

Modelagem Preditiva em IoT - Previsão de Uso de Energia

Definição projeto

Este projeto de IoT tem como objetivo a criação de modelos preditivos para a previsão de consumo de energia de eletrodomésticos. Os dados utilizados incluem medições de sensores de temperatura e umidade de uma rede sem fio, previsão do tempo de uma estação de um aeroporto e uso de energia utilizada por luminárias.

Nesse projeto de aprendizado de máquina você deve realizar a filtragem de dados para remover parâmetros não-preditivos e selecionar os melhores recursos (melhores features) para previsão. O conjunto de dados foi coletado por um período de 10 minutos por cerca de 5 meses. As condições de temperatura e umidade da casa foram monitoradas com uma rede de sensores sem fio ZigBee.

Cada nó sem fio transmitia as condições de temperatura e umidade em torno de 3 min. Em seguida, a média dos dados foi calculada para períodos de 10 minutos. Os dados de energia foram registrados a cada 10 minutos com medidores de energia de barramento m. O tempo da estação meteorológica mais próxima do aeroporto (Aeroporto de Chievres, Bélgica) foi baixado de um conjunto de dados públicos do Reliable Prognosis (rp5.ru) e mesclado com os conjuntos de dados experimentais usando a coluna de data e hora. Duas variáveis aleatórias foram incluídas no conjunto de dados para testar os modelos de regressão e filtrar os atributos não preditivos (parâmetros).

Objetivo

Seu trabalho agora é construir um modelo preditivo que possa prever o consumo de energia com base nos dados de sensores IoT coletados. Recomendamos usar Random Forest para a seleção de atributos e SVM, Regressão Logística Multilinear ou Gradient Boosting para o modelo preditivo. Recomendamos ainda o uso da linguagem R.

Citação

Esse projeto da formação cientista de dados da @Data Science Academy

Dicionario dados

date time = ano-mês-dia hora:minuto:segundo

Appliances = uso de energia em Wh (variável alvo para previsão)

lights = uso de energia de luminárias na casa em Wh

T1 = Temperatura na área da cozinha, em Celsius RH_1 = Umidade na área da cozinha, em %

T2 = Temperatura na zona da sala, em Celsius RH_2 = Umidade na área da sala, em %

T3 = Temperatura na zona da lavanderia RH_3 = Umidade na área da lavanderia, em %

T4 = Temperatura em sala de escritório, em Celsius RH_4 = Umidade na sala do escritório, em %

T5 = Temperatura no banheiro, em Celsius RH_5 = Umidade no banheiro, em %

T6 = Temperatura exterior ao edifício (lado norte), em Celsius RH_6 = Umidade externa ao edifício (lado norte), em %

T7 = Temperatura na sala de passar roupa, em Celsius RH_7 = Umidade na sala de passar roupa, em %

T8 = Temperatura no quarto do adolescente 2, em Celsius RH_8 = Umidade no quarto do adolescente 2, em %

T9 = Temperatura no quarto dos pais, em Celsius RH_9 = Umidade no quarto dos pais, em %

TO = Temperatura externa (da estação meteorológica de Chievres), em Celsius

Pressure = (da estação meteorológica de Chievres), em mm Hg

RH_out = umidade externa (da estação meteorológica de Chievres), em% Wind speed = Velocidade do vento (da estação meteorológica de Chievres), em m/s

Visibilidade = (da estação meteorológica de Chievres), em km Tdewpoint = (da estação meteorológica de Chievres), °C

rv1 = variável aleatória 1, adimensional rv2 = variável aleatória 2, adimensional

```
## Importando as bibliotecas
library(readr)
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(ggplot2)
library(corrplot)
```

```
## corrplot 0.92 loaded
```

```
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

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

```
library(lubridate)  
library(caret)
```

```
## Loading required package: lattice
```

```
library(randomForest)
```

```
## randomForest 4.7-1.1
```

```
## Type rfNews() to see new features/changes/bug fixes.
```

```
##  
## Attaching package: 'randomForest'
```

```
## The following object is masked from 'package:ggplot2':  
##  
##    margin
```

```
## The following object is masked from 'package:dplyr':  
##  
##    combine
```

```
library(xgboost)
```

```
##  
## Attaching package: 'xgboost'
```

```
## The following object is masked from 'package:dplyr':  
##  
##    slice
```

```
library(forecast)
```

```
## Warning: package 'forecast' was built under R version 4.3.1
```

```
## Registered S3 method overwritten by 'quantmod':  
##    method           from  
##    as.zoo.data.frame zoo
```

```
library(e1071)
library(class)
```

Dataset

```
## Dataset
data_train <- read_csv("projeto8-training.csv")
```

```
## Rows: 14803 Columns: 32
## — Column specification —————
## Delimiter: ","
## chr   (2): WeekStatus, Day_of_week
## dbl  (29): Appliances, lights, T1, RH_1, T2, RH_2, T3, RH_3, T4, RH_4, T5, R...
## dtm   (1): date
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
data_test <- read_csv("projeto8-testing.csv")
```

```
## Rows: 4932 Columns: 32
## — Column specification —————
## Delimiter: ","
## chr   (2): WeekStatus, Day_of_week
## dbl  (29): Appliances, lights, T1, RH_1, T2, RH_2, T3, RH_3, T4, RH_4, T5, R...
## dtm   (1): date
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
# Visualizando dados
head(data_train)
```

	date	Appliances	lights	T1	RH_1	T2	RH_2	T3	RH_3	
	<dtm>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	
	2016-01-11 17:00:00	60	30	19.89000	47.59667	19.2	44.79000	19.79	44.73000	1
	2016-01-11 17:10:00	60	30	19.89000	46.69333	19.2	44.72250	19.79	44.79000	1
	2016-01-11 17:20:00	50	30	19.89000	46.30000	19.2	44.62667	19.79	44.93333	1
	2016-01-11 17:40:00	60	40	19.89000	46.33333	19.2	44.53000	19.79	45.00000	1
	2016-01-11 17:50:00	50	40	19.89000	46.02667	19.2	44.50000	19.79	44.93333	1
	2016-01-11 18:10:00	60	50	19.85667	45.56000	19.2	44.50000	19.73	44.90000	1

6 rows | 1-10 of 32 columns

```
head(data_test)
```

	date <dtm>	Appliances <dbl>	lights <dbl>	T1 <dbl>	RH_1 <dbl>	T2 <dbl>	RH_2 <dbl>	T3 <dbl>	RH_3 <dbl>
	2016-01-11 17:30:00	50	40	19.89000	46.06667	19.20000	44.59000	19.79	45.000
	2016-01-11 18:00:00	60	50	19.89000	45.76667	19.20000	44.50000	19.79	44.900
	2016-01-11 18:40:00	230	70	19.92667	45.86333	19.35667	44.40000	19.79	44.900
	2016-01-11 18:50:00	580	60	20.06667	46.39667	19.42667	44.40000	19.79	44.826
	2016-01-11 19:30:00	100	10	20.56667	53.89333	20.03333	46.75667	20.10	48.466
	2016-01-11 19:50:00	70	30	20.85667	53.66000	20.20000	47.05667	20.20	48.447

6 rows | 1-10 of 32 columns

```
# Visualizando 5 últimos dados
tail(data_train)
```

	date <dtm>	Appliances <dbl>	lights <dbl>	T1 <dbl>	RH_1 <dbl>	T2 <dbl>	RH_2 <dbl>	T3 <dbl>	RH_3 <dbl>
	2016-05-27 16:50:00	120	0	25.50000	47.45667	26.00000	42.32000	27.66333	40
	2016-05-27 17:00:00	110	0	25.60000	47.19333	25.96857	42.52857	27.39000	41
	2016-05-27 17:10:00	90	0	25.53333	46.86000	25.97800	42.53400	27.32333	41
	2016-05-27 17:30:00	90	0	25.50000	46.50000	25.75400	42.08000	27.13333	41
	2016-05-27 17:50:00	420	10	25.50000	46.99000	25.41400	43.03600	26.89000	41
	2016-05-27 18:00:00	430	10	25.50000	46.60000	25.26429	42.97143	26.82333	41

6 rows | 1-10 of 32 columns

```
# View dados
View(data_train)
```

```
View(data_test)
```

```
# Verifique as primeiras linhas dos dados
head(data_train)
```

date <dtm>	Appliances <dbl>	lights <dbl>	T1 <dbl>	RH_1 <dbl>	T2 <dbl>	RH_2 <dbl>	T3 <dbl>	RH_3 <dbl>	
2016-01-11 17:00:00	60	30	19.89000	47.59667	19.2	44.79000	19.79	44.73000	1
2016-01-11 17:10:00	60	30	19.89000	46.69333	19.2	44.72250	19.79	44.79000	1
2016-01-11 17:20:00	50	30	19.89000	46.30000	19.2	44.62667	19.79	44.93333	1
2016-01-11 17:40:00	60	40	19.89000	46.33333	19.2	44.53000	19.79	45.00000	1
2016-01-11 17:50:00	50	40	19.89000	46.02667	19.2	44.50000	19.79	44.93333	1
2016-01-11 18:10:00	60	50	19.85667	45.56000	19.2	44.50000	19.73	44.90000	1

6 rows | 1-10 of 32 columns

```
# Verifique a estrutura dos dados
str(data_train)
```

```

## spc_tbl_ [14,803 x 32] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
## $ date      : POSIXct[1:14803], format: "2016-01-11 17:00:00" "2016-01-11 17:10:00" ...
## $ Appliances : num [1:14803] 60 60 50 60 50 60 60 70 430 250 ...
## $ lights     : num [1:14803] 30 30 30 40 40 50 40 40 50 40 ...
## $ T1         : num [1:14803] 19.9 19.9 19.9 19.9 19.9 ...
## $ RH_1       : num [1:14803] 47.6 46.7 46.3 46.3 46 ...
## $ T2         : num [1:14803] 19.2 19.2 19.2 19.2 19.2 ...
## $ RH_2       : num [1:14803] 44.8 44.7 44.6 44.5 44.5 ...
## $ T3         : num [1:14803] 19.8 19.8 19.8 19.8 19.8 ...
## $ RH_3       : num [1:14803] 44.7 44.8 44.9 45 44.9 ...
## $ T4         : num [1:14803] 19 19 18.9 18.9 18.9 ...
## $ RH_4       : num [1:14803] 45.6 46 45.9 45.5 45.7 ...
## $ T5         : num [1:14803] 17.2 17.2 17.2 17.2 17.1 ...
## $ RH_5       : num [1:14803] 55.2 55.2 55.1 55.1 55 ...
## $ T6         : num [1:14803] 7.03 6.83 6.56 6.37 6.3 ...
## $ RH_6       : num [1:14803] 84.3 84.1 83.2 84.9 85.8 ...
## $ T7         : num [1:14803] 17.2 17.2 17.2 17.2 17.1 ...
## $ RH_7       : num [1:14803] 41.6 41.6 41.4 41.2 41.3 ...
## $ T8         : num [1:14803] 18.2 18.2 18.2 18.1 18.1 ...
## $ RH_8       : num [1:14803] 48.9 48.9 48.7 48.6 48.6 ...
## $ T9         : num [1:14803] 17 17.1 17 17 17 ...
## $ RH_9       : num [1:14803] 45.5 45.6 45.5 45.4 45.3 ...
## $ T_out      : num [1:14803] 6.6 6.48 6.37 6.13 6.02 ...
## $ Press_mm_hg: num [1:14803] 734 734 734 734 734 ...
## $ RH_out     : num [1:14803] 92 92 92 92 92 ...
## $ Windspeed  : num [1:14803] 7 6.67 6.33 5.67 5.33 ...
## $ Visibility : num [1:14803] 63 59.2 55.3 47.7 43.8 ...
## $ Tdewpoint  : num [1:14803] 5.3 5.2 5.1 4.9 4.8 ...
## $ rv1        : num [1:14803] 13.3 18.6 28.6 10.1 44.9 ...
## $ rv2        : num [1:14803] 13.3 18.6 28.6 10.1 44.9 ...
## $ NSM        : num [1:14803] 61200 61800 62400 63600 64200 65400 66000 66600 68400 69000 ...
## $ WeekStatus : chr [1:14803] "Weekday" "Weekday" "Weekday" "Weekday" ...
## $ Day_of_week: chr [1:14803] "Monday" "Monday" "Monday" "Monday" ...
## - attr(*, "spec")=
## .. cols(
## ..   date = col_datetime(format = ""),
## ..   Appliances = col_double(),
## ..   lights = col_double(),
## ..   T1 = col_double(),
## ..   RH_1 = col_double(),
## ..   T2 = col_double(),
## ..   RH_2 = col_double(),
## ..   T3 = col_double(),
## ..   RH_3 = col_double(),
## ..   T4 = col_double(),
## ..   RH_4 = col_double(),
## ..   T5 = col_double(),
## ..   RH_5 = col_double(),
## ..   T6 = col_double(),
## ..   RH_6 = col_double(),
## ..   T7 = col_double(),
## ..   RH_7 = col_double(),

```

```
## .. T8 = col_double(),
## .. RH_8 = col_double(),
## .. T9 = col_double(),
## .. RH_9 = col_double(),
## .. T_out = col_double(),
## .. Press_mm_hg = col_double(),
## .. RH_out = col_double(),
## .. Windspeed = col_double(),
## .. Visibility = col_double(),
## .. Tdewpoint = col_double(),
## .. rv1 = col_double(),
## .. rv2 = col_double(),
## .. NSM = col_double(),
## .. WeekStatus = col_character(),
## .. Day_of_week = col_character()
## .. )
## - attr(*, "problems")=<externalptr>
```

```
# Verifique se há valores ausentes
sum(is.na(data_train))
```

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

Análise dados

```
# Resumo estatístico das variáveis numéricas:
summary(data_train)
```



```

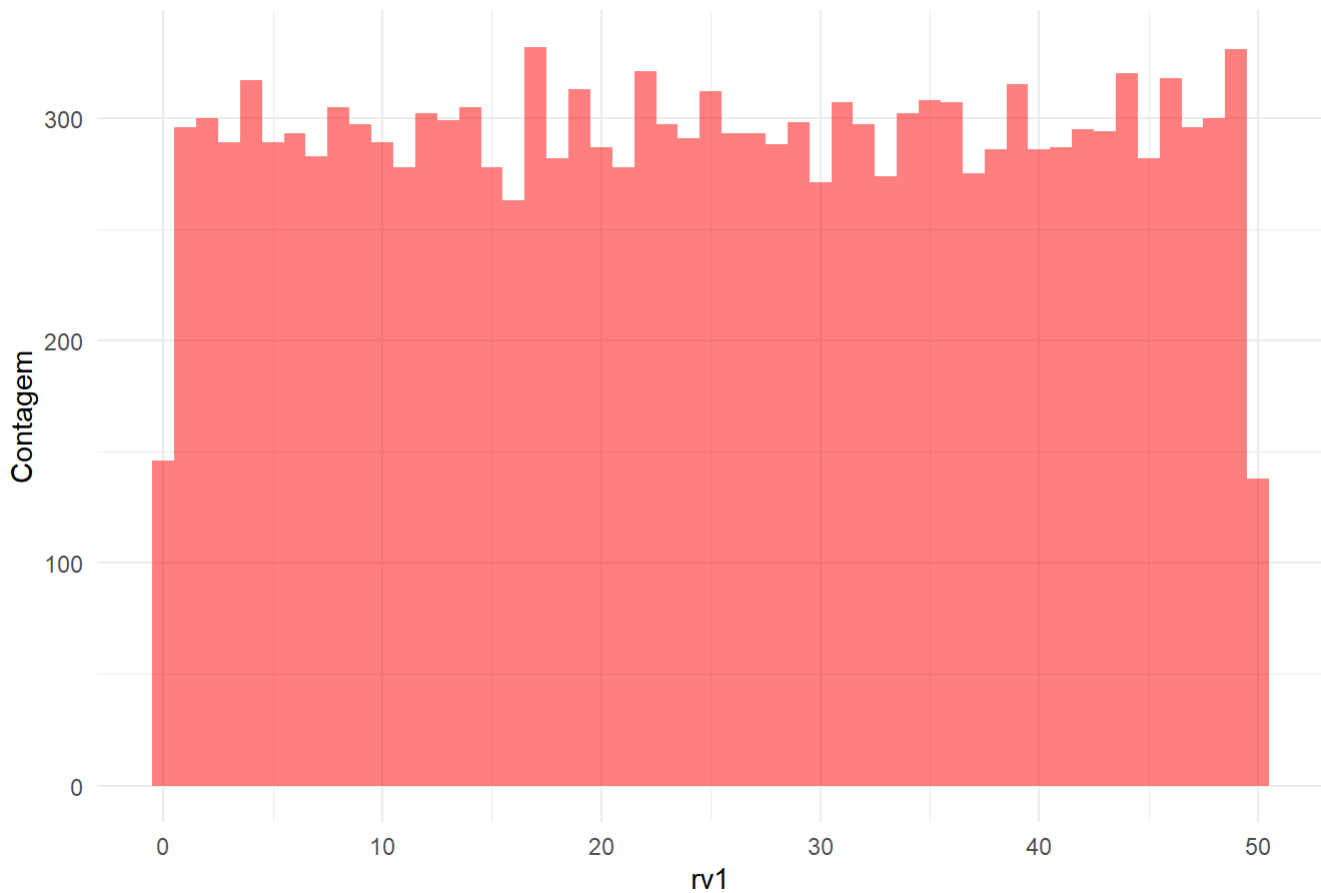
##      date                Appliances      lights
## Min.   :2016-01-11 17:00:00.00 Min.   : 10.00 Min.   : 0.000
## 1st Qu.:2016-02-14 22:55:00.00 1st Qu.: 50.00 1st Qu.: 0.000
## Median :2016-03-19 20:20:00.00 Median : 60.00 Median : 0.000
## Mean   :2016-03-20 02:37:28.56 Mean   : 98.01 Mean   : 3.803
## 3rd Qu.:2016-04-23 06:55:00.00 3rd Qu.:100.00 3rd Qu.: 0.000
## Max.   :2016-05-27 18:00:00.00 Max.   :1080.00 Max.   :50.000
##      T1      RH_1      T2      RH_2
## Min.   :16.79 Min.   :27.02 Min.   :16.10 Min.   :20.89
## 1st Qu.:20.73 1st Qu.:37.36 1st Qu.:18.82 1st Qu.:37.90
## Median :21.60 Median :39.66 Median :20.00 Median :40.50
## Mean   :21.68 Mean   :40.27 Mean   :20.34 Mean   :40.42
## 3rd Qu.:22.60 3rd Qu.:43.09 3rd Qu.:21.50 3rd Qu.:43.29
## Max.   :26.26 Max.   :63.36 Max.   :29.86 Max.   :56.03
##      T3      RH_3      T4      RH_4
## Min.   :17.20 Min.   :28.77 Min.   :15.10 Min.   :27.66
## 1st Qu.:20.79 1st Qu.:36.90 1st Qu.:19.50 1st Qu.:35.53
## Median :22.10 Median :38.53 Median :20.67 Median :38.40
## Mean   :22.26 Mean   :39.25 Mean   :20.86 Mean   :39.03
## 3rd Qu.:23.29 3rd Qu.:41.76 3rd Qu.:22.10 3rd Qu.:42.13
## Max.   :29.24 Max.   :50.16 Max.   :26.20 Max.   :51.06
##      T5      RH_5      T6      RH_6
## Min.   :15.33 Min.   :29.86 Min.   : -6.065 Min.   : 1.00
## 1st Qu.:18.27 1st Qu.:45.40 1st Qu.: 3.657 1st Qu.:30.10
## Median :19.39 Median :49.09 Median : 7.295 Median :55.30
## Mean   :19.59 Mean   :50.96 Mean   : 7.921 Mean   :54.62
## 3rd Qu.:20.60 3rd Qu.:53.66 3rd Qu.:11.245 3rd Qu.:83.33
## Max.   :25.75 Max.   :95.95 Max.   :28.290 Max.   :99.90
##      T7      RH_7      T8      RH_8
## Min.   :15.39 Min.   :23.20 Min.   :16.31 Min.   :29.60
## 1st Qu.:18.70 1st Qu.:31.50 1st Qu.:20.79 1st Qu.:39.06
## Median :20.03 Median :34.82 Median :22.13 Median :42.36
## Mean   :20.26 Mean   :35.39 Mean   :22.03 Mean   :42.92
## 3rd Qu.:21.60 3rd Qu.:39.00 3rd Qu.:23.39 3rd Qu.:46.56
## Max.   :26.00 Max.   :51.40 Max.   :27.23 Max.   :58.78
##      T9      RH_9      T_out      Press_mm_hg
## Min.   :14.89 Min.   :29.17 Min.   : -5.000 Min.   :729.3
## 1st Qu.:18.00 1st Qu.:38.50 1st Qu.: 3.667 1st Qu.:750.9
## Median :19.39 Median :40.86 Median : 6.900 Median :756.1
## Mean   :19.48 Mean   :41.54 Mean   : 7.413 Mean   :755.5
## 3rd Qu.:20.60 3rd Qu.:44.36 3rd Qu.:10.400 3rd Qu.:760.9
## Max.   :24.50 Max.   :53.33 Max.   :25.967 Max.   :772.3
##      RH_out      Windspeed      Visibility      Tdewpoint
## Min.   : 24.00 Min.   : 0.000 Min.   : 1.00 Min.   : -6.600
## 1st Qu.: 70.00 1st Qu.: 2.000 1st Qu.:29.00 1st Qu.: 0.900
## Median : 83.67 Median : 3.667 Median :40.00 Median : 3.450
## Mean   : 79.73 Mean   : 4.034 Mean   :38.33 Mean   : 3.757
## 3rd Qu.: 91.67 3rd Qu.: 5.500 3rd Qu.:40.00 3rd Qu.: 6.533
## Max.   :100.00 Max.   :13.500 Max.   :66.00 Max.   :15.500
##      rv1      rv2      NSM      WeekStatus
## Min.   : 0.00532 Min.   : 0.00532 Min.   : 0 Length:14803
## 1st Qu.:12.58042 1st Qu.:12.58042 1st Qu.:21600 Class :character

```

