duffystad    1
##  997:       Grass-roots cohesive monitoring    New Darlene    1
##  998:          Expanded intangible solution  South Jessica    1
##  999:  Proactive bandwidth-monitored policy    West Steven    0
## 1000:       Virtual 5thgeneration emulation    Ronniemouth    0
##                       Country           Timestamp Clicked on Ad
##    1:                Tunisia 2016-03-27 00:53:11             0
##    2:                  Nauru 2016-04-04 01:39:02             0
##    3:            San Marino 2016-03-13 20:35:42             0
##    4:                  Italy 2016-01-10 02:31:19             0
##    5:                Iceland 2016-06-03 03:36:18             0
##   ---
##  996:                Lebanon 2016-02-11 21:49:00             1
##  997: Bosnia and Herzegovina 2016-04-22 02:07:01             1
##  998:               Mongolia 2016-02-01 17:24:57             1
##  999:              Guatemala 2016-03-24 02:35:54             0
## 1000:                 Brazil 2016-06-03 21:43:21             1
```

Checking the data summary

```
summary(advert)
```

```
##  Daily Time Spent on Site      Age         Area Income    Daily Internet
Usage
##  Min.   :32.60           Min.   :19.00   Min.   :13996   Min.   :104.8
##  1st Qu.:51.36           1st Qu.:29.00   1st Qu.:47032   1st Qu.:138.8
##  Median :68.22           Median :35.00   Median :57012   Median :183.1
##  Mean   :65.00           Mean   :36.01   Mean   :55000   Mean   :180.0
##  3rd Qu.:78.55           3rd Qu.:42.00   3rd Qu.:65471   3rd Qu.:218.8
##  Max.   :91.43           Max.   :61.00   Max.   :79485   Max.   :270.0
##  Ad Topic Line          City                Male         Country
##  Length:1000        Length:1000        Min.   :0.000   Length:1000
##  Class :character   Class :character   1st Qu.:0.000   Class :character
##  Mode  :character   Mode  :character   Median :0.000   Mode  :character
##                                        Mean   :0.481
##                                        3rd Qu.:1.000
##                                        Max.   :1.000
##    Timestamp                     Clicked on Ad
##  Min.   :2016-01-01 02:52:10   Min.   :0.0
##  1st Qu.:2016-02-18 02:55:42   1st Qu.:0.0
##  Median :2016-04-07 17:27:29   Median :0.5
##  Mean   :2016-04-10 10:34:06   Mean   :0.5
```

```
##  3rd Qu.:2016-05-31 03:18:14   3rd Qu.:1.0
##  Max.   :2016-07-24 00:22:16   Max.   :1.0
```

From the data summary we get the measures of central tendency (median, mean, mode and quantile)

Checking the top and bottom columns

```
tail(advert)
```

```
##    Daily Time Spent on Site Age Area Income Daily Internet Usage
## 1:                    43.70  28    63126.96                173.01
## 2:                    72.97  30    71384.57                208.58
## 3:                    51.30  45    67782.17                134.42
## 4:                    51.63  51    42415.72                120.37
## 5:                    55.55  19    41920.79                187.95
## 6:                    45.01  26    29875.80                178.35
##                          Ad Topic Line          City Male
## 1:        Front-line bifurcated ability  Nicholasland    0
## 2:        Fundamental modular algorithm     Duffystad    1
## 3:      Grass-roots cohesive monitoring   New Darlene    1
## 4:         Expanded intangible solution South Jessica    1
## 5: Proactive bandwidth-monitored policy   West Steven    0
## 6:      Virtual 5thgeneration emulation   Ronniemouth    0
##                   Country           Timestamp Clicked on Ad
## 1:                Mayotte 2016-04-04 03:57:48             1
## 2:                Lebanon 2016-02-11 21:49:00             1
## 3: Bosnia and Herzegovina 2016-04-22 02:07:01             1
## 4:               Mongolia 2016-02-01 17:24:57             1
## 5:              Guatemala 2016-03-24 02:35:54             0
## 6:                 Brazil 2016-06-03 21:43:21             1
```

