Homework #1

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Marketing Analytics

From TIME's Best Innovation List of 2023, this homework discusses the E-Assist Stroller, the traditional stroller as its' lookalike innovation, and the potential market share of the product in Germany and Europe.

By the 1840s, the stroller was popular enough to come in a variety of offerings. In 1889, William H. Richardson changed the baby stroller industry by using a special joint to allow a bassinet to be turned to face the operator or face away, as in conventional strollers of the day. The last thirty years of the 20th century saw a ton of substantial advancements in strollers including advances in comfort, safety, versatility, and style.

One of the advanced forms of stroller in this industry is the new E-Assist Stroller by Cybex. What makes this stroller unique is that The motor will kick in to help push up hills, or hold back on downhills to save parents' backs. The stroller has more than 20 configurations, and can carry up to two little ones(TIMES,2024).

While the traditional stroller and the E-Assist Stroller share similar designs and serve the same purpose of transporting babies, the E-Assist Stroller focuses on alleviating parents' back pain, which justifies its higher price point.

This homework analyzes sales data of baby strollers in Germany over an 11-year period (2014–2024). Since Germany's fertility rate is 1.46%, which matches Europe's overall fertility rate (Eurostat, 2021), the findings from the German market can be somewhat extrapolated to the rest of Europe.

Reference list

Innovation

https://time.com/7094758/cybex-e-gazelle-s/

History of baby strollers

https://tacticalbabygear.com/blogs/news/the-history-of-the-baby-stroller?srsltid=AfmBOoriFViqRu1tNAbHp3ZaUBgPT7ZomPVV4FIErJEw9cEDobDGLF0t

Data

https://www.statista.com/statistics/1334833/baby-carriages-car-seats-for-children-sales-germany/

Euronews

https://www.euronews.com/health/2024/09/28/europes-fertility-crisis-which-european-country-is-having-the-fewest-babies

Marketing_Analytics_HW1

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```
library(readxl)
library(ggplot2)
library(ggpubr)
library(knitr)
library(diffusion)
```

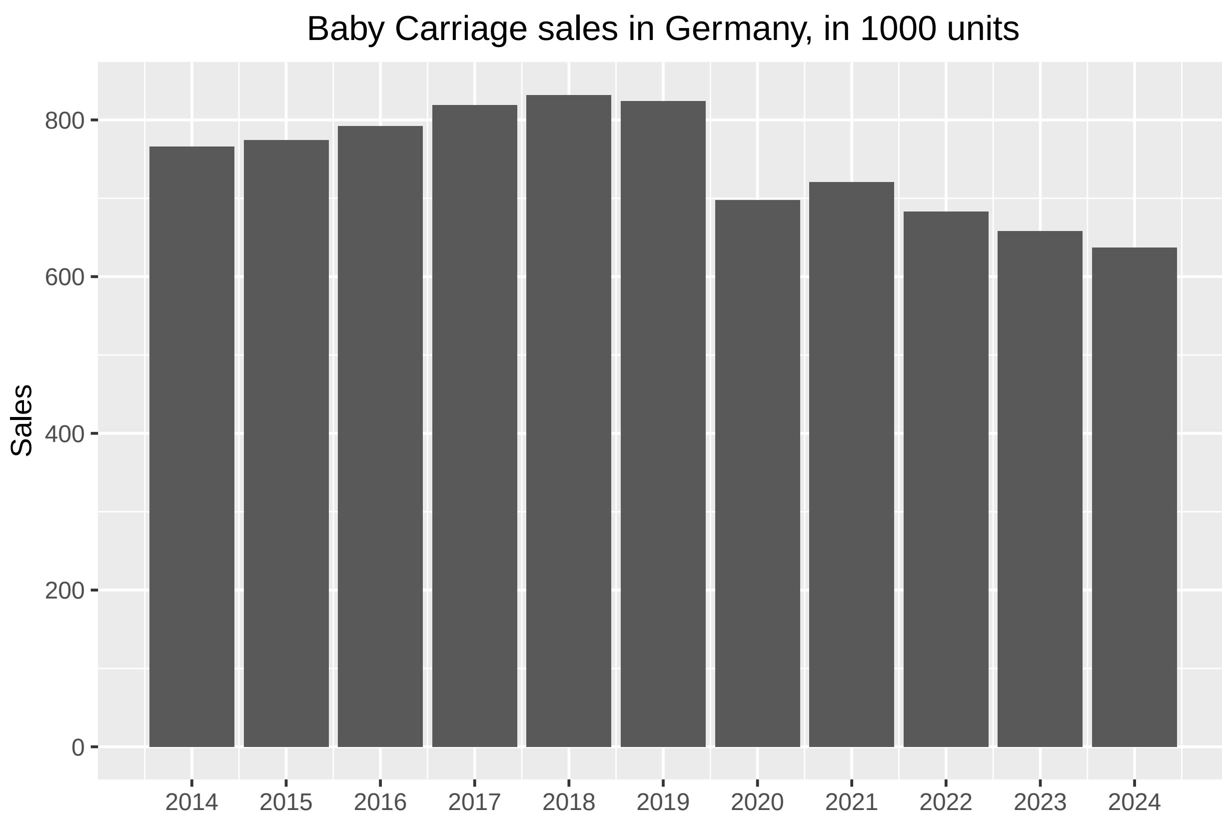
```
data <- read_excel("stroller data.xlsx", sheet = 2)
```