```
## Median :25.04399 Median :25.04399 Median :43200 Mode :character
## Mean :25.07809 Mean :25.07809 Mean :42986
## 3rd Qu.:37.66591 3rd Qu.:37.66591 3rd Qu.:64800
## Max. :49.99653 Max. :49.99653 Max. :85800
## Day_of_week
## Length:14803
## Class :character
## Mode :character
##
##
##
```

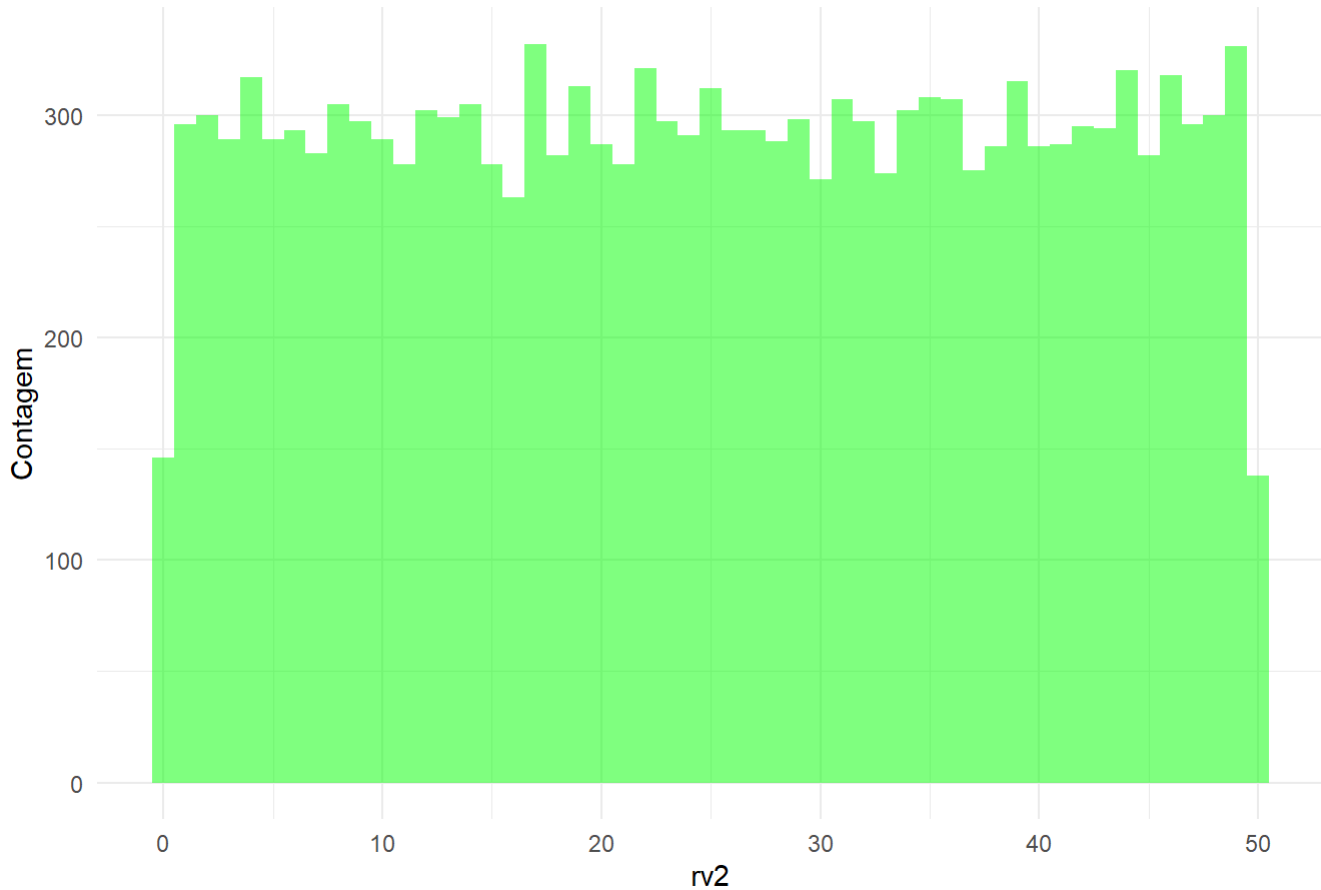
```
# Gráfico variável alvo - rv1
ggplot(data_train, aes(x = rv1)) +
  geom_histogram(binwidth = 1, fill = "red", alpha = 0.5) +
  labs(x = "rv1", y = "Contagem", title = "Histograma: Distribuição de rv1") +
  theme_minimal()
```

Histograma: Distribuição de rv1



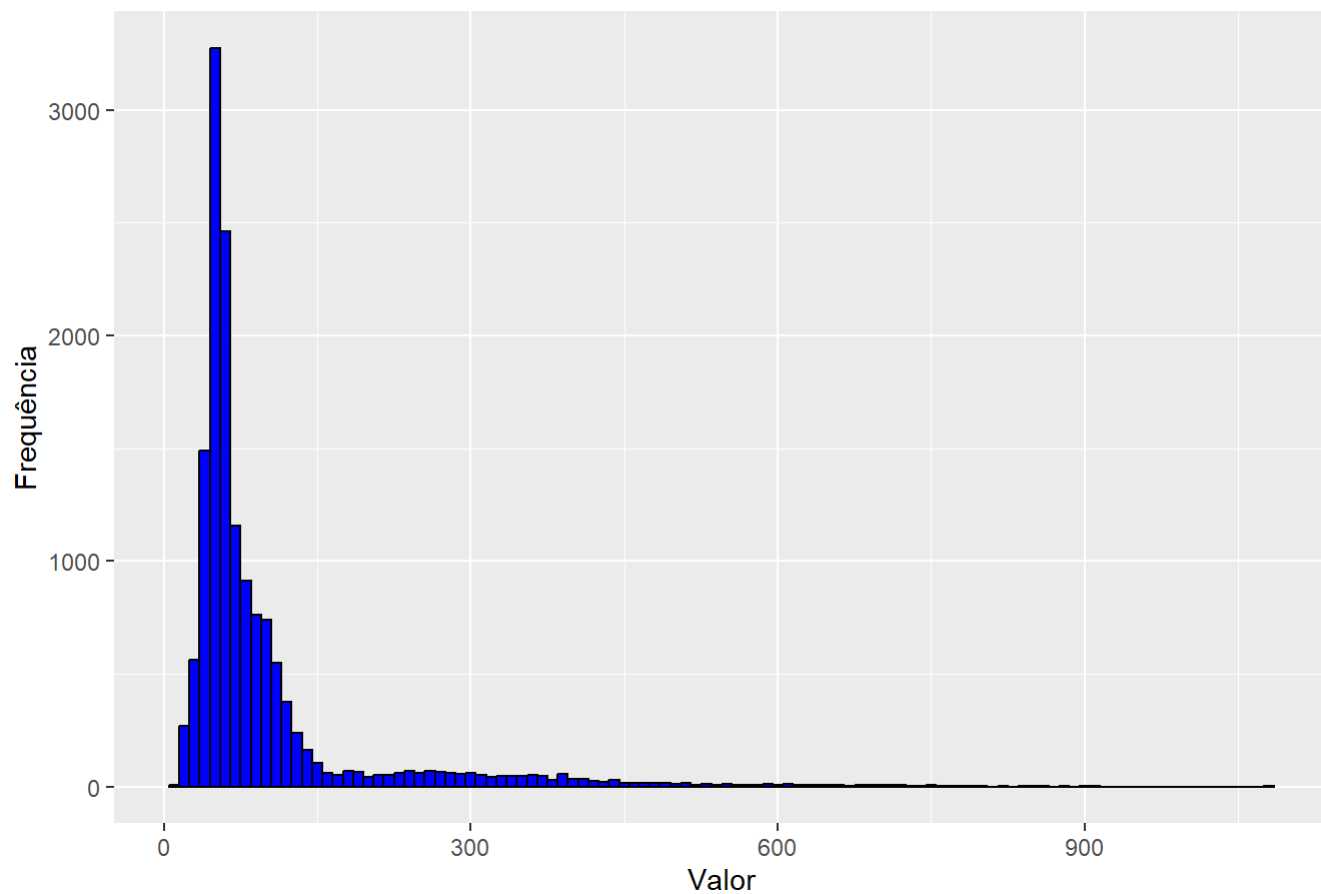
```
# Gráfico variável alvo - rv2
ggplot(data_train, aes(x = rv2)) +
  geom_histogram(binwidth = 1, fill = "green", alpha = 0.5) +
  labs(x = "rv2", y = "Contagem", title = "Histograma: Distribuição de rv2") +
  theme_minimal()
```

Histograma: Distribuição de rv2



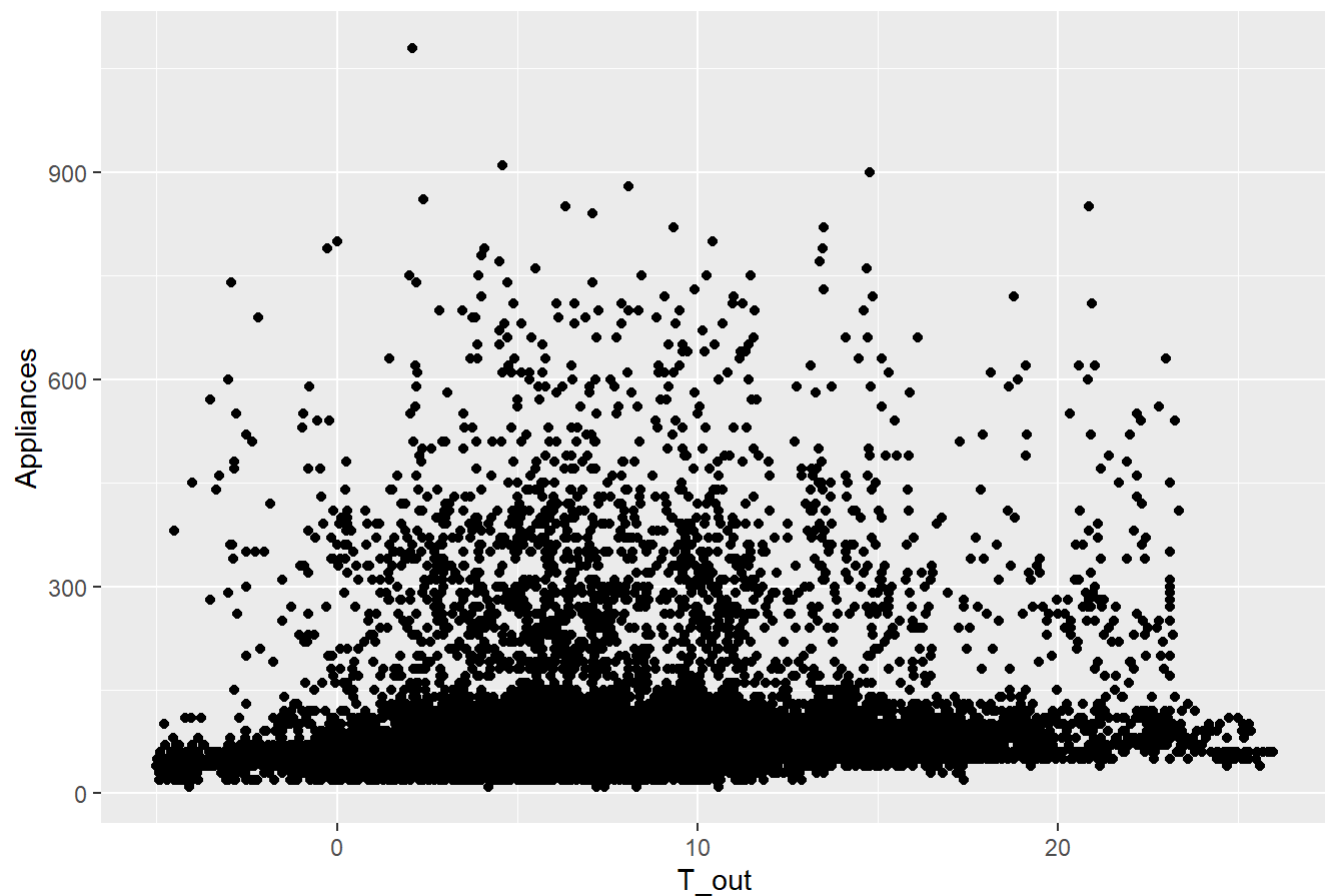
```
# Gráfico Appliances
ggplot(data_train, aes(x = Appliances)) +
  geom_histogram(binwidth = 10, fill = "blue", color = "black") +
  labs(title = "Histograma de Appliances", x = "Valor", y = "Frequência")
```

Histograma de Appliances



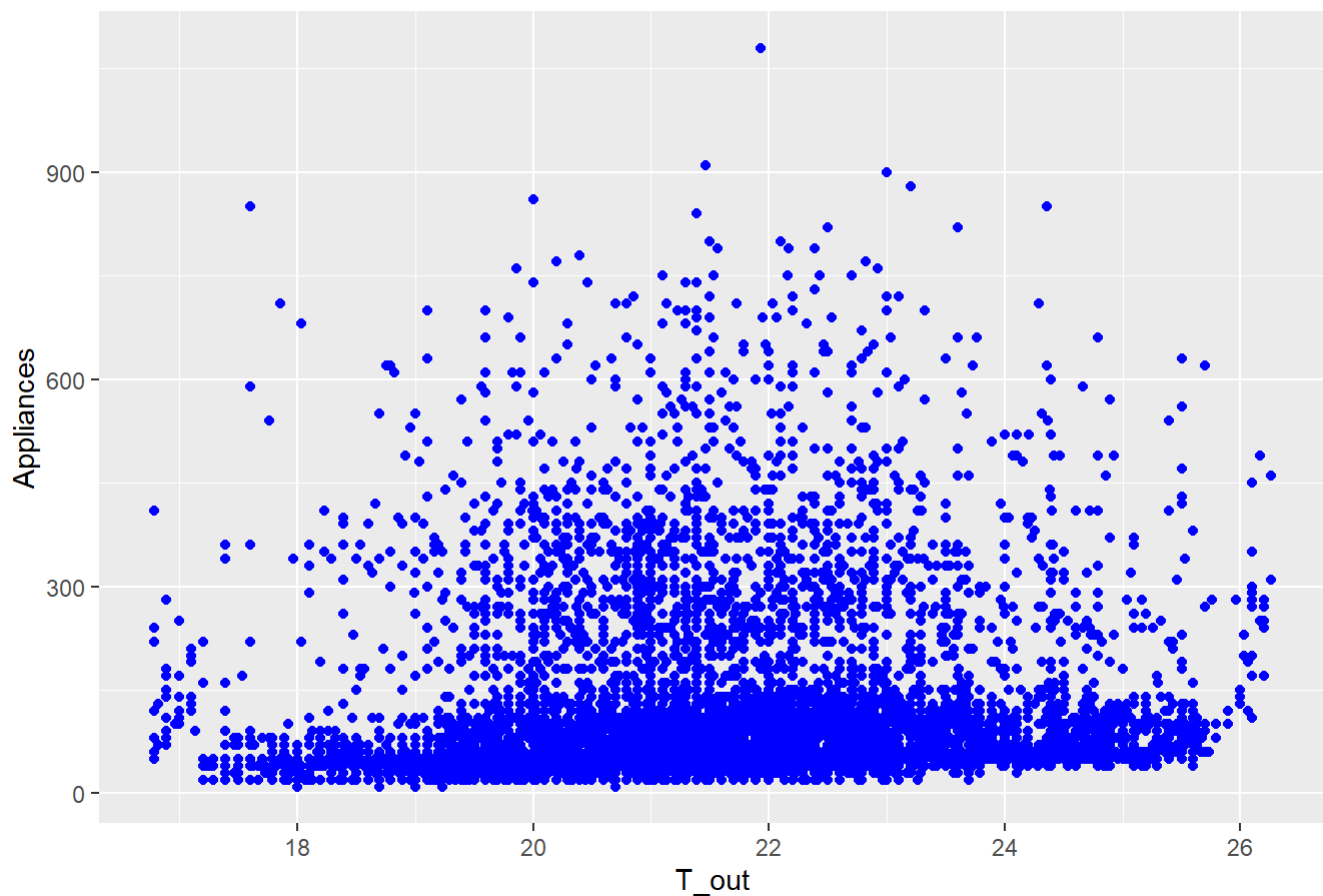
```
# Gráfico Scatterplot Appliances
ggplot(data_train, aes(x = T_out, y = Appliances)) +
  geom_point() +
  labs(title = "Scatterplot de Appliances", x = "T_out", y = "Appliances")
```

Scatterplot de Appliances



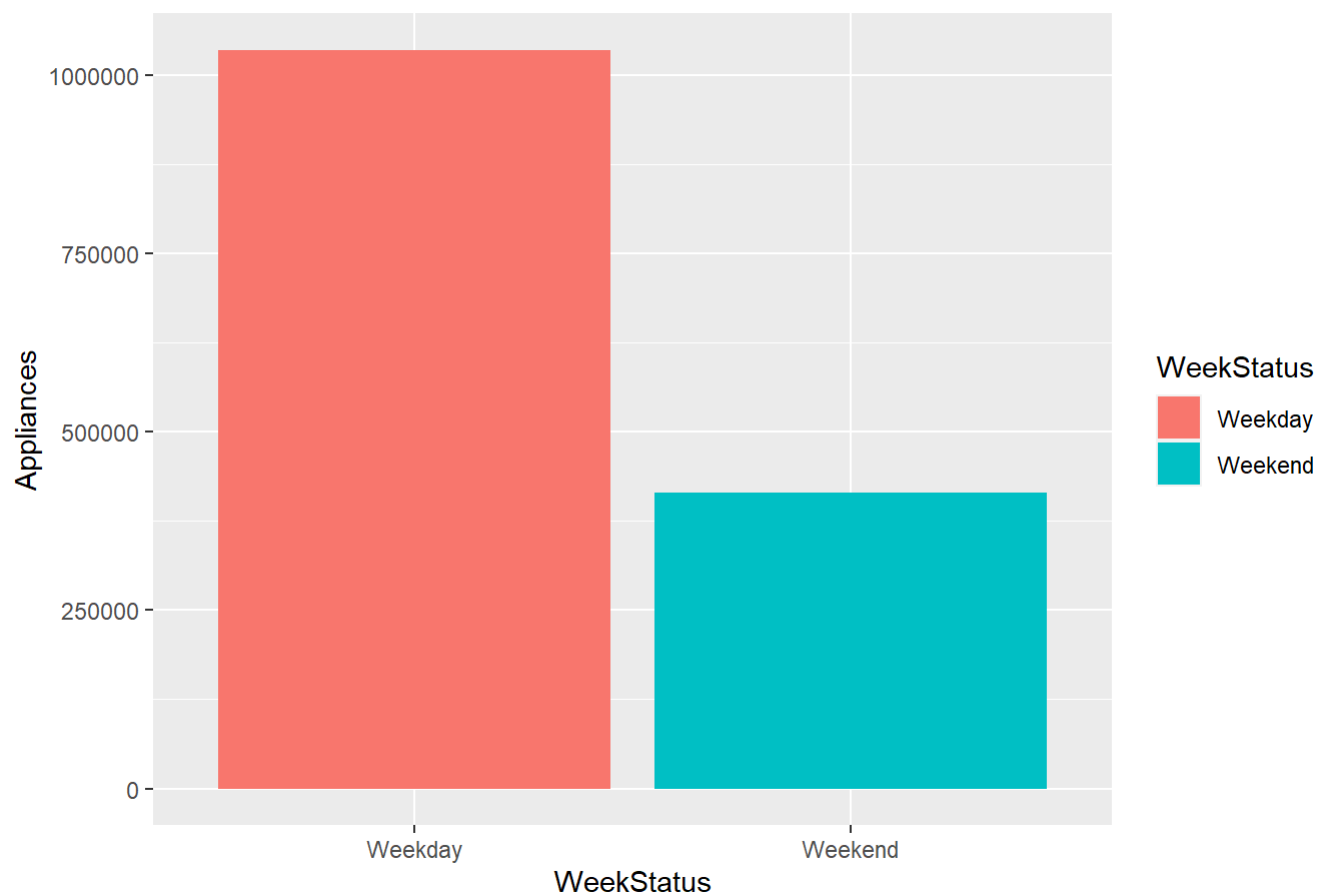
```
# Gráfico scatterplot com regressão
ggplot(data_train, aes(x = T1, y = Appliances)) +
  geom_point(color = "blue") +           # Adicione os pontos
  labs(title = "Gráfico de Regressão Linear",
        x = "T_out",
        y = "Appliances")
```

Gráfico de Regressão Linear



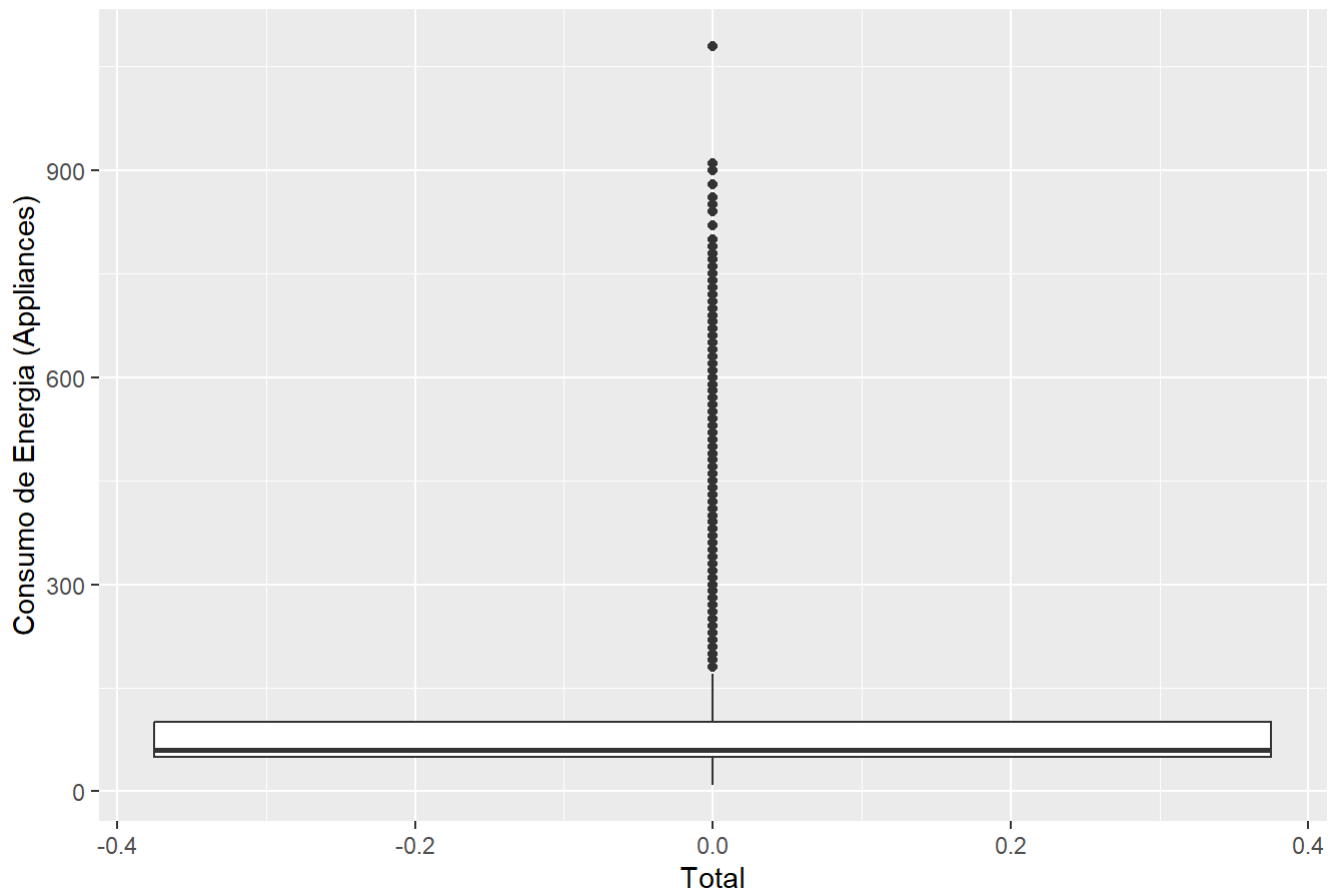
```
# Crie um gráfico de barras
ggplot(data_train, aes(x = WeekStatus, y = Appliances, fill = WeekStatus)) +
  geom_bar(stat = "identity") +
  labs(title = "Eletrodomésticos por Status da Semana",
       x = "WeekStatus",
       y = "Appliances")
```

Eletrodomésticos por Status da Semana



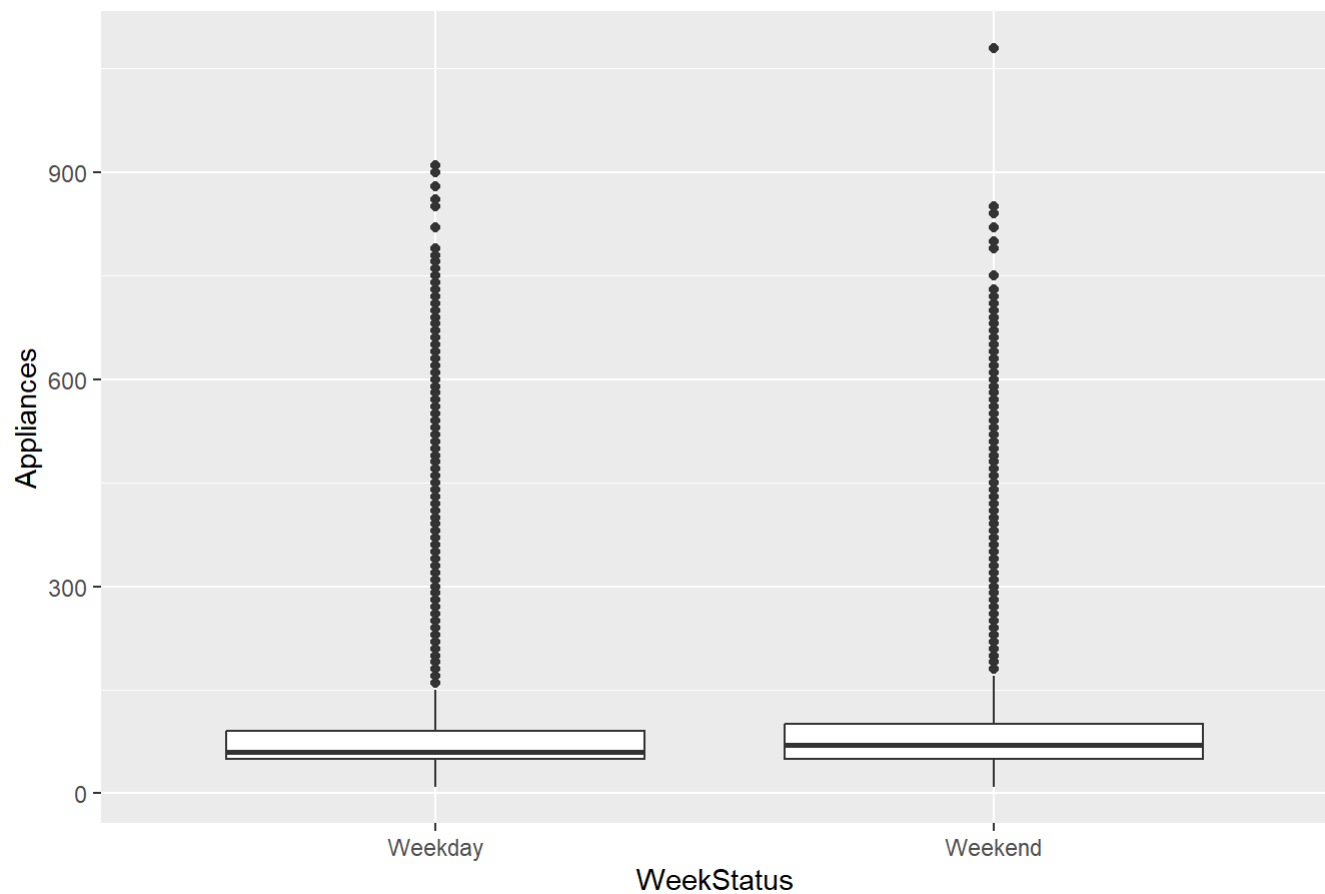
```
# Gráfico (boxplot)
ggplot(data_train, aes(y = Appliances)) +
  geom_boxplot() +
  ylab("Consumo de Energia (Appliances)") +
  xlab("Total") +
  ggtitle("Gráfico variável alvo com outliers")
```

Gráfico variável alvo com outliers



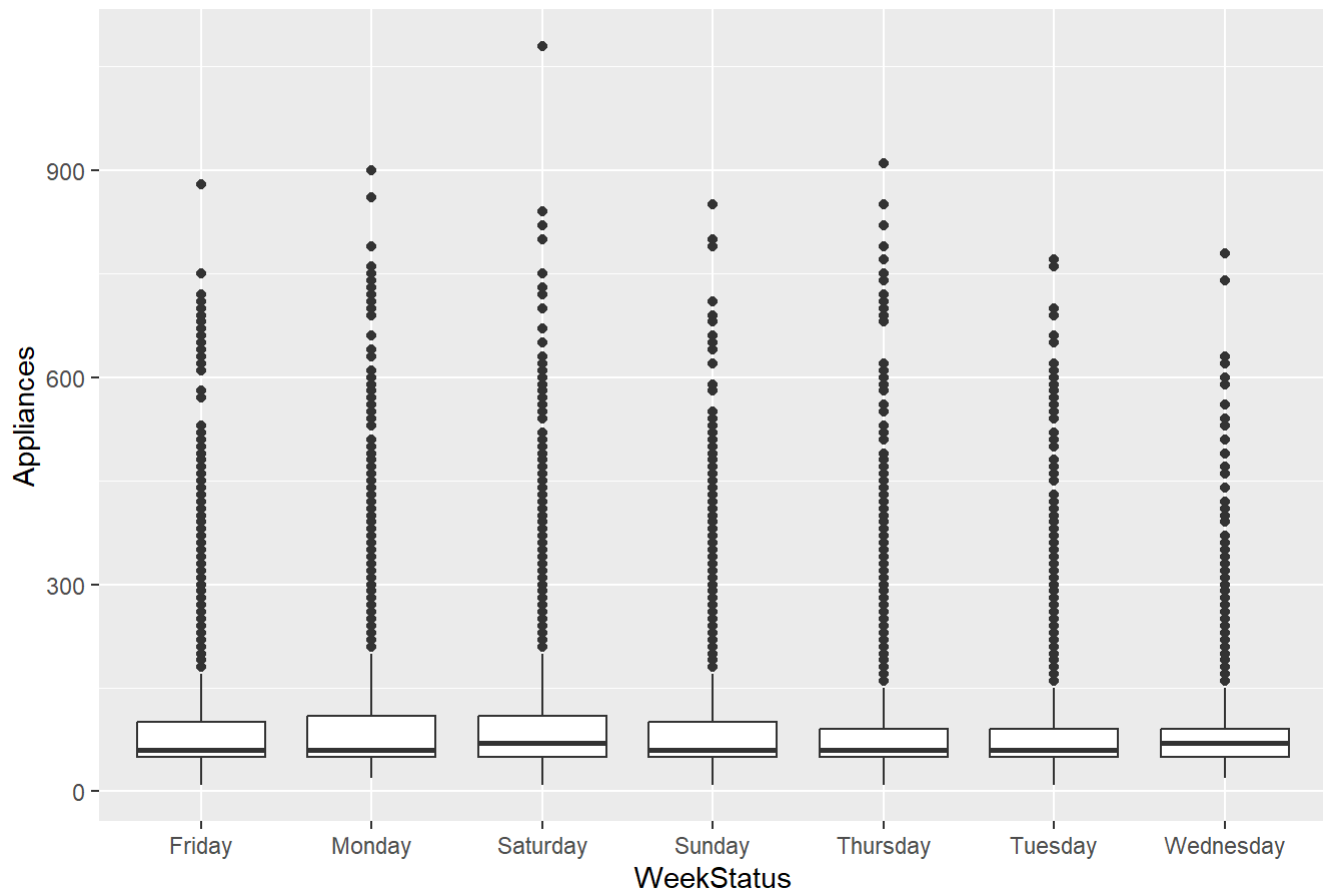
```
# Gráfico boxplot
ggplot(data_train, aes(x = WeekStatus , y = Appliances)) +
  geom_boxplot() +
  labs(title = "Boxplot Eletrodomésticas por Status da Semana", x = "WeekStatus", y = "Appliances")
```


Boxplot Eletrodomésticas por Status da Semana



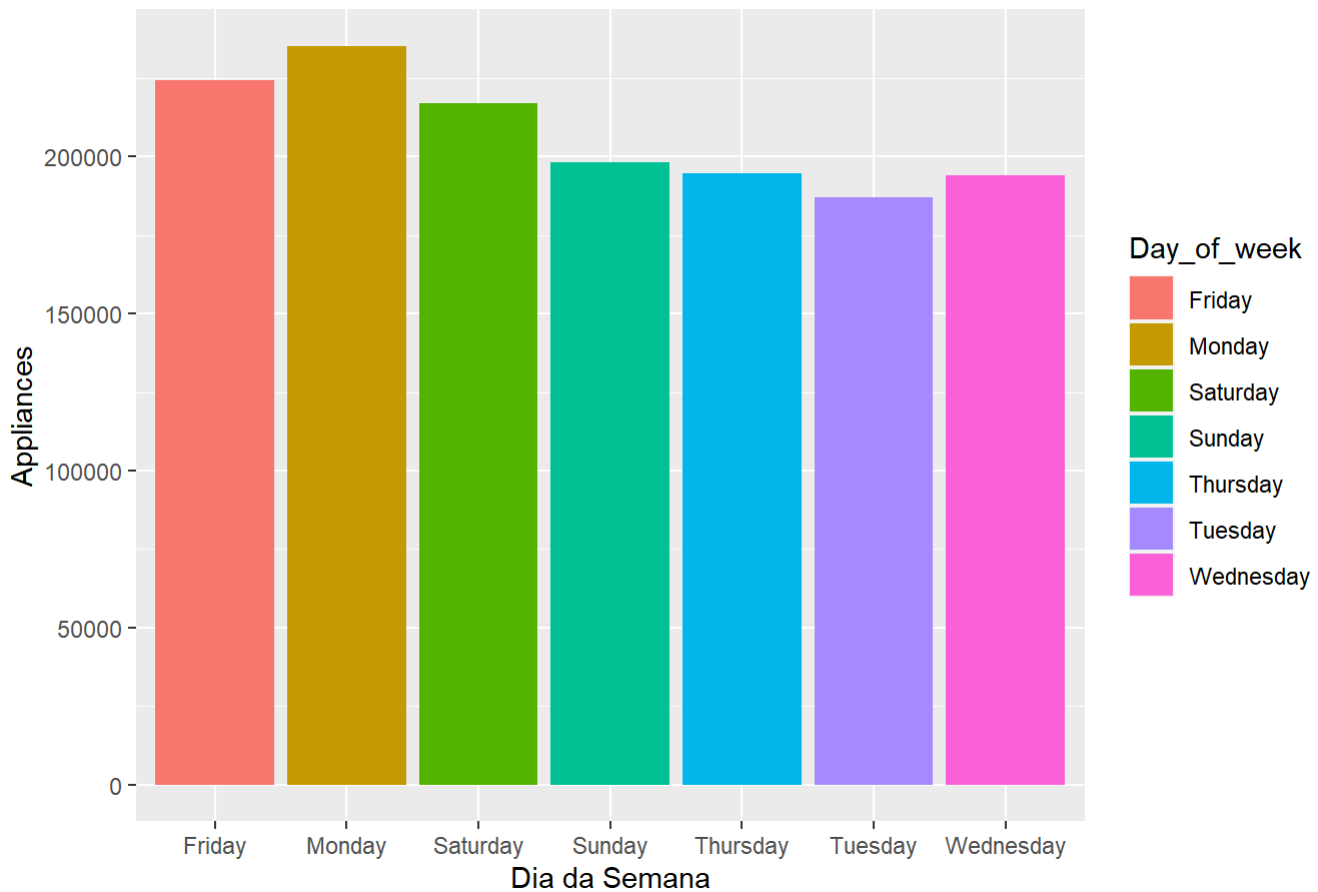
```
# Gráfico boxplot
ggplot(data_train, aes(x = Day_of_week, y = Appliances)) +
  geom_boxplot() +
  labs(title = "Boxplot Eletrodomésticas por Dia da semana", x = "WeekStatus", y = "Appliances")
```

Boxplot Eletrodomésticas por Dia da semana



```
# Crie um gráfico de barras
ggplot(data_train, aes(x = Day_of_week, y = Appliances, fill = Day_of_week)) +
  geom_bar(stat = "identity") +
  labs(title = "Gráfico barras eletrodomésticos por Dia da Semana",
       x = "Dia da Semana",
       y = "Appliances")
```

Gráfico barras eletrodomésticos por Dia da Semana



Série temporal para dados

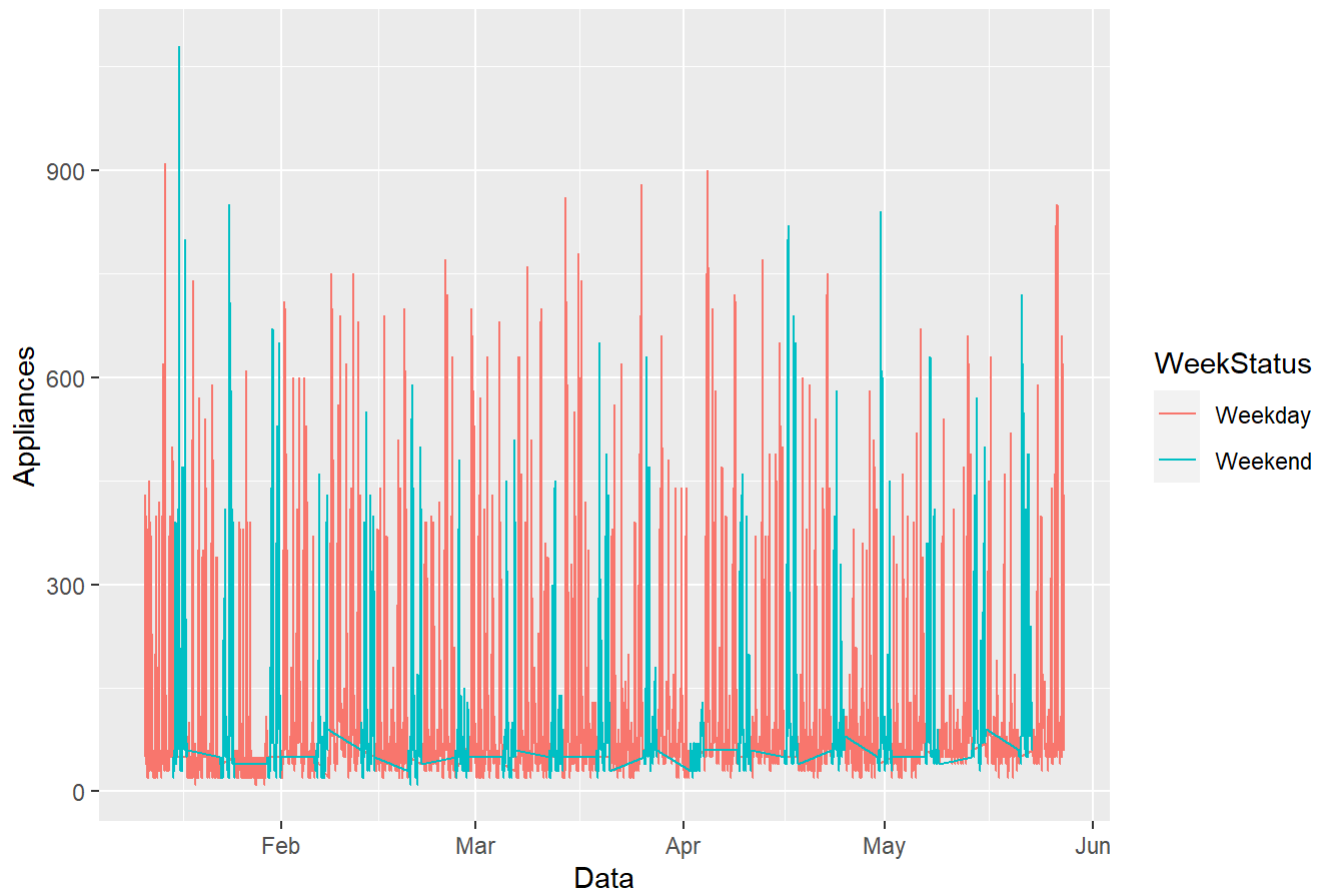
```
# Converta a coluna "date" em um objeto de data
# Supondo que a coluna "date" esteja no formato correto
data_train$date <- ymd_hms(data_train$date)
```

```
## Warning: 113 failed to parse.
```

```
# Gráfico de série temporal
ggplot(data_train, aes(x = date, y = Appliances, color = WeekStatus)) +
  geom_line() +
  labs(title = "Gráfico série temporal eletrodomésticos por Dia da Semana",
       x = "Data",
       y = "Appliances")
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
```

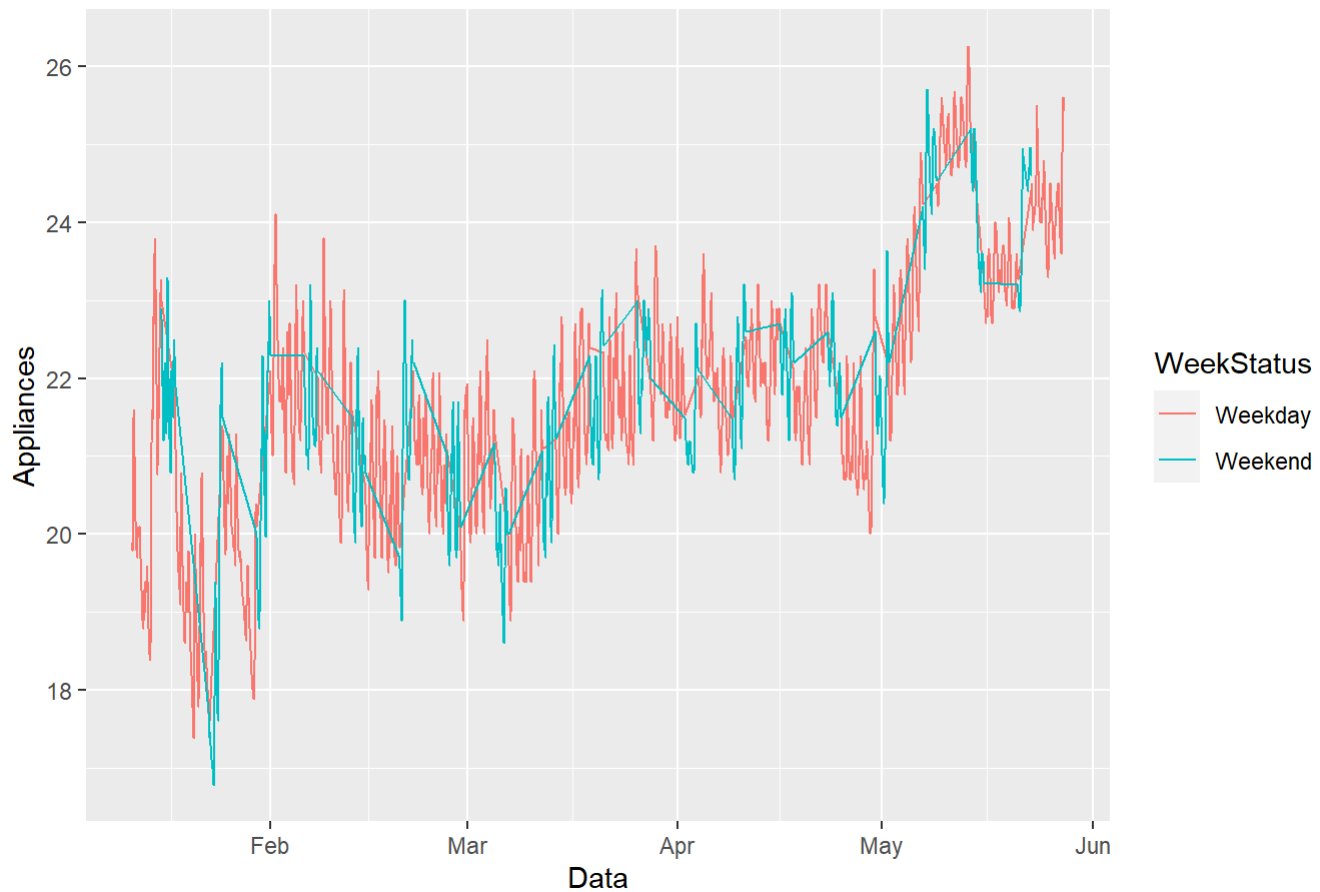
Gráfico série temporal eletrodomésticos por Dia da Semana



```
ggplot(data_train, aes(x = date, y = T1, color = WeekStatus)) +  
  geom_line() +  
  labs(title = "Gráfico barras eletrodomésticos por Dia da Semana",  
        x = "Data",  
        y = "Appliances")
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
```

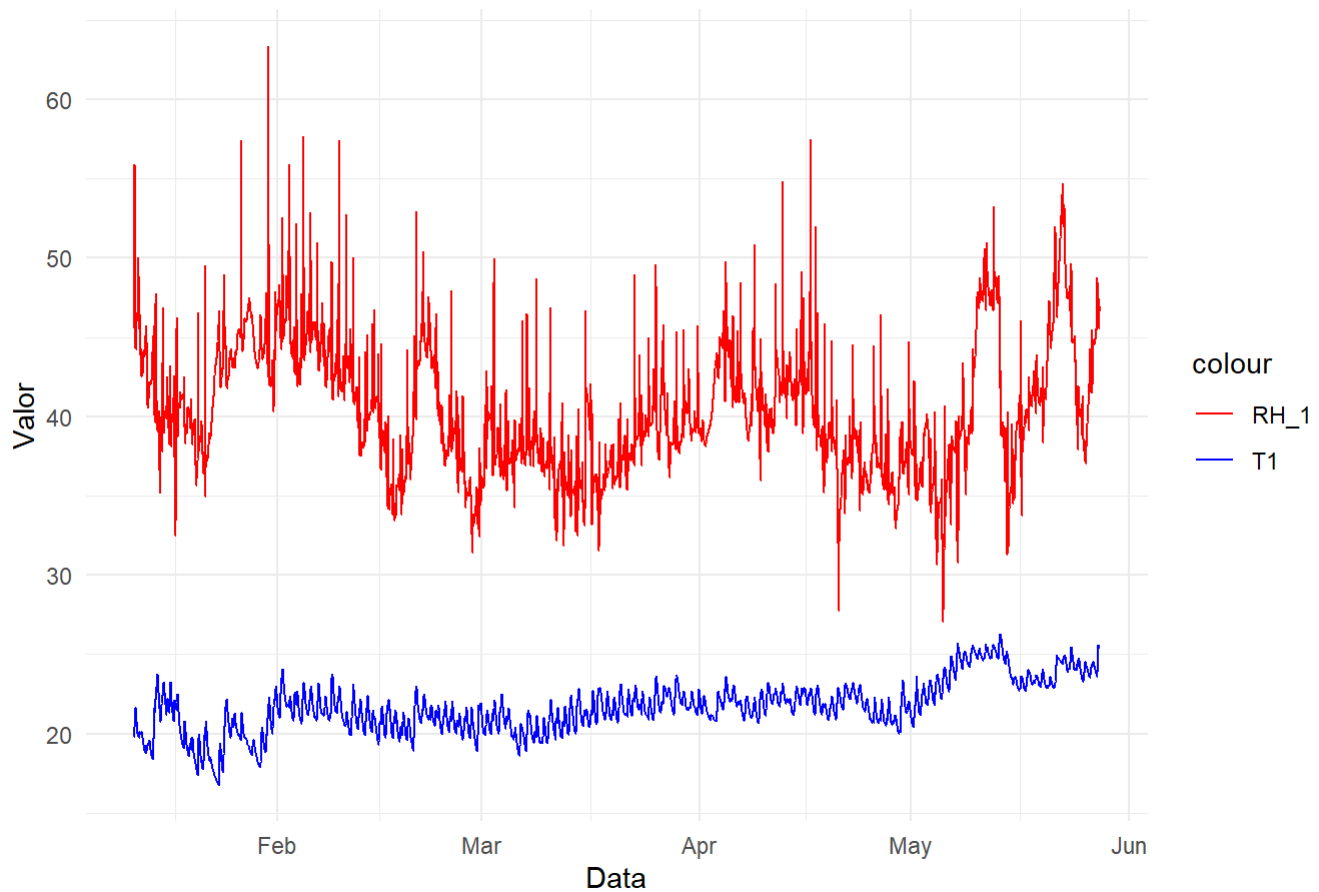
Gráfico barras eletrodomésticos por Dia da Semana



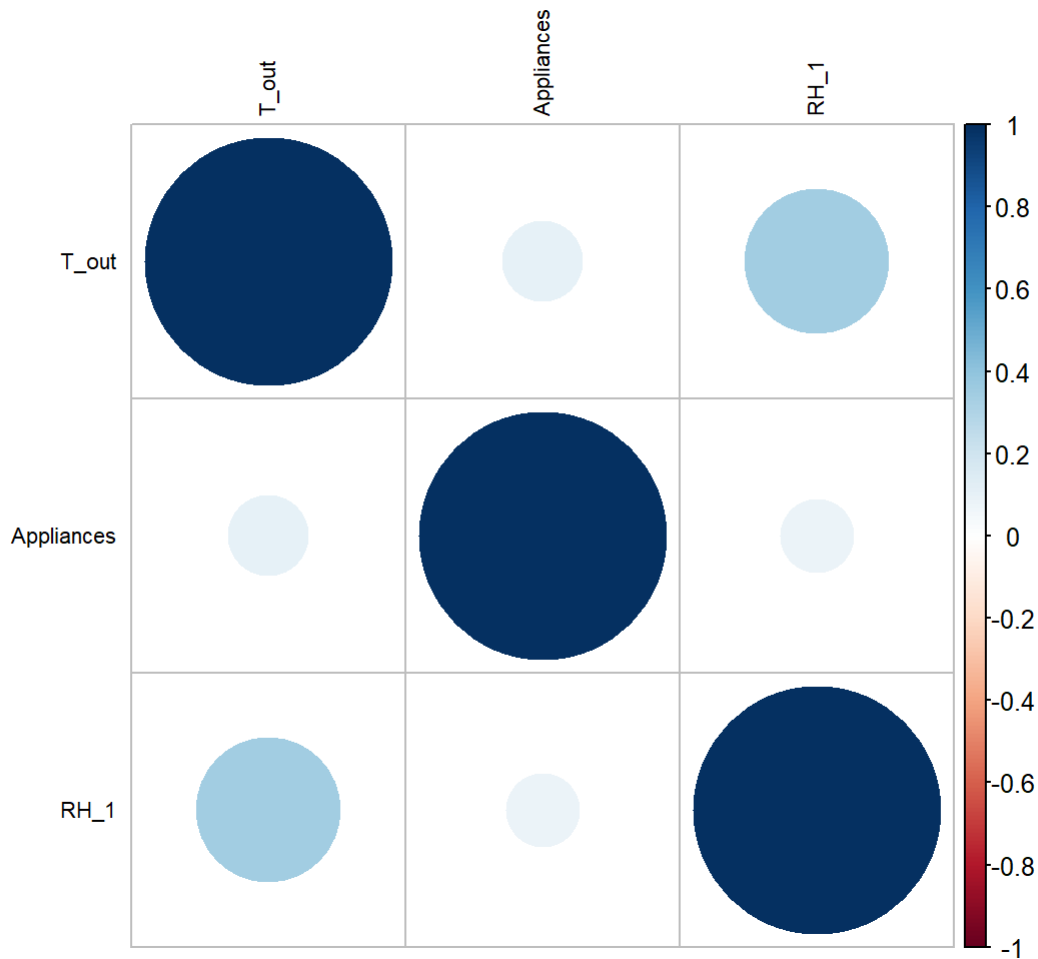
```
# Gráfico de séries temporais para T1 e RH_1
ggplot(data_train, aes(x = date)) +
  geom_line(aes(y = T1, color = "T1")) +
  geom_line(aes(y = RH_1, color = "RH_1")) +
  labs(title = "Séries Temporais de T1 e RH_1",
        x = "Data",
        y = "Valor") +
  scale_color_manual(values = c("T1" = "blue", "RH_1" = "red")) +
  theme_minimal()
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
## Removed 113 rows containing missing values (`geom_line()`).
```

Séries Temporais de T1 e RH_1



```
# Crie a matriz de correlação (substitua as variáveis pelas desejadas)
correlation_matrix <- cor(data_train[, c("T_out", "Appliances", "RH_1")])
corrplot(correlation_matrix, method = "circle", type = "full", tl.cex = 0.7, tl.col = "black") #
Plot da matriz de correlação
```

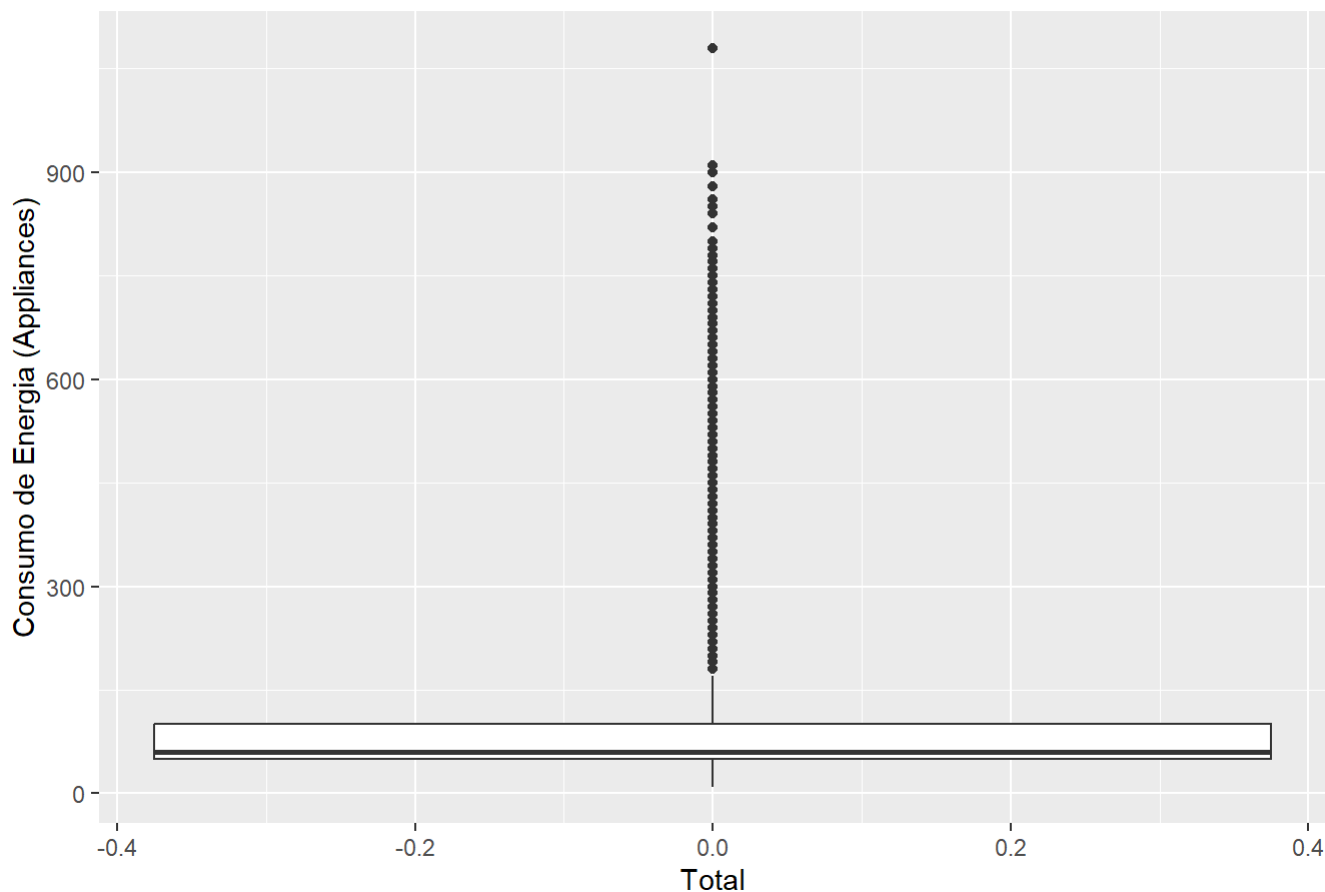


Verificação de outliers

```
## Verificação de outliers
# Trate os valores ausentes, por exemplo, preenchendo-os com a média
data_train$Appliances[is.na(data_train$Appliances)] <- mean(data_train$Appliances, na.rm = TRUE)
```

```
# 1) Verifique a presença de outliers (boxplot)
ggplot(data_train, aes(y = Appliances)) +
  geom_boxplot() +
  ylab("Consumo de Energia (Appliances)") +
  xlab("Total") +
  ggtitle("Gráfico variável alvo com outliers")
```

Gráfico variável alvo com outliers



```
# Trate os outliers, se necessário
Q1 <- quantile(data_train$Appliances, 0.25)
Q3 <- quantile(data_train$Appliances, 0.75)
IQR <- Q3 - Q1
limite_superior <- Q3 + 1.5 * IQR
```

