Call Center Optimization

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Problem Statment

Assume, you are setting up a call center for a mid-sized E-Commerce firm. You have been asked to find the total strength of callers required for this requirement. This requirement will be outsourced to a call center which guarantees availability of caller for 24 hours with the exact same efficiency.

Using this efficiency, you have also estimated the time of each call from the customer and the duration of these calls. This estimation is based on your market research and prediction through customer behavior in past. You can assume that this prediction is accurate. Now, you need to estimate the following:

1. What is the minimum number of callers required if you need to ensure that no customer waits to reach out to the representative (Zero waiting time)?
2. What is the minimum number of callers required if you need to ensure that no customer waits for more than 30 minutes (Max. 30 minutes waiting time)?

Data

The data provided consists of 10,000 calls which are made in a day and looks like this

```
#Read data
setwd('C:/Users/gaura/Documents/Projects/R/Call Centre Optimization problem')
data <- read.csv("Case_Level2.csv")
head(data,10)
```

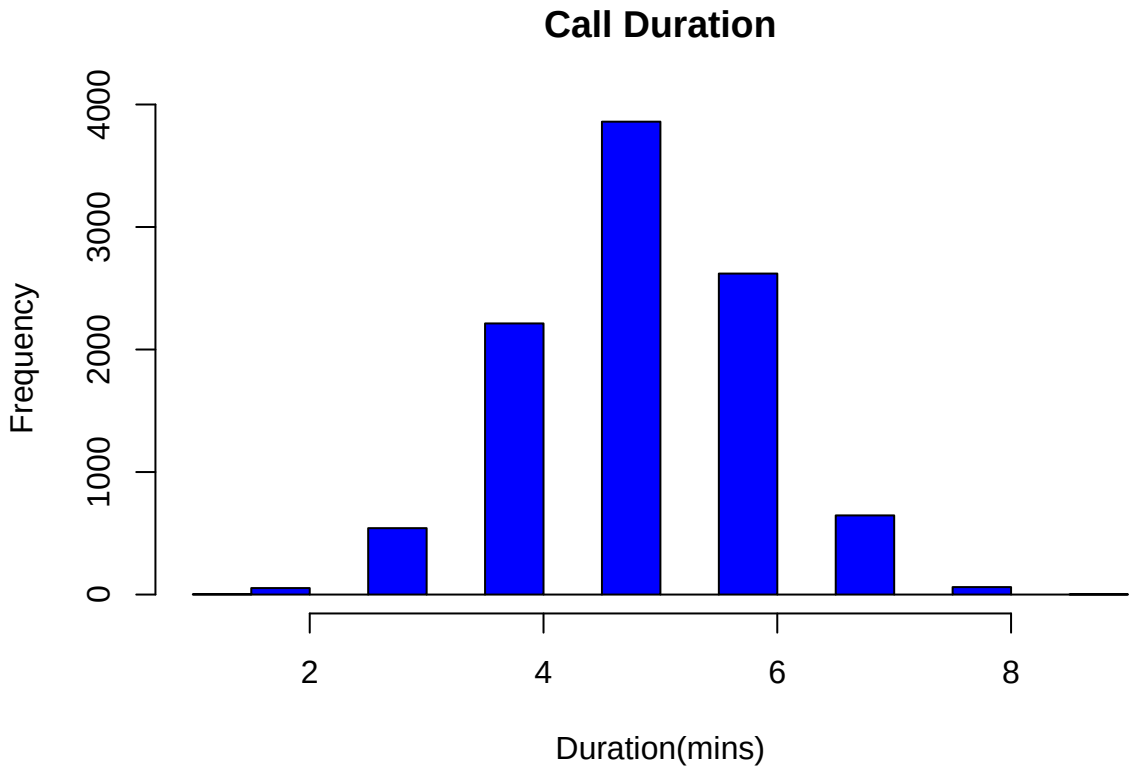
```
##    Call Time Duration.of.calls
## 1  2737   28                 6
## 2  6710   42                 6
## 3  9332   85                 4
## 4  6183  121                 6
## 5  8297  157                 4
## 6  6877  165                 5
## 7  3517  166                 5
## 8  3131  169                 8
## 9  9688  170                 6
## 10 9344  177                 5
```

1. The duration of calls is in "Minutes".
2. Time is the time (in minutes) from 00:00 midnight.
3. Call represents the ID of the customer.
4. Assume that every caller has same efficiency and takes equal duration of calls as given in data.