```
## New names:
## * ‘‘ -> ‘...2‘
## * ‘‘ -> ‘...3‘
```

```
data_stroller<- data[3:13, ]
colnames(data_stroller) <- c("Year", "Car Seats", "Carriages")
data_stroller$Year <- as.integer(data_stroller$Year)
data_stroller$Carriages <- as.integer(data_stroller$Carriages)
data_stroller
```

```
## # A tibble: 11 x 3
##     Year ‘Car Seats‘ Carriages
##    <int> <chr>           <int>
##  1  2014 2164              766
##  2  2015 2257              774
##  3  2016 2331              792
##  4  2017 2470              819
##  5  2018 2513              832
##  6  2019 2523              824
##  7  2020 2182              698
##  8  2021 2240              721
##  9  2022 2133              683
## 10  2023 2017              658
## 11  2024 1936              637
```

```
#Visualizing the dataset
ggplot(data = data_stroller, aes(x = Year, y = Carriages)) + geom_bar(stat = 'identity')+
  labs(title = 'Baby Carriage sales in Germany, in 1000 units', x= ' ', y = 'Sales')+
  scale_x_continuous(breaks = 2014:2024, labels = 2014:2024)+
  theme(plot.title = element_text(hjust = 0.5))
```




```r
#Defining F(x) and f(x)
bass.f <- function(t,p,q){((p+q)^2/p)*exp(-(p+q)*t)/(1+(q/p)*exp(-(p+q)*t))^2}

bass.F <- function(t,p,q){(1-exp(-(p+q)*t))/(1+(q/p)*exp(-(p+q)*t))
}
```

```r
#3
sales = data_stroller$Carriages
t = 1:length(sales)
bass_m = nls(sales ~ m*(((p+q)^2/p)*exp(-(p+q)*t))/
               (1+(q/p)*exp(-(p+q)*t))^2,
              start=c(list(m=sum(sales),p=0.02,q=0.4)))