```
# Verificação outliers
out <- data_train$Appliances[data_train$Appliances > limite_superior] <- limite_superior
out
```

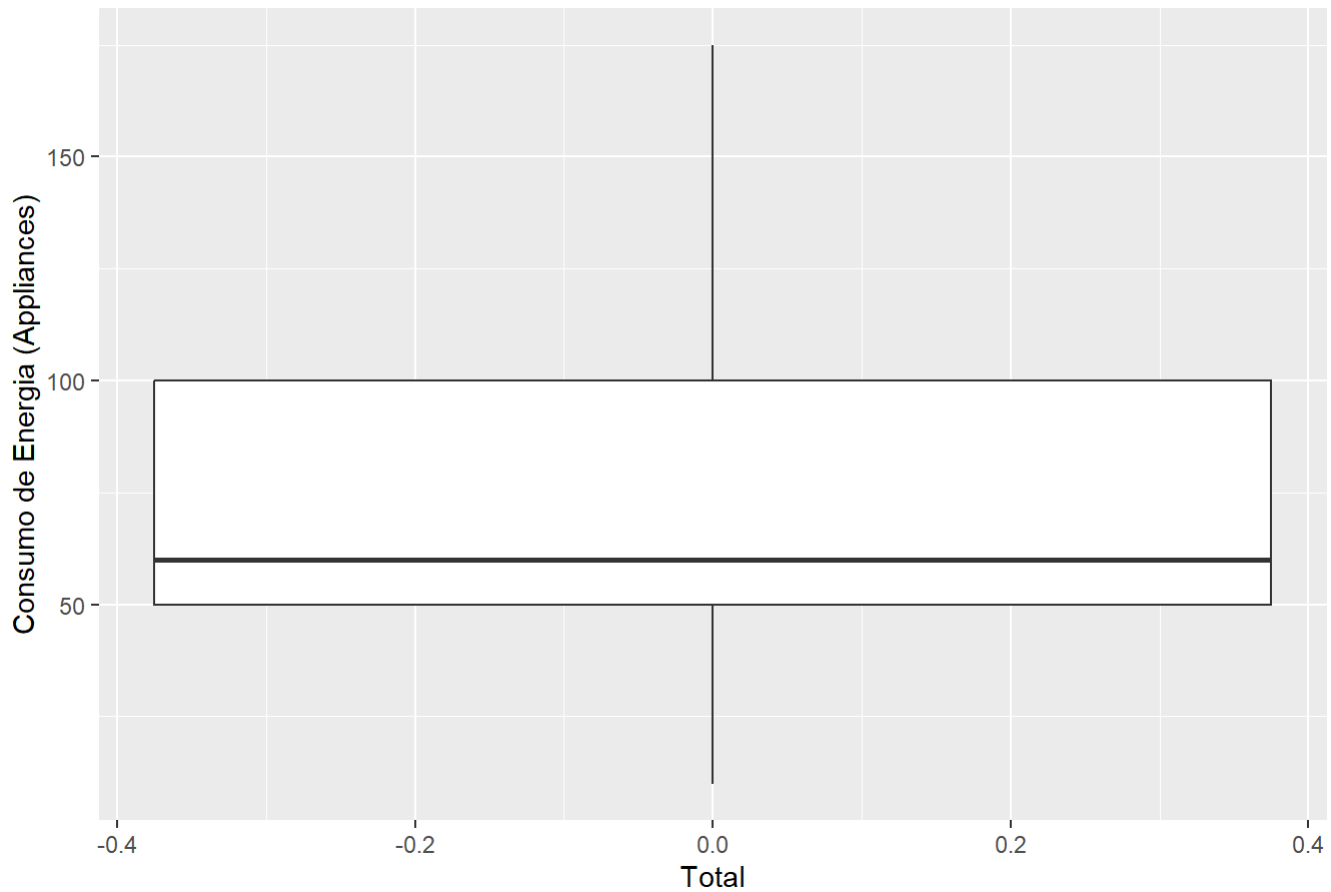
```
## 75%
## 175
```

```
## Limpeza de dados
colunas_com_valores_ausentes <- colnames(data_train)[apply(data_train, 2, function(x) any(is.na(x)))]
data_sem_valores_ausentes <- na.omit(data_train)
data_train$Appliances[is.na(data_train$Appliances)] <- mean(data_train$Appliances, na.rm = TRUE)
colunas_com_valores_ausentes <- colnames(data_train)[apply(data_train, 2, function(x) any(is.na(x)))]
```



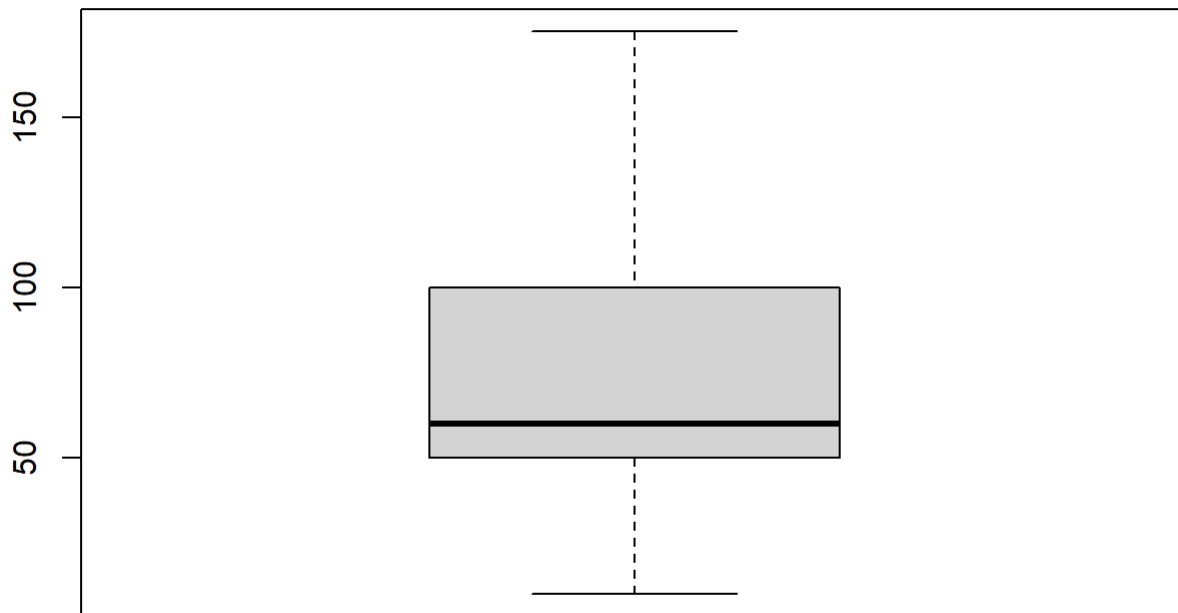
```
# Gráfico sem outliers
ggplot(data_train, aes(y = Appliances)) +
  geom_boxplot() +
  ylab("Consumo de Energia (Appliances)") +
  xlab("Total") +
  ggtitle("Gráfico variável alvo sem outliers")
```

Gráfico variável alvo sem outliers



```
# 2) Verifique a presença de outliers (boxplot)
boxplot(data_train$Appliances)
title("Gráfico variável alvo sem outlier")
```

Gráfico variável alvo sem outlier



Treino e teste

OBS: Colunas alvos são RV1 RV2

```
# Divisão dos dados em conjuntos de treinamento e teste (por exemplo, 80% treinamento, 20% teste)
set.seed(123) # Para garantir a reprodutibilidade
sample_indices <- sample(nrow(data_train), 0.8 * nrow(data_train))
x_train <- data_train[sample_indices, ]
y_test <- data_train[-sample_indices, ]
```

```
# Visualizando os dados treino
dim(x_train)
```

```
## [1] 11842    32
```

```
# Visualizando os dados teste
dim(y_test)
```

```
## [1] 2961    32
```

Modelo machine learning

```
# Modelo de regressão linear múltipla
modelo_regressao <- lm(Appliances ~ rv1 + rv2, data = x_train)
modelo_regressao
```

```
##
## Call:
## lm(formula = Appliances ~ rv1 + rv2, data = x_train)
##
## Coefficients:
## (Intercept)          rv1          rv2
##    80.22956    -0.05358         NA
```

```
# Visualize os coeficientes do modelo
summary(modelo_regressao)
```

```
##
## Call:
## lm(formula = Appliances ~ rv1 + rv2, data = x_train)
##
## Residuals:
##    Min     1Q  Median     3Q    Max
## -70.08 -29.05 -18.23  20.48  97.44
##
## Coefficients: (1 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  80.22956    0.79080  101.454  <2e-16 ***
## rv1         -0.05358    0.02726   -1.965   0.0494 *
## rv2              NA          NA      NA      NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 42.98 on 11840 degrees of freedom
## Multiple R-squared:  0.0003261, Adjusted R-squared:  0.0002416
## F-statistic: 3.862 on 1 and 11840 DF, p-value: 0.04942
```

```
# Previsão
predictions_modelo_regressao <- predict(modelo_regressao, newdata = y_test)
predictions_modelo_regressao
```

##	1	2	3	4	5	6	7	8
##	80.06405	78.93813	78.90743	79.94040	78.74805	78.81051	78.11497	78.95008
##	9	10	11	12	13	14	15	16
##	79.05595	80.04022	79.33912	79.32123	79.15803	80.07169	77.88214	78.53251
##	17	18	19	20	21	22	23	24
##	79.88299	78.26918	78.51481	79.01363	78.86020	80.02312	78.27583	79.01568
##	25	26	27	28	29	30	31	32
##	78.81075	79.44270	77.85487	79.72274	78.76248	79.18773	77.97795	78.84513
##	33	34	35	36	37	38	39	40
##	79.50908	78.84036	79.88357	77.69008	77.67564	79.53943	77.94180	79.22636
##	41	42	43	44	45	46	47	48
##	78.53806	78.96867	78.34775	80.05689	78.20780	78.56756	79.77529	78.95090
##	49	50	51	52	53	54	55	56
##	79.35353	79.96390	79.15681	80.00691	77.63317	79.39244	79.15975	78.77726
##	57	58	59	60	61	62	63	64
##	79.20006	79.76933	78.96532	79.48792	77.74227	79.61217	79.33610	77.60813
##	65	66	67	68	69	70	71	72
##	78.46198	79.28774	79.73378	78.22674	78.33865	77.98363	78.78869	77.76361
##	73	74	75	76	77	78	79	80
##	77.70470	78.31193	78.32075	78.89583	78.88409	79.72117	78.46671	77.63231
##	81	82	83	84	85	86	87	88
##	78.20260	79.29584	78.60498	79.32827	79.32711	77.80165	78.16507	78.47561
##	89	90	91	92	93	94	95	96
##	79.10888	77.97237	77.61589	77.68208	79.31812	79.35929	79.54382	78.01002
##	97	98	99	100	101	102	103	104
##	79.01913	78.43994	78.41903	78.70880	79.71044	79.69528	78.01125	78.81754
##	105	106	107	108	109	110	111	112
##	79.25901	79.89891	79.09331	78.11567	79.09748	77.80363	78.68041	78.27451
##	113	114	115	116	117	118	119	120
##	78.77671	78.59689	79.80571	78.28153	80.15350	78.56751	79.44644	79.00761
##	121	122	123	124	125	126	127	128
##	78.55461	77.92924	77.75073	78.35507	77.79162	78.68437	77.75330	79.06427
##	129	130	131	132	133	134	135	136
##	79.53117	78.29966	78.04948	78.91760	77.65287	77.82051	80.03404	80.18146
##	137	138	139	140	141	142	143	144
##	78.30382	77.83579	79.08207	78.59540	78.26058	80.08829	78.43377	79.58760
##	145	146	147	148	149	150	151	152
##	77.57000	78.77163	78.81570	79.47375	77.67127	77.56469	80.21422	78.03395
##	153	154	155	156	157	158	159	160
##	78.64491	79.32845	77.71304	80.10623	77.73876	78.99096	79.63814	78.51841
##	161	162	163	164	165	166	167	168
##	78.87024	79.42686	79.30154	78.10876	79.92922	78.91423	77.99828	79.48366
##	169	170	171	172	173	174	175	176
##	79.03561	79.80077	78.08137	79.19755	77.67575	78.18664	79.82808	78.14315
##	177	178	179	180	181	182	183	184
##	77.72305	78.35071	78.33785	79.88714	80.04942	79.96642	79.38777	77.65489
##	185	186	187	188	189	190	191	192
##	78.20761	79.15089	78.20897	79.41313	77.91328	78.24192	78.85796	79.15998
##	193	194	195	196	197	198	199	200
##	77.61705	78.88754	79.04093	78.36896	79.78519	80.12713	79.22887	79.59088
##	201	202	203	204	205	206	207	208
##	78.50163	79.60875	79.80385	80.13436	79.84576	79.62721	79.21060	79.87964

##	209	210	211	212	213	214	215	216
##	77.91652	79.53328	78.37574	80.17120	79.39208	79.42343	79.79397	77.98072
##	217	218	219	220	221	222	223	224
##	79.03697	78.38143	77.81800	79.99065	78.79746	78.59134	80.17351	79.19163
##	225	226	227	228	229	230	231	232
##	79.10630	78.26791	79.96153	77.99915	78.86518	77.95410	79.63037	80.11225
##	233	234	235	236	237	238	239	240
##	79.98606	79.65314	79.05167	77.97787	77.83810	78.52016	78.74414	78.17666
##	241	242	243	244	245	246	247	248
##	78.12071	80.11250	78.69494	77.96833	78.67212	78.54961	78.00833	77.62449
##	249	250	251	252	253	254	255	256
##	79.30451	80.00157	78.77401	79.21499	80.07252	78.64454	79.01710	80.16130
##	257	258	259	260	261	262	263	264
##	80.01373	77.83451	79.40802	78.63030	78.55370	79.06833	77.91200	79.29757
##	265	266	267	268	269	270	271	272
##	80.18032	78.68375	79.87695	80.09403	78.78837	77.64405	78.52467	79.88556
##	273	274	275	276	277	278	279	280
##	78.90945	78.10740	79.54347	79.76071	78.06804	79.62313	79.01424	79.41353
##	281	282	283	284	285	286	287	288
##	79.37111	80.01769	77.56450	78.19980	80.04666	78.94256	80.13116	79.82837
##	289	290	291	292	293	294	295	296
##	78.41125	80.22794	79.55526	79.40086	78.76106	80.04453	79.58409	79.19253
##	297	298	299	300	301	302	303	304
##	78.10984	79.94495	79.35518	79.48720	78.45219	79.89778	78.31270	79.65390
##	305	306	307	308	309	310	311	312
##	78.64702	80.20103	79.69051	78.40525	78.79878	78.39105	77.78073	78.68766
##	313	314	315	316	317	318	319	320
##	79.81129	78.11670	79.15580	80.09922	79.64189	79.78585	78.32540	78.72176
##	321	322	323	324	325	326	327	328
##	79.82044	77.78210	77.93562	78.63410	78.08518	79.33637	78.31897	78.46243
##	329	330	331	332	333	334	335	336
##	78.18649	80.21156	78.91181	77.88348	77.75871	77.85024	78.86267	79.04761
##	337	338	339	340	341	342	343	344
##	79.46262	78.53631	79.14654	79.58918	78.77797	80.15051	79.14146	77.89363
##	345	346	347	348	349	350	351	352
##	78.08442	78.14077	78.77407	78.46180	77.64453	77.89603	78.37688	78.58265
##	353	354	355	356	357	358	359	360
##	79.32422	79.77764	80.20131	77.93552	78.59508	79.25650	78.94854	78.35009
##	361	362	363	364	365	366	367	368
##	78.76341	79.64536	79.32248	79.96499	79.37054	77.95321	79.09624	79.71483
##	369	370	371	372	373	374	375	376
##	79.97585	77.83121	78.70303	77.94998	77.69274	78.20152	79.78996	77.84540
##	377	378	379	380	381	382	383	384
##	78.82461	79.15341	78.69669	77.73766	78.38720	78.94781	78.53238	79.65097
##	385	386	387	388	389	390	391	392
##	79.92420	78.17019	79.31613	79.68194	78.54578	80.17367	79.20725	79.95589
##	393	394	395	396	397	398	399	400
##	78.12495	79.70956	77.66911	80.01543	77.94038	77.91754	79.56581	79.58880
##	401	402	403	404	405	406	407	408
##	79.97463	79.88897	79.14080	79.62975	78.65811	78.78353	78.16836	80.03911
##	409	410	411	412	413	414	415	416
##	79.11267	77.92337	79.39760	78.81219	78.37056	79.48069	77.73449	80.07212

##	417	418	419	420	421	422	423	424
##	77.77669	78.27067	79.99982	78.10101	78.03922	80.22263	77.64659	78.75790
##	425	426	427	428	429	430	431	432
##	79.78039	77.73068	78.30056	78.79087	79.86559	79.92458	78.08595	78.79071
##	433	434	435	436	437	438	439	440
##	77.92426	77.91693	78.94937	77.68257	79.94344	79.75433	77.70778	79.08353
##	441	442	443	444	445	446	447	448
##	79.16769	79.82161	79.92655	79.13919	79.27443	77.59685	77.89775	77.95143
##	449	450	451	452	453	454	455	456
##	80.18604	78.91417	78.39992	78.60527	78.25813	78.83714	78.55934	78.39041
##	457	458	459	460	461	462	463	464
##	78.05012	78.43928	77.90527	78.79022	77.71152	77.79056	79.15776	80.19991
##	465	466	467	468	469	470	471	472
##	79.66336	79.51804	78.19716	79.21847	78.93094	78.43287	78.57329	78.73172
##	473	474	475	476	477	478	479	480
##	78.83858	80.16876	80.08901	80.10555	77.95452	78.84836	80.05847	79.86741
##	481	482	483	484	485	486	487	488
##	79.19248	78.78236	77.61093	79.42539	77.60426	77.65355	80.09127	78.17283
##	489	490	491	492	493	494	495	496
##	80.00311	79.33586	79.02290	79.39624	80.12722	77.88229	77.96667	79.02476
##	497	498	499	500	501	502	503	504
##	79.08103	80.03872	78.22069	80.05698	78.43197	79.13942	77.87046	79.94205
##	505	506	507	508	509	510	511	512
##	79.62745	79.33631	77.62797	77.58492	77.73290	78.00996	77.55284	77.89197
##	513	514	515	516	517	518	519	520
##	79.20026	79.33231	79.71873	78.66333	77.99073	78.56464	78.31253	79.18390
##	521	522	523	524	525	526	527	528
##	79.96657	79.63493	79.81294	79.42603	78.56295	78.67668	80.03478	79.88080
##	529	530	531	532	533	534	535	536
##	77.72724	80.03826	79.62401	77.90661	79.12524	79.33078	79.76768	78.51650
##	537	538	539	540	541	542	543	544
##	78.72437	77.73330	79.48940	78.16535	79.85368	79.60627	78.76411	79.54297
##	545	546	547	548	549	550	551	552
##	78.18646	79.10858	79.33695	77.80655	79.87385	78.06941	77.55793	80.16217
##	553	554	555	556	557	558	559	560
##	79.64112	79.38276	78.11401	79.63939	79.72641	77.67925	78.16713	80.19398
##	561	562	563	564	565	566	567	568
##	78.74146	78.28477	80.01955	77.58008	78.61097	78.70543	79.63050	77.58328
##	569	570	571	572	573	574	575	576
##	78.71676	78.05294	78.68704	78.10963	79.91267	79.29040	80.03617	78.42258
##	577	578	579	580	581	582	583	584
##	79.56794	80.09508	79.62526	79.23646	79.59726	79.85352	79.87417	80.00926
##	585	586	587	588	589	590	591	592
##	79.63644	78.08358	77.95417	79.21820	79.20842	79.84120	78.74656	78.25885
##	593	594	595	596	597	598	599	600
##	79.22174	79.51711	80.12649	78.14278	80.18082	79.25973	79.71722	80.14427
##	601	602	603	604	605	606	607	608
##	79.03789	77.62809	79.16653	78.94345	77.64951	78.06741	78.47358	77.60108
##	609	610	611	612	613	614	615	616
##	79.50376	79.16125	80.04020	78.63449	78.24161	78.62662	78.83867	78.38138
##	617	618	619	620	621	622	623	624
##	78.66929	77.91920	79.15015	78.65517	79.54296	80.19066	78.93895	79.88889

##	625	626	627	628	629	630	631	632
##	78.69537	78.55550	78.13872	79.52108	77.92250	78.32376	79.22002	79.31274
##	633	634	635	636	637	638	639	640
##	77.83430	78.83728	78.23461	79.09651	79.19827	78.27098	79.71415	80.18958
##	641	642	643	644	645	646	647	648
##	79.19255	78.80906	80.10023	80.14460	78.11774	79.94594	78.35646	79.00504
##	649	650	651	652	653	654	655	656
##	79.30612	78.17418	79.19373	78.90853	78.70406	79.54176	78.44933	78.39288
##	657	658	659	660	661	662	663	664
##	79.64423	80.11391	78.48611	77.80434	78.24685	80.11105	78.47264	77.93829
##	665	666	667	668	669	670	671	672
##	79.59105	79.31772	79.68632	77.82762	78.78408	77.64953	78.56608	78.93034
##	673	674	675	676	677	678	679	680
##	79.58909	79.60650	79.43282	79.53819	79.99300	79.56980	79.05413	77.67675
##	681	682	683	684	685	686	687	688
##	79.06527	79.02644	79.54842	79.01106	78.22641	78.79276	79.07022	79.21792
##	689	690	691	692	693	694	695	696
##	78.35147	80.07996	77.85325	78.26487	79.17493	78.00735	78.47431	79.93959
##	697	698	699	700	701	702	703	704
##	79.63008	78.81038	80.02447	79.63472	77.60265	79.83561	78.82751	78.99914
##	705	706	707	708	709	710	711	712
##	78.71226	80.18826	79.58857	78.85204	79.76941	78.21911	78.78132	78.09702
##	713	714	715	716	717	718	719	720
##	78.32235	78.04382	78.63111	79.13004	79.77243	78.03737	78.49038	78.82425
##	721	722	723	724	725	726	727	728
##	79.28103	78.78115	78.73840	77.64083	77.90734	79.67777	78.76239	80.10952
##	729	730	731	732	733	734	735	736
##	79.94295	79.32544	78.62927	78.42730	79.68341	77.92818	79.75903	78.92137
##	737	738	739	740	741	742	743	744
##	78.58358	78.89269	79.64308	78.97372	79.95075	77.63823	79.09358	78.80863
##	745	746	747	748	749	750	751	752
##	79.54473	79.10026	79.43314	79.85104	77.76134	79.01316	78.52755	79.29247
##	753	754	755	756	757	758	759	760
##	78.71126	78.26886	79.37110	79.05283	78.70251	78.02406	78.38793	79.18198
##	761	762	763	764	765	766	767	768
##	79.30854	79.09544	79.04712	79.08566	77.79089	79.12864	79.87228	78.17519
##	769	770	771	772	773	774	775	776
##	78.32621	78.08303	79.60422	78.06576	79.07484	79.03104	79.60428	77.61514
##	777	778	779	780	781	782	783	784
##	78.84915	78.81413	79.41355	79.34417	79.36073	79.48316	78.53094	79.13786
##	785	786	787	788	789	790	791	792
##	79.38659	78.93103	77.98245	79.20777	79.76270	79.31174	78.68011	79.75103
##	793	794	795	796	797	798	799	800
##	79.18822	77.57293	77.63756	79.87297	78.00165	79.89871	78.90403	80.22242
##	801	802	803	804	805	806	807	808
##	77.82513	78.29358	77.73114	78.53348	79.06461	79.56774	79.00812	78.38183
##	809	810	811	812	813	814	815	816
##	79.32369	78.49925	78.99213	77.66564	77.81656	78.42868	78.75842	80.21435
##	817	818	819	820	821	822	823	824
##	78.51914	79.35779	78.64137	78.21140	78.54106	78.00651	77.72224	77.56739
##	825	826	827	828	829	830	831	832
##	79.18191	78.98026	79.90840	79.17207	77.75869	77.61276	78.34009	78.68977

##	833	834	835	836	837	838	839	840
##	79.93181	77.68688	79.07118	78.57070	79.81810	80.17629	80.12367	79.08151
##	841	842	843	844	845	846	847	848
##	78.65595	78.55809	79.19219	78.23737	77.94811	79.16852	78.79866	79.13237
##	849	850	851	852	853	854	855	856
##	80.07279	78.64651	79.16033	80.14112	78.46691	79.92035	77.82775	78.93981
##	857	858	859	860	861	862	863	864
##	78.67332	77.75649	80.01515	79.47902	78.41197	79.91014	77.84046	78.18759
##	865	866	867	868	869	870	871	872
##	79.80833	78.14921	78.02092	80.18495	78.30416	80.02728	79.84345	77.62892
##	873	874	875	876	877	878	879	880
##	77.99271	78.86395	78.81766	77.99186	78.80835	77.63029	77.97717	78.80977
##	881	882	883	884	885	886	887	888
##	79.73628	78.24540	79.21348	78.98921	80.21799	79.27729	78.52241	79.69411
##	889	890	891	892	893	894	895	896
##	80.18883	79.85300	78.48701	77.81166	79.87343	79.66479	78.31479	78.95048
##	897	898	899	900	901	902	903	904
##	78.43108	78.44444	80.13995	78.74844	79.82584	80.01058	80.12809	79.52991
##	905	906	907	908	909	910	911	912
##	78.09188	78.33633	79.82751	79.99342	78.93605	78.30716	78.63921	79.98788
##	913	914	915	916	917	918	919	920
##	79.00471	79.91624	77.61561	79.98174	78.17660	78.46498	77.60074	77.60487
##	921	922	923	924	925	926	927	928
##	79.69609	79.74415	78.29183	79.97329	77.94365	79.38031	79.02983	78.50736
##	929	930	931	932	933	934	935	936
##	77.89619	79.34404	79.98748	78.56272	78.72788	79.47220	78.75346	79.84598
##	937	938	939	940	941	942	943	944
##	80.06956	78.73913	78.90051	79.04527	80.09060	78.98307	77.78799	78.11827
##	945	946	947	948	949	950	951	952
##	77.76170	79.44999	79.34036	78.73903	77.95331	78.13079	77.91657	79.57807
##	953	954	955	956	957	958	959	960
##	77.75599	79.46557	77.80049	78.18378	79.42489	78.18267	77.93777	79.30604
##	961	962	963	964	965	966	967	968
##	79.60401	77.77664	79.89941	78.88717	78.91694	80.07605	79.73638	79.95154
##	969	970	971	972	973	974	975	976
##	78.85314	80.05149	79.19692	79.65599	78.63337	79.79210	77.86930	78.57808
##	977	978	979	980	981	982	983	984
##	77.88907	78.95714	78.25314	79.95828	78.52901	78.34864	77.65090	77.60716
##	985	986	987	988	989	990	991	992
##	78.79589	77.94267	79.80761	78.09934	78.31533	78.24595	78.95314	78.98661
##	993	994	995	996	997	998	999	1000
##	77.62387	77.56250	80.01290	77.79338	79.16537	78.60286	79.75901	78.80976
##	1001	1002	1003	1004	1005	1006	1007	1008
##	79.38027	78.09270	79.33253	78.33922	78.13806	78.37325	77.75409	78.60067
##	1009	1010	1011	1012	1013	1014	1015	1016
##	79.28745	78.51905	80.01305	77.69649	78.27471	78.05625	77.84114	78.46414
##	1017	1018	1019	1020	1021	1022	1023	1024
##	79.62778	79.76705	80.08833	80.08129	78.90366	78.76212	78.42301	78.97997
##	1025	1026	1027	1028	1029	1030	1031	1032
##	77.61076	77.85685	79.65261	79.71030	79.63496	79.58757	79.40804	78.24928
##	1033	1034	1035	1036	1037	1038	1039	1040
##	78.85848	80.06419	78.85191	79.77697	79.76706	79.86012	79.00377	78.84799

##	1041	1042	1043	1044	1045	1046	1047	1048
##	79.37859	79.63251	79.86200	79.45233	79.54918	78.65416	79.94396	79.87132
##	1049	1050	1051	1052	1053	1054	1055	1056
##	80.09316	79.13811	80.09843	79.36424	77.57874	79.14712	78.06158	77.73282
##	1057	1058	1059	1060	1061	1062	1063	1064
##	78.19584	78.92119	78.67556	78.78340	79.98449	79.13908	78.98570	78.23396
##	1065	1066	1067	1068	1069	1070	1071	1072
##	80.12573	79.56174	78.79143	78.48352	79.54298	79.32322	79.26729	79.15053
##	1073	1074	1075	1076	1077	1078	1079	1080
##	78.32664	77.56202	77.74440	78.75527	77.56771	79.10967	78.78821	79.41272
##	1081	1082	1083	1084	1085	1086	1087	1088
##	79.52110	79.07311	79.78820	78.55533	79.17480	78.92748	78.45117	77.91023
##	1089	1090	1091	1092	1093	1094	1095	1096
##	77.88998	77.76598	79.53246	78.98904	79.41880	79.33276	78.29283	79.35365
##	1097	1098	1099	1100	1101	1102	1103	1104
##	78.53948	78.67532	78.59151	79.04674	79.95583	79.46274	79.01210	80.09169
##	1105	1106	1107	1108	1109	1110	1111	1112
##	79.60388	79.78149	78.28012	79.88960	78.23935	79.41618	80.18309	79.46803
##	1113	1114	1115	1116	1117	1118	1119	1120
##	78.77923	78.08522	79.68018	78.76736	79.71244	79.83627	78.09785	77.86039
##	1121	1122	1123	1124	1125	1126	1127	1128
##	79.27489	77.92243	78.19694	79.71189	77.82373	79.35017	80.09934	79.74815
##	1129	1130	1131	1132	1133	1134	1135	1136
##	78.82476	79.85060	78.79249	80.05477	78.28034	78.11403	79.16506	79.98193
##	1137	1138	1139	1140	1141	1142	1143	1144
##	79.26582	80.18599	79.31246	79.82449	79.78962	78.22406	78.00927	79.89069
##	1145	1146	1147	1148	1149	1150	1151	1152
##	79.96409	79.41455	78.94579	78.38659	78.12927	78.61340	78.54007	79.24608
##	1153	1154	1155	1156	1157	1158	1159	1160
##	78.38001	79.68207	78.36980	79.83710	77.63098	80.00535	79.35080	79.72844
##	1161	1162	1163	1164	1165	1166	1167	1168
##	78.02584	78.06442	78.53682	79.11848	79.30159	79.09093	78.09812	79.65196
##	1169	1170	1171	1172	1173	1174	1175	1176
##	79.44541	79.54133	78.47877	78.59201	78.67132	80.08743	79.98678	79.39858
##	1177	1178	1179	1180	1181	1182	1183	1184
##	78.40771	79.02651	79.81888	78.78591	80.01842	79.95958	79.03365	79.66663
##	1185	1186	1187	1188	1189	1190	1191	1192
##	79.53958	77.85795	78.99664	79.55525	80.09422	78.47818	78.47574	78.06390
##	1193	1194	1195	1196	1197	1198	1199	1200
##	79.27682	77.81068	78.79443	79.66959	78.47274	80.20338	78.91706	79.79921
##	1201	1202	1203	1204	1205	1206	1207	1208
##	77.89102	79.83637	80.09319	80.20054	80.21398	78.24591	78.81691	79.93762
##	1209	1210	1211	1212	1213	1214	1215	1216
##	78.07711	78.18785	77.86321	80.17917	78.89665	77.74571	80.22135	79.28335
##	1217	1218	1219	1220	1221	1222	1223	1224
##	78.14505	80.20502	79.36733	79.22054	79.88370	79.51949	78.61461	79.05628
##	1225	1226	1227	1228	1229	1230	1231	1232
##	78.87422	78.27526	78.83828	78.29929	77.60243	78.96020	80.11458	77.96578
##	1233	1234	1235	1236	1237	1238	1239	1240
##	78.54573	79.09855	79.06394	79.88717	78.86652	78.52195	78.66750	80.18190
##	1241	1242	1243	1244	1245	1246	1247	1248
##	79.76021	78.86797	78.46183	77.82028	78.11194	77.93301	78.85400	79.80294

##	1249	1250	1251	1252	1253	1254	1255	1256
##	77.56359	78.57243	78.65787	78.92063	79.59161	79.55020	79.24158	79.77015
##	1257	1258	1259	1260	1261	1262	1263	1264
##	79.55672	80.16398	79.06440	78.43189	79.12688	78.58035	80.12370	78.65694
##	1265	1266	1267	1268	1269	1270	1271	1272
##	79.76416	78.55510	79.75364	78.14197	79.70410	77.86548	78.98794	79.06188
##	1273	1274	1275	1276	1277	1278	1279	1280
##	80.02808	79.12065	77.59271	78.03026	79.22644	77.86998	78.35442	79.49839
##	1281	1282	1283	1284	1285	1286	1287	1288
##	77.92973	78.06929	78.89296	79.24313	79.55789	79.17753	79.88007	77.70051
##	1289	1290	1291	1292	1293	1294	1295	1296
##	77.60819	77.72775	77.91023	78.76457	79.02980	78.28912	77.92177	78.65180
##	1297	1298	1299	1300	1301	1302	1303	1304
##	78.58946	80.15419	79.80974	77.91650	79.71547	78.56357	78.77414	78.29993
##	1305	1306	1307	1308	1309	1310	1311	1312
##	78.50999	79.56157	78.54240	78.26163	79.21219	79.80542	79.35804	79.29439
##	1313	1314	1315	1316	1317	1318	1319	1320
##	78.76913	79.04338	78.49602	79.51220	79.99645	77.83087	78.04918	78.97078
##	1321	1322	1323	1324	1325	1326	1327	1328
##	77.98256	79.29403	77.67257	79.24095	79.15221	78.01713	78.38932	79.29400
##	1329	1330	1331	1332	1333	1334	1335	1336
##	78.89350	77.93882	78.64829	77.67621	80.11071	80.09039	79.46493	79.76557
##	1337	1338	1339	1340	1341	1342	1343	1344
##	79.96633	79.36087	78.97439	78.07281	78.56700	78.61029	80.05711	79.24360
##	1345	1346	1347	1348	1349	1350	1351	1352
##	79.02021	79.28588	78.98702	79.89693	77.80066	80.09300	78.80290	78.05721
##	1353	1354	1355	1356	1357	1358	1359	1360
##	78.75489	78.04054	77.76810	78.35186	78.58307	78.10702	79.63893	79.79589
##	1361	1362	1363	1364	1365	1366	1367	1368
##	77.87242	80.22188	80.13549	77.75656	78.94249	79.20942	78.95618	78.74804
##	1369	1370	1371	1372	1373	1374	1375	1376
##	80.07553	78.22084	78.26932	79.89852	78.47135	78.35625	78.14198	77.99755
##	1377	1378	1379	1380	1381	1382	1383	1384
##	79.34888	78.75853	78.74698	77.86267	78.09610	79.36383	79.92283	78.20568
##	1385	1386	1387	1388	1389	1390	1391	1392
##	79.33144	80.08121	79.21635	79.78248	78.73325	78.23739	79.42474	77.74926
##	1393	1394	1395	1396	1397	1398	1399	1400
##	77.56800	78.72729	79.24466	77.74020	78.35384	78.76234	78.01345	80.09701
##	1401	1402	1403	1404	1405	1406	1407	1408
##	77.58164	79.87053	78.31498	77.72601	79.29962	79.56109	77.82763	78.27220
##	1409	1410	1411	1412	1413	1414	1415	1416
##	78.40559	78.93798	78.31474	80.11549	78.17569	77.82501	78.17441	78.17971
##	1417	1418	1419	1420	1421	1422	1423	1424
##	79.52657	78.19188	78.45818	78.27097	78.79748	78.25027	79.14977	78.77318
##	1425	1426	1427	1428	1429	1430	1431	1432
##	80.20849	78.08615	77.56248	80.09391	79.66566	77.82257	79.55010	79.44320
##	1433	1434	1435	1436	1437	1438	1439	1440
##	80.22139	79.73048	78.29230	78.53297	79.81076	80.17968	78.10121	78.62842
##	1441	1442	1443	1444	1445	1446	1447	1448
##	77.59877	78.48332	79.89025	79.37849	79.23494	79.98494	79.24927	78.83408
##	1449	1450	1451	1452	1453	1454	1455	1456
##	80.04994	79.14795	77.67501	78.58664	79.88456	78.42353	78.67826	80.22405

##	1457	1458	1459	1460	1461	1462	1463	1464
##	78.18804	78.11538	77.72689	79.50515	79.73394	77.95945	79.89989	78.14073
##	1465	1466	1467	1468	1469	1470	1471	1472
##	79.47396	80.17539	79.25179	78.37082	78.99509	78.41469	77.59585	77.57108
##	1473	1474	1475	1476	1477	1478	1479	1480
##	78.00719	79.50001	79.32813	77.71004	77.66454	80.15708	79.95542	77.61671
##	1481	1482	1483	1484	1485	1486	1487	1488
##	78.51944	78.91819	79.48635	78.08840	79.98869	78.09295	78.64484	77.79991
##	1489	1490	1491	1492	1493	1494	1495	1496
##	79.75131	79.66903	78.81364	79.61859	79.95615	77.83533	78.34154	78.46664
##	1497	1498	1499	1500	1501	1502	1503	1504
##	79.77995	79.88186	78.37105	77.88391	78.71717	77.59166	77.87163	79.87887
##	1505	1506	1507	1508	1509	1510	1511	1512
##	77.98004	78.29383	80.01022	80.03022	80.21406	79.92378	79.14690	79.58186
##	1513	1514	1515	1516	1517	1518	1519	1520
##	79.27889	79.81905	78.35036	77.92543	79.67321	80.15249	79.95390	79.03972
##	1521	1522	1523	1524	1525	1526	1527	1528
##	80.17362	78.36270	79.18324	80.11814	77.62451	78.13009	78.01821	79.46710
##	1529	1530	1531	1532	1533	1534	1535	1536
##	78.46644	78.12457	78.31413	77.69774	78.95611	78.86814	79.27285	79.22620
##	1537	1538	1539	1540	1541	1542	1543	1544
##	78.59703	77.89899	78.45142	79.02722	78.55099	79.49447	78.91973	79.29204
##	1545	1546	1547	1548	1549	1550	1551	1552
##	79.70183	79.72992	79.22585	79.11858	77.76561	78.37533	78.42819	78.72862
##	1553	1554	1555	1556	1557	1558	1559	1560
##	78.98279	78.59196	79.48574	79.58162	78.06246	78.53789	78.54321	79.08485
##	1561	1562	1563	1564	1565	1566	1567	1568
##	78.76709	80.05295	79.69187	79.34646	78.86609	78.52361	77.87118	78.73399
##	1569	1570	1571	1572	1573	1574	1575	1576
##	78.23999	78.42500	79.40092	77.98824	78.32535	77.57139	78.38820	77.64458
##	1577	1578	1579	1580	1581	1582	1583	1584
##	80.17466	77.73724	78.00614	79.42881	79.42232	79.12704	78.17465	79.88498
##	1585	1586	1587	1588	1589	1590	1591	1592
##	78.21425	79.78094	78.97928	77.61140	78.03099	78.03086	78.67427	78.46573
##	1593	1594	1595	1596	1597	1598	1599	1600
##	78.53015	78.22202	79.36327	77.58979	79.16613	78.51392	78.12449	79.41871
##	1601	1602	1603	1604	1605	1606	1607	1608
##	78.68249	78.50670	79.60707	79.31214	78.05212	77.58254	79.61508	80.02164
##	1609	1610	1611	1612	1613	1614	1615	1616
##	79.58326	78.56107	79.97880	80.13880	78.14712	78.44556	78.03629	78.73188
##	1617	1618	1619	1620	1621	1622	1623	1624
##	80.03184	80.10629	80.22477	77.81132	79.52126	79.18613	79.12930	78.51387
##	1625	1626	1627	1628	1629	1630	1631	1632
##	77.62423	79.70222	79.30650	78.61622	78.26260	80.14057	79.08059	79.52333
##	1633	1634	1635	1636	1637	1638	1639	1640
##	77.88231	77.73148	78.86657	79.68981	78.09565	79.75353	78.48298	78.35607
##	1641	1642	1643	1644	1645	1646	1647	1648
##	78.77964	78.31028	80.05792	78.15737	77.70506	78.22782	79.84603	78.46383
##	1649	1650	1651	1652	1653	1654	1655	1656
##	79.88486	78.47860	78.36709	80.05298	78.66748	79.03723	79.53928	79.35735
##	1657	1658	1659	1660	1661	1662	1663	1664
##	79.27377	78.31779	79.59377	77.86842	78.74187	80.12610	79.95769	78.91973

##	1665	1666	1667	1668	1669	1670	1671	1672
##	79.29358	77.61146	77.69646	79.82657	78.65946	78.33708	78.82614	78.99670
##	1673	1674	1675	1676	1677	1678	1679	1680
##	78.08451	77.90293	79.34665	77.70657	77.60070	80.16779	80.09874	77.72794
##	1681	1682	1683	1684	1685	1686	1687	1688
##	79.49107	78.86126	79.07775	79.66696	77.92515	80.15563	79.70196	80.14468
##	1689	1690	1691	1692	1693	1694	1695	1696
##	79.85360	78.67493	78.05650	78.25934	78.43973	77.90144	77.80035	80.09573
##	1697	1698	1699	1700	1701	1702	1703	1704
##	77.62629	78.53925	78.51610	77.95398	78.93190	77.78273	79.16294	79.08867
##	1705	1706	1707	1708	1709	1710	1711	1712
##	78.91658	79.46075	78.69362	77.73715	77.63536	79.23522	77.98192	77.89191
##	1713	1714	1715	1716	1717	1718	1719	1720
##	80.19147	80.06323	79.09536	78.05800	78.21897	78.88365	77.90626	80.14706
##	1721	1722	1723	1724	1725	1726	1727	1728
##	78.39874	79.69063	79.60482	80.09933	78.31394	79.62696	77.90991	78.03445
##	1729	1730	1731	1732	1733	1734	1735	1736
##	78.84641	77.73887	77.60036	78.68908	79.25588	78.88890	79.77800	78.95401
##	1737	1738	1739	1740	1741	1742	1743	1744
##	79.40085	79.75900	78.90871	78.97728	79.61441	79.18044	79.20919	78.10609
##	1745	1746	1747	1748	1749	1750	1751	1752
##	79.80103	78.07930	79.26691	80.05680	79.09188	78.13734	78.26841	79.11190
##	1753	1754	1755	1756	1757	1758	1759	1760
##	77.62634	79.70536	78.88703	78.74080	78.71382	80.19016	77.74783	78.65581
##	1761	1762	1763	1764	1765	1766	1767	1768
##	78.26470	79.69651	78.88398	78.44372	78.42058	78.30768	79.49198	77.89397
##	1769	1770	1771	1772	1773	1774	1775	1776
##	78.54314	80.09216	78.35784	80.22064	78.92627	79.35544	79.50256	78.52828
##	1777	1778	1779	1780	1781	1782	1783	1784
##	80.18479	78.37652	80.18941	77.63342	79.61842	78.60006	77.86245	77.96702
##	1785	1786	1787	1788	1789	1790	1791	1792
##	78.97476	78.16503	78.32537	78.96801	79.18098	77.69739	77.87034	77.72582
##	1793	1794	1795	1796	1797	1798	1799	1800
##	80.08583	78.43918	79.58006	79.32292	80.05058	79.04989	78.74352	77.57572
##	1801	1802	1803	1804	1805	1806	1807	1808
##	79.47259	78.48600	78.55144	78.66241	77.99100	79.76651	78.60363	79.17082
##	1809	1810	1811	1812	1813	1814	1815	1816
##	79.44170	80.21432	79.24734	77.56369	79.61360	79.66908	77.99427	78.61120
##	1817	1818	1819	1820	1821	1822	1823	1824
##	78.71812	79.30574	79.05347	79.95546	80.11929	78.68143	77.95989	77.96941
##	1825	1826	1827	1828	1829	1830	1831	1832
##	78.30373	78.32326	78.25541	78.23202	80.07588	79.02649	80.02638	79.76488
##	1833	1834	1835	1836	1837	1838	1839	1840
##	79.55799	78.97514	79.36861	78.84574	78.77313	78.18583	78.21155	78.81819
##	1841	1842	1843	1844	1845	1846	1847	1848
##	79.07988	79.82197	80.01341	78.64512	79.49881	78.33728	78.15466	78.21738
##	1849	1850	1851	1852	1853	1854	1855	1856
##	78.92763	79.39394	78.74142	79.18677	79.84496	78.26091	77.57935	77.58684
##	1857	1858	1859	1860	1861	1862	1863	1864
##	77.77889	79.45030	78.67662	79.68761	80.14148	78.94742	77.88915	77.56390
##	1865	1866	1867	1868	1869	1870	1871	1872
##	79.72468	79.93688	78.07864	80.11706	77.93667	78.34688	77.58896	77.92926

##	1873	1874	1875	1876	1877	1878	1879	1880
##	77.90895	78.58497	78.60238	77.91214	80.18478	78.55722	79.70803	80.18054
##	1881	1882	1883	1884	1885	1886	1887	1888
##	78.87578	78.50334	78.27940	79.38129	79.51312	78.87770	77.56431	79.43626
##	1889	1890	1891	1892	1893	1894	1895	1896
##	78.99317	79.57803	78.92563	79.43886	78.11692	78.92268	77.87379	78.67445
##	1897	1898	1899	1900	1901	1902	1903	1904
##	78.82117	79.44742	79.73995	79.48988	79.36957	77.75405	77.66438	78.44035
##	1905	1906	1907	1908	1909	1910	1911	1912
##	79.10572	78.73030	80.00090	78.79925	78.95460	79.27026	78.27050	77.57880
##	1913	1914	1915	1916	1917	1918	1919	1920
##	79.16873	80.11634	79.10450	78.85703	79.35404	80.05267	79.77825	80.11670
##	1921	1922	1923	1924	1925	1926	1927	1928
##	78.70141	77.92275	80.16709	78.84509	80.18444	77.73782	77.85771	79.54881
##	1929	1930	1931	1932	1933	1934	1935	1936
##	79.70227	80.00375	79.28431	78.39662	78.99844	79.09469	78.29891	78.58111
##	1937	1938	1939	1940	1941	1942	1943	1944
##	79.76763	79.16399	78.65370	77.79981	80.08594	79.98136	79.41556	80.16709
##	1945	1946	1947	1948	1949	1950	1951	1952
##	79.28760	78.98298	79.82606	77.88536	77.76150	78.28530	78.87838	77.99050
##	1953	1954	1955	1956	1957	1958	1959	1960
##	77.68283	79.24850	80.18679	79.31812	78.56954	80.16510	78.33531	78.44055
##	1961	1962	1963	1964	1965	1966	1967	1968
##	78.01125	78.58710	79.13089	77.57838	80.06341	79.45786	78.51799	78.96102
##	1969	1970	1971	1972	1973	1974	1975	1976
##	79.84183	77.60101	77.99250	79.08376	78.78565	78.52572	80.13931	79.76082
##	1977	1978	1979	1980	1981	1982	1983	1984
##	77.89958	77.69956	79.61184	79.65999	78.36823	79.61547	78.79463	78.43170
##	1985	1986	1987	1988	1989	1990	1991	1992
##	77.70079	77.92628	79.88943	78.75179	78.16487	78.35225	78.07377	78.05166
##	1993	1994	1995	1996	1997	1998	1999	2000
##	77.68449	79.98177	77.88892	79.98064	79.77068	79.66759	79.30203	79.44741
##	2001	2002	2003	2004	2005	2006	2007	2008
##	79.13733	79.61258	79.88708	79.63554	77.98551	80.00434	79.93849	79.84566
##	2009	2010	2011	2012	2013	2014	2015	2016
##	79.59997	77.73694	78.12395	80.04378	79.81977	78.71869	77.59138	80.02794
##	2017	2018	2019	2020	2021	2022	2023	2024
##	78.74137	80.12333	78.28000	79.68220	78.16057	78.87502	77.92998	79.95922
##	2025	2026	2027	2028	2029	2030	2031	2032
##	78.84314	78.16353	79.75644	78.70703	79.21009	79.76531	77.95790	77.95024
##	2033	2034	2035	2036	2037	2038	2039	2040
##	77.88822	79.78041	78.50196	79.94626	77.57367	78.64914	80.19335	78.57350
##	2041	2042	2043	2044	2045	2046	2047	2048
##	78.18659	77.94930	79.53707	78.46708	77.79674	79.69519	77.88067	79.36210
##	2049	2050	2051	2052	2053	2054	2055	2056
##	78.76739	79.01931	78.18147	78.10425	78.10503	78.47366	78.90631	78.53883
##	2057	2058	2059	2060	2061	2062	2063	2064
##	77.86892	78.99545	80.00451	79.09780	78.49068	79.97257	79.33388	78.57626
##	2065	2066	2067	2068	2069	2070	2071	2072
##	79.01423	79.33769	77.84004	79.15525	78.13154	77.85703	77.85429	79.43542
##	2073	2074	2075	2076	2077	2078	2079	2080
##	77.69541	78.43573	78.78789	79.70821	78.91139	79.55391	78.02965	78.95789

##	2081	2082	2083	2084	2085	2086	2087	2088
##	79.93488	78.88653	78.99244	77.76434	78.17149	78.91878	78.01643	78.21525
##	2089	2090	2091	2092	2093	2094	2095	2096
##	78.06357	79.60113	79.39727	78.96898	77.75223	77.69438	79.44930	78.09246
##	2097	2098	2099	2100	2101	2102	2103	2104
##	78.63190	78.02806	78.64251	79.62407	79.66182	79.51220	78.12413	79.57111
##	2105	2106	2107	2108	2109	2110	2111	2112
##	79.79432	78.70056	78.73058	77.84318	79.50725	79.95351	80.21445	77.98717
##	2113	2114	2115	2116	2117	2118	2119	2120
##	78.93778	79.42120	77.73008	77.94653	79.05168	80.03818	77.60547	77.87300
##	2121	2122	2123	2124	2125	2126	2127	2128
##	79.11126	78.67315	78.23571	79.33746	79.10761	78.61436	79.46723	79.05858
##	2129	2130	2131	2132	2133	2134	2135	2136
##	79.08183	77.94352	79.96919	78.68704	79.84495	79.99230	77.74914	79.96475
##	2137	2138	2139	2140	2141	2142	2143	2144
##	78.98999	79.90011	78.22830	77.98746	78.40063	77.57814	78.15457	79.41840
##	2145	2146	2147	2148	2149	2150	2151	2152
##	78.89210	79.68803	77.63749	78.96254	78.30538	79.73073	80.13767	79.19397
##	2153	2154	2155	2156	2157	2158	2159	2160
##	78.61568	80.05073	79.55397	79.32095	78.18458	78.30921	77.78707	78.35661
##	2161	2162	2163	2164	2165	2166	2167	2168
##	79.01662	79.37127	79.26293	77.98324	79.08489	79.71086	79.43416	78.04191
##	2169	2170	2171	2172	2173	2174	2175	2176
##	78.48952	79.53295	78.27342	80.10744	80.13566	77.82721	77.97888	79.49592
##	2177	2178	2179	2180	2181	2182	2183	2184
##	78.31951	79.06149	80.19794	79.02189	78.30064	79.14776	79.44369	78.43686
##	2185	2186	2187	2188	2189	2190	2191	2192
##	77.62262	77.76071	78.53366	79.88079	78.24961	78.75715	80.01593	79.70965
##	2193	2194	2195	2196	2197	2198	2199	2200
##	79.59076	77.77845	78.39650	80.18124	79.33026	79.40580	80.20879	80.18526
##	2201	2202	2203	2204	2205	2206	2207	2208
##	78.26874	78.51331	78.51811	78.90309	78.86828	79.10501	78.14518	77.90450
##	2209	2210	2211	2212	2213	2214	2215	2216
##	78.62819	78.37793	78.72873	78.35130	78.59005	79.73697	79.37365	79.52957
##	2217	2218	2219	2220	2221	2222	2223	2224
##	79.05950	79.22292	80.05312	78.92844	78.55447	79.18551	78.33527	79.66354
##	2225	2226	2227	2228	2229	2230	2231	2232
##	80.18608	80.08477	77.88525	78.18686	79.95771	79.20657	78.10269	79.88209
##	2233	2234	2235	2236	2237	2238	2239	2240
##	78.36834	78.68251	78.56981	78.38299	79.99337	78.74367	79.64172	79.64519
##	2241	2242	2243	2244	2245	2246	2247	2248
##	78.39678	79.42881	79.45568	78.56978	77.86091	79.46899	78.72801	78.61767
##	2249	2250	2251	2252	2253	2254	2255	2256
##	78.84816	78.44252	78.64635	80.00069	78.77848	79.17891	77.78780	79.02406
##	2257	2258	2259	2260	2261	2262	2263	2264
##	79.61984	77.76853	79.95694	79.42592	79.49100	79.25625	78.86261	78.02313
##	2265	2266	2267	2268	2269	2270	2271	2272
##	79.00295	77.61070	78.82434	78.38502	78.53785	79.00148	79.41059	77.71970
##	2273	2274	2275	2276	2277	2278	2279	2280
##	79.54346	79.74541	79.12572	79.99535	77.84996	78.54090	77.66301	78.02098
##	2281	2282	2283	2284	2285	2286	2287	2288
##	78.68165	79.81292	79.61624	77.57840	78.62535	78.65633	80.02642	79.16986

##	2289	2290	2291	2292	2293	2294	2295	2296
##	78.87473	78.08312	77.81259	78.50880	78.76016	78.22044	78.33557	78.97413
##	2297	2298	2299	2300	2301	2302	2303	2304
##	79.60112	77.93059	78.11418	77.63270	78.78924	78.24892	78.95081	79.30134
##	2305	2306	2307	2308	2309	2310	2311	2312
##	77.91087	78.83199	79.55464	77.67105	78.03165	79.90729	78.82520	78.75043
##	2313	2314	2315	2316	2317	2318	2319	2320
##	77.93430	80.19464	78.07649	78.86122	78.70600	78.59258	79.99012	78.31141
##	2321	2322	2323	2324	2325	2326	2327	2328
##	78.36517	79.99142	79.38363	77.57341	79.22233	79.98711	80.20065	79.33231
##	2329	2330	2331	2332	2333	2334	2335	2336
##	78.40409	78.83600	79.02346	78.94873	78.50227	79.53084	78.48147	79.07105
##	2337	2338	2339	2340	2341	2342	2343	2344
##	77.69263	78.95936	77.61786	77.75377	78.63448	78.73468	80.00235	79.95623
##	2345	2346	2347	2348	2349	2350	2351	2352
##	78.87777	79.74182	79.96739	80.15453	78.29568	77.80766	79.31009	78.97271
##	2353	2354	2355	2356	2357	2358	2359	2360
##	79.51747	79.49049	78.55823	78.97048	79.14586	78.30522	80.03304	78.47780
##	2361	2362	2363	2364	2365	2366	2367	2368
##	79.69006	79.06455	79.14108	80.10673	78.16687	78.81762	78.24252	78.31928
##	2369	2370	2371	2372	2373	2374	2375	2376
##	78.23115	80.10754	78.40752	79.13634	78.74510	79.85113	77.78926	78.53264
##	2377	2378	2379	2380	2381	2382	2383	2384
##	80.15862	79.69075	77.70582	78.94539	79.00352	78.14685	80.19512	78.25555
##	2385	2386	2387	2388	2389	2390	2391	2392
##	79.38100	78.30392	77.66976	78.07634	79.64708	79.70751	78.35950	77.56340
##	2393	2394	2395	2396	2397	2398	2399	2400
##	80.16059	78.83281	79.49028	79.73057	79.33376	79.28033	78.33857	79.25325
##	2401	2402	2403	2404	2405	2406	2407	2408
##	79.68309	78.31079	78.87417	78.90691	79.82842	77.66595	78.11008	80.08697
##	2409	2410	2411	2412	2413	2414	2415	2416
##	78.48999	79.03281	77.77572	79.79300	77.86595	78.95191	78.95705	79.80767
##	2417	2418	2419	2420	2421	2422	2423	2424
##	78.70671	78.79625	77.77372	80.13950	78.51695	78.46948	79.98111	77.62405
##	2425	2426	2427	2428	2429	2430	2431	2432
##	80.05620	78.72494	79.97433	78.45337	79.58161	79.80359	77.59727	79.23270
##	2433	2434	2435	2436	2437	2438	2439	2440
##	80.22881	78.15147	79.28658	79.14939	78.51502	79.32515	78.02567	80.21279
##	2441	2442	2443	2444	2445	2446	2447	2448
##	78.54368	79.65438	79.92764	79.99210	79.66973	80.09200	78.26569	78.54504
##	2449	2450	2451	2452	2453	2454	2455	2456
##	79.25879	79.10643	78.16657	79.76311	78.78809	77.56148	79.91467	78.21000
##	2457	2458	2459	2460	2461	2462	2463	2464
##	78.32506	78.70789	77.89296	80.19666	78.87359	79.86841	79.89782	80.16799
##	2465	2466	2467	2468	2469	2470	2471	2472
##	79.09632	78.63548	80.14426	77.62873	80.20574	78.64029	78.15166	79.53170
##	2473	2474	2475	2476	2477	2478	2479	2480
##	79.42928	79.59838	77.79463	78.99449	80.03906	79.86367	79.80209	79.26009
##	2481	2482	2483	2484	2485	2486	2487	2488
##	79.84498	79.05607	77.98742	78.34115	80.05514	78.35492	78.58162	80.20753
##	2489	2490	2491	2492	2493	2494	2495	2496
##	78.78979	78.58686	80.07219	80.17557	78.58010	77.97989	78.76575	80.16627

##	2497	2498	2499	2500	2501	2502	2503	2504
##	79.60534	78.61057	78.28220	79.96711	79.01439	79.52853	78.58183	78.85126
##	2505	2506	2507	2508	2509	2510	2511	2512
##	79.85074	79.46063	80.22266	79.57664	79.15232	79.04348	77.76516	78.01795
##	2513	2514	2515	2516	2517	2518	2519	2520
##	79.56055	78.05693	78.66292	79.32166	77.95680	80.12647	79.51390	78.50535
##	2521	2522	2523	2524	2525	2526	2527	2528
##	79.64358	79.79357	78.00715	78.50958	78.93703	77.58493	80.03649	78.58856
##	2529	2530	2531	2532	2533	2534	2535	2536
##	77.62237	79.69350	78.11781	80.12392	79.05372	77.67525	78.31495	78.84729
##	2537	2538	2539	2540	2541	2542	2543	2544
##	79.61358	79.13131	79.42665	78.36646	78.76490	78.00762	79.32977	77.90669
##	2545	2546	2547	2548	2549	2550	2551	2552
##	77.97317	78.95968	78.76802	79.95109	78.14534	77.80461	77.64267	79.38974
##	2553	2554	2555	2556	2557	2558	2559	2560
##	80.02627	77.86983	78.95086	79.29915	78.01366	80.01106	77.80154	77.59984
##	2561	2562	2563	2564	2565	2566	2567	2568
##	79.98306	79.34276	79.13929	79.21172	80.13382	77.75812	77.89085	80.08431
##	2569	2570	2571	2572	2573	2574	2575	2576
##	79.88723	80.11497	79.82352	79.53107	78.69794	79.64856	80.07329	80.16416
##	2577	2578	2579	2580	2581	2582	2583	2584
##	77.63852	77.58866	79.49435	79.41997	78.32597	78.15121	79.54288	78.81174
##	2585	2586	2587	2588	2589	2590	2591	2592
##	79.06853	78.10881	78.72121	78.59091	78.49616	78.46504	79.63545	79.37013
##	2593	2594	2595	2596	2597	2598	2599	2600
##	80.18573	78.48444	78.53358	77.70225	77.67663	79.40037	80.11938	79.34427
##	2601	2602	2603	2604	2605	2606	2607	2608
##	79.93865	78.65223	78.26398	77.89419	77.56714	77.74818	78.36560	78.39165
##	2609	2610	2611	2612	2613	2614	2615	2616
##	78.33951	78.86701	79.77630	78.53318	77.65272	79.74412	79.54517	79.48635
##	2617	2618	2619	2620	2621	2622	2623	2624
##	78.84694	80.15760	79.99198	78.25070	78.16004	80.11779	79.81309	78.25878
##	2625	2626	2627	2628	2629	2630	2631	2632
##	78.54646	78.04288	79.01531	77.66994	77.59989	79.46123	78.28802	77.65410
##	2633	2634	2635	2636	2637	2638	2639	2640
##	77.85728	78.53964	78.76344	79.83796	77.96945	78.60372	77.99210	80.19345
##	2641	2642	2643	2644	2645	2646	2647	2648
##	80.14462	80.09078	77.86139	78.78147	79.29842	79.23421	77.79967	78.99869
##	2649	2650	2651	2652	2653	2654	2655	2656
##	78.38274	78.67557	79.70984	78.05277	79.92346	78.57806	77.63518	77.60217
##	2657	2658	2659	2660	2661	2662	2663	2664
##	78.85336	78.79257	78.22131	79.16475	78.63010	78.49321	77.59897	78.82566
##	2665	2666	2667	2668	2669	2670	2671	2672
##	79.19395	78.66711	78.67931	78.67298	78.99103	78.62924	77.78879	78.56832
##	2673	2674	2675	2676	2677	2678	2679	2680
##	79.16475	77.74429	79.37136	79.61160	79.74267	79.48632	80.05672	79.99847
##	2681	2682	2683	2684	2685	2686	2687	2688
##	78.81185	79.79303	79.24168	80.11873	78.48620	78.15456	77.56084	77.97304
##	2689	2690	2691	2692	2693	2694	2695	2696
##	80.11757	79.01862	78.19603	78.77226	79.86983	79.30525	78.16147	77.80388
##	2697	2698	2699	2700	2701	2702	2703	2704
##	78.43846	78.93042	79.28108	79.91080	79.97768	80.12849	78.36633	78.33039

##	2705	2706	2707	2708	2709	2710	2711	2712
##	78.55559	78.53581	79.83006	77.73086	78.40404	78.83732	78.76683	79.52826
##	2713	2714	2715	2716	2717	2718	2719	2720
##	79.82697	77.85812	78.29434	79.59497	77.81142	78.47180	80.02267	79.88274
##	2721	2722	2723	2724	2725	2726	2727	2728
##	77.95537	79.10032	77.82385	78.08696	78.27147	78.82958	78.62555	78.00202
##	2729	2730	2731	2732	2733	2734	2735	2736
##	78.94245	79.20936	78.75134	79.66731	78.94903	79.29541	79.57027	80.09940
##	2737	2738	2739	2740	2741	2742	2743	2744
##	79.76653	79.71544	78.22569	77.74113	78.41499	78.07241	79.44064	78.84051
##	2745	2746	2747	2748	2749	2750	2751	2752
##	80.15175	79.93319	78.98870	78.14035	80.22797	77.58162	78.25829	77.89923
##	2753	2754	2755	2756	2757	2758	2759	2760
##	78.64757	80.09210	78.03636	78.02797	79.53645	78.69053	77.65301	78.80381
##	2761	2762	2763	2764	2765	2766	2767	2768
##	78.35496	78.20150	79.23263	79.19995	78.08709	78.34821	80.07310	79.01089
##	2769	2770	2771	2772	2773	2774	2775	2776
##	77.67701	77.73188	79.47630	77.63979	79.69400	79.62495	79.81482	78.67059
##	2777	2778	2779	2780	2781	2782	2783	2784
##	79.65440	77.63418	77.79444	79.02072	80.20403	78.79585	78.74732	78.72971
##	2785	2786	2787	2788	2789	2790	2791	2792
##	78.08522	80.02485	77.69565	78.90553	79.53216	78.44434	78.24580	79.50659
##	2793	2794	2795	2796	2797	2798	2799	2800
##	79.51653	79.28359	79.98379	78.28952	78.66209	78.48564	78.13178	79.68803
##	2801	2802	2803	2804	2805	2806	2807	2808
##	78.22950	79.19343	79.51153	77.58437	79.27847	78.38421	77.68023	78.92553
##	2809	2810	2811	2812	2813	2814	2815	2816
##	77.98433	78.25869	79.08305	79.71130	78.75348	77.94627	77.55834	78.53513
##	2817	2818	2819	2820	2821	2822	2823	2824
##	79.25752	79.84606	79.70636	79.32051	80.14759	80.13433	77.73363	78.12326
##	2825	2826	2827	2828	2829	2830	2831	2832
##	78.57551	78.88613	78.13451	77.62264	79.87493	80.02411	79.07643	78.98888
##	2833	2834	2835	2836	2837	2838	2839	2840
##	78.92066	78.50759	79.77881	79.88699	77.72181	79.19783	78.81610	78.15450
##	2841	2842	2843	2844	2845	2846	2847	2848
##	79.91249	78.41802	78.89851	78.53055	78.01889	77.72469	80.06424	78.45397
##	2849	2850	2851	2852	2853	2854	2855	2856
##	78.51203	78.60402	78.28796	79.18556	79.91371	78.60686	78.58395	79.22068
##	2857	2858	2859	2860	2861	2862	2863	2864
##	79.27369	78.98075	79.10348	79.68742	77.98497	79.67250	78.90687	78.39009
##	2865	2866	2867	2868	2869	2870	2871	2872
##	78.24329	78.22999	80.08569	79.74449	79.74531	79.82619	79.68131	80.16079
##	2873	2874	2875	2876	2877	2878	2879	2880
##	77.57528	78.09737	79.03721	79.06458	79.13776	78.20104	78.25135	80.20084
##	2881	2882	2883	2884	2885	2886	2887	2888
##	79.26055	78.11603	78.55305	78.01309	77.71274	78.05374	79.74098	78.81944
##	2889	2890	2891	2892	2893	2894	2895	2896
##	77.74519	78.39483	80.20875	78.77482	77.85920	79.85575	79.40002	77.90437
##	2897	2898	2899	2900	2901	2902	2903	2904
##	78.86137	79.97976	79.04865	79.01938	79.62808	78.43685	78.12071	78.15972
##	2905	2906	2907	2908	2909	2910	2911	2912
##	78.56003	79.67938	77.79138	79.05207	78.66980	77.84508	79.79592	78.32074