Data Exploration

Lets us check the distribution of call duration

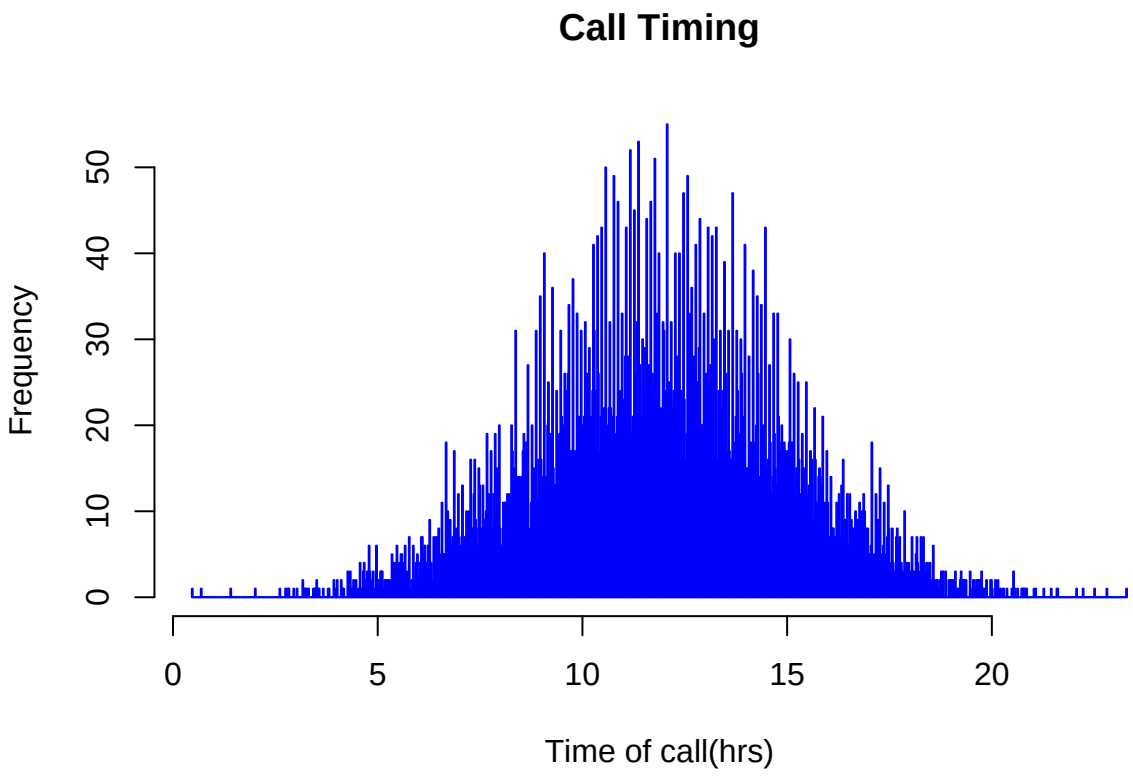
```
hist(data$Duration.of.calls,col='blue', main = "Call Duration", xlab = "Duration(mins)")
```



We see that most of the calls end up between 3-7 minutes with a peak of 5 mins.

Let's Check the Time of Call Variable.

```
data['Time of call(hrs)'] = round((data$Time/60),2)
hist(data$`Time of call(hrs)`, main = "Call Timing", col = 'blue',breaks = 1000,border = "blue", xlab =
```



This looks like a normally distributed pattern. We see that maximum calls are between 5 am to 9 pm with a peak at 12 noon.

Solution

```
#Create a matrix where we will store the maximum waiting time for each value of the number of callers
caller_opt =data.frame( Number_of_callers= integer(), Wait_Time = integer())


#Run loop for every number of callers possible. Here we have taken the range from 1 to 100
 for (number_of_callers in (1:50)){
  #Initialize the available time for each caller
  caller <- rep(0,number_of_callers)

  #Index will be used to refer a caller
  index <- 1:number_of_callers

  #Here we store the difference of each callers availability from the time when the call was made
  caller_diff <- rep(0,number_of_callers)


  #We add two columns to the table : Caller assigned to the customer & Wait time for the customer
  data$assigned <- 1
  data$waittime <- 0
```