```
head(advert)
```

```
##    Daily Time Spent on Site Age Area Income Daily Internet Usage
## 1:                    68.95  35    61833.90                256.09
## 2:                    80.23  31    68441.85                193.77
## 3:                    69.47  26    59785.94                236.50
## 4:                    74.15  29    54806.18                245.89
## 5:                    68.37  35    73889.99                225.58
## 6:                    59.99  23    59761.56                226.74
##                           Ad Topic Line           City Male    Country
## 1:    Cloned 5thgeneration orchestration    Wrightburgh    0    Tunisia
## 2:    Monitored national standardization      West Jodi    1      Nauru
## 3:      Organic bottom-line service-desk       Davidton    0 San Marino
## 4: Triple-buffered reciprocal time-frame West Terrifurt    1      Italy
## 5:         Robust logistical utilization   South Manuel    0    Iceland
## 6:       Sharable client-driven software      Jamieberg    1     Norway
##              Timestamp Clicked on Ad
## 1: 2016-03-27 00:53:11             0
## 2: 2016-04-04 01:39:02             0
## 3: 2016-03-13 20:35:42             0
```

```
## 4: 2016-01-10 02:31:19             0
## 5: 2016-06-03 03:36:18             0
## 6: 2016-05-19 14:30:17             0
```

Checking the class

```
class(advert)
```

```
## [1] "data.table" "data.frame"
```

Structure of the dataset

```
str(advert)
```

```
## Classes 'data.table' and 'data.frame':   1000 obs. of  10 variables:
##  $ Daily Time Spent on Site: num  69 80.2 69.5 74.2 68.4 ...
##  $ Age                     : int  35 31 26 29 35 23 33 48 30 20 ...
##  $ Area Income             : num  61834 68442 59786 54806 73890 ...
##  $ Daily Internet Usage    : num  256 194 236 246 226 ...
##  $ Ad Topic Line           : chr  "Cloned 5thgeneration orchestration"
"Monitored national standardization" "Organic bottom-line service-desk"
"Triple-buffered reciprocal time-frame" ...
##  $ City                    : chr  "Wrightburgh" "West Jodi" "Davidton"
"West Terrifurt" ...
##  $ Male                    : int  0 1 0 1 0 1 0 1 1 1 ...
##  $ Country                 : chr  "Tunisia" "Nauru" "San Marino" "Italy"
...
##  $ Timestamp               : POSIXct, format: "2016-03-27 00:53:11" "2016-
04-04 01:39:02" ...
##  $ Clicked on Ad           : int  0 0 0 0 0 0 0 1 0 0 ...
##  - attr(*, ".internal.selfref")=<externalptr>
```

#3. Cleaning the dataset

##3.1 Finding missing values

```
colSums(is.na(advert))
```

```
## Daily Time Spent on Site                      Age              Area Income
##                        0                        0                        0
##     Daily Internet Usage            Ad Topic Line                     City
##                        0                        0                        0
##                     Male                  Country                Timestamp
##                        0                        0                        0
##            Clicked on Ad
##                        0
```

No missing data was found

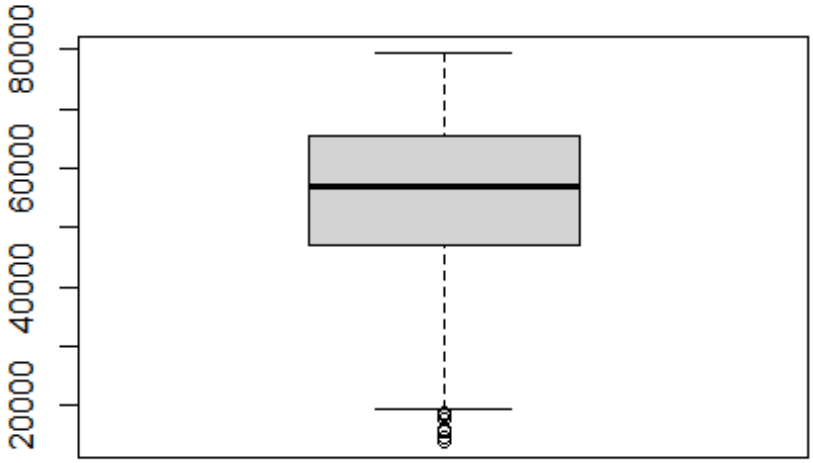
3.2 Checking for duplicates