```
##      2913      2914      2915      2916      2917      2918      2919      2920
## 78.24432 77.80362 79.22083 79.46896 79.86528 79.84791 77.76357 78.47944
##      2921      2922      2923      2924      2925      2926      2927      2928
## 78.03310 78.83450 77.70916 79.30095 80.01787 77.85547 77.99909 77.70037
##      2929      2930      2931      2932      2933      2934      2935      2936
## 78.68606 78.83206 78.36565 79.28869 79.02267 79.71733 79.44710 79.07734
##      2937      2938      2939      2940      2941      2942      2943      2944
## 79.43933 77.84784 79.91278 79.91481 78.90450 77.58172 79.42011 79.62923
##      2945      2946      2947      2948      2949      2950      2951      2952
## 77.86564 79.25110 77.60959 79.10679 78.12497 78.24515 77.78322 78.51053
##      2953      2954      2955      2956      2957      2958      2959      2960
## 80.13985 78.66503 78.86657 78.28892 77.62108 79.42155 79.18262 78.62113
##      2961
## 77.58910
```

Modelo SVM Regressor

```
# SVM
svm_model <- svm(Appliances ~ ., data = x_train, kernel = "radial")
svm_model
```

```
##
## Call:
## svm(formula = Appliances ~ ., data = x_train, kernel = "radial")
##
##
## Parameters:
##   SVM-Type:  eps-regression
##   SVM-Kernel: radial
##         cost:  1
##        gamma: 0.02702703
##     epsilon: 0.1
##
##
## Number of Support Vectors: 9230
```

```
# Visualize os coeficientes do modelo
summary(svm_model)
```

```
##  
## Call:  
## svm(formula = Appliances ~ ., data = x_train, kernel = "radial")  
##  
##  
## Parameters:  
##   SVM-Type:  eps-regression  
## SVM-Kernel:  radial  
##      cost:   1  
##      gamma:  0.02702703  
##      epsilon: 0.1  
##  
##  
## Number of Support Vectors:  9230
```