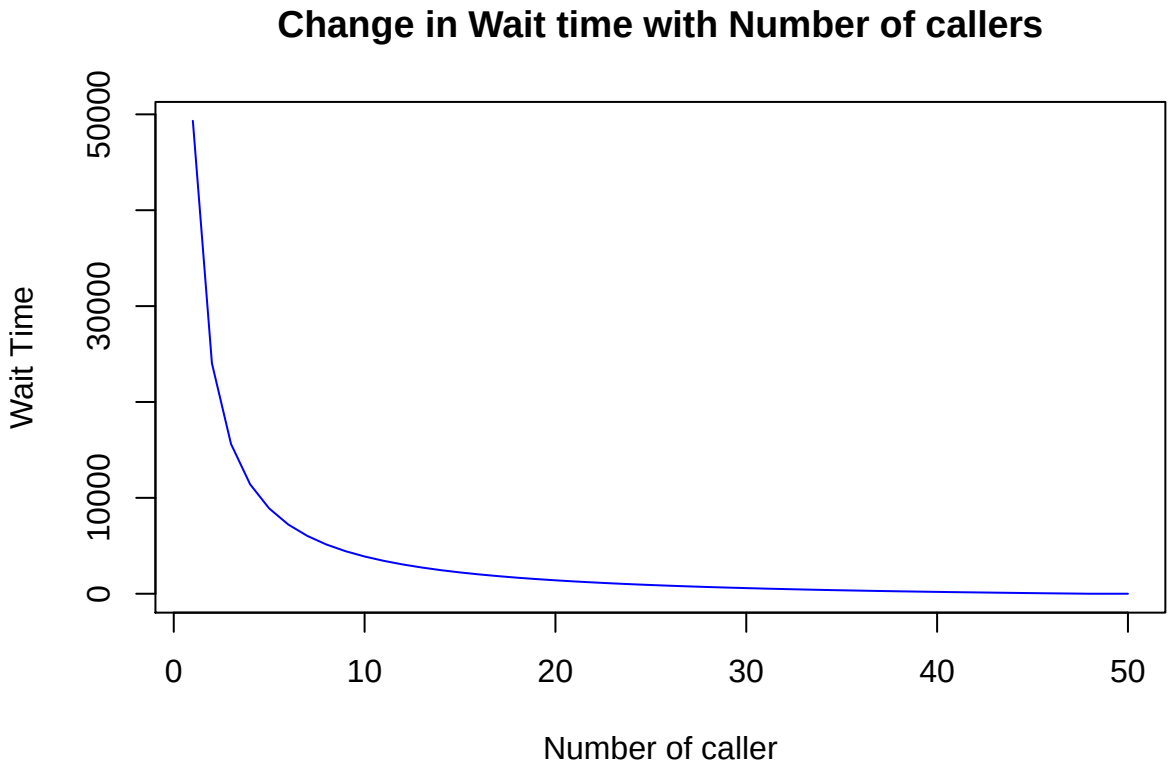
```
  for (i in 1:length(data$Call))
  {
    caller_diff <- data$Time[i] - caller
    best_caller_diff <- max(caller_diff)
    index1 <- index[min(index[caller_diff == best_caller_diff])]
    data$assigned[i] <-  index1
    data$waittime[i] <- max(-best_caller_diff,0)
    caller[index1] <- caller[index1] + data$Duration.of.calls[i]
  }
  caller_opt[number_of_callers,1] = number_of_callers
  caller_opt[number_of_callers,2] = max(data$waittime)

 }
print(caller_opt)
```

```
##    Number_of_callers Wait_Time
## 1                  1     49323
## 2                  2     24036
## 3                  3     15620
## 4                  4     11416
## 5                  5      8896
## 6                  6      7220
## 7                  7      6028
## 8                  8      5134
## 9                  9      4439
## 10                10      3884
## 11                11      3431
## 12                12      3053
## 13                13      2732
## 14                14      2458
## 15                15      2222
## 16                16      2015
## 17                17      1834
## 18                18      1672
## 19                19      1529
## 20                20      1399
## 21                21      1282
## 22                22      1176
## 23                23      1079
## 24                24       990
## 25                25       908
## 26                26       834
## 27                27       765
## 28                28       701
## 29                29       642
## 30                30       586
## 31                31       534
## 32                32       486
## 33                33       440
## 34                34       397
## 35                35       358
## 36                36       321
## 37                37       286
## 38                38       253
```

```
## 39                39       222
## 40                40       192
## 41                41       164
## 42                42       138
## 43                43       112
## 44                44        87
## 45                45        64
## 46                46        42
## 47                47        21
## 48                48         0
## 49                49         0
## 50                50         0
```

Final Result

```
plot(caller_opt, type = 'l', col = 'blue' , xlab = 'Number of caller', ylab = 'Wait Time', main = 'Chang
```



Coming back to questions in the problem statement we can answer them using the above data:

Answer 1- is 48 i.e. 48 callers are required to make sure we have no waiting time. Answer 2- is 47 which gives a maximum wait time of 21 minutes i.e. we need minimum of 47 callers to ensure that no caller waits for more than 30 mins (max wait time is 30 mins).

We can observe from the graph that deciding the right number of callers is immensely important. Even a small difference in number of calls required can increase the wait time for a customer significantly. Even 3 or 4 less than the optimum number of callers i.e 47 can increas the wait time to around an hour.