```
sum(duplicated(advert))
```

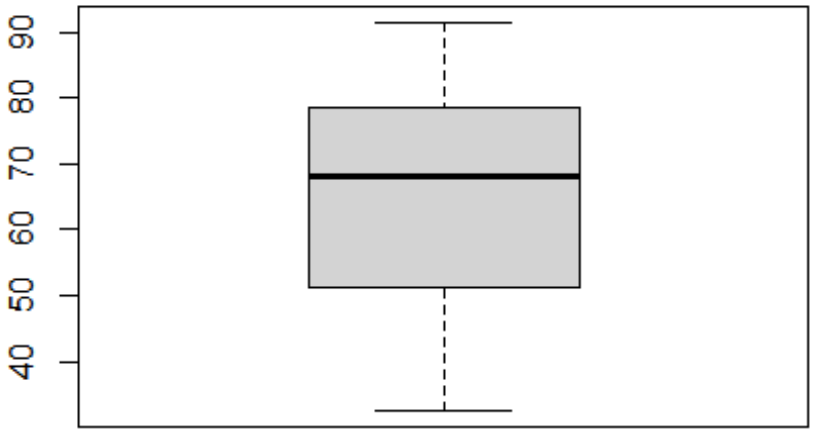
```
## [1] 0
```

3.3 Checking for outliers

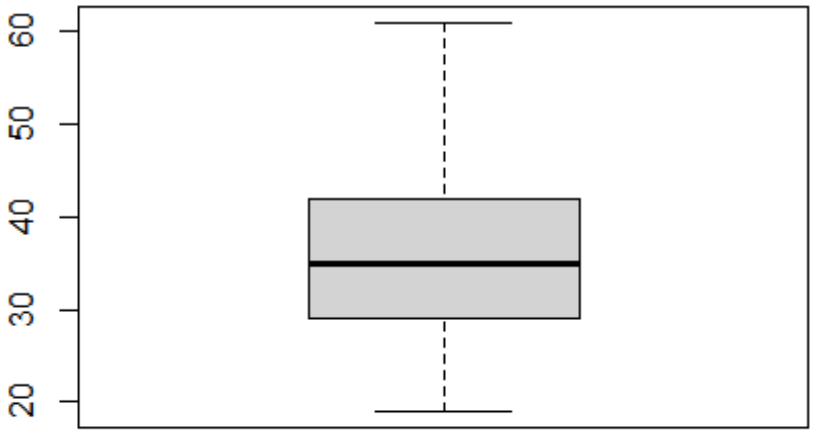
```
# Area Income
boxplot(advert$`Area Income`)
```



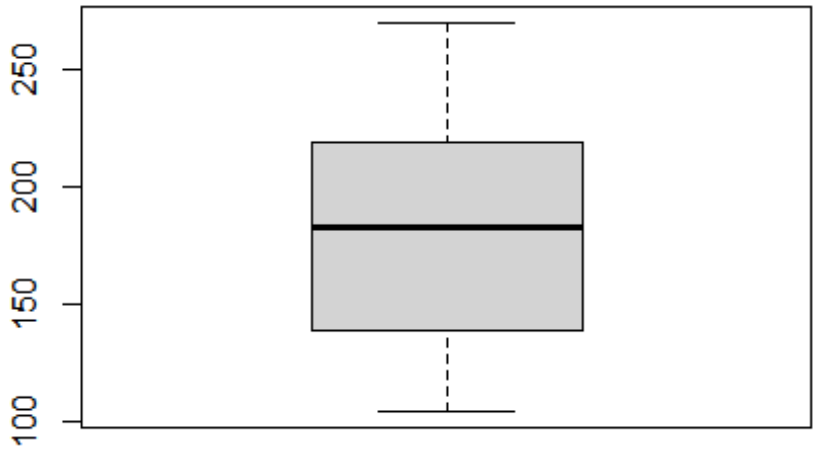