```
# Previsão  
predictions_svm <- predict(svm_model, newdata = y_test)  
predictions_svm
```

##	1	2	3	4	5	6	7	8
##	109.49010	96.19641	97.07711	87.89374	77.98892	78.37393	77.68409	65.14421
##	9	10	11	12	13	14	15	16
##	53.69817	52.97022	46.51584	43.31695	56.85061	101.98905	52.83511	59.70627
##	17	18	19	20	21	22	23	24
##	63.02448	54.44911	55.83244	57.76421	57.17179	58.40197	51.22299	76.42115
##	25	26	27	28	29	30	31	32
##	58.59492	35.39596	29.94764	33.69820	31.58758	34.07845	34.81521	32.86327
##	33	34	35	36	37	38	39	40
##	33.26215	33.87726	35.09023	35.25168	36.92738	99.89474	78.40318	42.08921
##	41	42	43	44	45	46	47	48
##	43.24257	83.00747	55.33090	55.78133	51.66184	51.24914	52.53803	57.24345
##	49	50	51	52	53	54	55	56
##	75.99755	101.94553	145.91726	125.45966	124.24867	122.12891	49.03480	44.80902
##	57	58	59	60	61	62	63	64
##	43.97411	42.28373	44.15314	45.58793	65.52253	89.76998	52.26777	74.62026
##	65	66	67	68	69	70	71	72
##	111.45927	124.02519	119.45353	79.54462	74.42806	61.14843	141.91794	122.04949
##	73	74	75	76	77	78	79	80
##	128.23390	51.87511	48.39344	51.49568	57.07038	57.28910	47.47705	45.99239
##	81	82	83	84	85	86	87	88
##	45.46357	52.56085	59.02994	44.63053	88.63122	69.70781	70.15678	49.20755
##	89	90	91	92	93	94	95	96
##	62.38675	81.19996	115.51864	87.96700	53.79021	46.70445	46.17559	46.83176
##	97	98	99	100	101	102	103	104
##	47.43852	47.37591	48.36490	48.85897	48.67444	77.18164	63.22787	64.69886
##	105	106	107	108	109	110	111	112
##	64.12273	61.83807	72.77854	78.90176	120.90304	139.57470	127.10327	137.66432
##	113	114	115	116	117	118	119	120
##	144.98371	141.25751	64.77761	53.51194	55.89467	53.71368	52.00977	53.08093
##	121	122	123	124	125	126	127	128
##	54.18046	55.97236	86.23871	108.14851	106.80683	114.75455	102.03434	104.14983
##	129	130	131	132	133	134	135	136
##	81.27257	81.49658	115.36394	101.59001	96.12966	112.77013	45.18239	43.35465
##	137	138	139	140	141	142	143	144
##	41.20429	37.67304	35.49197	36.18373	36.91531	38.15547	37.49306	39.86194
##	145	146	147	148	149	150	151	152
##	41.37857	45.63687	45.89807	48.76083	46.81355	47.01452	78.17314	61.04043
##	153	154	155	157	158	159	160	161
##	115.93490	106.84417	46.22368	37.36148	42.45961	41.65061	43.29466	43.46078
##	162	163	164	165	166	167	168	169
##	49.24704	46.31972	45.34071	41.34666	36.16170	35.03668	37.77366	35.71898
##	170	171	172	173	174	175	176	177
##	45.95931	46.67616	61.19135	59.64189	108.56937	58.85927	48.31031	46.06186
##	178	179	180	181	182	183	184	185
##	42.46155	42.25528	41.47153	42.05512	43.79242	45.19141	76.04124	64.76621
##	186	187	188	189	190	191	192	193
##	91.47037	83.31724	63.86552	67.47119	74.07892	82.48640	84.59184	80.69912
##	194	195	196	197	198	199	200	201
##	184.14338	132.77793	89.64730	81.75564	79.87448	80.98765	43.71633	43.22872
##	202	203	204	205	206	207	208	209
##	44.03178	45.60259	46.86850	45.57174	47.17209	65.89410	53.50509	58.50285

##	210	211	212	213	214	215	216	217
##	60.53837	104.96520	83.42095	102.93427	88.69094	90.27693	105.46541	57.90765
##	218	219	220	221	222	223	224	225
##	50.78590	47.25159	46.29737	38.92522	38.06409	43.73106	40.30798	40.21899
##	226	227	228	229	230	231	232	233
##	37.99328	43.49753	34.95343	36.16242	36.63382	42.01866	45.26149	43.57065
##	234	235	236	237	238	239	240	241
##	44.43813	40.37620	35.37614	36.53528	34.81230	34.55901	35.34377	36.60302
##	242	243	244	245	246	247	248	249
##	37.82440	37.19682	52.22983	60.97578	141.85464	103.71014	108.98195	121.64362
##	250	251	252	253	254	255	256	257
##	151.21294	124.36470	127.40020	120.72231	123.34525	124.10928	88.07294	82.52248
##	258	259	260	261	262	263	264	265
##	78.85574	82.67183	84.66919	84.85846	85.69159	72.23078	43.69025	45.36503
##	266	267	268	269	270	271	272	273
##	43.39523	42.80262	49.38288	132.40583	158.35105	173.35310	171.11316	181.81818
##	274	275	276	277	278	279	280	281
##	105.24881	83.37660	77.10611	68.86726	110.35547	81.54720	75.73061	48.85544
##	282	283	284	285	286	287	288	289
##	50.22541	42.98683	45.13038	48.95598	45.79005	47.39816	44.57024	45.48873
##	290	291	292	293	294	295	296	297
##	45.48308	46.78425	46.11257	44.03436	49.04249	47.78959	46.32125	56.82720
##	298	299	300	301	302	303	304	305
##	58.31935	54.94529	99.25843	69.59628	89.54473	67.34386	54.03035	52.48058
##	306	307	308	309	310	311	312	313
##	51.55088	49.27888	48.88286	44.49442	41.92160	41.41467	41.53585	43.22498
##	314	315	316	317	318	319	320	321
##	58.62151	45.32249	45.80520	42.38631	39.97922	40.30720	36.85407	62.06474
##	322	323	324	325	326	327	328	329
##	81.68407	56.14617	81.23896	41.09606	38.28483	35.44434	34.92230	38.81658
##	330	331	332	333	334	335	336	337
##	42.68051	41.97154	44.45044	41.36051	42.81853	38.49483	37.61504	38.09734
##	338	339	340	341	342	343	344	345
##	38.32088	36.26078	39.23244	36.78638	38.95298	34.12539	35.25671	34.93090
##	346	347	348	349	350	351	352	353
##	37.82739	37.78621	37.85710	37.75601	38.68627	40.48696	41.01840	41.91481
##	354	355	356	357	358	359	360	361
##	43.82487	44.58316	44.59626	40.28940	38.60241	43.56836	46.42143	38.87764
##	362	363	364	365	366	367	368	369
##	38.93049	38.08819	27.86977	28.12274	34.47112	30.41658	30.39817	32.04699
##	370	371	372	373	374	375	376	377
##	34.70749	34.03826	36.59388	38.32568	36.83307	34.92135	38.91082	33.20357
##	378	379	380	381	382	383	384	385
##	35.07260	37.05352	41.87385	42.27111	72.40278	82.16701	56.70735	58.97712
##	386	387	388	389	390	391	392	393
##	43.40191	35.67662	34.71777	42.64018	37.65189	36.93764	36.97404	57.28999
##	394	395	396	397	398	399	400	401
##	127.14394	99.33037	115.21639	132.77066	107.84808	99.98303	92.83844	87.32167
##	402	404	405	406	407	408	409	410
##	76.56759	48.30920	45.25497	44.63048	43.38608	46.32925	47.29710	46.76297
##	411	412	413	414	415	416	417	418
##	49.08695	120.36814	149.27424	104.38755	140.12144	109.31388	104.95195	92.90861

##	419	420	421	422	423	424	425	426
##	126.35520	127.33243	129.39356	142.48368	116.21415	98.26063	92.71917	57.12006
##	428	429	430	431	432	433	434	435
##	47.73350	43.86334	44.01480	51.99703	43.83010	51.88993	60.02847	77.47895
##	436	437	438	439	440	441	442	443
##	112.78882	140.45203	132.23583	143.57377	164.70456	157.35486	151.55538	150.40861
##	444	445	446	448	449	450	451	452
##	162.44168	145.04726	110.32163	49.07734	43.59451	45.66725	46.20928	45.00406
##	453	454	455	456	457	458	459	460
##	47.41811	46.38943	41.14457	69.61124	66.49389	63.52223	74.44317	72.26286
##	461	462	463	464	465	466	467	468
##	60.98616	65.87537	65.76555	77.69311	90.76550	103.58493	93.72585	112.72920
##	469	470	471	472	473	474	475	476
##	68.21288	58.59179	73.97184	56.68142	72.52787	75.35709	96.18073	102.40151
##	477	478	479	480	481	482	483	484
##	83.33803	87.06336	86.02957	87.03938	94.89676	97.17424	92.70219	124.98576
##	485	486	487	488	489	490	491	492
##	95.22075	114.23393	147.00356	138.20261	137.43477	131.52918	104.83839	89.58853
##	493	494	495	496	497	498	499	500
##	83.24622	44.10158	41.30573	44.65836	44.26585	71.47291	64.30333	72.98036
##	501	502	503	504	505	506	507	508
##	83.48181	113.76384	108.13140	128.83006	123.47015	115.84697	109.55074	79.82723
##	509	510	511	512	514	515	516	517
##	78.66804	80.09727	98.84044	99.23506	47.72586	44.99337	38.63095	38.86690
##	518	519	520	521	522	523	524	525
##	42.47944	41.17780	57.03622	45.18332	45.08313	46.84015	66.74243	61.44971
##	526	527	528	529	530	531	532	533
##	62.33937	65.59851	76.75075	68.53941	68.57268	104.35964	72.54532	74.45893
##	534	535	536	537	538	539	540	541
##	59.90565	56.26044	44.19926	43.06539	43.27199	43.98511	43.26036	46.13579
##	542	543	544	545	546	547	548	549
##	45.13734	47.54122	73.27021	75.26634	74.20556	99.46637	82.16387	87.56292
##	550	551	552	553	554	555	556	558
##	94.99817	94.70622	106.41828	111.39637	91.05507	80.70559	70.35721	44.77261
##	559	560	561	562	563	564	565	566
##	42.35248	47.11403	44.72974	42.21734	45.77669	39.95731	45.36160	72.99155
##	567	568	569	570	571	572	573	574
##	70.84304	75.52651	99.17500	104.52600	99.39663	101.94388	121.55597	125.58210
##	575	576	577	578	579	580	581	582
##	116.12499	119.10074	119.05489	119.01957	120.94409	114.48650	57.34030	45.94051
##	583	584	585	586	587	588	589	590
##	44.30269	49.40050	45.34269	63.19149	79.09872	88.72463	128.65631	141.64327
##	591	592	593	594	595	596	597	598
##	142.49903	146.51354	165.85537	140.53325	123.16651	99.26573	123.32803	86.03955
##	599	601	602	603	604	605	606	607
##	91.81841	48.78083	60.11440	59.70479	57.57850	57.30539	55.51543	53.70223
##	608	609	610	611	612	613	614	615
##	53.78143	53.07181	52.09080	57.87767	85.70846	64.06050	92.19938	98.19056
##	616	617	618	619	620	621	622	623
##	99.62675	100.17999	86.55488	113.11849	113.96284	112.37103	132.22781	136.08088
##	624	625	626	627	628	629	630	631
##	119.01080	114.98453	110.03541	99.55755	97.79447	74.16701	73.81978	64.96293

##	632	633	634	635	636	637	638	639
##	62.53463	62.99102	64.99555	65.40521	66.61396	67.10797	66.88527	61.17713
##	640	641	642	643	644	645	646	647
##	62.33234	84.22353	104.44269	92.03285	93.76665	105.88105	95.03420	85.04714
##	648	649	650	651	652	653	654	655
##	73.52411	74.71208	90.19647	130.18690	132.18646	125.39276	120.26006	117.67645
##	656	657	658	659	660	661	662	663
##	106.91099	48.12884	53.10149	51.95869	52.10790	51.61828	47.80532	48.47852
##	664	665	666	667	668	669	670	671
##	50.09452	48.81749	51.70146	69.81616	70.61603	94.44323	126.80825	100.30444
##	672	673	674	675	676	677	678	679
##	110.90415	97.09928	109.73481	60.89990	59.38356	57.40690	56.75379	55.47798
##	680	681	682	683	684	685	686	687
##	55.55307	57.19554	72.24486	63.25575	80.18007	134.83334	134.88151	128.86953
##	688	689	690	691	692	693	694	695
##	121.76870	102.14596	109.86942	111.81624	111.06460	91.17525	86.74452	87.73512
##	696	697	698	699	700	701	702	703
##	76.07268	52.59538	49.27754	44.45645	46.99283	47.87626	51.68190	54.04432
##	704	705	706	707	708	709	710	711
##	58.69325	62.99883	62.94318	67.96229	72.94969	76.52561	98.97531	89.70951
##	712	713	714	715	716	717	718	719
##	90.55244	89.22190	91.06576	87.02627	109.42941	105.14292	78.73449	82.54642
##	720	721	722	723	724	725	726	727
##	70.04101	53.73881	52.88370	52.82831	52.46155	51.77635	54.96898	58.28980
##	728	729	730	731	732	733	734	735
##	63.59585	104.42722	104.27030	84.68564	85.89469	115.70982	111.63266	118.57649
##	736	737	738	739	740	741	742	743
##	138.43585	122.30888	124.03275	101.73589	96.70573	53.76978	46.34816	55.20661
##	744	745	746	747	748	749	750	751
##	71.48521	41.49803	87.88835	113.32430	134.83702	136.12599	115.95370	83.66909
##	752	753	754	755	756	757	758	759
##	128.50083	92.44869	69.27125	59.84674	45.73721	46.56381	43.93911	46.85937
##	760	761	762	763	764	765	766	767
##	52.03861	80.56374	98.97487	109.23943	92.86924	60.91983	67.15115	58.44082
##	768	769	770	771	772	773	774	775
##	67.98826	67.09008	63.45195	47.58152	58.75403	66.75577	74.66128	74.18440
##	776	777	778	779	780	781	782	783
##	96.44535	89.77708	85.05782	75.01343	85.25678	83.26027	88.81979	58.49221
##	784	786	787	788	789	790	791	792
##	55.25942	43.10927	46.01101	44.26432	48.03522	47.96228	52.58656	60.69922
##	793	794	795	796	797	798	799	800
##	66.71844	80.42368	76.16633	74.97540	90.78459	104.07763	100.77069	92.90425
##	801	802	803	804	805	806	807	808
##	70.35192	60.40014	60.59950	67.45552	66.75388	67.17776	87.91483	86.59457
##	809	810	811	812	813	814	815	816
##	92.64109	44.98761	43.52282	45.63719	44.85850	44.12612	43.83068	45.14342
##	817	818	819	820	821	822	823	824
##	43.88658	47.11557	47.63733	61.53904	61.80808	72.67609	76.13707	119.25498
##	825	826	827	828	829	830	831	832
##	72.26995	64.17730	86.07972	90.17365	68.49490	61.69431	57.92536	54.58879
##	833	834	835	836	837	838	839	840
##	57.88874	52.25831	50.10497	44.52356	47.71603	45.78667	45.38702	43.92792

##	841	842	843	844	845	846	847	848
##	43.53090	43.69774	41.72241	44.23814	47.20348	47.62094	85.41971	114.37255
##	849	850	851	852	853	854	855	857
##	96.06164	94.82833	93.93432	107.03665	117.59704	98.72185	43.54090	46.43703
##	858	859	860	861	862	863	864	865
##	45.87536	46.78915	43.85907	44.94972	42.80521	43.87475	44.55613	48.28555
##	866	867	868	869	870	871	872	873
##	45.69054	74.67142	88.45882	82.93457	97.18911	96.46909	94.52013	96.33669
##	874	875	876	877	878	879	880	881
##	100.23052	97.29981	89.53642	112.60850	97.90534	101.87609	78.25772	85.35589
##	882	883	884	885	886	887	888	889
##	73.41595	62.11000	55.28394	54.19527	51.79049	53.69814	62.26483	68.59567
##	890	891	892	893	894	895	896	897
##	65.22664	62.47971	62.07603	68.67888	70.24775	69.22526	66.34904	89.21646
##	898	899	900	901	902	903	904	905
##	94.87742	64.17998	61.26253	64.15883	111.07371	103.27851	73.42499	64.16576
##	906	907	908	909	910	911	912	913
##	67.84592	52.28616	53.66773	54.28434	53.40184	52.24522	51.41787	52.24492
##	914	915	916	917	918	919	920	921
##	52.52510	50.40195	52.43028	55.88876	62.39434	66.41465	67.53367	68.84949
##	922	923	924	925	926	927	928	929
##	69.80494	85.74647	78.68844	91.52909	82.61672	80.10173	84.71370	72.85334
##	930	931	932	933	934	935	936	937
##	66.20944	48.82214	47.79796	45.61333	46.69090	47.64166	70.90210	79.23036
##	938	939	940	941	942	943	944	945
##	77.71923	90.19531	111.30249	103.19194	98.44052	82.01664	78.56327	75.76010
##	946	947	948	949	950	951	952	953
##	59.91466	59.51436	50.75912	53.47702	47.86254	46.83796	47.49004	46.60702
##	954	955	956	957	958	959	960	961
##	47.10536	47.15983	47.34472	47.81737	46.96254	49.57448	149.59009	144.25110
##	962	963	964	965	966	967	968	969
##	172.89781	110.13077	143.25402	118.50325	84.15418	74.67149	51.08511	50.00810
##	970	971	972	973	974	975	976	977
##	52.22668	50.61112	55.69254	55.45898	56.52964	57.64170	68.05613	57.24465
##	978	979	980	981	982	983	984	985
##	55.70027	66.98244	71.89969	51.11298	47.36308	57.58643	57.50005	72.99201
##	986	987	988	989	990	991	992	993
##	43.24002	45.84957	43.74803	44.05260	44.47564	44.25617	45.20892	60.92542
##	994	995	996	997	998	999	1000	1001
##	70.76633	76.44106	88.78535	101.53093	85.54476	92.23727	83.06649	81.57839
##	1002	1003	1004	1005	1006	1007	1008	1009
##	90.70959	80.47511	70.15702	50.50998	50.83573	47.74968	49.42901	50.81217
##	1010	1011	1012	1013	1014	1015	1016	1017
##	49.27273	59.74024	64.95197	61.42636	47.31990	46.26991	46.08187	50.07007
##	1018	1019	1020	1021	1022	1023	1024	1025
##	53.41715	54.42635	73.04375	74.65994	53.96227	50.77505	42.41695	45.49851
##	1026	1027	1028	1029	1030	1031	1032	1033
##	45.54045	45.16634	45.84036	46.62519	60.92745	69.82997	68.81898	75.76973
##	1034	1035	1036	1037	1038	1039	1040	1041
##	93.62315	114.97393	130.12807	131.28112	147.66276	143.15778	150.06390	76.81809
##	1042	1043	1044	1045	1046	1047	1048	1049
##	71.43037	52.06158	42.23962	41.43703	45.65117	51.97543	50.83483	51.30988

##	1050	1051	1052	1053	1054	1055	1056	1057
##	64.89977	61.88924	60.78377	75.24822	60.29529	55.31889	56.85940	92.09762
##	1058	1059	1060	1061	1062	1063	1064	1065
##	90.21382	81.89702	62.27113	74.62551	57.56089	57.77869	43.65552	51.02637
##	1066	1067	1068	1069	1070	1071	1072	1073
##	44.01075	42.17325	42.41335	45.51461	46.96534	86.87707	87.42927	72.76538
##	1074	1075	1076	1077	1078	1079	1080	1081
##	73.10529	67.19290	67.11404	67.68597	79.75018	65.87141	63.33060	64.59124
##	1082	1083	1084	1085	1086	1087	1088	1089
##	68.07032	121.39817	124.31119	157.07526	117.28011	74.93404	66.52368	43.82987
##	1090	1091	1092	1093	1094	1095	1096	1097
##	42.33729	41.99814	46.68886	57.82869	71.01049	70.89133	66.13315	75.80057
##	1098	1099	1100	1101	1102	1103	1104	1105
##	90.56418	85.50522	60.48740	97.19243	96.07717	50.58845	49.71086	43.70723
##	1106	1107	1108	1109	1110	1111	1112	1113
##	41.33981	38.99441	42.46748	61.30066	60.92513	68.69649	88.67823	84.57841
##	1114	1115	1116	1117	1118	1119	1120	1121
##	76.42614	76.57273	81.56146	83.37586	94.19199	75.59466	100.17241	99.78718
##	1122	1123	1124	1125	1126	1127	1128	1129
##	96.04063	93.97610	90.27908	90.88930	83.50833	72.43047	71.93217	72.21918
##	1130	1131	1132	1133	1134	1135	1136	1137
##	54.64000	45.34218	45.34294	43.14123	44.29506	42.65832	42.96949	41.38251
##	1138	1139	1140	1141	1142	1143	1144	1145
##	47.50233	45.26132	45.96520	55.94105	80.60165	84.74404	71.58874	63.31389
##	1146	1147	1148	1149	1150	1151	1152	1153
##	78.66746	123.49490	86.02338	94.98669	87.21177	88.30985	68.01549	64.24655
##	1154	1155	1156	1157	1158	1159	1160	1161
##	48.77286	45.18228	42.56292	43.65448	43.30742	45.30258	45.73355	49.21910
##	1162	1163	1164	1165	1166	1167	1168	1169
##	63.58201	73.37285	80.61447	84.61978	80.43525	86.25206	108.05639	109.54057
##	1170	1171	1172	1173	1174	1175	1176	1177
##	122.41833	118.97543	118.81461	98.45803	79.57530	49.63085	45.83625	46.10013
##	1178	1179	1180	1181	1182	1183	1184	1185
##	46.96337	45.87265	55.18874	56.96539	63.35107	107.27846	122.61832	128.30433
##	1186	1187	1188	1189	1190	1191	1192	1193
##	124.65533	137.08676	146.47291	136.07293	118.32994	104.28178	90.78404	91.34821
##	1194	1195	1196	1197	1198	1199	1200	1201
##	86.18210	116.31445	110.59653	107.78507	102.58349	88.53714	70.63829	59.43248
##	1202	1203	1204	1205	1206	1207	1208	1209
##	53.64656	46.78028	46.83975	46.42906	47.15796	55.54194	54.94448	51.76260
##	1210	1211	1212	1213	1214	1215	1216	1217
##	56.63985	53.68837	88.41788	121.68461	118.01227	106.22221	108.52202	109.70489
##	1218	1219	1220	1221	1222	1223	1224	1225
##	80.22343	68.01510	66.71818	63.01606	49.53815	48.60761	44.89959	49.89615
##	1226	1227	1228	1229	1230	1231	1232	1233
##	49.10406	52.27541	61.45309	56.53357	66.78125	87.67217	92.48462	96.79263
##	1234	1235	1236	1237	1238	1239	1240	1241
##	113.10894	110.87391	102.78981	117.80016	104.27703	111.89621	82.99524	84.51374
##	1242	1243	1244	1245	1246	1247	1248	1249
##	73.77649	59.46740	48.44844	42.62073	41.88260	42.67114	46.54228	54.06003
##	1250	1251	1252	1253	1254	1255	1256	1257
##	62.69043	79.74042	62.84381	68.98613	74.13140	127.15106	136.14332	131.34895

##	1258	1259	1260	1261	1262	1263	1264	1265
##	48.21070	40.85449	40.76682	38.59523	37.68701	41.13685	38.40266	39.09562
##	1266	1267	1268	1269	1270	1271	1272	1273
##	37.57082	38.93319	47.33398	49.71133	66.27079	59.22604	42.99082	42.04698
##	1274	1275	1276	1277	1278	1279	1280	1281
##	44.93681	61.19766	50.31375	47.78491	52.03526	96.87862	102.24320	91.35214
##	1282	1283	1284	1285	1286	1287	1288	1289
##	58.84573	54.65569	43.21253	42.18659	40.96422	44.18477	43.81310	44.02092
##	1290	1291	1292	1293	1294	1295	1296	1297
##	43.53287	45.41458	46.87075	46.86356	55.25047	56.26564	88.57197	106.35560
##	1298	1299	1300	1301	1302	1303	1304	1305
##	101.34667	85.07171	90.44769	99.85972	94.92936	103.48626	125.12926	128.52006
##	1306	1308	1309	1310	1311	1312	1313	1314
##	95.41485	55.64980	51.47089	50.11540	51.93312	53.78069	54.46279	56.59622
##	1315	1316	1317	1318	1319	1320	1321	1322
##	57.67206	78.02664	76.04460	69.35183	73.65932	75.91962	83.64137	87.40872
##	1323	1324	1325	1326	1327	1328	1329	1330
##	87.91320	112.41225	91.29829	68.14144	66.71548	65.00549	61.45718	53.29126
##	1331	1332	1333	1334	1335	1336	1337	1338
##	50.44354	52.73545	49.31716	48.79848	51.99117	51.51155	62.45423	66.85089
##	1339	1340	1341	1342	1343	1344	1345	1346
##	76.58985	93.68643	103.93088	163.48126	169.54739	140.62521	144.26440	160.52387
##	1347	1348	1349	1350	1351	1352	1353	1354
##	112.36560	121.62125	103.99371	108.23212	107.52227	93.65853	113.38752	84.82066
##	1355	1356	1357	1358	1359	1360	1361	1362
##	73.27958	67.37576	57.36050	47.44244	37.81491	42.67226	44.46032	44.06373
##	1363	1364	1365	1366	1367	1368	1369	1370
##	44.23676	46.38383	55.06540	62.19187	62.32194	48.33036	56.02875	48.22892
##	1371	1372	1373	1374	1375	1376	1377	1378
##	58.71901	51.24606	54.54939	66.50515	57.71196	62.10955	44.63615	57.67535
##	1379	1380	1381	1382	1383	1384	1385	1386
##	83.17608	68.91456	73.91950	109.54419	116.90064	102.12943	101.52334	58.32430
##	1387	1388	1389	1390	1391	1392	1393	1394
##	50.94757	49.47702	54.82524	49.84409	42.84365	47.08962	43.49774	55.07276
##	1395	1396	1397	1398	1399	1400	1401	1402
##	54.81358	58.09810	65.67439	108.28518	88.91346	92.44770	141.57265	153.50679
##	1403	1404	1405	1406	1407	1408	1409	1410
##	154.06814	124.84595	124.33234	141.54110	156.69321	128.88847	126.48582	64.42602
##	1412	1413	1414	1415	1416	1417	1418	1419
##	62.83599	59.51482	59.04728	58.14691	56.04402	51.34199	53.72248	55.21457
##	1420	1421	1422	1423	1424	1425	1426	1427
##	59.16331	64.18545	71.26965	60.48626	64.74661	62.83291	63.99710	82.36020
##	1428	1429	1430	1431	1432	1433	1434	1435
##	78.77181	131.34238	106.36441	89.18112	78.80509	67.17945	42.42968	46.52153
##	1436	1437	1438	1439	1440	1441	1442	1443
##	46.52080	42.09817	44.23545	45.48476	44.38692	43.71406	46.30093	64.57994
##	1444	1445	1446	1447	1448	1449	1450	1451
##	63.27622	63.63861	64.32903	65.98845	70.47634	70.46932	69.21691	74.11405
##	1452	1453	1454	1455	1456	1457	1458	1459
##	68.03428	63.66586	50.95363	50.45743	51.75994	50.53127	50.41163	51.58485
##	1460	1461	1462	1463	1464	1465	1466	1467
##	51.72083	55.46018	57.48707	57.71016	107.78498	111.50368	92.96254	89.88445

##	1468	1469	1470	1471	1472	1473	1475	1476
##	93.81135	113.10808	98.97921	85.59476	75.95589	68.61969	51.58332	47.89321
##	1477	1478	1479	1480	1481	1482	1483	1484
##	49.93116	58.96097	52.34256	78.15403	94.69273	84.68686	93.76681	109.98559
##	1485	1486	1487	1488	1489	1490	1491	1492
##	120.11281	99.96328	97.61443	90.14420	93.51041	109.51673	109.48600	111.06029
##	1493	1494	1495	1496	1497	1498	1499	1500
##	124.52934	88.47813	91.24725	84.33745	73.11138	69.29891	57.07151	51.62100
##	1501	1502	1503	1504	1505	1506	1507	1508
##	51.14214	49.49489	48.68503	52.00483	49.61346	52.76622	66.49490	67.36442
##	1509	1510	1511	1512	1513	1514	1515	1516
##	68.88858	67.02279	61.39812	60.19993	58.06725	58.77247	56.88284	75.10541
##	1517	1518	1519	1520	1521	1523	1524	1525
##	91.36081	99.53887	80.61243	85.32725	85.91989	58.17261	52.06608	44.61714
##	1526	1527	1528	1529	1530	1531	1532	1533
##	50.66244	56.94085	51.21191	42.28062	55.40527	58.86233	57.82852	55.83358
##	1534	1535	1536	1537	1538	1539	1540	1541
##	52.65038	50.79804	55.02197	59.23205	81.77543	60.17112	52.34571	51.88111
##	1542	1543	1544	1545	1546	1547	1548	1549
##	60.00192	67.77886	64.41363	63.69897	79.44021	96.81153	74.40918	84.32481
##	1550	1551	1552	1553	1554	1555	1556	1558
##	89.91176	112.63669	116.26691	99.24959	100.08235	83.88878	44.75101	45.56342
##	1559	1560	1561	1562	1563	1564	1565	1566
##	45.15554	46.19287	45.05563	49.52369	49.85182	49.40766	55.40297	57.45280
##	1567	1568	1569	1570	1571	1572	1573	1575
##	67.04022	59.54619	52.39510	54.81232	108.35662	90.04200	73.13446	53.14421
##	1576	1577	1578	1579	1580	1581	1582	1583
##	50.76965	51.51794	48.94454	50.36883	50.33748	51.46092	56.37883	60.31417
##	1584	1585	1586	1587	1588	1589	1590	1591
##	64.61534	70.04558	68.50277	92.05802	95.42987	88.71113	110.14131	105.82156
##	1592	1593	1594	1595	1596	1597	1598	1599
##	97.54401	125.08012	128.78818	132.31075	109.48264	72.24074	58.61168	42.76504
##	1600	1601	1602	1603	1604	1605	1606	1607
##	48.25750	46.53469	47.47314	48.80468	48.58996	59.68984	61.37152	102.73688
##	1608	1609	1610	1611	1612	1613	1614	1615
##	93.49206	93.92176	96.05099	90.47022	97.50929	97.30705	100.64559	103.72031
##	1616	1617	1618	1619	1620	1621	1622	1623
##	101.65844	70.44650	68.96253	60.03289	58.50360	52.90862	52.06873	65.19043
##	1624	1625	1626	1627	1628	1629	1630	1631
##	68.39000	77.57792	87.68964	83.30316	83.80653	82.15514	68.18262	65.46996
##	1632	1633	1634	1635	1636	1637	1638	1639
##	61.59079	59.18922	60.41913	58.00451	63.14782	65.70289	63.89806	69.58133
##	1640	1641	1642	1643	1644	1645	1646	1647
##	82.94527	96.10530	88.24700	97.84556	110.12287	103.76446	119.63019	117.74703
##	1648	1649	1650	1651	1652	1653	1654	1655
##	127.04561	107.19597	46.52043	60.99980	55.04985	56.55852	76.72140	90.01107
##	1656	1657	1658	1659	1660	1661	1662	1663
##	88.11188	87.02224	93.87152	127.37279	129.27924	134.51189	121.84695	115.95866
##	1664	1665	1666	1667	1668	1669	1670	1671
##	104.77961	96.88467	88.89849	80.99151	81.63992	78.61632	65.06458	63.35771
##	1672	1673	1674	1675	1676	1677	1678	1679
##	64.89504	66.78582	68.00997	66.10005	73.77371	77.94511	97.85631	118.15052

##	1680	1681	1682	1683	1684	1685	1686	1687
##	81.69332	84.63954	79.32607	46.07067	44.27225	48.83395	51.88305	51.40482
##	1688	1689	1690	1691	1692	1693	1694	1695
##	57.95357	58.27410	56.09164	61.17750	63.63636	75.85124	68.53374	76.55025
##	1696	1697	1698	1699	1700	1701	1702	1703
##	81.23219	77.51962	92.95949	93.30261	93.11862	94.93718	102.33770	98.68742
##	1704	1705	1706	1707	1708	1709	1710	1711
##	96.28395	93.78927	94.03036	85.77561	74.05541	68.53655	58.42805	62.10397
##	1712	1713	1714	1715	1716	1717	1718	1719
##	64.17991	65.96620	58.42332	53.23616	51.49283	51.44214	52.25978	52.23629
##	1720	1721	1722	1723	1724	1725	1726	1727
##	53.27023	53.67315	51.95155	62.60502	64.11085	86.33550	84.75060	87.35098
##	1728	1729	1730	1731	1732	1733	1734	1735
##	82.16409	77.09432	69.60880	67.09909	59.96720	61.10251	60.81104	61.88917
##	1736	1737	1738	1739	1740	1741	1742	1743
##	48.45974	45.58304	46.97968	46.46657	49.39259	51.40907	52.49693	50.16786
##	1744	1745	1746	1747	1748	1749	1750	1751
##	52.99453	52.95624	55.60674	53.16347	57.79037	56.15633	57.82431	58.29875
##	1752	1753	1754	1755	1756	1757	1758	1759
##	58.64161	61.67997	63.87420	60.95859	61.22215	61.15200	61.74033	57.02796
##	1760	1761	1762	1763	1764	1765	1766	1767
##	38.67380	48.43290	50.59575	54.12293	55.93455	62.81840	63.30609	69.20136
##	1768	1769	1770	1771	1772	1773	1774	1775
##	81.45679	90.11353	95.18532	95.13939	97.22436	90.98449	92.69620	88.12922
##	1776	1777	1779	1780	1781	1782	1783	1784
##	85.95636	86.32623	61.05483	56.30168	51.07276	59.90780	63.78053	66.86886
##	1785	1786	1787	1788	1789	1790	1791	1792
##	80.00334	148.11843	164.38028	173.91855	167.91847	153.01334	147.09014	152.04731
##	1793	1794	1795	1796	1797	1798	1799	1800
##	161.11033	165.98976	157.33786	89.04564	87.73447	79.99802	70.67043	63.09451
##	1801	1802	1803	1804	1805	1806	1807	1808
##	63.94259	60.55246	59.18984	71.72229	69.81913	93.71707	91.82997	82.38755
##	1809	1810	1811	1812	1813	1814	1815	1816
##	101.93266	105.16159	112.05868	96.95132	96.45578	155.74061	134.31096	137.20614
##	1817	1818	1819	1820	1821	1822	1824	1825
##	130.01004	82.03143	70.94512	61.41395	58.88254	48.03396	48.41579	51.18845
##	1826	1827	1828	1829	1830	1831	1832	1833
##	51.77889	58.85839	62.71975	59.37700	61.21315	65.79159	91.06593	98.42050
##	1834	1835	1836	1837	1838	1839	1840	1841
##	103.44317	120.67809	125.41422	104.58803	83.08692	69.79681	69.93644	65.82661
##	1843	1844	1845	1846	1847	1848	1849	1850
##	54.09772	50.70246	50.37830	51.09314	56.11599	56.73451	55.26945	54.57387
##	1851	1852	1853	1854	1855	1856	1857	1858
##	58.98706	79.45224	81.37115	55.90805	52.08175	49.01638	66.37410	55.73587
##	1859	1860	1861	1862	1863	1864	1865	1866
##	65.80656	61.69961	65.98401	58.52822	55.57711	48.71087	34.14442	47.19105
##	1867	1868	1869	1870	1871	1872	1873	1874
##	51.06321	49.27437	50.51034	53.19489	56.78251	56.38424	56.53627	56.39443
##	1875	1876	1877	1878	1879	1880	1881	1882
##	61.86708	72.90343	83.81045	90.13237	95.56996	109.67746	107.27959	131.38400
##	1883	1884	1885	1886	1887	1888	1889	1891
##	144.37205	167.60658	130.32543	109.47855	81.65954	65.64322	62.21453	50.88415

##	1892	1893	1894	1895	1896	1897	1898	1899
##	51.81170	58.20201	54.24089	54.30267	66.18225	63.56473	66.08343	76.17005
##	1900	1901	1902	1903	1904	1905	1906	1907
##	88.01017	93.06532	98.21142	94.12654	86.32450	88.28403	105.63713	107.88933
##	1908	1909	1910	1911	1912	1913	1914	1915
##	126.26521	116.11618	71.83298	53.89344	54.23138	51.10667	54.11014	51.99460
##	1916	1917	1918	1919	1920	1921	1922	1923
##	52.36631	51.59861	53.85468	52.37556	52.95350	54.47809	67.54754	56.54245
##	1924	1925	1926	1927	1928	1929	1930	1932
##	69.89293	76.47316	61.58740	78.02024	75.87533	74.19037	60.93778	51.13084
##	1933	1934	1935	1936	1937	1938	1939	1940
##	50.98177	53.13863	57.77265	56.59713	50.50755	49.23031	52.25359	77.18257
##	1941	1942	1943	1944	1945	1946	1947	1948
##	79.27466	87.46270	96.77897	122.02462	106.82201	89.02462	98.39107	71.51947
##	1949	1950	1951	1952	1953	1954	1955	1956
##	73.07388	58.43047	55.88819	56.67232	57.22668	58.41332	59.87340	60.77088
##	1957	1958	1959	1960	1961	1962	1963	1964
##	64.59816	67.99383	64.33549	56.78863	55.41810	53.28413	54.05324	58.38614
##	1965	1966	1967	1968	1969	1970	1971	1972
##	71.40144	68.87245	62.76582	70.41432	149.18821	71.42750	47.72469	47.15622
##	1973	1974	1975	1976	1977	1978	1979	1980
##	47.24332	50.33739	54.43248	52.47077	51.11009	51.36806	53.89210	58.62027
##	1981	1982	1983	1984	1985	1986	1987	1988
##	58.10475	58.15500	65.61803	71.65425	71.42977	67.74508	68.56605	78.38077
##	1989	1990	1991	1992	1993	1994	1995	1996
##	96.52915	97.37971	90.28356	74.74618	88.30869	93.15075	71.72933	70.52769
##	1997	1998	1999	2000	2001	2002	2003	2004
##	38.57905	36.13878	52.70716	52.77227	51.73278	51.82897	55.25466	62.46786
##	2005	2006	2007	2008	2009	2010	2011	2012
##	68.74719	67.91614	71.73336	71.17615	73.60823	70.90646	81.85607	80.47202
##	2013	2014	2015	2016	2017	2018	2019	2020
##	61.38839	62.13178	85.61084	72.55794	74.76603	78.81531	89.49006	85.58229
##	2021	2022	2023	2024	2025	2026	2027	2028
##	91.25532	94.52359	104.65520	46.97104	51.61339	54.18658	57.76144	57.68229
##	2029	2030	2031	2032	2033	2034	2035	2036
##	56.93504	59.58539	105.88452	100.01614	97.80768	90.95958	106.47842	108.10085
##	2037	2038	2039	2040	2041	2042	2043	2044
##	83.66348	83.53244	85.18460	67.98611	53.65436	52.05498	47.40678	53.51632
##	2045	2046	2047	2048	2049	2050	2051	2052
##	61.54976	66.26654	68.80027	73.15700	75.11802	105.46707	110.73511	127.30571
##	2053	2054	2055	2056	2057	2058	2059	2060
##	129.47027	151.57741	147.27197	127.97189	124.42883	130.47752	121.82600	106.27021
##	2061	2062	2063	2064	2065	2066	2067	2068
##	79.60436	74.27562	54.10989	53.22728	50.36218	48.88129	51.84016	52.04520
##	2069	2070	2071	2072	2073	2074	2075	2076
##	54.62919	56.18538	56.24408	54.26266	57.80170	56.44816	145.15969	139.27164
##	2077	2078	2079	2080	2081	2082	2083	2084
##	134.68685	128.32065	115.42053	113.90947	115.15278	91.28747	101.86819	105.24421
##	2085	2086	2087	2088	2089	2090	2091	2092
##	118.65849	98.02448	96.11703	88.24448	87.40303	50.42593	56.54698	55.83510
##	2093	2094	2095	2096	2097	2098	2099	2100
##	49.67018	53.80625	52.07142	54.90040	47.29695	48.96735	54.12838	50.32196

##	2101	2102	2103	2104	2105	2106	2107	2108
##	56.58821	60.32767	68.95840	99.61532	84.31274	107.30010	107.01676	123.47787
##	2109	2110	2111	2112	2113	2114	2115	2117
##	121.47335	121.08068	117.62519	71.66409	55.05056	48.95096	47.90750	44.28615
##	2118	2119	2120	2121	2122	2123	2124	2125
##	46.98276	49.31663	57.09985	52.78159	63.99644	64.61130	48.63486	49.91452
##	2126	2127	2128	2129	2130	2131	2132	2133
##	48.57209	62.36422	42.41809	100.96343	108.37971	46.48191	53.00871	50.20965
##	2134	2135	2136	2137	2138	2139	2140	2141
##	44.10162	74.96614	51.86457	56.47307	71.81654	75.47648	80.45242	96.24176
##	2142	2143	2144	2145	2146	2147	2148	2149
##	117.83841	88.80510	44.24053	45.33035	45.27792	46.67445	45.20461	47.08480
##	2150	2151	2152	2153	2154	2155	2156	2157
##	49.80705	54.86443	51.07975	55.66628	58.98556	51.80245	54.89946	77.45510
##	2158	2159	2160	2161	2162	2163	2164	2165
##	69.01663	72.70813	82.49655	91.09055	85.68125	69.33760	70.08910	62.01797
##	2166	2167	2168	2169	2170	2171	2172	2173
##	66.34211	63.37382	65.99262	64.71941	91.39576	134.77603	140.35872	122.98698
##	2174	2175	2176	2177	2178	2179	2180	2181
##	161.94981	153.53543	103.36071	53.06833	53.81732	59.07170	55.07440	54.47766
##	2182	2183	2184	2185	2186	2187	2188	2189
##	54.49468	59.80826	75.17364	86.58040	95.99139	123.22765	117.67434	110.83030
##	2190	2191	2192	2193	2194	2195	2196	2197
##	119.89153	102.01007	92.52664	91.65590	108.14625	97.69422	75.62194	49.27147
##	2198	2199	2200	2201	2202	2203	2204	2205
##	36.06411	57.43121	56.10315	51.32669	50.98151	53.78645	56.16156	59.06904
##	2206	2207	2208	2209	2210	2211	2212	2213
##	59.38588	67.61922	82.53445	95.88402	79.78544	79.20983	82.15811	83.33535
##	2214	2215	2216	2217	2218	2219	2220	2221
##	85.26774	91.66155	91.60369	93.55931	92.38179	90.01101	73.98026	62.98602
##	2222	2223	2224	2225	2226	2227	2228	2229
##	62.61407	62.21314	64.00483	65.47864	65.33534	62.16551	64.42433	67.22576
##	2230	2231	2232	2233	2234	2235	2236	2237
##	67.72296	64.80473	69.47188	66.89895	78.75960	92.30702	94.78983	87.29925
##	2238	2240	2241	2242	2243	2244	2245	2246
##	100.62410	53.95202	54.23922	49.49091	49.98449	51.88276	58.04114	50.80767
##	2247	2248	2249	2250	2251	2252	2253	2254
##	51.06077	54.14013	57.72511	59.29048	54.32350	53.89784	54.77647	118.13346
##	2255	2256	2257	2258	2259	2260	2261	2262
##	109.43008	111.72063	107.57092	104.92731	65.07067	48.00094	51.94530	51.35352
##	2263	2264	2265	2266	2267	2268	2269	2270
##	51.96661	51.96176	60.60654	68.01337	61.67928	69.46456	73.63318	78.40036
##	2271	2272	2273	2274	2275	2276	2277	2278
##	73.53629	92.79983	94.61608	90.74345	86.30462	98.93164	116.83999	110.25644
##	2279	2280	2281	2282	2283	2284	2285	2286
##	104.99603	100.99476	97.59486	95.92147	66.57681	57.69465	53.28848	48.48312
##	2287	2288	2289	2290	2291	2292	2293	2294
##	54.74842	52.25445	52.75911	55.29586	55.05315	61.46929	64.05821	57.32025
##	2295	2296	2297	2298	2299	2300	2301	2302
##	70.09271	62.95079	52.34556	56.90374	77.79985	154.48109	93.03307	84.00154
##	2303	2304	2305	2306	2307	2308	2309	2310
##	54.20194	54.13813	54.31677	53.73183	55.03786	54.35189	53.28394	56.04215

##	2311	2312	2313	2314	2315	2316	2317	2318
##	72.68749	96.11135	79.09956	75.80547	67.66901	67.82520	63.06636	61.92764
##	2319	2320	2321	2322	2323	2324	2325	2326
##	63.45103	87.24478	95.95860	104.92127	80.13349	77.83638	89.33439	88.90658
##	2327	2328	2329	2330	2331	2332	2333	2334
##	85.50049	82.76867	78.52800	81.59776	69.06727	62.71195	61.58087	49.80789
##	2335	2336	2337	2338	2339	2340	2341	2342
##	49.57766	52.29449	53.51745	55.23197	53.72872	57.33156	66.15457	73.24256
##	2343	2344	2345	2346	2347	2348	2349	2350
##	112.12263	133.97583	160.62059	148.47011	131.28519	135.64354	102.96320	108.97000
##	2351	2352	2353	2354	2355	2356	2357	2358
##	117.25914	104.39253	103.41660	79.24725	71.84544	51.46819	54.85627	52.99387
##	2359	2360	2361	2362	2363	2364	2365	2366
##	55.53977	54.03388	54.22509	55.09312	55.60450	57.49616	56.23568	56.92055
##	2367	2368	2369	2370	2371	2372	2373	2374
##	79.69479	60.97820	88.41833	87.79783	90.53275	95.60298	91.16664	91.95639
##	2375	2376	2377	2378	2379	2380	2382	2383
##	89.50669	117.19737	117.21682	104.72498	99.75521	73.71939	53.88001	55.89000
##	2384	2385	2386	2387	2388	2389	2390	2391
##	55.89397	56.98302	57.28746	54.47992	57.49520	60.17016	58.37035	58.41141
##	2392	2393	2394	2395	2396	2397	2398	2399
##	76.15490	86.33248	92.22852	106.59242	104.75979	104.64413	95.01666	82.09307
##	2400	2401	2402	2403	2404	2405	2406	2407
##	73.86976	72.66364	52.71565	52.95944	50.99704	52.53797	52.92702	47.82688
##	2408	2409	2410	2411	2412	2413	2414	2415
##	53.09773	49.67443	56.68499	55.91103	58.74060	104.79883	107.15583	112.78535
##	2416	2417	2418	2419	2420	2422	2423	2424
##	95.49032	90.17801	74.98871	43.14126	31.71102	52.70071	54.20066	56.61143
##	2425	2426	2427	2428	2429	2430	2431	2432
##	57.24039	62.36270	74.85336	82.62795	71.23929	72.89009	80.45128	81.30750
##	2433	2434	2435	2436	2437	2438	2439	2440
##	107.53601	78.56844	61.45050	57.21586	54.89217	56.63651	57.16050	57.33471
##	2441	2442	2443	2444	2445	2446	2447	2448
##	55.75855	53.31627	53.47327	53.98640	60.83905	74.26172	75.02646	65.00111
##	2449	2450	2451	2452	2453	2454	2455	2456
##	60.00909	61.46146	68.03391	75.41147	78.88684	96.94900	89.40164	92.22815
##	2457	2458	2459	2461	2462	2463	2464	2465
##	74.61322	60.53782	58.21014	52.53283	52.22525	73.93895	75.27361	70.37745
##	2466	2467	2468	2469	2470	2471	2472	2473
##	71.09669	81.08593	76.36854	78.60245	113.56947	118.47916	99.06970	91.30155
##	2474	2475	2476	2477	2478	2479	2480	2481
##	83.54485	83.56148	62.37920	57.85241	63.31417	62.20386	56.16273	58.44576
##	2482	2483	2484	2485	2486	2487	2488	2489
##	53.52901	55.61094	58.22179	61.58674	61.22320	66.51014	87.88757	99.17514
##	2490	2491	2492	2493	2494	2495	2496	2497
##	104.00913	108.69107	93.89728	85.68313	80.15566	81.50322	90.42621	106.22593
##	2498	2499	2500	2501	2502	2503	2504	2505
##	71.75042	57.79943	62.93388	56.86616	57.81602	55.40090	54.86694	54.55943
##	2506	2507	2508	2509	2510	2511	2512	2513
##	52.67045	57.55422	50.55782	48.03989	59.54842	67.93346	54.95827	58.59135
##	2514	2515	2516	2517	2518	2519	2520	2521
##	54.72792	52.13601	54.53163	54.62877	64.07644	59.88120	57.92143	62.07882

##	2522	2523	2524	2525	2526	2527	2528	2529
##	54.38390	61.80059	56.05604	50.22249	60.99428	55.64692	52.11850	50.83671
##	2530	2531	2532	2533	2534	2535	2536	2537
##	60.31249	55.56691	59.73380	70.22232	82.83776	74.35195	85.58108	80.18167
##	2538	2539	2540	2541	2542	2543	2544	2545
##	98.83846	86.64301	85.72152	51.26666	51.99377	55.39939	54.20806	54.69198
##	2546	2547	2548	2549	2550	2551	2552	2553
##	62.95701	55.79721	56.58010	57.11193	58.09444	58.13456	51.90649	65.52691
##	2554	2555	2556	2557	2558	2559	2560	2561
##	55.78094	56.04477	55.87097	67.45975	75.79811	71.66794	94.15903	99.99974
##	2562	2563	2564	2565	2566	2567	2568	2569
##	86.78698	71.88154	74.88411	75.91922	61.38679	53.57985	65.21062	60.93403
##	2570	2571	2572	2573	2574	2575	2576	2577
##	62.67787	64.39996	62.77524	67.89568	73.67772	82.69675	81.89676	91.82727
##	2578	2579	2580	2581	2582	2583	2584	2585
##	80.43125	74.86673	75.15190	75.81002	61.35751	62.86042	51.70951	54.37082
##	2586	2587	2588	2589	2590	2591	2592	2593
##	53.65510	53.76749	54.82883	58.39357	60.85606	64.34655	54.64175	57.17011
##	2594	2595	2596	2597	2598	2599	2600	2601
##	51.46913	68.87288	72.93000	92.39788	86.72588	86.72882	75.85785	70.30262
##	2602	2603	2604	2605	2606	2607	2608	2609
##	57.27510	60.26965	62.73139	61.73530	122.64725	123.11758	122.27487	116.22604
##	2610	2611	2612	2613	2614	2615	2616	2617
##	121.50298	141.95273	138.99382	131.31617	152.56793	162.97273	168.86741	156.23080
##	2618	2619	2620	2621	2622	2623	2624	2625
##	100.97004	89.94303	74.57114	71.19321	55.41365	63.14535	59.33817	61.17401
##	2626	2627	2628	2629	2630	2631	2632	2633
##	62.94990	62.63558	65.83497	66.27822	63.75134	100.79199	104.63335	101.88074
##	2634	2635	2636	2637	2638	2639	2640	2641
##	108.80930	102.11811	103.10118	103.80421	107.31643	92.62851	70.26632	65.55064
##	2642	2643	2644	2645	2646	2647	2648	2649
##	56.48071	55.12283	52.80476	51.57421	51.63943	67.11630	81.92652	81.20400
##	2650	2651	2652	2653	2654	2655	2656	2657
##	97.89713	91.01677	101.29589	105.08239	105.17671	104.31747	99.26357	114.52811
##	2658	2659	2660	2661	2662	2663	2664	2665
##	105.69006	102.33056	107.87522	93.00052	105.27888	86.74314	81.81786	60.03584
##	2666	2667	2668	2669	2670	2671	2672	2673
##	57.96601	56.47258	56.17513	56.42934	56.03787	54.05358	54.25860	56.83987
##	2674	2675	2676	2677	2678	2679	2680	2681
##	76.70543	84.70542	86.43099	77.89473	86.20391	97.10444	121.97666	109.00883
##	2682	2683	2684	2685	2686	2687	2688	2689
##	98.25358	96.98354	98.76540	112.48999	109.48829	112.87454	100.16058	88.14215
##	2690	2691	2692	2693	2694	2695	2696	2697
##	77.40992	79.55922	65.52809	49.07712	54.52528	55.28348	56.75162	56.80159
##	2698	2699	2700	2701	2702	2703	2704	2705
##	53.15095	54.05303	52.72715	53.15938	56.84956	53.96416	51.81266	47.33280
##	2706	2707	2708	2709	2710	2711	2712	2713
##	51.01037	55.04006	55.49019	59.43520	60.27461	64.99842	69.23040	77.72654
##	2714	2715	2716	2717	2718	2719	2720	2721
##	78.27631	92.83157	94.37846	88.16417	71.29826	59.74440	51.80640	46.76571
##	2722	2723	2724	2725	2726	2727	2728	2729
##	54.80698	54.67204	56.08257	56.90183	55.52743	51.71023	56.11604	54.51577

##	2730	2731	2732	2733	2734	2735	2736	2737
##	55.41825	59.25149	76.91572	74.06285	71.70681	92.76657	97.85890	92.53842
##	2738	2739	2740	2741	2742	2743	2744	2745
##	99.22039	74.68523	81.23110	70.30032	46.88737	45.64332	46.35137	53.73103
##	2746	2747	2748	2749	2750	2751	2752	2753
##	53.10832	51.45503	54.50610	54.97318	58.82451	56.70460	57.33216	54.77000
##	2754	2755	2756	2757	2758	2759	2760	2761
##	58.80868	57.22138	60.41134	62.61444	66.50075	79.32298	83.89683	89.43345
##	2762	2763	2764	2765	2766	2767	2768	2769
##	92.79527	87.91297	84.01210	84.30128	83.63827	63.41045	36.84236	53.27735
##	2770	2771	2772	2773	2774	2775	2776	2777
##	53.34132	55.17987	58.16257	58.91727	90.82427	63.75007	85.02047	80.51941
##	2778	2779	2780	2781	2782	2783	2784	2785
##	95.30315	84.26054	76.24367	76.77187	57.50102	64.12359	65.30031	65.41076
##	2786	2787	2788	2789	2790	2791	2792	2793
##	77.92109	68.93446	75.67335	81.28760	76.77726	85.19086	83.78256	54.18224
##	2794	2795	2796	2797	2798	2799	2800	2801
##	54.41824	52.82146	50.13016	49.42580	50.71493	53.60808	54.90515	132.77462
##	2802	2803	2804	2805	2806	2807	2808	2809
##	146.58047	149.94107	130.87143	150.08528	141.09490	130.70169	139.98998	130.23804
##	2810	2811	2812	2813	2814	2815	2816	2817
##	129.94714	132.95829	134.94854	128.06439	113.87525	110.35224	110.06151	114.05983
##	2818	2819	2820	2821	2822	2823	2824	2825
##	98.39633	99.05638	61.72671	68.09358	88.55554	88.69484	101.07684	105.02456
##	2826	2827	2828	2829	2830	2831	2832	2833
##	111.72494	117.02478	113.16604	104.22214	97.58260	97.28793	100.77849	98.20112
##	2834	2835	2836	2837	2838	2839	2840	2841
##	96.40868	95.09559	100.84301	70.09040	54.34905	52.34123	55.46727	56.20716
##	2842	2843	2844	2845	2846	2847	2848	2849
##	56.39557	56.06465	56.84678	54.52852	53.25732	57.88215	58.46923	69.84288
##	2850	2851	2852	2853	2854	2855	2856	2857
##	83.19724	85.98595	90.42805	105.14032	101.20473	103.50961	114.78320	111.73404
##	2858	2859	2860	2861	2862	2863	2864	2865
##	106.45347	81.19692	54.19024	54.13176	64.83277	90.68779	90.69345	90.10188
##	2866	2867	2868	2869	2870	2871	2872	2873
##	102.75667	122.94925	127.47827	128.35354	122.14591	117.07808	120.03659	112.19971
##	2874	2875	2876	2877	2878	2879	2880	2881
##	118.28925	127.09013	124.53889	123.11771	94.11988	91.50269	101.66062	80.34166
##	2882	2883	2884	2885	2886	2887	2888	2889
##	57.63421	52.42327	51.72181	51.56069	52.26688	53.32272	53.59085	56.60569
##	2890	2891	2892	2893	2894	2895	2896	2897
##	51.91870	52.11012	88.15244	92.91122	75.21846	75.19064	74.49093	78.22513
##	2898	2899	2900	2901	2902	2903	2904	2905
##	79.36797	92.78695	95.07222	89.36740	91.64940	90.16987	92.50885	91.00101
##	2906	2907	2908	2909	2910	2911	2912	2913
##	87.51907	78.26345	75.22155	65.43410	64.84443	64.03784	63.78128	61.40548
##	2914	2915	2916	2917	2918	2919	2920	2921
##	53.96802	53.94093	54.50750	56.31917	57.47914	56.79888	55.82495	56.43328
##	2922	2923	2924	2925	2926	2927	2928	2929
##	56.34461	59.25434	60.55146	69.31280	79.46997	83.46425	96.11751	94.50231
##	2930	2931	2932	2933	2934	2935	2936	2937
##	90.89100	100.35496	91.17318	114.31390	124.11219	126.23348	136.36345	117.97876