summary(bass_m)
```

```
##
## Formula: sales ~ m * (((p + q)^2/p) * exp(-(p + q) * t))/(1 + (q/p) *
##     exp(-(p + q) * t))^2
##
## Parameters:
##    Estimate Std. Error t value Pr(>|t|)
## m 1.377e+04  1.064e+03  12.945 1.20e-06 ***
## p 5.371e-02  2.911e-03  18.449 7.68e-08 ***
## q 9.625e-02  1.915e-02   5.027  0.00102 **
## ---
```

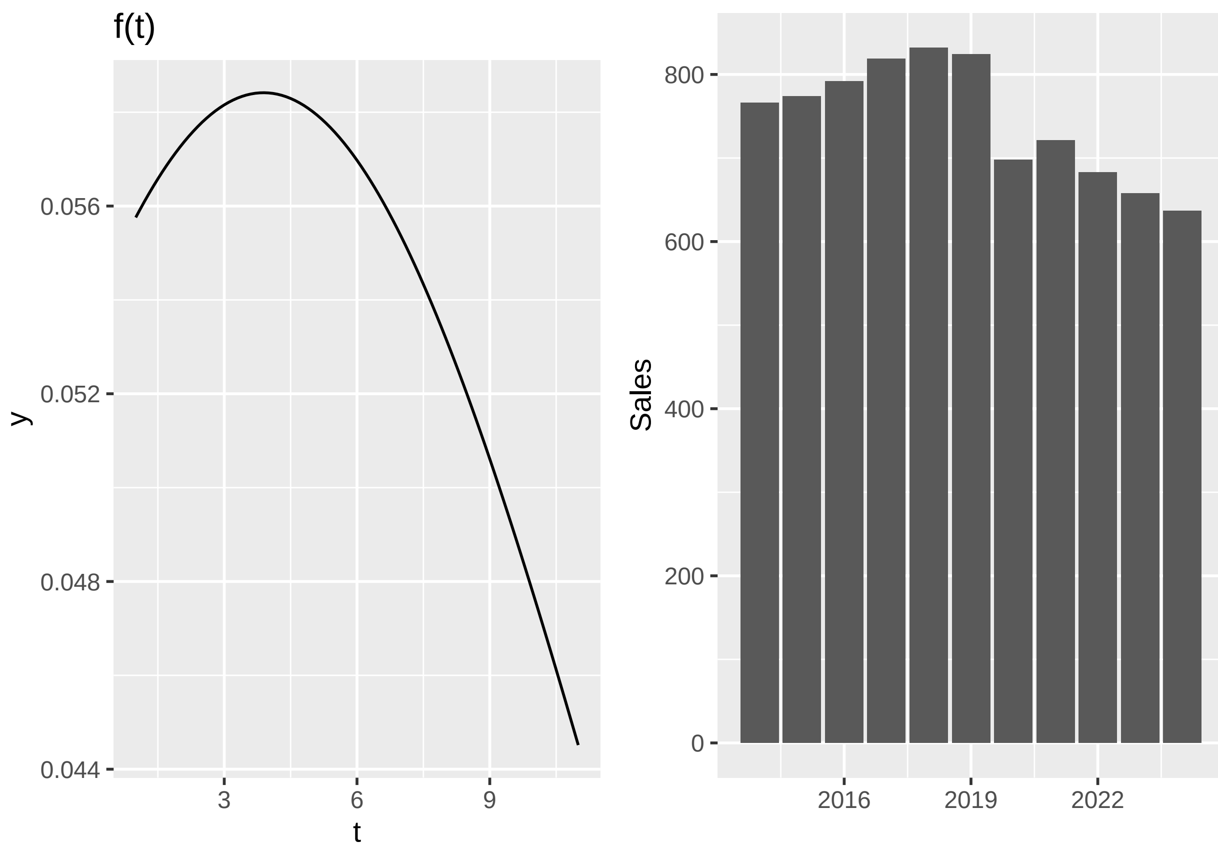
```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 31.98 on 8 degrees of freedom
##
## Number of iterations to convergence: 6
## Achieved convergence tolerance: 9.554e-07
```