```
# Time spent on site
boxplot(advert$`Daily Time Spent on Site`)
```




```
# Age
boxplot(advert$Age)
```

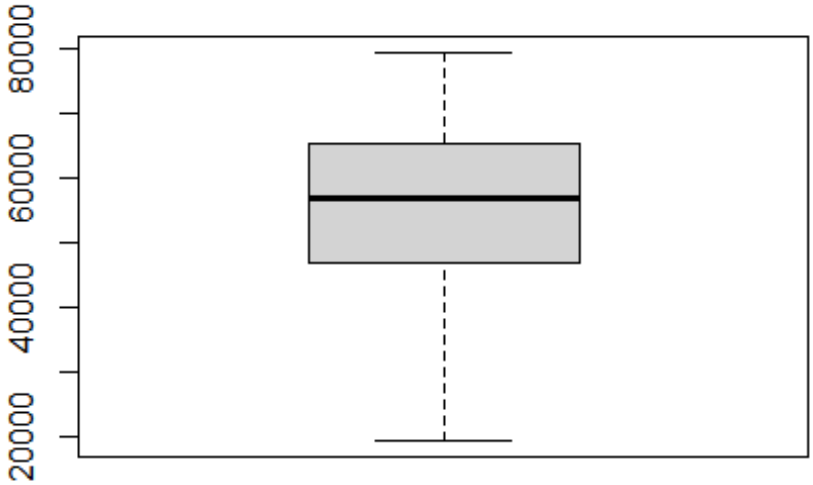


```
# Daily internet usage
boxplot(advert$`Daily Internet Usage`)
```



##3.4 Removing outliers

```
outlier <- 47032 - 1.5 * IQR(advert$`Area Income`)
advert$`Area Income`[advert$`Area Income` < outlier]<- outlier

boxplot(advert$`Area Income`)
```



We remove outliers by limiting extreme values in the statistical data to reduce the effect of possibly spurious outliers

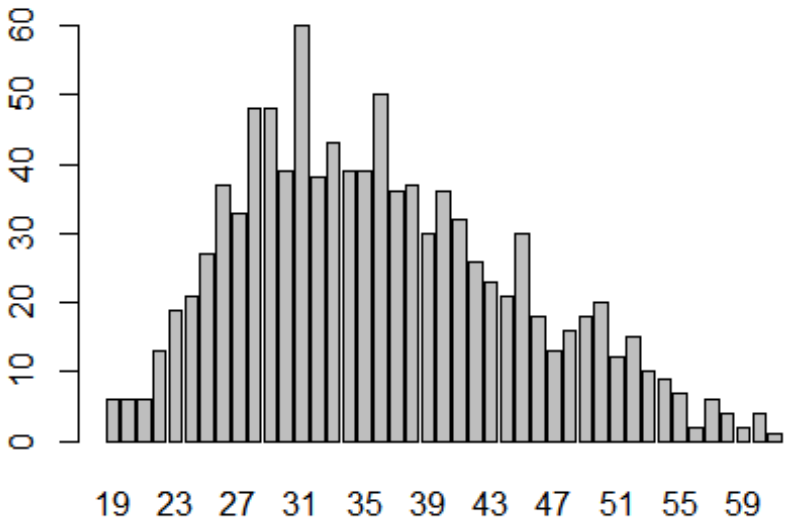
4. Exploratory Data Analysis

4.1 Univariate Analysis

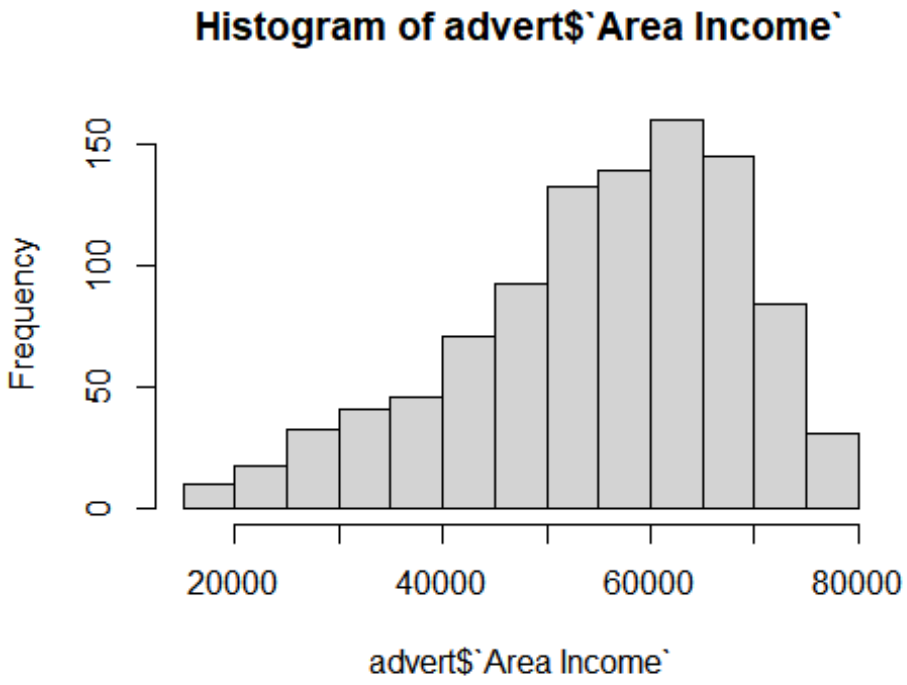
```
# Age Frequency
# fetching the age
age <- advert$Age
age_freq <- table(age)
age_freq
```