```
##      2938      2939      2940      2941      2942      2943      2944      2945
## 112.47622 103.66359 98.49662 74.07172 67.35703 60.31933 56.78980 57.07218
##      2946      2947      2948      2949      2950      2951      2952      2953
## 56.68671 57.15486 52.42870 54.39902 55.49521 57.32415 56.77456 124.99813
##      2954      2955      2956      2957      2958      2959      2960      2961
## 132.01019 153.86331 149.58126 114.13437 112.67458 107.15386 98.05617 96.59341
```

Regressão Logística Multilinear

```
# Regressão Logística Multilinear
lm_model <- lm(Appliances ~ ., data = x_train)
lm_model
```

```
##
## Call:
## lm(formula = Appliances ~ ., data = x_train)
##
## Coefficients:
##      (Intercept)          date          lights
##      2.622e+03      -1.813e-06      1.028e+00
##           T1           RH_1           T2
##      -1.191e+00      7.005e+00      -7.447e+00
##           RH_2           T3           RH_3
##      -5.731e+00      1.151e+01      2.390e+00
##           T4           RH_4           T5
##      -1.358e-01      -4.222e-01      -2.765e-02
##           RH_5           T6           RH_6
##      1.662e-01      3.429e+00      4.530e-02
##           T7           RH_7           T8
##      -1.996e+00      -3.305e-01      6.571e+00
##           RH_8           T9           RH_9
##      -2.723e+00      -5.157e+00      -1.124e+00
##           T_out      Press_mm_hg      RH_out
##      -3.504e+00      6.235e-02      -8.865e-02
##           Windspeed      Visibility      Tdewpoint
##      8.123e-01      4.872e-02      1.282e+00
##           rv1           rv2           NSM
##      -2.395e-02           NA      1.684e-04
##      WeekStatusWeekend      Day_of_weekMonday      Day_of_weekSaturday
##      -2.035e+00      -5.054e+00      6.435e+00
##      Day_of_weekSunday      Day_of_weekThursday      Day_of_weekTuesday
##           NA      -6.625e+00      -8.817e+00
##      Day_of_weekWednesday
##      -3.233e+00
```

```
# Visualize os coeficientes do modelo
summary(lm_model)
```

```
##
## Call:
## lm(formula = Appliances ~ ., data = x_train)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -101.954  -22.494   -7.115   12.028  137.679
##
## Coefficients: (2 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.622e+03  5.477e+02   4.788 1.71e-06 ***
## date          -1.813e-06  3.794e-07  -4.779 1.78e-06 ***
## lights         1.028e+00  4.793e-02  21.454 < 2e-16 ***
## T1            -1.191e+00  9.277e-01  -1.284 0.199096
## RH_1           7.005e+00  3.329e-01  21.039 < 2e-16 ***
## T2            -7.447e+00  8.101e-01  -9.193 < 2e-16 ***
## RH_2          -5.731e+00  3.795e-01 -15.101 < 2e-16 ***
## T3             1.151e+01  5.478e-01  21.014 < 2e-16 ***
## RH_3           2.390e+00  3.472e-01   6.884 6.13e-12 ***
## T4            -1.358e-01  5.319e-01  -0.255 0.798448
## RH_4          -4.222e-01  3.217e-01  -1.312 0.189461
## T5            -2.765e-02  5.879e-01  -0.047 0.962487
## RH_5           1.662e-01  4.379e-02   3.794 0.000149 ***
## T6             3.429e+00  3.176e-01  10.796 < 2e-16 ***
## RH_6           4.530e-02  3.786e-02   1.196 0.231589
## T7            -1.996e+00  6.577e-01  -3.034 0.002417 **
## RH_7          -3.305e-01  2.161e-01  -1.529 0.126313
## T8             6.571e+00  5.021e-01  13.088 < 2e-16 ***
## RH_8          -2.723e+00  1.998e-01 -13.624 < 2e-16 ***
## T9            -5.157e+00  9.279e-01  -5.557 2.80e-08 ***
## RH_9          -1.124e+00  2.169e-01  -5.182 2.23e-07 ***
## T_out         -3.504e+00  7.671e-01  -4.568 4.98e-06 ***
## Press_mm_hg     6.235e-02  5.335e-02   1.169 0.242545
## RH_out         -8.865e-02  1.603e-01  -0.553 0.580320
## Windspeed       8.123e-01  1.754e-01   4.632 3.66e-06 ***
## Visibility      4.872e-02  2.890e-02   1.685 0.091920 .
## Tdewpoint       1.282e+00  7.383e-01   1.736 0.082506 .
## rv1            -2.395e-02  2.288e-02  -1.047 0.295291
## rv2              NA         NA         NA         NA
## NSM             1.684e-04  1.978e-05   8.513 < 2e-16 ***
## WeekStatusWeekend -2.035e+00  1.324e+00  -1.536 0.124446
## Day_of_weekMonday -5.054e+00  1.292e+00  -3.913 9.17e-05 ***
## Day_of_weekSaturday 6.435e+00  1.307e+00   4.923 8.62e-07 ***
## Day_of_weekSunday   NA         NA         NA         NA
## Day_of_weekThursday -6.625e+00  1.296e+00  -5.113 3.21e-07 ***
## Day_of_weekTuesday -8.817e+00  1.282e+00  -6.878 6.37e-12 ***
## Day_of_weekWednesday -3.233e+00  1.303e+00  -2.481 0.013099 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 35.88 on 11719 degrees of freedom
## (88 observations deleted due to missingness)
```

```
## Multiple R-squared:  0.3079, Adjusted R-squared:  0.3059  
## F-statistic: 153.3 on 34 and 11719 DF,  p-value: < 2.2e-16
```

