Problem 2

HW2

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```
suppressPackageStartupMessages({
  library(purrr)
  library(tidyr)
  library(ggplot2)
  library(dplyr)
})

set.seed(123456) # PLEASE DO NOT CHANGE THE SEED
```

Monte-Carlo Simulations for Poisson Process

You are working for Poisson Car Dealerships Inc. and your task is to optimize the employment in a particular popular car dealership location.

The customers arrive to that dealership according to a Poisson arrival process (meaning that the number of customers that will arrive to the dealership on a particular hour is distributed with Poisson distribution and average arrival rate λ)

Salesmen are assigned to customers on 1-on-1 basis. Say, if 1 customer comes in at 3pm, then he occupies 1 salesman for that entire hour. The occupied salesman will be free again at 4pm to work with another customer.

Assume your dealership is open 24 hours a day / 7 days a week.

Question 1

- Please simulate one possible future for the next month (30 days = 720 hours) assuming the average arrival rate $\lambda = 6$ customers per hour.
- Hints:
  - you will need to use what you know about Poisson distribution
- Output:
  - Please create data.frame `df1` with N rows that contains your sample values in column `df1$X`, current hour (in 0-23 format) in `df1$hour` and current day (in 1-30 format) `df1$day`.

```
pois_lambda <- 6
N <- 720L

# Please write your code below

df1 <- data.frame(X = rpois(N,pois_lambda),
                  hour = rep(0:23, N/24),
                  day = rep(1:30, each=24))
head(df1)
```

```
##   X hour day
## 1 8    0   1
## 2 8    1   1
## 3 5    2   1
## 4 5    3   1
## 5 5    4   1
## 6 4    5   1
```

Question 2

- Please simulate $R = 2000L$ possible ways your future may look for the next month (30 days = 720 hours)
- Output:
  - Please create data.frame `df2` with $N \times R$ rows that contains your sample values in column `df2$X`, current hour (in 0-23 format) in `df2$hour`, current day (in 1-30 format) `df2$day` and sample id in column `df2$id`.

```
R <- 2000L

# Please write your code below

df2 <- data.frame(id = rep(1:R, each=N),
                  X = rpois(R*N,pois_lambda),
                  hour = rep(0:23, R*N/24),
                  day = rep(rep(1:30, each=24),R))
head(df2)
```

```
##   id X hour day
## 1  1 2    0   1
## 2  1 1    1   1
## 3  1 9    2   1
## 4  1 6    3   1
## 5  1 3    4   1
## 6  1 3    5   1
```

Question 3

- Please compute how many salesmen you should keep on duty each hour to make sure that in 99% of **hours** there are enough salesmen for every customer (without waiting).
- Hints:
  - you may want to look at `quantile()` function
- Output:
  - Please save the value into numeric variable `q3`

```
# Please write your code below

q3 <- quantile(df2$X,0.99)
q3
```

```
## 99%
##  12
```