```
## age
## 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
44
##  6  6  6 13 19 21 27 37 33 48 48 39 60 38 43 39 39 50 36 37 30 36 32 26 23
21
## 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61
## 30 18 13 16 18 20 12 15 10  9  7  2  6  4  2  4  1
```

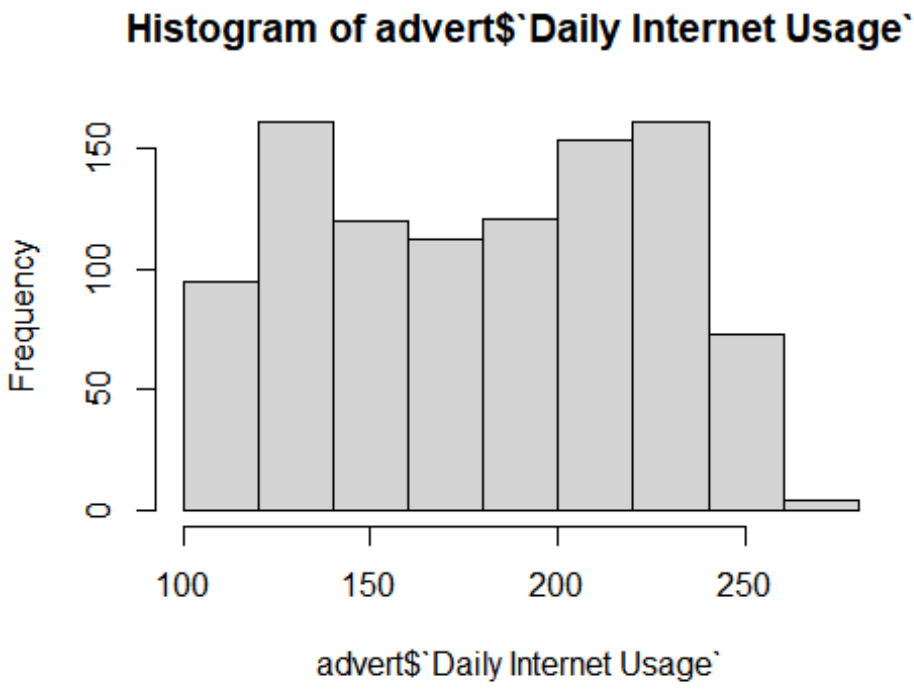
```
# Creating a bar graph of age
barplot(age_freq)
```



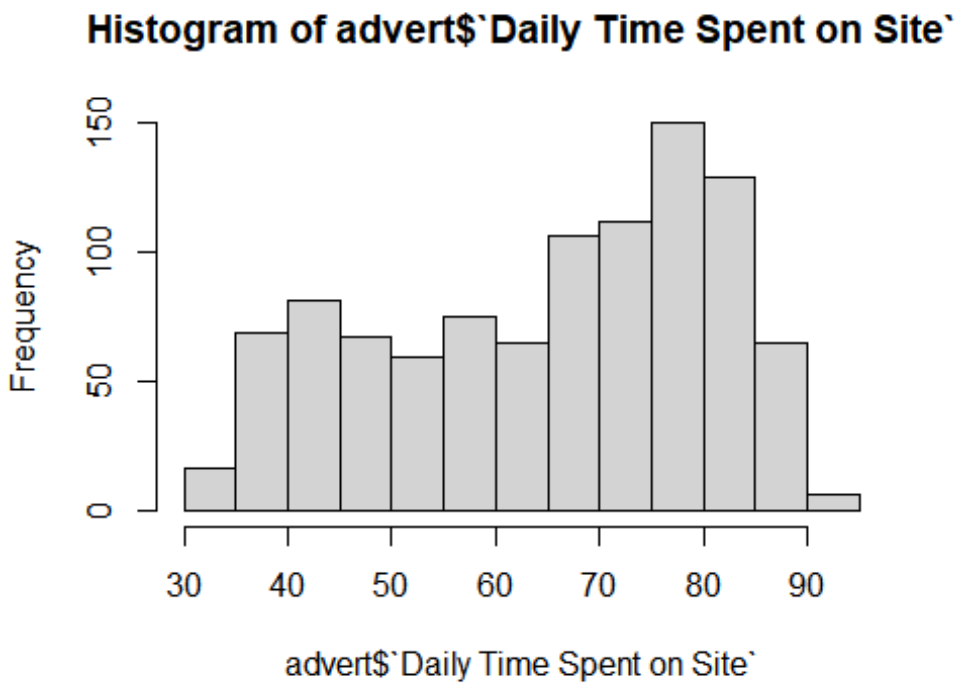