```
# Previsão  
predictions_lm <- predict(lm_model, newdata = y_test)  
predictions_lm
```

##	1	2	3	4	5	6	7	8
##	112.99098	85.89121	88.07560	83.05560	61.26336	61.44689	60.48400	49.23677
##	9	10	11	12	13	14	15	16
##	37.48933	37.06832	37.39349	45.40261	57.43474	100.41308	69.88917	74.15924
##	17	18	19	20	21	22	23	24
##	74.84929	65.04549	69.84745	72.30964	72.23986	67.30039	65.81573	78.73805
##	25	26	27	28	29	30	31	32
##	69.75337	56.50494	55.64896	56.44531	45.64572	45.68337	41.17721	38.74555
##	33	34	35	36	37	38	39	40
##	41.01746	42.02865	43.38341	44.86885	45.59411	64.58199	57.59345	52.14578
##	41	42	43	44	45	46	47	48
##	52.80979	73.44231	68.58250	67.77527	67.00338	66.70550	65.42835	77.02748
##	49	50	51	52	53	54	55	56
##	73.61527	85.23453	97.11251	87.71832	100.56739	109.55350	60.93453	51.76754
##	57	58	59	60	61	62	63	64
##	52.02083	53.84669	53.29217	54.48415	67.95994	79.25039	65.10383	73.55005
##	65	66	67	68	69	70	71	72
##	98.36033	108.48952	118.68941	83.71740	77.89555	60.13210	124.96947	96.53748
##	73	74	75	76	77	78	79	80
##	135.45146	56.58372	45.37462	33.13672	30.46095	31.30919	40.29411	40.58391
##	81	82	83	84	85	86	87	88
##	42.36495	45.46097	54.17230	46.34936	74.07189	66.36833	64.93970	55.88614
##	89	90	91	92	93	94	95	96
##	63.24783	53.78272	85.57777	82.37402	66.31328	43.94601	43.42575	36.80562
##	97	98	99	100	101	102	103	104
##	37.71205	32.20281	32.78546	37.35605	39.40898	57.60268	53.15527	50.40987
##	105	106	107	108	109	110	111	112
##	42.21431	42.25194	42.50333	52.45840	94.26877	107.36649	98.35507	112.04020
##	113	114	115	116	117	118	119	120
##	143.58761	143.75504	84.02421	59.60527	59.93518	55.67530	55.71044	55.51000
##	121	122	123	124	125	126	127	128
##	54.93016	56.87159	77.06606	64.74962	68.17483	72.98813	68.61553	75.20561
##	129	130	131	132	133	134	135	136
##	68.00911	69.40844	129.30479	100.77626	93.42568	110.02134	55.38065	59.69364
##	137	138	139	140	141	142	143	144
##	47.30786	45.59329	43.66307	44.29242	46.76613	51.67793	53.08373	62.02874
##	145	146	147	148	149	150	151	152
##	64.93211	74.77177	76.98197	79.25049	77.62679	74.09234	93.34303	80.87687
##	153	154	155	156	157	158	159	160
##	109.57701	100.17317	74.71754	NA	45.63730	48.59693	48.82529	48.76546
##	161	162	163	164	165	166	167	168
##	50.57201	57.83332	56.45098	53.89378	56.83756	55.15584	54.32428	55.98005
##	169	170	171	172	173	174	175	176
##	55.70663	58.93746	66.35087	65.81412	57.72302	108.74150	77.25588	62.96196
##	177	178	179	180	181	182	183	184
##	59.42872	44.35219	43.00202	43.45774	43.19284	47.08769	53.58278	85.06828
##	185	186	187	188	189	190	191	192
##	72.34925	90.59249	83.69620	70.37135	74.05781	84.51143	86.84671	87.80329
##	193	194	195	196	197	198	199	200
##	88.60694	178.75139	125.12984	94.95618	92.13466	86.69740	81.48515	54.42080
##	201	202	203	204	205	206	207	208
##	54.70220	53.88893	52.06481	52.61181	54.36174	61.70109	85.36114	65.57042

##	209	210	211	212	213	214	215	216
##	65.51021	66.54962	126.16458	103.81145	100.62410	89.76218	92.43141	104.42873
##	217	218	219	220	221	222	223	224
##	69.40816	63.68432	53.69830	49.43906	46.42742	49.86923	51.30992	54.56923
##	225	226	227	228	229	230	231	232
##	55.55114	55.14606	55.85524	53.74514	61.58354	69.33917	71.53815	73.16534
##	233	234	235	236	237	238	239	240
##	75.14593	78.77757	76.29665	72.81820	72.14871	73.42700	73.47220	73.03003
##	241	242	243	244	245	246	247	248
##	62.90696	63.50894	63.49667	66.57483	64.36222	83.93179	74.26888	76.66131
##	249	250	251	252	253	254	255	256
##	81.10903	92.29784	83.44602	87.32484	89.31133	84.06846	84.33005	75.75470
##	257	258	259	260	261	262	263	264
##	76.06446	70.82298	70.83761	71.26510	70.17660	70.63554	66.26999	51.34939
##	265	266	267	268	269	270	271	272
##	50.68735	51.35731	51.72960	55.43321	75.20647	96.40078	105.90499	93.17518
##	273	274	275	276	277	278	279	280
##	92.02078	102.26550	88.89210	82.24711	77.81550	91.30553	69.24524	69.57167
##	281	282	283	284	285	286	287	288
##	41.29939	44.74654	44.12828	45.61568	46.56791	47.35562	46.34538	46.05252
##	289	290	291	292	293	294	295	296
##	46.37069	46.01766	49.88818	51.33091	52.35027	66.61794	66.37912	65.71792
##	297	298	299	300	301	302	303	304
##	69.40876	72.42572	70.08320	89.31533	76.77639	82.25507	65.66508	45.73779
##	305	306	307	308	309	310	311	312
##	45.09559	48.10292	51.26972	48.80975	46.46035	46.07837	46.18212	45.78853
##	313	314	315	316	317	318	319	320
##	50.31805	63.83703	54.92997	59.25480	58.99909	63.31410	63.14136	65.23906
##	321	322	323	324	325	326	327	328
##	81.32405	132.56781	65.42495	84.41216	45.24926	43.59967	40.96778	40.17632
##	329	330	331	332	333	334	335	336
##	51.54715	54.69070	55.70823	55.99750	57.41247	57.17477	59.66193	57.92948
##	337	338	339	340	341	342	343	344
##	58.20031	59.13282	60.06907	63.70047	63.28705	63.90598	63.11573	42.43076
##	345	346	347	348	349	350	351	352
##	42.25557	45.22227	44.16451	44.57644	43.72954	44.23562	45.14943	43.62218
##	353	354	355	356	357	358	359	360
##	44.86020	46.24732	45.12481	46.97659	52.28595	61.04274	65.46352	68.92321
##	361	362	363	364	365	366	367	368
##	60.49230	60.06239	60.07336	50.00283	50.31184	52.11934	52.54290	54.53789
##	369	370	371	372	373	374	375	376
##	58.42032	56.77361	59.22369	62.80762	62.16655	64.79421	67.22579	66.74720
##	377	378	379	380	381	382	383	384
##	69.95741	72.56033	72.86829	71.88235	73.79266	83.84443	76.38703	65.62533
##	385	386	387	388	389	390	391	392
##	66.00968	63.41151	61.33132	61.18282	64.04657	64.52610	62.77863	67.07412
##	393	394	395	396	397	398	399	400
##	65.77338	87.06880	76.53059	85.17967	110.12818	244.17790	100.18729	92.26995
##	401	402	403	404	405	406	407	408
##	89.97890	84.80039	NA	61.27995	53.42930	53.42500	54.75910	52.72299
##	409	410	411	412	413	414	415	416
##	53.23996	54.52358	54.67510	85.72881	90.75118	70.63641	89.32435	78.72445

##	417	418	419	420	421	422	423	424
##	83.97814	74.79362	95.19661	112.45517	125.18819	127.23922	110.72712	101.98048
##	425	426	427	428	429	430	431	432
##	101.68008	86.48073	NA	63.24888	60.55112	58.12393	68.23998	61.24293
##	433	434	435	436	437	438	439	440
##	71.21130	67.52590	65.98965	86.39373	106.11661	91.27299	95.95460	108.87972
##	441	442	443	444	445	446	447	448
##	113.73910	114.37243	112.91221	137.19222	142.48506	139.23187	NA	54.76780
##	449	450	451	452	453	454	455	456
##	56.05994	55.07000	54.66186	56.08360	58.65162	58.45663	56.94521	96.21773
##	457	458	459	460	461	462	463	464
##	101.42349	89.29602	108.31338	99.52326	75.23783	81.96706	83.05062	88.02281
##	465	466	467	468	469	470	471	472
##	97.83734	150.75191	149.35639	139.84035	98.37147	94.61354	85.42931	64.97653
##	473	474	475	476	477	478	479	480
##	79.07080	84.77275	98.27797	98.93060	67.99992	69.17158	70.70566	71.44978
##	481	482	483	484	485	486	487	488
##	90.33664	95.04961	93.58180	103.11810	102.20526	114.96998	155.10020	160.26180
##	489	490	491	492	493	494	495	496
##	146.63722	131.40774	110.01513	104.98266	107.53210	77.73466	67.33765	66.39397
##	497	498	499	500	501	502	503	504
##	66.41381	95.62021	88.53562	91.90673	100.66829	124.75649	116.15944	132.01502
##	505	506	507	508	509	510	511	512
##	127.62619	126.30724	128.91287	80.77130	73.69097	70.48126	118.52370	100.05218
##	513	514	515	516	517	518	519	520
##	NA	54.80313	57.82881	65.04167	66.15799	67.02751	66.50644	87.12863
##	521	522	523	524	525	526	527	528
##	72.14552	72.60371	71.28351	82.15148	71.28716	71.08781	69.35855	79.63811
##	529	530	531	532	533	534	535	536
##	64.84904	64.75786	116.08871	76.51036	80.15586	80.34518	77.07107	63.41106
##	537	538	539	540	541	542	543	544
##	63.72834	64.48740	71.81148	72.00803	72.66757	70.56634	73.94936	84.59944
##	545	546	547	548	549	550	551	552
##	91.18197	94.54300	120.57212	97.64848	91.60165	77.09987	86.67124	95.99648
##	553	554	555	556	557	558	559	560
##	109.82730	93.37758	78.72608	79.36184	NA	52.27170	53.89240	58.97275
##	561	562	563	564	565	566	567	568
##	57.09174	58.51261	60.52088	59.55521	57.88136	81.49179	87.46902	90.14989
##	569	570	571	572	573	574	575	576
##	110.89234	106.00748	103.23344	105.43844	116.93243	118.81123	113.32020	112.53051
##	577	578	579	580	581	582	583	584
##	107.40942	105.84037	118.80396	133.52269	107.85453	62.49625	61.57187	59.95811
##	585	586	587	588	589	590	591	592
##	57.17658	87.91268	78.34861	79.15873	123.89169	142.02242	154.71578	150.64403
##	593	594	595	596	597	598	599	600
##	156.59395	129.41375	128.90939	136.99161	139.15254	127.24941	123.02370	NA
##	601	602	603	604	605	606	607	608
##	74.63435	68.45998	70.69557	69.84907	70.49132	70.22172	70.77486	71.25944
##	609	610	611	612	613	614	615	616
##	68.30470	67.19411	69.04824	98.20925	63.10755	64.32528	65.16356	65.51537
##	617	618	619	620	621	622	623	624
##	63.37353	60.67598	94.70491	91.91900	89.91584	121.21788	129.51395	106.94250

##	625	626	627	628	629	630	631	632
##	101.86187	102.56052	98.36415	97.29846	85.71148	83.38537	78.73581	79.23162
##	633	634	635	636	637	638	639	640
##	78.77878	79.72092	77.76361	79.70282	80.66936	78.87391	68.94969	67.66155
##	641	642	643	644	645	646	647	648
##	82.45641	103.77156	88.69435	85.46033	94.62292	92.92049	89.67402	84.09710
##	649	650	651	652	653	654	655	656
##	84.98751	83.72796	143.65163	110.49116	100.00406	98.86209	113.68568	113.88048
##	657	658	659	660	661	662	663	664
##	67.40165	67.64319	64.28871	64.16700	61.78551	61.20944	53.76721	55.90762
##	665	666	667	668	669	670	671	672
##	57.60513	55.09103	79.47590	72.98581	97.00854	123.02015	95.27746	95.46542
##	673	674	675	676	677	678	679	680
##	91.91943	115.00727	79.65354	78.45017	65.10638	63.96789	58.80572	58.19442
##	681	682	683	684	685	686	687	688
##	58.12889	72.31984	71.93919	78.71364	118.10974	123.41673	121.10164	118.28880
##	689	690	691	692	693	694	695	696
##	109.15133	104.99232	133.44854	112.96478	125.62185	131.98063	124.31589	135.44295
##	697	698	699	700	701	702	703	704
##	75.12033	73.71591	68.96449	71.94203	71.63611	75.57678	73.90774	73.58584
##	705	706	707	708	709	710	711	712
##	75.06382	76.38564	79.75815	84.05357	89.74278	118.36182	100.62860	99.70431
##	713	714	715	716	717	718	719	720
##	93.82302	96.83377	98.20274	143.34053	146.44680	99.00532	117.41693	98.91700
##	721	722	723	724	725	726	727	728
##	62.13855	57.11245	56.67628	56.49127	55.09263	57.37911	61.17285	64.55321
##	729	730	731	732	733	734	735	736
##	113.25886	115.71854	85.08939	88.11422	117.94347	109.74764	113.17064	138.33521
##	737	738	739	740	741	742	743	744
##	123.51992	135.79701	114.53633	111.21197	82.56932	61.58787	73.30594	83.60924
##	745	746	747	748	749	750	751	752
##	63.12134	91.43468	120.34063	123.72291	125.40389	115.05266	93.28998	143.39339
##	753	754	755	756	757	758	759	760
##	118.31707	110.66203	79.91408	65.63768	64.28252	55.88559	57.00859	67.35990
##	761	762	763	764	765	766	767	768
##	76.56840	96.13069	108.99062	100.22544	78.20721	83.37868	56.45971	58.94848
##	769	770	771	772	773	774	775	776
##	61.22743	57.37414	47.56695	58.11443	67.16925	74.43268	71.97623	95.05527
##	777	778	779	780	781	782	783	784
##	89.26897	84.37325	86.47633	76.16020	76.32478	86.51627	61.61145	61.60648
##	785	786	787	788	789	790	791	792
##	NA	38.32254	46.39063	46.90396	51.15584	52.08699	60.95013	70.24922
##	793	794	795	796	797	798	799	800
##	81.72157	95.09358	87.78803	96.45222	99.94570	118.90082	107.72054	110.25282
##	801	802	803	804	805	806	807	808
##	85.65820	79.82666	76.44917	72.68064	73.06100	73.35478	93.61778	85.41114
##	809	810	811	812	813	814	815	816
##	92.07618	52.05648	51.08310	50.24259	50.78959	51.28759	51.57468	50.44350
##	817	818	819	820	821	822	823	824
##	51.00772	51.62297	51.26525	74.92085	67.30320	83.73002	75.65142	117.31470
##	825	826	827	828	829	830	831	832
##	101.63662	100.17215	112.08428	108.22882	95.18506	92.11985	91.24161	90.75616

##	833	834	835	836	837	838	839	840
##	91.41596	90.15931	91.06109	80.01858	79.57240	71.72651	70.06275	67.60061
##	841	842	843	844	845	846	847	848
##	66.54436	67.44981	66.60744	66.24595	68.23113	64.52580	64.29284	99.05084
##	849	850	851	852	853	854	855	856
##	87.91453	77.74078	72.58796	114.93549	138.36840	110.88280	101.93345	NA
##	857	858	859	860	861	862	863	864
##	64.56807	60.51913	60.90143	57.54058	55.96019	56.05630	54.42009	54.28032
##	865	866	867	868	869	870	871	872
##	54.70030	56.16556	77.99061	93.62554	79.87067	99.38928	101.13589	122.03824
##	873	874	875	876	877	878	879	880
##	117.58203	116.59749	116.00901	118.73169	121.68571	111.70707	117.63724	104.21620
##	881	882	883	884	885	886	887	888
##	112.88301	112.43428	81.61656	71.30936	59.99736	60.97571	62.85085	73.43579
##	889	890	891	892	893	894	895	896
##	84.61521	73.79347	69.75354	67.23454	78.34046	78.37789	78.54470	70.47295
##	897	898	899	900	901	902	903	904
##	86.28423	92.46468	73.20616	71.85620	70.60967	107.23085	96.73519	86.52624
##	905	906	907	908	909	910	911	912
##	67.77544	70.23572	51.61583	49.92224	48.27296	46.30508	47.40548	50.08081
##	913	914	915	916	917	918	919	920
##	48.74711	50.27391	48.96925	51.80705	58.18666	61.66233	64.78310	67.40557
##	921	922	923	924	925	926	927	928
##	69.28712	69.45572	87.27195	78.01199	102.19101	91.37045	80.13625	74.03310
##	929	930	931	932	933	934	935	936
##	61.35308	67.92421	63.87698	45.25493	44.55083	49.87723	49.26342	56.87802
##	937	938	939	940	941	942	943	944
##	70.56565	81.06101	85.54533	111.98467	98.88057	100.73144	92.95107	89.39124
##	945	946	947	948	949	950	951	952
##	87.72823	87.53450	67.98599	49.43336	52.46102	50.59319	50.76459	51.60119
##	953	954	955	956	957	958	959	960
##	52.62893	52.89988	51.78942	52.19573	53.26644	52.39102	53.51641	132.22836
##	961	962	963	964	965	966	967	968
##	126.93640	152.47867	115.41022	161.76210	121.70620	111.14178	111.99224	65.22346
##	969	970	971	972	973	974	975	976
##	63.53374	61.26015	58.21648	64.18883	62.00839	63.33819	68.49368	84.10639
##	977	978	979	980	981	982	983	984
##	70.00380	73.11086	93.67177	93.06451	90.29044	89.22939	91.40781	91.53744
##	985	986	987	988	989	990	991	992
##	78.73684	48.20064	53.45834	51.42038	51.90981	52.29745	56.20122	57.42046
##	993	994	995	996	997	998	999	1000
##	55.35691	61.75039	66.30987	76.53404	91.57382	108.64339	108.57882	97.76576
##	1001	1002	1003	1004	1005	1006	1007	1008
##	91.77333	89.28955	99.14489	88.31035	68.24123	67.77597	57.85144	60.17501
##	1009	1010	1011	1012	1013	1014	1015	1016
##	60.66199	59.98316	66.82552	77.69263	67.52436	64.09007	64.53520	66.83568
##	1017	1018	1019	1020	1021	1022	1023	1024
##	69.33323	69.77265	68.78834	90.06480	82.02797	74.69766	44.91012	34.94628
##	1025	1026	1027	1028	1029	1030	1031	1032
##	42.01509	43.03492	44.16993	43.61538	45.06317	52.45205	56.35930	54.15444
##	1033	1034	1035	1036	1037	1038	1039	1040
##	63.25274	88.32984	106.33664	117.62814	118.65032	117.63654	123.54597	140.15804

##	1041	1042	1043	1044	1045	1046	1047	1048
##	97.62618	97.42033	86.09692	43.95720	45.32568	50.93752	66.31937	66.43147
##	1049	1050	1051	1052	1053	1054	1055	1056
##	70.08256	84.14460	83.74786	81.50571	88.59219	79.72360	68.92485	64.97399
##	1057	1058	1059	1060	1061	1062	1063	1064
##	97.40721	86.49822	88.97954	71.15342	69.73313	65.36972	72.94999	41.26129
##	1065	1066	1067	1068	1069	1070	1071	1072
##	44.22784	43.18190	42.05139	41.63047	44.59700	47.71653	98.28074	85.54135
##	1073	1074	1075	1076	1077	1078	1079	1080
##	63.19216	62.17036	69.97137	83.12731	83.81263	99.47470	88.21577	83.23023
##	1081	1082	1083	1084	1085	1086	1087	1088
##	76.49917	76.52784	111.58834	109.64806	162.74577	122.88044	77.96573	75.63826
##	1089	1090	1091	1092	1093	1094	1095	1096
##	48.71198	48.06439	51.15707	50.21189	68.30858	81.57052	82.35310	85.08673
##	1097	1098	1099	1100	1101	1102	1103	1104
##	78.73441	97.27430	90.40320	75.23960	92.32644	89.77092	59.93356	59.52443
##	1105	1106	1107	1108	1109	1110	1111	1112
##	59.90733	48.30751	47.96839	54.80691	77.52151	68.20112	71.39946	94.57721
##	1113	1114	1115	1116	1117	1118	1119	1120
##	87.73496	79.59433	85.53974	87.84554	89.06187	100.11485	97.16133	100.40710
##	1121	1122	1123	1124	1125	1126	1127	1128
##	101.12804	101.66727	99.92801	110.61983	107.10562	105.77294	88.47953	86.43092
##	1129	1130	1131	1132	1133	1134	1135	1136
##	86.36965	82.86493	73.28617	63.17593	58.57886	58.06620	59.29909	59.21062
##	1137	1138	1139	1140	1141	1142	1143	1144
##	56.78603	59.34655	60.13029	61.04735	74.38461	77.56271	76.15944	82.58634
##	1145	1146	1147	1148	1149	1150	1151	1152
##	82.41574	83.82595	116.14959	114.75708	128.10002	119.45301	110.75417	110.48395
##	1153	1154	1155	1156	1157	1158	1159	1160
##	96.34128	68.46993	63.77047	61.96970	57.36472	59.76283	64.86774	64.72216
##	1161	1162	1163	1164	1165	1166	1167	1168
##	59.30080	59.00252	66.68212	69.39857	70.38238	70.68071	71.05405	104.55834
##	1169	1170	1171	1172	1173	1174	1175	1176
##	93.88104	113.50409	102.37824	116.67795	124.84407	124.02331	59.21714	52.19096
##	1177	1178	1179	1180	1181	1182	1183	1184
##	50.29775	52.49464	50.91837	55.08507	56.19697	66.06649	97.75982	107.82847
##	1185	1186	1187	1188	1189	1190	1191	1192
##	112.53893	114.22559	118.88982	128.22990	136.48387	125.49769	119.47513	106.25088
##	1193	1194	1195	1196	1197	1198	1199	1200
##	97.70365	95.85766	111.47378	87.27856	102.94442	103.00903	97.98046	78.44085
##	1201	1202	1203	1204	1205	1206	1207	1208
##	80.52086	69.59105	44.04907	40.54228	40.58297	46.75736	61.00483	74.69976
##	1209	1210	1211	1212	1213	1214	1215	1216
##	75.71333	97.86152	97.42042	115.01810	146.53091	132.02686	115.72522	113.80069
##	1217	1218	1219	1220	1221	1222	1223	1224
##	112.44547	104.38024	78.02790	78.58328	75.88181	69.41295	57.24871	50.21371
##	1225	1226	1227	1228	1229	1230	1231	1232
##	53.57990	50.71737	50.33622	66.13022	57.07886	65.91720	70.96942	70.39560
##	1233	1234	1235	1236	1237	1238	1239	1240
##	70.42647	91.72322	82.57037	72.94570	91.51416	86.24217	107.61485	95.61986
##	1241	1242	1243	1244	1245	1246	1247	1248
##	89.53763	84.44879	77.43477	61.71074	46.74492	42.07338	34.90822	35.58371

##	1249	1250	1251	1252	1253	1254	1255	1256
##	41.83068	57.84409	71.09535	72.76947	78.23052	80.98314	116.36811	121.87103
##	1257	1258	1259	1260	1261	1262	1263	1264
##	116.92353	63.42920	49.88434	48.93279	44.23187	40.80077	39.25520	39.32085
##	1265	1266	1267	1268	1269	1270	1271	1272
##	39.92170	38.66372	39.18861	49.01593	39.88829	66.02282	61.83131	46.89184
##	1273	1274	1275	1276	1277	1278	1279	1280
##	47.11093	61.60273	78.73557	83.19182	84.95794	83.56431	96.53244	94.36704
##	1281	1282	1283	1284	1285	1286	1287	1288
##	75.67778	60.41395	56.45454	39.92369	39.60203	37.57389	42.46729	41.24526
##	1289	1290	1291	1292	1293	1294	1295	1296
##	40.39828	40.09490	42.86632	43.02019	42.43970	62.44250	51.45906	56.03112
##	1297	1298	1299	1300	1301	1302	1303	1304
##	75.62328	104.41221	100.34156	104.50174	112.42150	102.06609	92.96256	110.51458
##	1305	1306	1307	1308	1309	1310	1311	1312
##	110.03170	99.93528	NA	52.96364	52.75807	51.98532	48.33015	48.99237
##	1313	1314	1315	1316	1317	1318	1319	1320
##	47.07750	45.35907	45.34368	65.15297	74.44166	88.92009	97.85920	97.94022
##	1321	1322	1323	1324	1325	1326	1327	1328
##	88.21109	87.16908	89.53892	93.18656	91.29474	75.09575	73.60695	71.25350
##	1329	1330	1331	1332	1333	1334	1335	1336
##	70.35749	48.26274	47.15881	40.99813	42.27476	43.18020	41.95923	39.67690
##	1337	1338	1339	1340	1341	1342	1343	1344
##	51.18290	52.49567	56.89430	58.48738	72.13589	114.39951	125.81495	110.70944
##	1345	1346	1347	1348	1349	1350	1351	1352
##	118.72290	129.99728	110.45610	118.85221	116.68225	107.00567	107.71256	97.84927
##	1353	1354	1355	1356	1357	1358	1359	1360
##	119.26455	95.35782	103.39569	92.42835	90.87513	58.84080	38.58505	41.25865
##	1361	1362	1363	1364	1365	1366	1367	1368
##	38.88399	40.10527	39.62134	40.37132	54.94582	52.76709	53.31595	47.81579
##	1369	1370	1371	1372	1373	1374	1375	1376
##	58.95700	55.63363	69.15179	69.10129	68.10554	73.93697	66.90759	82.52672
##	1377	1378	1379	1380	1381	1382	1383	1384
##	74.54412	87.28661	103.63026	81.26181	80.08905	117.09485	119.62326	91.04899
##	1385	1386	1387	1388	1389	1390	1391	1392
##	103.82639	78.90803	64.69257	63.67306	75.07376	63.19223	59.50116	59.25667
##	1393	1394	1395	1396	1397	1398	1399	1400
##	37.25903	43.96734	46.57007	45.04443	52.63216	106.32479	96.02247	99.19835
##	1401	1402	1403	1404	1405	1406	1407	1408
##	141.81472	144.31815	153.99336	131.32105	125.80667	142.84620	162.21297	138.96933
##	1409	1410	1411	1412	1413	1414	1415	1416
##	134.38587	89.62739	NA	72.53755	71.97470	71.98829	72.58982	73.43955
##	1417	1418	1419	1420	1421	1422	1423	1424
##	65.61485	63.81687	64.08059	65.82455	67.91714	83.10387	58.55394	63.19931
##	1425	1426	1427	1428	1429	1430	1431	1432
##	68.19141	77.61953	87.85313	92.47405	128.99458	108.46627	105.07956	97.83097
##	1433	1434	1435	1436	1437	1438	1439	1440
##	91.94301	52.13713	49.91158	51.08809	50.55563	52.68019	50.81413	52.69034
##	1441	1442	1443	1444	1445	1446	1447	1448
##	51.49942	51.13216	69.95386	71.48911	69.74607	71.24113	72.36111	86.54780
##	1449	1450	1451	1452	1453	1454	1455	1456
##	85.59250	87.42559	80.65063	76.15422	73.02738	60.27934	59.75872	60.85646

##	1457	1458	1459	1460	1461	1462	1463	1464
##	58.67062	58.21777	59.57660	60.38412	60.99275	60.68157	63.80033	120.62608
##	1465	1466	1467	1468	1469	1470	1471	1472
##	120.61661	105.85858	101.91555	104.26855	113.74236	99.94870	100.93266	94.50821
##	1473	1474	1475	1476	1477	1478	1479	1480
##	87.14110	NA	60.33599	57.82001	59.74218	67.48686	67.52951	69.75165
##	1481	1482	1483	1484	1485	1486	1487	1488
##	74.51785	84.41137	92.38611	104.06737	114.33780	99.60320	96.65457	94.48026
##	1489	1490	1491	1492	1493	1494	1495	1496
##	92.17253	102.96017	101.32293	101.95042	118.21917	102.97439	101.95234	87.57514
##	1497	1498	1499	1500	1501	1502	1503	1504
##	85.04333	84.14189	65.07011	59.84402	55.07635	51.70718	51.07811	48.97320
##	1505	1506	1507	1508	1509	1510	1511	1512
##	50.16030	53.27779	66.76655	74.39196	78.88570	79.12153	79.44644	77.49111
##	1513	1514	1515	1516	1517	1518	1519	1520
##	76.52982	77.00613	79.30961	98.91522	104.20672	110.48123	97.42725	107.52449
##	1521	1522	1523	1524	1525	1526	1527	1528
##	98.75284	NA	65.47441	45.07718	48.04580	38.61529	38.77617	42.80601
##	1529	1530	1531	1532	1533	1534	1535	1536
##	54.62144	73.37271	80.76412	79.32975	77.79454	75.25481	72.84998	79.49738
##	1537	1538	1539	1540	1541	1542	1543	1544
##	81.13138	85.96917	73.99811	57.05655	53.90626	55.34244	54.84345	59.50449
##	1545	1546	1547	1548	1549	1550	1551	1552
##	55.15524	69.06372	95.22243	72.63038	80.69496	86.84051	110.41405	118.02748
##	1553	1554	1555	1556	1557	1558	1559	1560
##	97.97611	110.25122	112.55249	72.10579	NA	50.25698	49.88632	51.32146
##	1561	1562	1563	1564	1565	1566	1567	1568
##	52.70253	53.15840	56.60000	54.78388	50.64447	52.69844	76.01305	69.26137
##	1569	1570	1571	1572	1573	1574	1575	1576
##	75.27214	77.49973	116.04202	81.48143	86.01309	NA	53.67759	51.61381
##	1577	1578	1579	1580	1581	1582	1583	1584
##	52.30680	51.04086	51.80496	53.77383	55.70170	55.67590	57.04429	70.84935
##	1585	1586	1587	1588	1589	1590	1591	1592
##	63.71161	61.71950	85.23375	86.77944	88.13734	102.47301	99.69104	95.59296
##	1593	1594	1595	1596	1597	1598	1599	1600
##	145.25580	141.59058	142.94132	130.90785	89.99407	87.32473	78.00887	56.33365
##	1601	1602	1603	1604	1605	1606	1607	1608
##	52.00191	57.29931	60.22675	59.87704	61.02033	62.38320	69.30854	110.21501
##	1609	1610	1611	1612	1613	1614	1615	1616
##	110.84014	111.26468	107.32312	114.77066	99.37382	106.37698	104.37963	95.94158
##	1617	1618	1619	1620	1621	1622	1623	1624
##	75.67107	71.05380	47.16037	45.96938	44.07751	43.34383	86.58292	91.91531
##	1625	1626	1627	1628	1629	1630	1631	1632
##	98.94827	94.84517	87.08178	84.43118	85.06263	90.32516	88.87116	87.43650
##	1633	1634	1635	1636	1637	1638	1639	1640
##	66.38310	60.84064	58.21883	59.42063	62.48996	59.54623	69.04251	66.88983
##	1641	1642	1643	1644	1645	1646	1647	1648
##	72.51482	70.29721	83.22309	113.05598	112.36951	115.11312	111.81657	115.13765
##	1649	1650	1651	1652	1653	1654	1655	1656
##	97.55907	49.49672	64.42715	47.50080	49.84110	71.64684	80.92175	79.03755
##	1657	1658	1659	1660	1661	1662	1663	1664
##	82.16106	85.06862	105.53038	127.38337	128.43766	133.39446	100.14348	92.74591

##	1665	1666	1667	1668	1669	1670	1671	1672
##	112.88404	113.90138	109.05693	108.39133	109.39058	74.54804	73.09017	74.14327
##	1673	1674	1675	1676	1677	1678	1679	1680
##	68.10139	65.06534	69.44346	69.48752	67.26588	103.49905	137.60524	90.32950
##	1681	1682	1683	1684	1685	1686	1687	1688
##	90.09755	87.53548	69.09760	50.29013	52.00117	51.47099	52.00955	54.58640
##	1689	1690	1691	1692	1693	1694	1695	1696
##	62.31162	48.26432	54.28321	54.57715	78.51263	78.23945	73.34242	76.23542
##	1697	1698	1699	1700	1701	1702	1703	1704
##	75.39707	100.71010	84.24638	85.07797	86.34803	92.85821	95.14418	83.86523
##	1705	1706	1707	1708	1709	1710	1711	1712
##	80.80676	92.83001	78.50866	70.06612	68.30142	70.32947	71.32549	72.24499
##	1713	1714	1715	1716	1717	1718	1719	1720
##	73.58233	66.71090	64.92820	59.43653	57.93901	60.67957	60.12791	60.23998
##	1721	1722	1723	1724	1725	1726	1727	1728
##	60.02098	59.48454	60.23703	58.99477	72.39594	75.04381	77.22037	83.00087
##	1729	1730	1731	1732	1733	1734	1735	1736
##	82.95661	80.58890	78.02700	79.33561	82.20264	83.54233	82.42728	74.68149
##	1737	1738	1739	1740	1741	1742	1743	1744
##	65.27717	66.66023	66.33566	63.04082	65.46228	64.91890	68.96392	74.85958
##	1745	1746	1747	1748	1749	1750	1751	1752
##	78.60728	78.54947	80.07082	83.79584	85.04537	84.25881	85.99130	86.93306
##	1753	1754	1755	1756	1757	1758	1759	1760
##	90.07813	90.16915	86.67507	85.05547	84.13613	82.80259	78.05855	54.19516
##	1761	1762	1763	1764	1765	1766	1767	1768
##	56.25138	56.77069	58.34381	54.14663	53.47383	54.38585	79.43923	82.14713
##	1769	1770	1771	1772	1773	1774	1775	1776
##	81.04393	80.92385	84.76719	82.97037	77.91630	84.29825	83.90952	83.40733
##	1777	1778	1779	1780	1781	1782	1783	1784
##	82.14378	NA	56.22195	51.79487	46.74880	51.92210	53.05737	61.26372
##	1785	1786	1787	1788	1789	1790	1791	1792
##	70.37483	116.97651	130.82971	137.73994	136.53377	137.80875	131.62684	134.81562
##	1793	1794	1795	1796	1797	1798	1799	1800
##	137.95469	140.00573	131.04882	98.05067	96.75972	92.27571	88.51397	88.09123
##	1801	1802	1803	1804	1805	1806	1807	1808
##	70.08488	67.79954	59.47640	72.49440	58.81894	90.74563	91.53626	79.75245
##	1809	1810	1811	1812	1813	1814	1815	1816
##	100.26278	104.79143	108.66598	89.85056	91.18025	115.95598	123.75937	121.77812
##	1817	1818	1819	1820	1821	1822	1823	1824
##	114.30905	91.26304	84.59240	76.27862	76.62739	74.86410	NA	56.89798
##	1825	1826	1827	1828	1829	1830	1831	1832
##	58.26601	59.07636	69.97445	61.92277	64.78846	68.05886	74.19414	83.55602
##	1833	1834	1835	1836	1837	1838	1839	1840
##	81.02683	86.95097	132.83030	128.00982	120.89626	109.04983	95.91586	95.26208
##	1841	1842	1843	1844	1845	1846	1847	1848
##	93.60080	NA	71.66917	65.42832	65.71407	62.92863	63.85539	64.48458
##	1849	1850	1851	1852	1853	1854	1855	1856
##	65.64761	66.66159	62.05300	67.54061	67.44896	78.83787	79.00901	78.95220
##	1857	1858	1859	1860	1861	1862	1863	1864
##	84.19644	83.95711	77.99948	80.71138	85.25204	84.37494	80.93601	75.77920
##	1865	1866	1867	1868	1869	1870	1871	1872
##	74.11524	57.78561	47.02148	45.69950	45.11022	42.58365	44.58223	46.13806

##	1873	1874	1875	1876	1877	1878	1879	1880
##	47.51614	52.43043	54.08528	77.94866	87.03854	97.02364	100.24855	108.06717
##	1881	1882	1883	1884	1885	1886	1887	1888
##	101.57733	115.09071	139.70374	159.12952	119.64153	114.40879	103.90215	85.04487
##	1889	1890	1891	1892	1893	1894	1895	1896
##	92.76619	NA	70.18332	66.90492	77.87521	66.72977	66.10091	70.85315
##	1897	1898	1899	1900	1901	1902	1903	1904
##	70.97018	74.08015	85.15947	111.26340	107.02527	105.45133	105.66476	98.17236
##	1905	1906	1907	1908	1909	1910	1911	1912
##	101.90231	110.37743	112.72164	124.73057	118.95882	97.47249	64.45005	61.31871
##	1913	1914	1915	1916	1917	1918	1919	1920
##	57.91572	57.17493	56.98378	56.65930	51.95690	52.62520	50.18876	56.02486
##	1921	1922	1923	1924	1925	1926	1927	1928
##	56.98163	64.34191	52.95969	83.54861	99.98135	89.07174	104.83410	81.53896
##	1929	1930	1931	1932	1933	1934	1935	1936
##	82.42769	77.04098	NA	58.62684	59.27569	61.24361	65.15407	65.72934
##	1937	1938	1939	1940	1941	1942	1943	1944
##	60.46204	62.47679	64.04895	78.42773	84.78652	88.04712	89.99172	119.47727
##	1945	1946	1947	1948	1949	1950	1951	1952
##	113.44197	87.35164	107.66439	80.41489	82.63696	62.28303	62.19635	59.41604
##	1953	1954	1955	1956	1957	1958	1959	1960
##	59.78141	60.39714	57.97083	50.98247	51.95604	63.07754	61.52460	52.02075
##	1961	1962	1963	1964	1965	1966	1967	1968
##	56.17355	59.88124	73.15027	82.18426	84.25157	83.05469	85.59787	87.80776
##	1969	1970	1971	1972	1973	1974	1975	1976
##	114.88031	109.87197	64.50820	61.95155	61.20233	62.50112	63.00356	61.86953
##	1977	1978	1979	1980	1981	1982	1983	1984
##	62.16810	61.96888	64.23911	61.02357	55.78438	73.11372	80.39728	85.25370
##	1985	1986	1987	1988	1989	1990	1991	1992
##	82.83270	79.94548	78.81820	77.66333	103.59738	104.54736	98.52769	79.95939
##	1993	1994	1995	1996	1997	1998	1999	2000
##	93.32098	92.52886	80.85355	81.73735	67.19146	65.81647	49.13067	49.80592
##	2001	2002	2003	2004	2005	2006	2007	2008
##	51.30197	51.94627	63.35341	62.97686	79.20099	73.84125	81.58390	86.32021
##	2009	2010	2011	2012	2013	2014	2015	2016
##	90.33907	82.53889	104.31340	105.91183	86.78856	85.01010	98.61099	90.46239
##	2017	2018	2019	2020	2021	2022	2023	2024
##	89.05448	88.49079	85.74746	86.89884	85.52600	91.46838	97.61456	62.91957
##	2025	2026	2027	2028	2029	2030	2031	2032
##	57.84882	57.17478	56.77705	57.91109	59.01269	60.75979	93.36129	117.67027
##	2033	2034	2035	2036	2037	2038	2039	2040
##	102.93506	103.41185	111.69274	105.08886	94.15815	92.19628	92.23793	80.81104
##	2041	2042	2043	2044	2045	2046	2047	2048
##	65.04093	60.87692	60.54975	62.81329	68.35664	71.65287	70.22921	76.95440
##	2049	2050	2051	2052	2053	2054	2055	2056
##	77.06864	110.92704	107.91299	122.77750	123.98718	143.67941	141.91709	121.87002
##	2057	2058	2059	2060	2061	2062	2063	2064
##	122.96668	129.86283	125.97350	119.67929	111.04516	105.83396	92.22676	65.02810
##	2065	2066	2067	2068	2069	2070	2071	2072
##	58.56221	58.54130	58.37733	59.95915	61.83750	62.71609	63.94453	65.67137
##	2073	2074	2075	2076	2077	2078	2079	2080
##	65.82167	66.79304	132.72081	115.09357	111.59554	107.27106	106.97052	108.39720

##	2081	2082	2083	2084	2085	2086	2087	2088
##	121.16093	102.47736	107.69443	110.57697	123.12216	103.48298	99.10103	89.34493
##	2089	2090	2091	2092	2093	2094	2095	2096
##	98.78584	87.29453	67.88930	68.72600	46.05282	47.49003	60.49386	59.66541
##	2097	2098	2099	2100	2101	2102	2103	2104
##	73.14837	77.97540	86.57472	86.13319	84.51586	86.60202	88.57199	109.55948
##	2105	2106	2107	2108	2109	2110	2111	2112
##	100.83301	113.27421	104.20247	126.18445	115.88670	125.41920	124.33670	91.16382
##	2113	2114	2115	2116	2117	2118	2119	2120
##	80.89195	78.94357	76.74099	NA	50.68413	48.37904	42.50125	64.79739
##	2121	2122	2123	2124	2125	2126	2127	2128
##	50.10974	73.70409	76.22020	67.02647	68.24063	69.60108	76.30479	66.81491
##	2129	2130	2131	2132	2133	2134	2135	2136
##	97.75001	102.80587	48.24314	45.59275	45.32128	32.95572	96.19218	84.42187
##	2137	2138	2139	2140	2141	2142	2143	2144
##	83.18275	86.86296	78.57552	99.31914	101.21659	112.86985	104.13213	75.50378
##	2145	2146	2147	2148	2149	2150	2151	2152
##	46.63190	46.45397	48.78466	45.00373	48.16362	55.48729	63.51550	77.69492
##	2153	2154	2155	2156	2157	2158	2159	2160
##	78.78509	80.11850	74.94289	72.58208	81.27312	73.68747	75.93925	74.19708
##	2161	2162	2163	2164	2165	2166	2167	2168
##	74.89507	79.35229	68.20268	65.13998	62.61684	51.87569	59.34531	58.48965
##	2169	2170	2171	2172	2173	2174	2175	2176
##	58.25320	99.58066	133.45470	136.77353	130.75089	172.27221	157.46062	129.49849
##	2177	2178	2179	2180	2181	2182	2183	2184
##	98.85277	83.04357	83.41770	81.87295	81.10616	81.73234	78.44619	84.11909
##	2185	2186	2187	2188	2189	2190	2191	2192
##	87.35764	98.17153	129.33359	124.65188	116.23134	125.98884	120.43588	108.59414
##	2193	2194	2195	2196	2197	2198	2199	2200
##	107.80698	110.69122	111.18189	102.59365	90.92780	81.55188	54.49164	51.98695
##	2201	2202	2203	2204	2205	2206	2207	2208
##	48.51635	50.02482	56.57275	60.14551	62.86429	66.07283	67.80692	89.37272
##	2209	2210	2211	2212	2213	2214	2215	2216
##	89.83274	77.33113	82.22390	84.51757	81.58569	86.66674	87.36137	84.77638
##	2217	2218	2219	2220	2221	2222	2223	2224
##	85.74730	84.31984	89.30926	86.00426	62.47984	60.62544	57.96626	59.57153
##	2225	2226	2227	2228	2229	2230	2231	2232
##	59.83151	59.95140	59.01041	62.02210	57.78529	54.43619	68.58966	96.64177
##	2233	2234	2235	2236	2237	2238	2239	2240
##	95.97765	100.08403	86.84087	85.35085	71.73348	78.47594	NA	63.20413
##	2241	2242	2243	2244	2245	2246	2247	2248
##	50.04875	44.91180	45.93154	45.61828	40.48365	65.62154	66.49643	67.40404
##	2249	2250	2251	2252	2253	2254	2255	2256
##	71.36680	75.59789	71.48729	70.13426	69.15519	120.29950	94.59639	89.48619
##	2257	2258	2259	2260	2261	2262	2263	2264
##	86.59639	86.92067	79.69222	67.13400	59.18834	57.84030	57.39690	54.83002
##	2265	2266	2267	2268	2269	2270	2271	2272
##	54.72344	80.25756	74.17296	85.93684	75.30635	79.94894	86.03226	75.54405
##	2273	2274	2275	2276	2277	2278	2279	2280
##	77.76499	77.58166	70.54529	85.61681	106.17656	73.66736	71.46183	70.50312
##	2281	2282	2283	2284	2285	2286	2287	2288
##	92.08638	78.24338	69.14660	80.07709	69.74621	52.54345	42.54216	46.31294

##	2289	2290	2291	2292	2293	2294	2295	2296
##	46.97850	47.92069	45.90144	40.39311	41.79941	65.31772	84.78622	73.17575
##	2297	2298	2299	2300	2301	2302	2303	2304
##	83.67470	76.17104	85.83780	125.99347	96.86572	92.04796	71.13939	67.22507
##	2305	2306	2307	2308	2309	2310	2311	2312
##	65.29379	63.91526	63.74544	62.55739	62.48731	64.30892	82.24967	100.80433
##	2313	2314	2315	2316	2317	2318	2319	2320
##	100.41711	95.74026	92.55407	92.43710	87.24036	80.64807	81.11654	104.25027
##	2321	2322	2323	2324	2325	2326	2327	2328
##	108.89764	119.27548	103.36622	91.10525	76.99768	73.49411	69.48858	67.70352
##	2329	2330	2331	2332	2333	2334	2335	2336
##	67.22534	74.91162	62.67810	59.84440	58.15864	45.42615	49.17456	54.18426
##	2337	2338	2339	2340	2341	2342	2343	2344
##	56.34946	55.81844	56.33915	60.84341	68.53134	76.79890	119.82158	122.12069
##	2345	2346	2347	2348	2349	2350	2351	2352
##	147.42587	137.99972	127.50554	136.62616	110.42228	120.05936	128.07600	119.53183
##	2353	2354	2355	2356	2357	2358	2359	2360
##	120.45391	103.71220	102.03479	94.66698	65.56328	63.99029	63.59800	62.71445
##	2361	2362	2363	2364	2365	2366	2367	2368
##	64.21089	65.98578	66.98817	69.98919	66.82595	65.16906	78.00343	61.85124
##	2369	2370	2371	2372	2373	2374	2375	2376
##	98.60310	93.10319	94.86438	100.12163	89.48094	87.43450	88.68513	102.39368
##	2377	2378	2379	2380	2381	2382	2383	2384
##	105.88826	87.73562	92.18480	75.69852	NA	48.13775	49.83714	51.58747
##	2385	2386	2387	2388	2389	2390	2391	2392
##	56.52869	55.43862	50.82513	71.52482	74.73993	79.67707	80.77349	82.49259
##	2393	2394	2395	2396	2397	2398	2399	2400
##	99.00627	98.62435	95.46810	90.19075	98.41502	88.06202	98.11224	97.53323
##	2401	2402	2403	2404	2405	2406	2407	2408
##	96.84494	69.65005	45.70413	45.42627	46.38107	45.78467	76.04193	78.93058
##	2409	2410	2411	2412	2413	2414	2415	2416
##	78.15066	77.61607	77.41906	76.81676	90.10954	93.20172	110.53182	83.25597
##	2417	2418	2419	2420	2421	2422	2423	2424
##	80.85273	77.40494	62.40825	59.48557	NA	47.83573	51.97828	51.63453
##	2425	2426	2427	2428	2429	2430	2431	2432
##	52.52231	60.90835	94.61759	112.78015	93.32908	91.61202	81.81859	80.48079
##	2433	2434	2435	2436	2437	2438	2439	2440
##	102.55728	79.35799	73.21070	54.78842	49.80891	54.72275	53.22297	52.27590
##	2441	2442	2443	2444	2445	2446	2447	2448
##	51.58311	53.81169	54.76724	58.34443	68.51550	83.92843	74.74451	62.69218
##	2449	2450	2451	2452	2453	2454	2455	2456
##	62.09728	58.36310	59.11459	75.11652	74.16934	98.87436	87.06466	74.60641
##	2457	2458	2459	2460	2461	2462	2463	2464
##	64.16104	55.44406	47.76337	NA	45.04928	43.73462	81.10151	88.81631
##	2465	2466	2467	2468	2469	2470	2471	2472
##	91.80407	94.36818	99.27883	85.35927	84.40075	92.20171	102.87189	79.61903
##	2473	2474	2475	2476	2477	2478	2479	2480
##	74.99982	75.19145	76.14991	73.74780	76.56262	66.27160	65.20222	52.47876
##	2481	2482	2483	2484	2485	2486	2487	2488
##	44.64123	45.04868	56.71974	60.93785	67.64369	67.20383	66.74165	79.17036
##	2489	2490	2491	2492	2493	2494	2495	2496
##	96.43596	105.30784	86.20036	101.45794	91.86572	88.72500	84.25972	82.31323

##	2497	2498	2499	2500	2501	2502	2503	2504
## 108.71053	88.86767	69.28327	68.87262	68.00674	68.76485	69.38501	69.92719	
##	2505	2506	2507	2508	2509	2510	2511	2512
## 67.47835	66.26560	64.83510	63.52023	62.56243	97.66168	98.73709	111.07626	
##	2513	2514	2515	2516	2517	2518	2519	2520
## 110.07307	112.42001	115.20271	117.39197	121.76386	113.84512	110.00372	107.24720	
##	2521	2522	2523	2524	2525	2526	2527	2528
## 104.17342	86.80448	88.57132	86.78935	83.86405	83.54999	67.78598	67.37964	
##	2529	2530	2531	2532	2533	2534	2535	2536
## 64.03272	75.26127	71.42759	79.06313	89.16287	109.42089	96.02206	115.28712	
##	2537	2538	2539	2540	2541	2542	2543	2544
## 111.69453	83.95859	82.72289	98.12317	48.41440	46.41835	48.05992	45.27176	
##	2545	2546	2547	2548	2549	2550	2551	2552
## 43.85946	50.22083	55.82212	64.59268	63.94371	70.45199	68.60253	72.26926	
##	2553	2554	2555	2556	2557	2558	2559	2560
## 81.95775	91.18165	92.61305	92.28174	93.47102	91.28876	82.61246	86.77798	
##	2561	2562	2563	2564	2565	2566	2567	2568
## 80.27359	64.09486	56.32545	65.27853	60.27188	69.02015	55.40762	63.83393	
##	2569	2570	2571	2572	2573	2574	2575	2576
## 67.70751	74.58032	82.24942	96.17706	104.23987	102.59101	101.31017	87.42947	
##	2577	2578	2579	2580	2581	2582	2583	2584
## 82.24734	79.93569	81.13899	80.79232	78.99875	83.46689	82.20394	62.37552	
##	2585	2586	2587	2588	2589	2590	2591	2592
## 57.28812	59.33804	60.12757	60.70281	63.78367	60.74943	73.78651	72.72432	
##	2593	2594	2595	2596	2597	2598	2599	2600
## 79.40618	78.48061	81.93722	78.71535	91.04487	84.90681	84.42342	83.93614	
##	2601	2602	2603	2604	2605	2606	2607	2608
## 72.58162	70.96790	65.86591	63.39642	66.90923	138.18776	139.35328	135.79635	
##	2609	2610	2611	2612	2613	2614	2615	2616
## 134.53305	122.81032	128.40379	114.34041	101.58517	107.45535	109.74062	106.58856	
##	2617	2618	2619	2620	2621	2622	2623	2624
## 122.61783	92.46912	77.44276	67.31568	67.30500	63.94605	48.15147	43.22968	
##	2625	2626	2627	2628	2629	2630	2631	2632
## 41.81280	42.72703	40.63621	38.89830	38.36055	36.48303	95.39298	108.36167	
##	2633	2634	2635	2636	2637	2638	2639	2640
## 105.29851	116.26928	74.77064	81.02600	79.16209	93.10404	102.45921	89.42072	
##	2641	2642	2643	2644	2645	2646	2647	2648
## 89.01694	57.05073	53.43656	53.33599	52.87911	53.45111	68.43790	86.42028	
##	2649	2650	2651	2652	2653	2654	2655	2656
## 80.92358	85.50328	77.77262	90.76804	96.32342	97.31194	102.57220	97.42172	
##	2657	2658	2659	2660	2661	2662	2663	2664
## 122.22190	127.23911	98.19810	116.41288	91.04195	107.77575	115.83533	111.56348	
##	2665	2666	2667	2668	2669	2670	2671	2672
## 88.88314	86.98569	79.54440	75.43908	71.80212	73.03396	72.42158	69.72754	
##	2673	2674	2675	2676	2677	2678	2679	2680
## 73.58947	90.39926	102.21575	108.35530	96.13580	100.01796	97.02771	129.38114	
##	2681	2682	2683	2684	2685	2686	2687	2688
## 111.00734	105.66052	102.88073	99.23062	113.64370	106.94873	126.33153	97.24634	
##	2689	2690	2691	2692	2693	2694	2695	2696
## 86.92880	84.09191	95.35297	82.50949	81.86840	66.34967	65.99288	65.11742	
##	2697	2698	2699	2700	2701	2702	2703	2704
## 64.06639	62.82352	52.96728	50.71108	57.31867	74.67675	78.84409	79.99780	

##	2705	2706	2707	2708	2709	2710	2711	2712
##	82.03160	81.40043	79.65343	82.95006	84.50674	85.86888	83.64191	84.77672
##	2713	2714	2715	2716	2717	2718	2719	2720
##	79.24136	78.06047	94.03049	89.28889	80.31694	72.33671	73.21653	69.14987
##	2721	2722	2723	2724	2725	2726	2727	2728
##	47.30622	56.86576	56.91654	57.79346	57.68340	53.39084	49.44252	64.37444
##	2729	2730	2731	2732	2733	2734	2735	2736
##	65.44485	66.15250	72.08918	84.69537	81.70339	89.40978	99.40254	96.90062
##	2737	2738	2739	2740	2741	2742	2743	2744
##	88.28637	111.73744	80.33086	92.47217	81.94556	66.05123	45.36079	46.04499
##	2745	2746	2747	2748	2749	2750	2751	2752
##	50.20016	48.00631	47.48508	38.24350	44.49440	74.88616	75.92609	85.29880
##	2753	2754	2755	2756	2757	2758	2759	2760
##	87.16445	86.47899	81.87867	78.23550	87.41770	86.33639	87.70381	89.69605
##	2761	2762	2763	2764	2765	2766	2767	2768
##	87.00076	86.56148	80.62488	77.66694	79.18773	73.46360	66.89253	64.54115
##	2769	2770	2771	2772	2773	2774	2775	2776
##	64.83342	65.96536	68.28454	66.77036	63.10154	98.02850	71.56599	90.39385
##	2777	2778	2779	2780	2781	2782	2783	2784
##	91.12026	101.62971	90.47064	88.67686	87.37582	74.25311	78.82931	76.88090
##	2785	2786	2787	2788	2789	2790	2791	2792
##	75.06382	82.89738	81.08366	84.57006	83.83075	84.08318	93.96940	84.14317
##	2793	2794	2795	2796	2797	2798	2799	2800
##	68.30742	70.76291	50.49006	51.50040	50.99624	52.01277	55.35125	56.63228
##	2801	2802	2803	2804	2805	2806	2807	2808
##	114.27082	119.43426	121.11351	117.93534	119.44853	118.37623	115.14185	113.45132
##	2809	2810	2811	2812	2813	2814	2815	2816
##	110.78353	109.67254	108.80738	108.47137	107.42647	100.11852	98.94304	101.71478
##	2817	2818	2819	2820	2821	2822	2823	2824
##	102.51909	120.34516	110.53161	91.47638	92.53967	100.63785	99.57990	97.76415
##	2825	2826	2827	2828	2829	2830	2831	2832
##	97.62406	97.11391	96.81894	110.57241	88.70862	96.39865	88.44072	74.77317
##	2833	2834	2835	2836	2837	2838	2839	2840
##	74.46128	76.17962	77.88086	90.82019	86.27077	68.18140	66.58979	64.05917
##	2841	2842	2843	2844	2845	2846	2847	2848
##	66.98709	68.14923	68.72583	68.22527	58.94942	54.55226	62.65197	64.61467
##	2849	2850	2851	2852	2853	2854	2855	2856
##	73.89874	76.40844	79.84469	80.66962	82.22258	85.38554	85.16613	95.21116
##	2857	2858	2859	2860	2861	2862	2863	2864
##	86.62300	102.60635	117.02507	54.93842	58.62393	49.33910	56.90239	60.05899
##	2865	2866	2867	2868	2869	2870	2871	2872
##	63.74849	81.28075	93.52139	102.56097	112.52456	111.27783	94.60076	94.69620
##	2873	2874	2875	2876	2877	2878	2879	2880
##	104.84368	107.24418	104.27126	100.44736	99.02956	83.97003	82.25216	91.44763
##	2881	2882	2883	2884	2885	2886	2887	2888
##	90.31234	70.71054	62.24578	52.87578	52.53900	51.51114	51.24112	52.48857
##	2889	2890	2891	2892	2893	2894	2895	2896
##	54.41290	44.12881	54.01669	93.15100	96.68061	95.39055	97.15135	96.51317
##	2897	2898	2899	2900	2901	2902	2903	2904
##	100.41019	102.16391	102.02039	104.95193	103.09758	103.79587	102.72141	105.44641
##	2905	2906	2907	2908	2909	2910	2911	2912
##	98.26447	92.17045	89.18766	90.27558	93.63351	94.83099	96.18552	96.49142

##	2913	2914	2915	2916	2917	2918	2919	2920
##	97.25101	79.34260	78.02191	77.38886	77.41720	75.39485	74.06034	74.08130
##	2921	2922	2923	2924	2925	2926	2927	2928
##	72.19995	71.62363	70.00439	68.48327	63.86935	83.73182	84.80133	96.91674
##	2929	2930	2931	2932	2933	2934	2935	2936
##	96.69763	94.92763	106.66029	90.74554	105.58259	110.27774	111.25292	126.17621
##	2937	2938	2939	2940	2941	2942	2943	2944
##	111.74858	115.37338	137.48912	116.35272	99.84294	95.14631	68.15086	70.39090
##	2945	2946	2947	2948	2949	2950	2951	2952
##	69.57886	69.53160	65.76875	64.17004	62.76961	66.85592	68.09747	69.50306
##	2953	2954	2955	2956	2957	2958	2959	2960
##	109.93519	118.79356	128.62845	135.81673	128.22322	121.49117	109.99636	104.09199
##	2961							
##	92.68856							

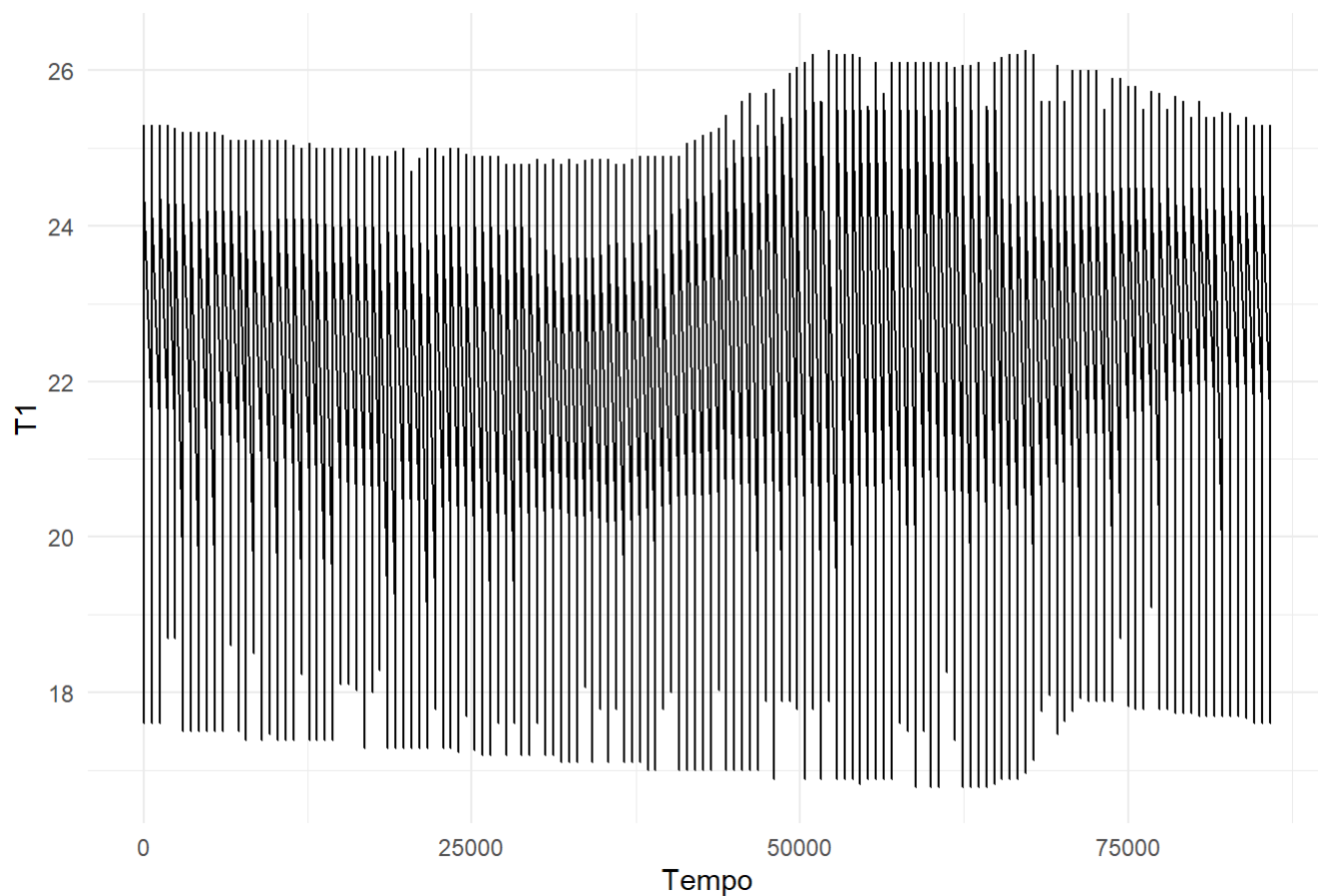
View dados

View(predictions_lm)

Segunda parte 2 - Análise série temporal Gráfico de série temporal

```
# Gráfico de série temporal para a variável T1
ggplot(data_train, aes(x = NSM, y = T1)) +
  geom_line() +
  labs(x = "Tempo", y = "T1", title = "Análise de Série Temporal para T1") +
  theme_minimal()
```

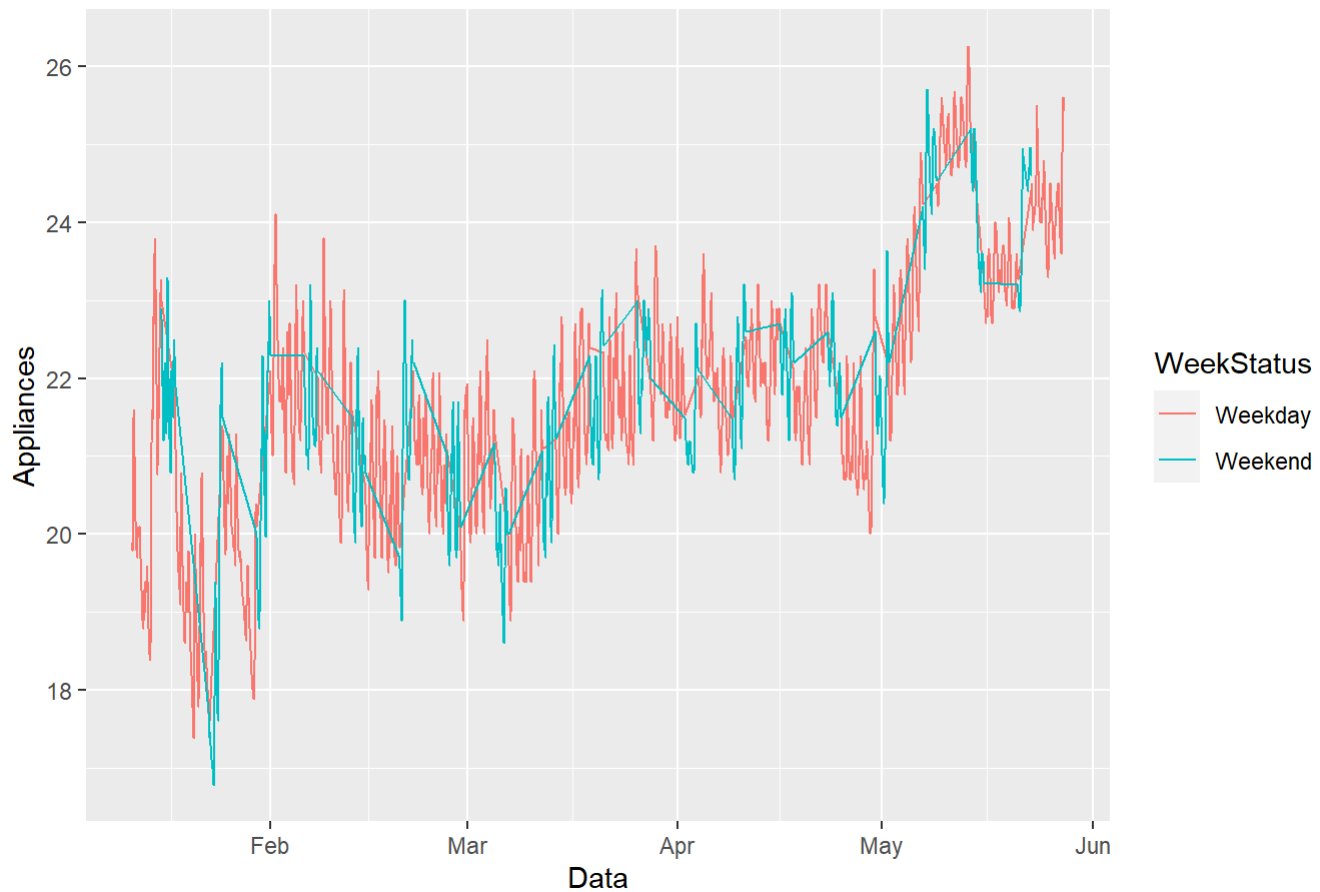
Análise de Série Temporal para T1



```
ggplot(data_train, aes(x = date, y = T1, color = WeekStatus)) +  
  geom_line() +  
  labs(title = "Gráfico de Série Temporal de Appliances por WeekStatus",  
        x = "Data",  
        y = "Appliances")
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
```

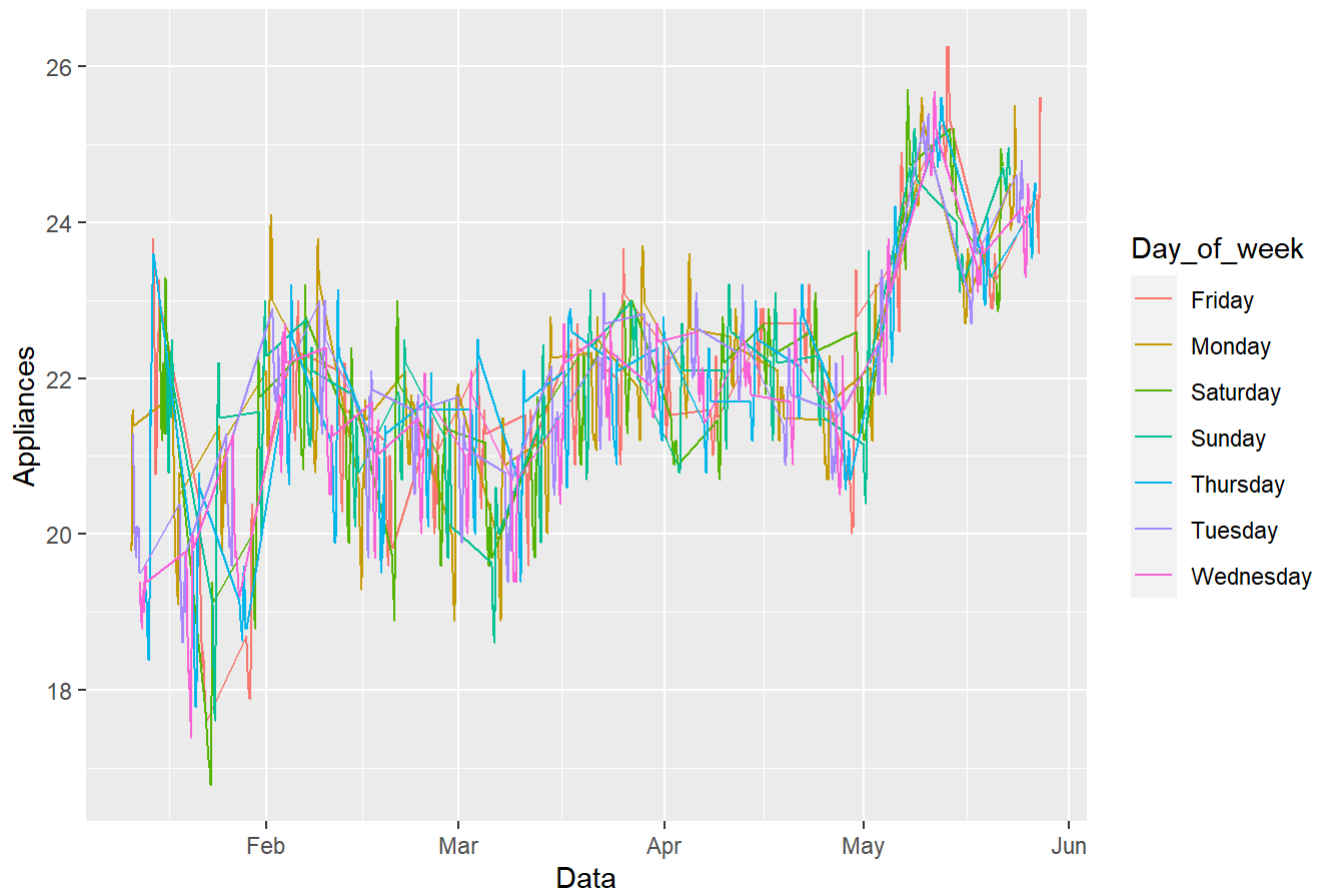
Gráfico de Série Temporal de Appliances por WeekStatus