```r
# Histogram for area income
hist(advert$`Area Income`)
```



```r
# Histogram for area income
hist(advert$`Daily Internet Usage`)
```



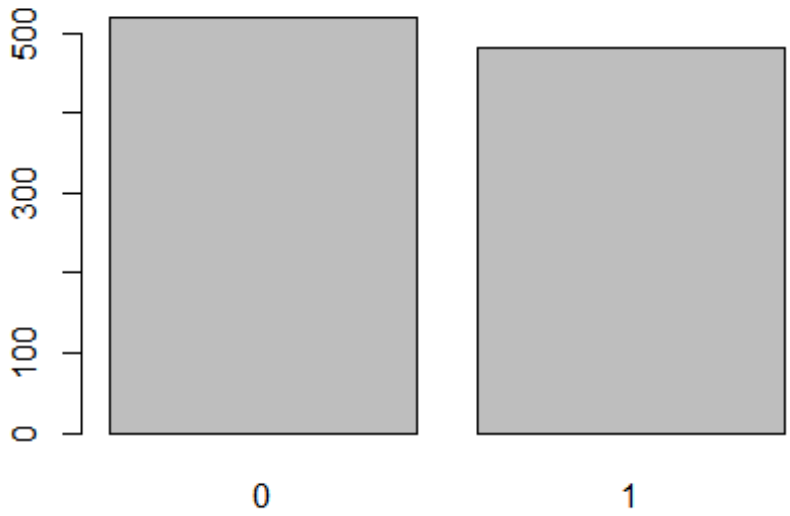

```r
# Histogram for Daily Time
hist(advert$`Daily Time Spent on Site`)
```




```
# Gender Frequency
# fetching the male column
male_female <- advert$Male
gender_freq <- table(male_female)
gender_freq
```

```
## male_female
##   0   1
## 519 481
```

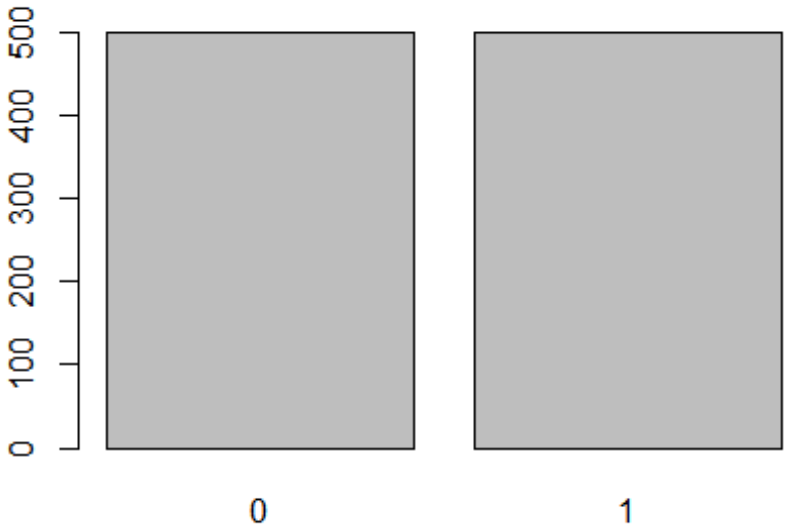
```
# Creating a bar graph of age
barplot(gender_freq)
```