```
ggplot(data_train, aes(x = date, y = T1, color = Day_of_week)) +  
  geom_line() +  
  labs(title = "Gráfico de Série Temporal de Appliances por WeekStatus",  
        x = "Data",  
        y = "Appliances")
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
```

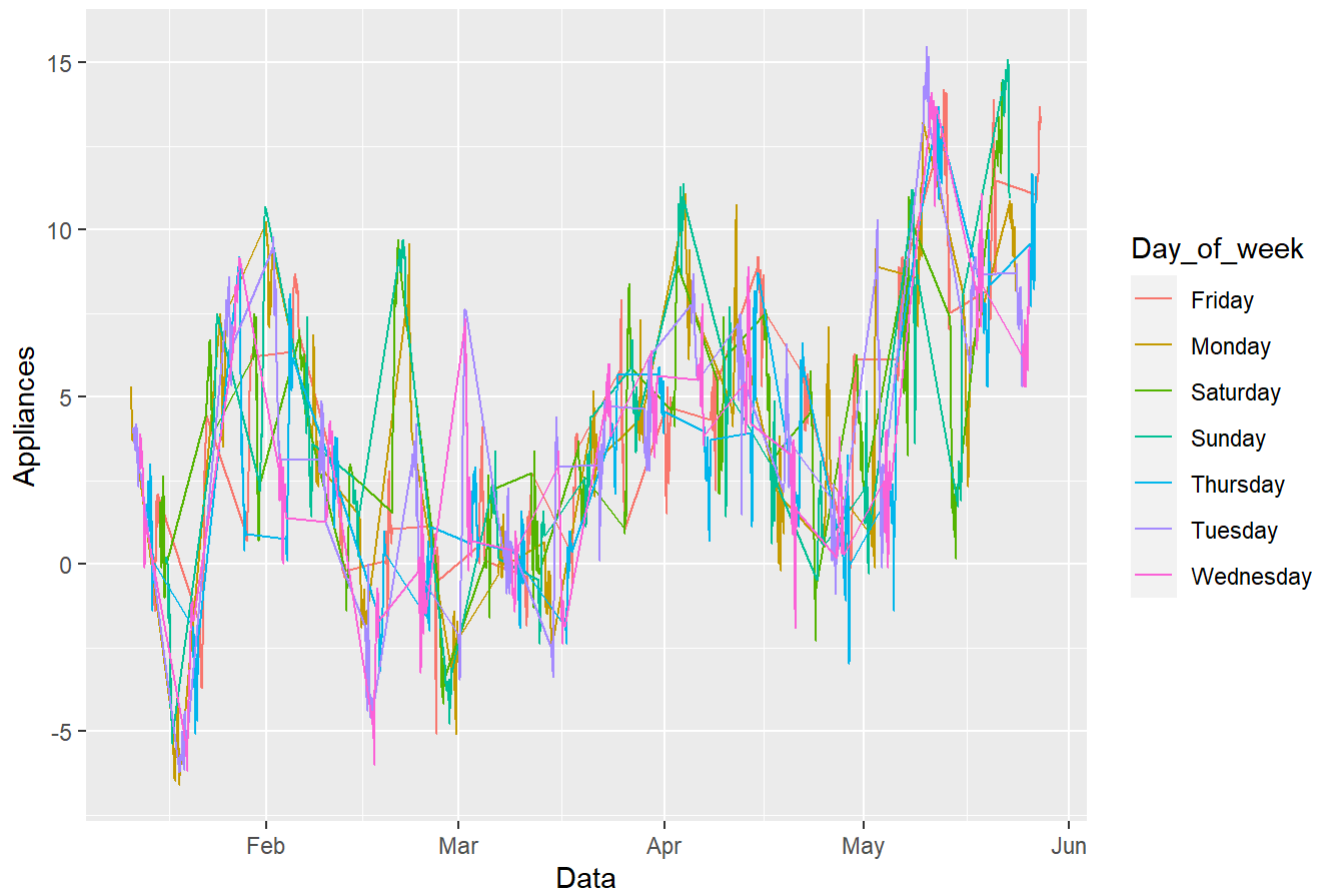
Gráfico de Série Temporal de Appliances por WeekStatus



```
ggplot(data_train, aes(x = date, y = Tdewpoint, color = Day_of_week)) +  
  geom_line() +  
  labs(title = "Gráfico de Série Temporal de Appliances por WeekStatus",  
        x = "Data",  
        y = "Appliances")
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
```

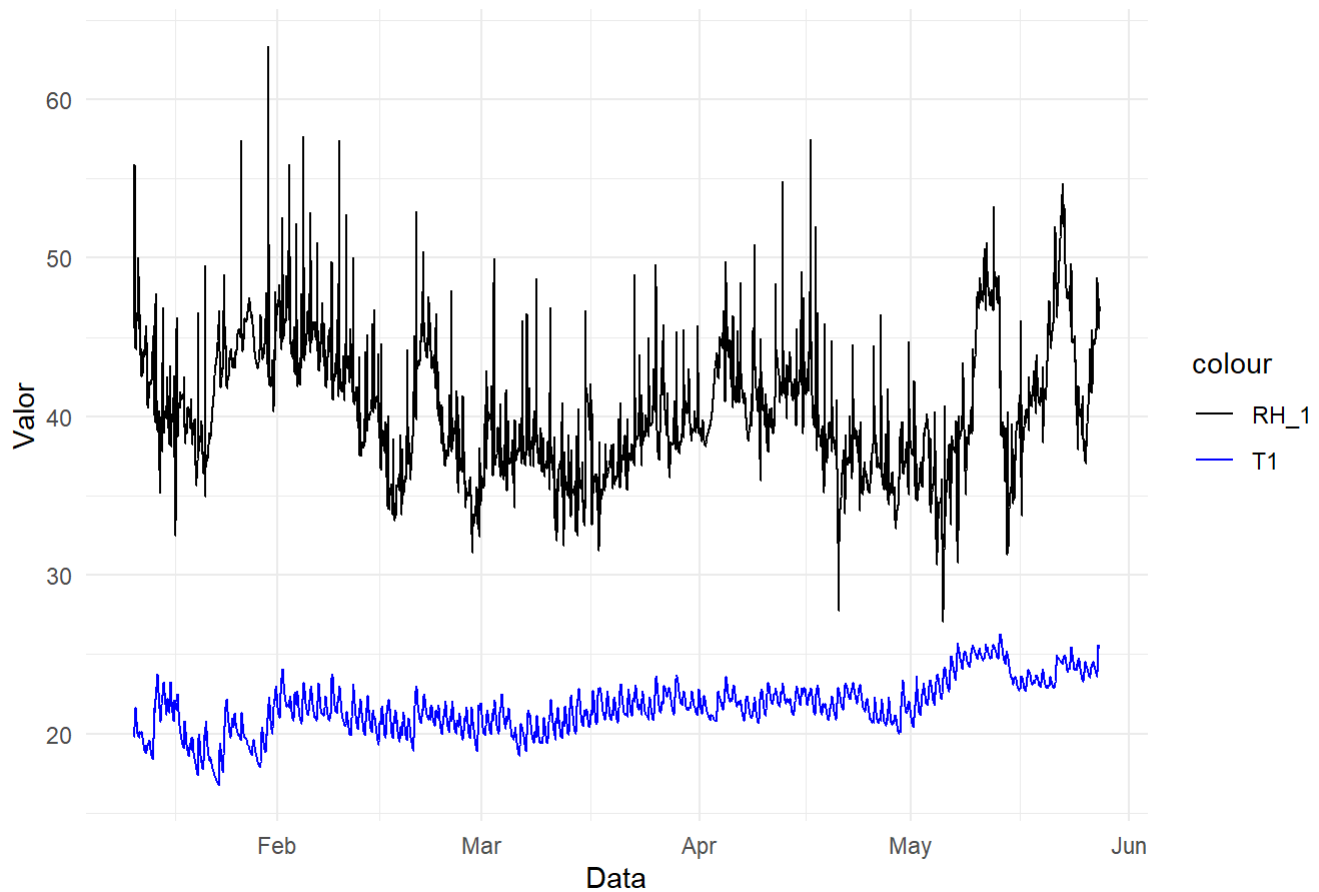
Gráfico de Série Temporal de Appliances por WeekStatus



```
# Gráfico de séries temporais para T1 e RH_1
ggplot(data_train, aes(x = date)) +
  geom_line(aes(y = T1, color = "T1")) +
  geom_line(aes(y = RH_1, color = "RH_1")) +
  labs(title = "Séries Temporais de T1 e RH_1",
        x = "Data",
        y = "Valor") +
  scale_color_manual(values = c("T1" = "blue", "RH_1" = "black")) +
  theme_minimal()
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
## Removed 113 rows containing missing values (`geom_line()`).
```

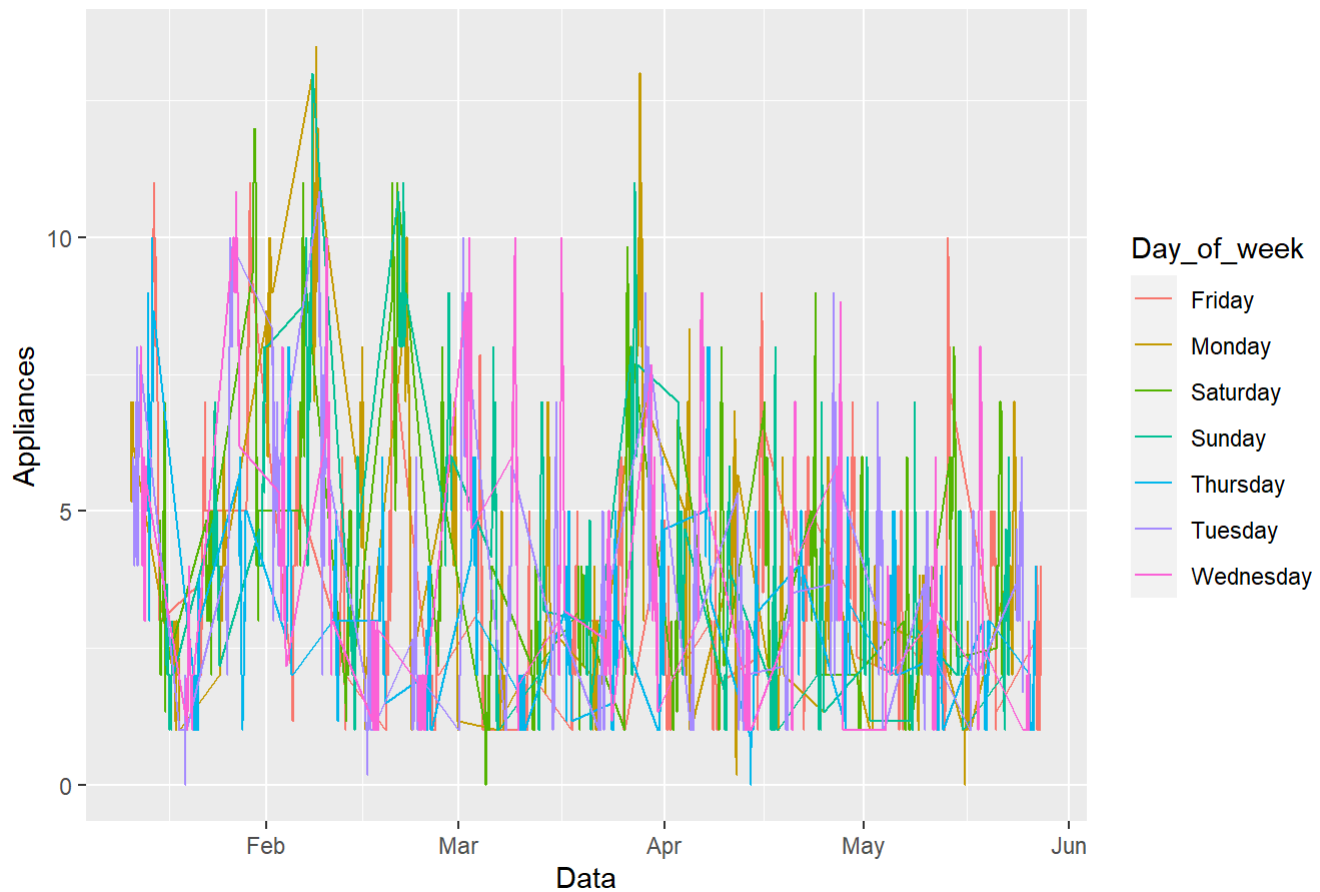
Séries Temporais de T1 e RH_1



```
# Gráfico de série temporal para Wind Speed (Velocidade do Vento) e T1 (Temperatura)
ggplot(data_train, aes(x = date, y = Windspeed, color = Day_of_week)) +
  geom_line() +
  labs(title = "Gráfico de Série Temporal de Appliances por WeekStatus",
        x = "Data",
        y = "Appliances")
```

```
## Warning: Removed 113 rows containing missing values (`geom_line()`).
```


Gráfico de Série Temporal de Appliances por WeekStatus



Terceira parte - Modelo série temporal ARIMA

```
# Converter a coluna "date" para o formato correto
data_train$date <- as.Date(data_train$date)
```

```
# série temporal a partir dos dados
# Suponhamos que seja uma série semanal (frequency = 7)
ts_data <- ts(data_train$rv1, frequency = 20)
ts_data
```

```

## Time Series:
## Start = c(1, 1)
## End = c(741, 3)
## Frequency = 20
##      [1] 13.275433157 18.606194982 28.642668168 10.084096552 44.919484248
##      [6] 33.039889624 31.455702195  3.089313523 34.351142333 19.205185911
##     [11] 38.492071000 35.880925413 19.001758972 38.872261066 46.735261555
##     [16]  6.277754798 13.361033436 19.305704627  0.669516658 43.484542286
##     [21] 17.017449834 24.104005774 29.978291271 24.677065352  9.310880071
##     [26] 41.368665930 39.711993036  5.397181294 36.185547302 20.563721482
##     [31] 41.047314706 32.353009691 39.146638114 27.651815582 26.485979010
##     [36] 39.467811584  1.166560117 36.615686934 23.880981107 21.904855361
##     [41] 12.239863852  3.533952357  4.973308009 25.931713160 33.100253821
##     [46] 45.643796213 14.680168638 16.619733709 32.543523354 38.315533532
##     [51]  4.212345718 43.766066502 16.953646892 41.972017509 17.334174458
##     [56] 44.609916792 43.216973532 19.499477174 21.732974239 35.625733936
##     [61] 19.999718445 16.267607594 37.854357401 10.134612757  6.084596051
##     [66] 12.274425698 11.981470755  2.946718864 32.114412927 43.813460635
##     [71] 38.945733872 39.865441294 22.763722681 20.504204102 40.543512139
##     [76] 30.246664514 32.736196404 17.659863597 13.513007294 31.674663222
##     [81] 10.660406761  6.468617404 46.203723492 29.938048357 48.808534746
##     [86] 36.589625594 17.836345604 21.573684528  7.410578034  0.653878774
##     [91] 35.778303305 22.314217431 32.005052257 24.779678893 24.217476218
##     [96] 37.741047225 22.694774461 25.558489189 10.377255664 29.785599816
##    [101]  3.853219014 32.139774610 46.430759982 29.904621118 28.045037400
##    [106] 26.301386196 49.254761194 30.077060882 11.943433888 12.908296334
##    [111] 36.465481168 22.628541570  8.756338421  5.249382020 43.227247451
##    [116] 30.732248584 27.857976942 22.656572273 25.022048631 26.481530140
##    [121] 13.887796632 10.634975962 14.239524049 22.311766166 38.999244489
##    [126] 44.030951743  3.190424026 16.774374584 36.186297331 16.880766675
##    [131] 31.520706124 42.030727700 42.806583236 19.567964051 19.024694280
##    [136] 44.772271300 30.265172326 14.686507755  9.563005494 44.322547165
##    [141] 25.166974287  9.459681122 37.905152619 36.224944633 47.186240915
##    [146] 27.382329351 35.587193386 19.445254991 46.365104429 29.528657941
##    [151]  5.518030247 42.025351606 15.898184222 13.375410368 25.839841820
##    [156] 13.447529601  9.058416367 25.928806874 28.139146790  6.457842723
##    [161] 12.818380201 35.896763799 48.070496821  5.007042328 38.161134475
##    [166] 47.398317733 40.931734419 15.414616535 32.478973025 47.667772556
##    [171] 16.998960171 13.123705506  8.272696659 25.506260328 25.547984918
##    [176] 12.881063041  2.323044348 20.892812917 42.700075114 17.361533886
##    [181] 18.724343227 31.571011420 34.481392440 34.470670624 27.745031158
##    [186] 21.481220389 22.636003140 15.322162944 28.917697200 45.518515212
##    [191] 10.546287533  6.634498760 23.004822293 47.147852962 38.098693080
##    [196] 46.645491442 23.533924879 30.179403385 24.249484029  5.440315825
##    [201] 12.386341649 24.925726536 18.643335404 46.734568512 26.199303893
##    [206] 13.898301474 39.377025387 35.123125627  8.251381933  3.222876939
##    [211] 37.735281081 31.020501652  8.478838333  3.110702615  5.451463431
##    [216] 19.085817586 14.932627103  9.610476752 12.858501065  9.061591141
##    [221] 23.865685484 38.536852144  1.389356120 26.365538849 44.015953445
##    [226] 18.653168599  2.397956583  6.931412336 16.074606020  7.741580566
##    [231] 11.065296386 11.319039809  6.570826692 49.078173016 16.350686341
##    [236] 25.346974854 34.072125738  4.958455160  2.521982975 46.462695987

```

```
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```

```
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```

```

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## [14276] 12.052734557 43.583068275 29.143122758 47.487683292 23.988743778
```



```
## [14281] 34.567580558 45.881673659 29.762732331 24.562516017 46.805940464
## [14286] 27.856250620 6.666652334 30.861281115 28.487013211 32.634813385
## [14291] 19.256768236 49.289072212 7.791339257 26.381535409 48.037298699
## [14296] 33.733355301 29.381756485 37.284580246 11.599347286 38.730088703
## [14301] 38.884780323 12.930700602 39.678077586 8.065670682 5.917951569
## [14306] 48.917345691 1.556927373 10.864171630 33.811556338 24.843511241
## [14311] 0.819839921 21.491623810 5.560207181 21.096124768 0.781173038
## [14316] 31.711304479 3.459547693 30.433690851 41.261211748 39.204291976
## [14321] 47.130771412 15.674368548 46.752210369 29.042499093 29.497885238
## [14326] 3.284373204 19.898854604 4.579589609 0.193765224 4.807108059
## [14331] 32.607687090 17.819164926 4.281749902 44.462345529 24.761996511
## [14336] 30.334451585 3.085709689 3.870445688 46.991320269 33.140628820
## [14341] 32.056900614 23.578070733 14.546397410 23.418983002 43.986092298
## [14346] 6.080003560 23.810726753 30.930191360 13.408538711 30.340030941
## [14351] 36.239053926 19.485799887 16.391373822 14.576969948 45.455144485
## [14356] 29.509140679 5.895341525 42.563275050 48.883163522 3.357086692
## [14361] 44.792121626 10.683816310 30.287041294 11.015423294 30.714505306
## [14366] 36.291008547 14.186402899 34.145939408 18.830291624 32.966186269
## [14371] 5.118773086 2.446503018 38.016658614 35.178926552 17.840947816
## [14376] 39.646956790 35.847880691 11.635198595 19.008471328 23.308435408
## [14381] 20.227108453 36.189042125 45.728050917 24.236722139 25.476304232
## [14386] 36.306199443 21.017888305 46.582967578 33.053555922 29.468658578
## [14391] 2.805516939 16.823471989 29.735459178 6.175395835 16.020843980
## [14396] 31.500198389 44.927997363 33.329084085 30.800520268 10.118897539
## [14401] 43.190386926 9.208627779 29.224776069 7.108817692 10.036956426
## [14406] 29.947987397 26.142319571 12.720617221 23.117942689 14.971141925
## [14411] 41.894205892 8.973916923 41.583187482 49.953418272 12.070566334
## [14416] 9.572387708 29.191314371 27.203320968 46.441279491 46.673150873
## [14421] 8.184011315 4.630306293 16.755317431 38.991948566 5.158330337
## [14426] 14.372107643 5.426727317 23.716571380 23.822732083 10.397370753
## [14431] 23.671827477 12.806350237 10.286022793 38.679772685 31.314739760
## [14436] 14.257958019 31.155984162 8.689791046 24.687493220 34.332920192
## [14441] 37.072805921 23.403469974 13.933231542 12.716055196 17.066851538
## [14446] 16.538032750 37.321057147 2.978700108 26.263020968 22.305001225
## [14451] 25.699760031 7.092181395 14.080180542 2.685336268 14.605631563
## [14456] 13.987739675 27.861132927 8.545045578 9.053744772 33.205354679
## [14461] 4.853220645 11.499501043 9.038398217 48.156173725 18.399819289
## [14466] 41.966657410 46.772238496 42.310955876 35.578035493 7.528765162
## [14471] 7.955473755 10.232947243 1.283602801 23.798790784 21.029852773
## [14476] 49.540962139 37.273408181 39.796361688 22.254711878 21.743848315
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## [14486] 31.943599146 36.539212812 18.086077645 46.724232577 39.350167732
## [14491] 46.745600947 28.104528121 39.448026742 49.713956122 31.291259557
## [14496] 45.153043070 41.623146657 29.947997315 41.369318275 46.975235431
## [14501] 40.610777203 31.351922499 8.990761708 9.119155502 30.516994721
## [14506] 49.981667311 26.319267671 35.938121250 21.724892280 15.469615674
## [14511] 34.255879722 25.484895834 46.169795305 24.865102454 25.567256100
## [14516] 42.615024187 46.369677363 41.761947551 43.792662432 22.151889768
## [14521] 5.759009090 13.711184310 45.858992473 34.244368365 30.213309743
## [14526] 0.388453272 40.331037820 44.941494416 12.124546582 12.271820207
## [14531] 5.131915282 24.368500372 36.517934757 27.152166713 46.609955735
## [14536] 1.076181745 36.748786445 44.241647562 18.055941362 8.450005995
```

```
## [14541] 0.865543121 24.937602668 38.354579243 48.332491994 6.977072114
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## [14551] 25.536674017 4.662426270 34.979087336 47.448862472 43.039254856
## [14556] 22.041158902 30.078809871 6.317674939 21.679778618 40.267541725
## [14561] 40.116016311 41.191385686 22.587450105 10.629632324 41.603611107
## [14566] 34.549152595 12.457655126 37.713014521 48.055630550 44.573882408
## [14571] 4.528404900 11.226356914 33.460038831 0.426913856 16.668609541
## [14576] 39.360698406 38.632622629 38.142641063 31.161104306 27.118024777
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## [14586] 15.810358222 42.392463062 45.507505245 30.874953442 21.977343538
## [14591] 42.061031959 15.138315363 46.713240922 16.386877396 46.704791556
## [14596] 44.044862536 29.112309881 22.280716628 12.924688903 44.505315099
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## [14606] 37.053570349 23.573954415 34.852615674 45.279052982 1.338587049
## [14611] 29.434225056 18.827473803 15.702455188 18.060625903 9.507935354
## [14616] 14.196239226 6.799218629 23.649398796 33.588685154 22.154282045
## [14621] 35.474011570 7.123359235 46.026586369 32.665180508 7.969307445
## [14626] 33.349564904 14.601972105 14.898082463 40.995866561 36.639479257
## [14631] 26.038163539 47.042037861 39.363056130 17.332185793 0.522493024
## [14636] 23.262942245 32.619808486 3.951223707 45.670604799 5.255086184
## [14641] 17.620728619 15.333014540 43.318838417 29.342170665 49.489173200
## [14646] 22.327649815 5.598963331 44.311360421 48.890633532 41.630661837
## [14651] 2.863564959 3.319312667 45.092472085 28.677673929 38.937367557
## [14656] 0.996145443 14.577912039 47.206214641 9.026488801 42.237557704
## [14661] 30.109398696 6.448073185 33.479252784 1.110415277 10.495936649
## [14666] 39.985524735 5.203382566 38.612466538 28.808728629 5.602309736
## [14671] 45.980143733 2.340605913 26.083700149 34.788994107 13.955015270
## [14676] 2.798618155 17.560913099 22.619054932 18.633749720 21.893521352
## [14681] 28.641836485 22.230974294 22.526146029 9.560650669 14.604372554
## [14686] 16.709729168 6.916181801 21.505661111 34.620887018 2.974551101
## [14691] 14.749339491 2.961299173 3.932150383 44.453642634 16.413328063
## [14696] 37.955283117 7.816151262 20.707077463 5.912560283 5.904957012
## [14701] 5.874652090 10.466359905 42.921227671 47.498466133 8.404687268
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## [14711] 15.139162459 7.202454924 49.420751340 0.948283379 3.884818137
## [14716] 14.009097789 26.865135890 29.750958888 44.064376573 6.689694722
## [14721] 22.000183561 49.298761296 37.477282085 9.807640873 6.939798628
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## [14736] 44.121459429 9.501440008 18.262584053 13.591738360 3.172277007
## [14741] 27.336017101 28.126602236 48.900519661 20.956115588 41.634207929
## [14746] 39.281242120 30.413698696 6.336068222 43.867511826 37.038056005
## [14751] 45.659774845 33.925615414 32.084907428 47.583559202 13.018373854
## [14756] 4.437507247 16.576131980 38.604235754 31.845926936 27.740214160
## [14761] 4.105906666 1.674412924 29.201291548 24.261825078 25.439579925
## [14766] 6.194313953 26.670008025 3.673609404 11.703932460 2.349840128
## [14771] 9.110548906 36.221175746 16.459798079 19.176571851 48.908236425
## [14776] 12.211281201 28.464211908 48.686115874 32.420347817 49.189027480
## [14781] 15.081162355 45.226865937 41.515043820 19.540642470 16.977597482
## [14786] 40.409885230 37.889085780 17.123314633 24.058431643 9.538671258
## [14791] 30.020684667 23.851736996 18.215602089 38.751593826 32.306223921
```

```
## [14796] 23.009520059 25.296731666 1.796394843 18.248201406 16.966162238
## [14801] 49.282939720 6.322783651 34.118850587
```

Modelo ARIMA

```
## Modelo ARIMA
arima_model <- auto.arima(ts_data)
arima_model
```

```
## Series: ts_data
## ARIMA(0,0,0) with non-zero mean
##
## Coefficients:
##          mean
##      25.0781
## s.e.    0.1190
##
## sigma^2 = 209.7: log likelihood = -60570.61
## AIC=121145.2   AICc=121145.2   BIC=121160.4
```

```
# Summary modelo
summary(arima_model)
```

```
## Series: ts_data
## ARIMA(0,0,0) with non-zero mean
##
## Coefficients:
##          mean
##      25.0781
## s.e.    0.1190
##
## sigma^2 = 209.7: log likelihood = -60570.61
## AIC=121145.2   AICc=121145.2   BIC=121160.4
##
## Training set error measures:
##              ME      RMSE      MAE      MPE      MAPE      MASE
## Training set -8.627933e-13 14.48105 12.53917 -403.2082 433.8955 0.75113
##              ACF1
## Training set 0.001005488
```

```
# Previsões
# Substitua 10 pelo número de períodos que deseja prever
forecast_values <- forecast(arima_model, h = 20)
forecast_values
```

##	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 741.15	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.20	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.25	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.30	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.35	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.40	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.45	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.50	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.55	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.60	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.65	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.70	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.75	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.80	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.85	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.90	25.07809	6.519251	43.63692	-3.305203	53.46138
## 741.95	25.07809	6.519251	43.63692	-3.305203	53.46138
## 742.00	25.07809	6.519251	43.63692	-3.305203	53.46138
## 742.05	25.07809	6.519251	43.63692	-3.305203	53.46138
## 742.10	25.07809	6.519251	43.63692	-3.305203	53.46138

Quarta parte - Modelo série temporal SARIMA

```
# Converter a coluna "date" para o formato correto
# Suponhamos que seja uma série semanal (frequency = 7)
ts_data <- ts(data_train$Appliances, frequency = 7)
```

```
# Modelo SARIMA
sarima_model <- auto.arima(ts_data, seasonal = TRUE)
sarima_model
```

```
## Series: ts_data
## ARIMA(3,0,2)(2,0,0)[7] with non-zero mean
##
## Coefficients:
##          ar1      ar2      ar3      ma1      ma2      sar1      sar2      mean
##      2.3799 -1.9220  0.5317 -1.6873  0.7710 -0.0080 -0.0235  78.9720
## s.e.  0.0299  0.0437  0.0166  0.0296  0.0224  0.0092  0.0090  1.5987
##
## sigma^2 = 619.2: log likelihood = -68581.5
## AIC=137181 AICc=137181 BIC=137249.4
```

```
# Summary dados
summary(sarima_model)
```

```
## Series: ts_data
## ARIMA(3,0,2)(2,0,0)[7] with non-zero mean
##
## Coefficients:
##          ar1      ar2      ar3      ma1      ma2      sar1      sar2      mean
##          2.3799 -1.9220  0.5317 -1.6873  0.7710 -0.0080 -0.0235  78.9720
## s.e.    0.0299   0.0437  0.0166  0.0296  0.0224  0.0092  0.0090  1.5987
##
## sigma^2 = 619.2: log likelihood = -68581.5
## AIC=137181   AICc=137181   BIC=137249.4
##
## Training set error measures:
##              ME      RMSE      MAE      MPE      MAPE      MASE
## Training set 0.006197961 24.87754 15.88375 -8.963835 22.37721 0.5611986
##              ACF1
## Training set 0.005737301
```

```
# Previsão dados
# Substitua "H" 10 pelo número de períodos que deseja prever
forecast_values <- forecast(sarima_model, h = 120)
forecast_values
```

##	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 2115.714	155.74547	123.85501	187.6359	106.9732207	204.5177
## 2115.857	144.41093	105.61854	183.2033	85.0830978	203.7388
## 2116.000	137.78780	95.87851	179.6971	73.6930733	201.8825
## 2116.143	133.24755	89.58458	176.9105	66.4707919	200.0243
## 2116.286	131.04745	86.15938	175.9355	62.3970726	199.6978
## 2116.429	128.33038	82.41125	174.2495	58.1031337	198.5576
## 2116.571	124.83143	77.93514	171.7277	53.1097423	196.5531
## 2116.714	123.02092	75.20143	170.8404	49.8873223	196.1545
## 2116.857	122.10974	73.35086	170.8686	47.5394647	196.6800
## 2117.000	119.79152	70.10358	169.4795	43.8003793	195.7827
## 2117.143	117.45794	66.88389	168.0320	40.1116131	194.8043
## 2117.286	114.50742	63.11843	165.8964	35.9147351	193.1001
## 2117.429	109.54152	57.42736	161.6557	29.8397940	189.2432
## 2117.571	106.64326	53.90184	159.3847	25.9822286	187.3043
## 2117.714	104.31840	51.14680	157.4900	22.9994514	185.6374
## 2117.857	101.98180	48.43314	155.5305	20.0861853	183.8774
## 2118.000	99.75331	45.88496	153.6217	17.3687761	182.1378
## 2118.143	97.69299	43.56029	151.8257	14.9041651	180.4818
## 2118.286	95.79659	41.44916	150.1440	12.6793688	178.9138
## 2118.429	94.13095	39.61109	148.6508	10.7500255	177.5119
## 2118.571	92.65334	37.99588	147.3108	9.0619621	176.2447
## 2118.714	91.29906	36.53121	146.0669	7.5388648	175.0593
## 2118.857	90.07239	35.21658	144.9282	6.1776715	173.9671
## 2119.000	89.00857	34.08234	143.9348	5.0061489	173.0110
## 2119.143	88.05820	33.07524	143.0412	3.9690218	172.1474
## 2119.286	87.22121	32.19225	142.2502	3.0616759	171.3807
## 2119.429	86.51771	31.45120	141.5842	2.3007527	170.7347
## 2119.571	85.84191	30.74458	140.9392	1.5778101	170.1060
## 2119.714	85.22077	30.09748	140.3440	0.9169774	169.5246
## 2119.857	84.66074	29.51609	139.8054	0.3242700	168.9972
## 2120.000	84.15262	28.99030	139.3149	-0.2108721	168.5161
## 2120.143	83.69014	28.51317	138.8671	-0.6957476	168.0760
## 2120.286	83.26885	28.07973	138.4580	-1.1356302	167.6733
## 2120.429	82.88300	27.68378	138.0822	-1.5369255	167.3029
## 2120.571	82.53084	27.32322	137.7385	-1.9019210	166.9636
## 2120.714	82.21040	26.99582	137.4250	-2.2330086	166.6538
## 2120.857	81.91854	26.69818	137.1389	-2.5337083	166.3708
## 2121.000	81.65175	26.42660	136.8769	-2.8078286	166.1113
## 2121.143	81.40869	26.17958	136.6378	-3.0569541	165.8743
## 2121.286	81.18707	25.95466	136.4195	-3.2836063	165.6577
## 2121.429	80.98427	25.74915	136.2194	-3.4905537	165.4591
## 2121.571	80.80082	25.56346	136.0382	-3.6774395	165.2791
## 2121.714	80.63426	25.39505	135.8735	-3.8468289	165.1154
## 2121.857	80.48280	25.24205	135.7235	-4.0006331	164.9662
## 2122.000	80.34514	25.10313	135.5872	-4.1402221	164.8305
## 2122.143	80.22006	24.97700	135.4631	-4.2669025	164.7070
## 2122.286	80.10640	24.86248	135.3503	-4.3818778	164.5947
## 2122.429	80.00317	24.75855	135.2478	-4.4861926	164.4925
## 2122.571	79.90937	24.66415	135.1546	-4.5808955	164.3996
## 2122.714	79.82410	24.57840	135.0698	-4.6669028	164.3151
## 2122.857	79.74661	24.50051	134.9927	-4.7450143	164.2382

## 2123.000	79.67619	24.42975	134.9226	-4.8159409	164.1683
## 2123.143	79.61218	24.36547	134.8589	-4.8803686	164.1047
## 2123.286	79.55400	24.30707	134.8009	-4.9388928	164.0469
## 2123.429	79.50114	24.25402	134.7483	-4.9920415	163.9943
## 2123.571	79.45306	24.20578	134.7003	-5.0403597	163.9465
## 2123.714	79.40934	24.16193	134.6567	-5.0842737	163.9029
## 2123.857	79.36959	24.12208	134.6171	-5.1241807	163.8634
## 2124.000	79.33346	24.08586	134.5811	-5.1604493	163.8274
## 2124.143	79.30060	24.05294	134.5483	-5.1934123	163.7946
## 2124.286	79.27074	24.02301	134.5185	-5.2233718	163.7648
## 2124.429	79.24358	23.99580	134.4914	-5.2506033	163.7378
## 2124.571	79.21889	23.97107	134.4667	-5.2753541	163.7131
## 2124.714	79.19645	23.94860	134.4443	-5.2978500	163.6907
## 2124.857	79.17604	23.92816	134.4239	-5.3182972	163.6704
## 2125.000	79.15749	23.90959	134.4054	-5.3368828	163.6519
## 2125.143	79.14063	23.89271	134.3885	-5.3537762	163.6350
## 2125.286	79.12530	23.87736	134.3732	-5.3691318	163.6197
## 2125.429	79.11136	23.86341	134.3593	-5.3830901	163.6058
## 2125.571	79.09869	23.85073	134.3466	-5.3957773	163.5932
## 2125.714	79.08717	23.83920	134.3351	-5.4073097	163.5816
## 2125.857	79.07670	23.82872	134.3247	-5.4177927	163.5712
## 2126.000	79.06718	23.81919	134.3152	-5.4273218	163.5617
## 2126.143	79.05852	23.81053	134.3065	-5.4359839	163.5530
## 2126.286	79.05065	23.80266	134.2986	-5.4438580	163.5452
## 2126.429	79.04350	23.79551	134.2915	-5.4510157	163.5380
## 2126.571	79.03700	23.78900	134.2850	-5.4575223	163.5315
## 2126.714	79.03109	23.78309	134.2791	-5.4634372	163.5256
## 2126.857	79.02571	23.77771	134.2737	-5.4688141	163.5202
## 2127.000	79.02083	23.77282	134.2688	-5.4737020	163.5154
## 2127.143	79.01639	23.76838	134.2644	-5.4781454	163.5109
## 2127.286	79.01235	23.76434	134.2604	-5.4821848	163.5069
## 2127.429	79.00868	23.76067	134.2567	-5.4858568	163.5032
## 2127.571	79.00534	23.75733	134.2534	-5.4891949	163.4999
## 2127.714	79.00231	23.75430	134.2503	-5.4922296	163.4968
## 2127.857	78.99955	23.75154	134.2476	-5.4949883	163.4941
## 2128.000	78.99704	23.74903	134.2451	-5.4974961	163.4916
## 2128.143	78.99476	23.74675	134.2428	-5.4997760	163.4893
## 2128.286	78.99269	23.74468	134.2407	-5.5018486	163.4872
## 2128.429	78.99081	23.74280	134.2388	-5.5037327	163.4853
## 2128.571	78.98910	23.74108	134.2371	-5.5054456	163.4836
## 2128.714	78.98754	23.73953	134.2355	-5.5070027	163.4821
## 2128.857	78.98612	23.73811	134.2341	-5.5084183	163.4807
## 2129.000	78.98484	23.73683	134.2328	-5.5097052	163.4794
## 2129.143	78.98367	23.73566	134.2317	-5.5108751	163.4782
## 2129.286	78.98260	23.73459	134.2306	-5.5119387	163.4771
## 2129.429	78.98164	23.73363	134.2296	-5.5129055	163.4762
## 2129.571	78.98076	23.73275	134.2288	-5.5137845	163.4753
## 2129.714	78.97996	23.73195	134.2280	-5.5145835	163.4745
## 2129.857	78.97923	23.73122	134.2272	-5.5153100	163.4738
## 2130.000	78.97857	23.73056	134.2266	-5.5159704	163.4731
## 2130.143	78.97797	23.72996	134.2260	-5.5165707	163.4725
## 2130.286	78.97743	23.72941	134.2254	-5.5171165	163.4720

## 2130.429	78.97693	23.72892	134.2249	-5.5176127	163.4715
## 2130.571	78.97648	23.72847	134.2245	-5.5180637	163.4710
## 2130.714	78.97607	23.72806	134.2241	-5.5184738	163.4706
## 2130.857	78.97570	23.72768	134.2237	-5.5188466	163.4702
## 2131.000	78.97536	23.72735	134.2234	-5.5191855	163.4699
## 2131.143	78.97505	23.72704	134.2231	-5.5194936	163.4696
## 2131.286	78.97477	23.72676	134.2228	-5.5197737	163.4693
## 2131.429	78.97451	23.72650	134.2225	-5.5200283	163.4691
## 2131.571	78.97428	23.72627	134.2223	-5.5202598	163.4688
## 2131.714	78.97407	23.72606	134.2221	-5.5204702	163.4686
## 2131.857	78.97388	23.72587	134.2219	-5.5206615	163.4684
## 2132.000	78.97371	23.72570	134.2217	-5.5208355	163.4682
## 2132.143	78.97355	23.72554	134.2216	-5.5209936	163.4681
## 2132.286	78.97341	23.72539	134.2214	-5.5211373	163.4679
## 2132.429	78.97327	23.72526	134.2213	-5.5212680	163.4678
## 2132.571	78.97316	23.72514	134.2212	-5.5213868	163.4677
## 2132.714	78.97305	23.72504	134.2211	-5.5214948	163.4676

Conclusão O melhor modelo que produziu resultados significativamente satisfatórios foi a Regressão Linear Múltipla. Em seguida, aplicamos o Modelo de Série Temporal ARIMA, que também obteve um desempenho notável, alcançando um coeficiente de determinação (R^2) muito satisfatório. Esses modelos nos proporcionaram uma visão clara e precisa das previsões de energia, permitindo-nos analisar e interpretar os resultados com confiança. É importante destacar que a combinação desses dois modelos demonstrou ser especialmente eficaz na previsão de demanda de energia.

Referência Link 1: <https://statplace.com.br/blog/regressao-logistica-multinomial/>
(<https://statplace.com.br/blog/regressao-logistica-multinomial/>) Link 2: <https://www.monolitonimbus.com.br/modelo-arima-e-previsao-no-r/>
(<https://www.monolitonimbus.com.br/modelo-arima-e-previsao-no-r/>)

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