```
# Clicked on Ad Frequency
# fetching the Clicked on Ad
Clicked.on.Ad <- advert$`Clicked on Ad`
clicked_freq <- table(Clicked.on.Ad)
clicked_freq
```

```
## Clicked.on.Ad
##   0   1
## 500 500
```

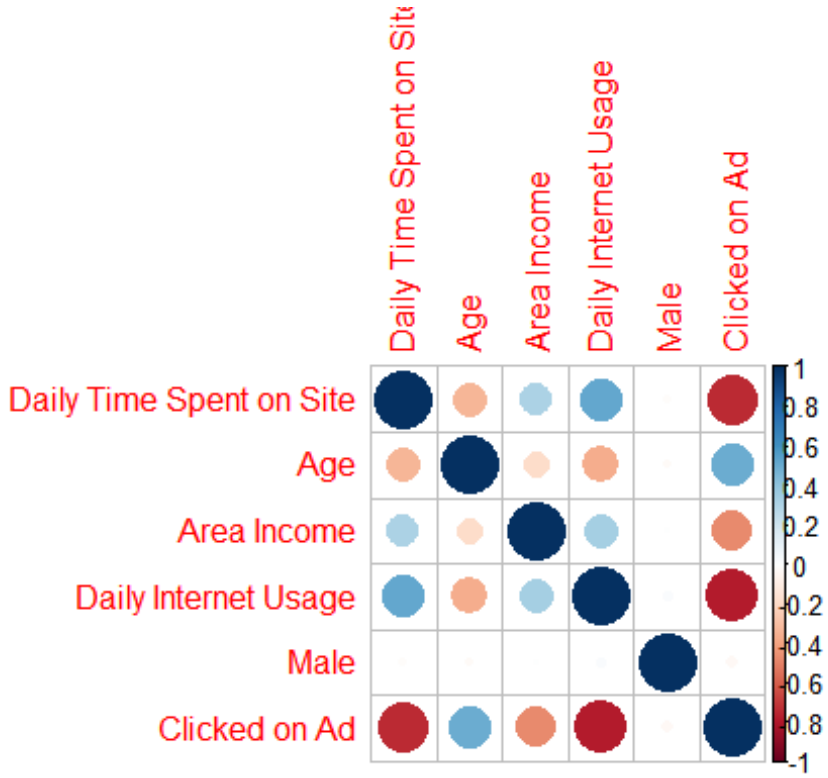
```
# Creating a bar graph of clicked on age
barplot(clicked_freq)
```



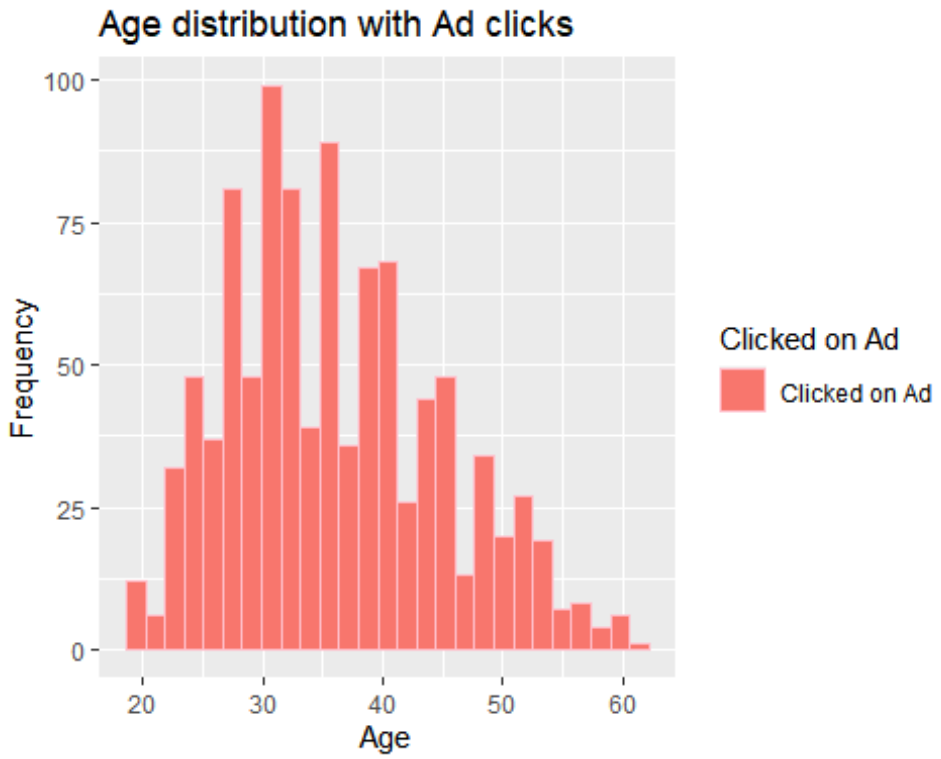
4.2 Bivariate analysis

Here we check for correlation between the different columns and the target variable Clicked on ad

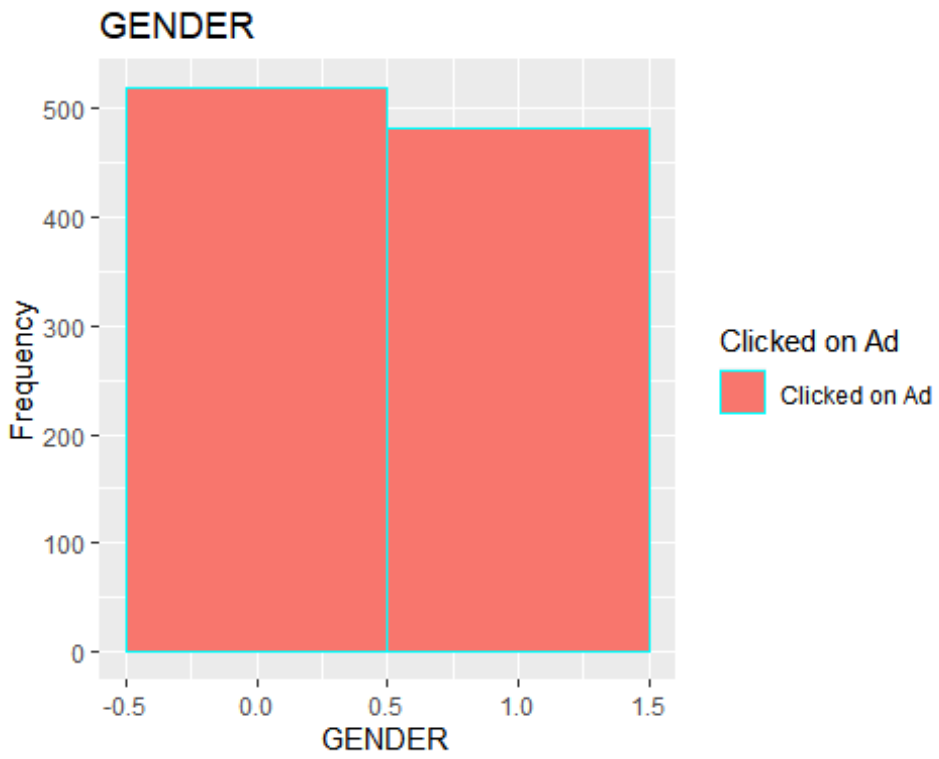
```
library(corrplot)

## corrplot 0.84 loaded

advert_num <- Filter(is.numeric, advert)
corrplot(cor(advert_num))
```




```
library(ggplot2)

ggplot(data = advert, aes(x = Age, fill = 'Clicked on Ad' ))+
    geom_histogram(bins = 27, color = 'pink') +
    labs(title = 'Age distribution with Ad clicks', x = 'Age', y =
'Frequency', fill = 'Clicked on Ad')
```




```
ggplot(data = advert, aes(x = Male, fill = 'Clicked on Ad'))+
    geom_histogram(bins = 2, color = 'cyan') +
    labs(title = 'GENDER', x = 'GENDER', y = 'Frequency', fill = 'Clicked on
Ad') +
        scale_color_brewer(palette = 'Set1')
```



Conclusion

The ages between 26 and 42 record the highest frequency of ad clicks. The female gender had the highest number of clicks.