```
#Parameter estimations result to m=13770, p= 0.05371, q=0.09625
```

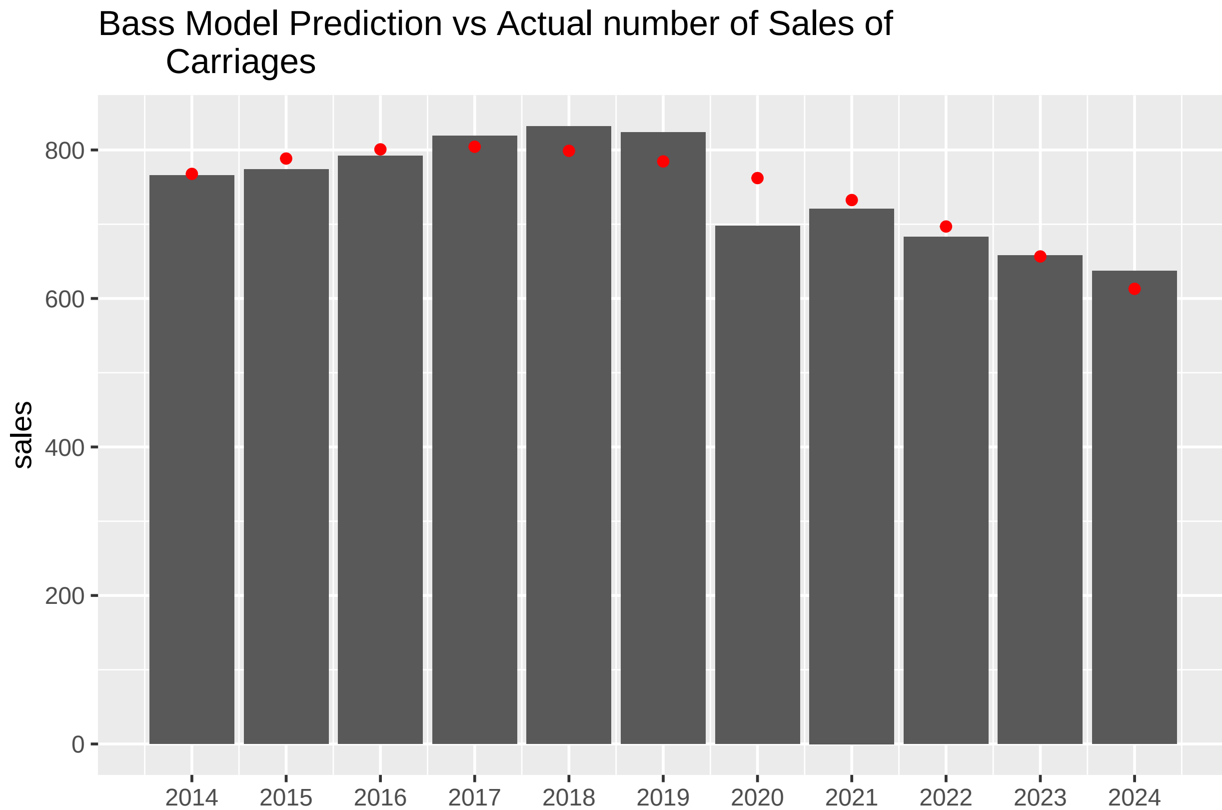
```
time_ad <- ggplot(data.frame(t = c(1:11)), aes(t)) +
  stat_function(fun = bass.f, args = c(p=0.053716, q=0.09625)) +
  labs(title = 'f(t)')

carriage_sales <- ggplot(data = data_stroller, aes(x = Year, y = Carriages)) +
  geom_bar(stat = 'identity') + labs(x = " ", y = "Sales")

ggarrange(time_ad, carriage_sales)
```




```
#7
data_stroller$pred_sales = bass.f(1:11, p = 0.053716, q =0.09625)*13770
ggplot(data = data_stroller, aes(x = Year, y = Carriages)) +
  geom_bar(stat = 'identity') +
  geom_point(mapping = aes(x=Year, y=pred_sales), color = 'red')+
  labs(title = "Bass Model Prediction vs Actual number of Sales of
      Carriages", x= ' ', y = 'sales')+scale_x_continuous(breaks = 2014:2024,
                                                          labels = 2014:2024)
```




```r
#5
sales_vector <- as.numeric(data_stroller$Carriages)
diff_m = diffusion(sales_vector)
p=round(diff_m$w,4)[1]
q=round(diff_m$w,4)[2]
m=round(diff_m$w,4)[3]
diff_m
```

```
## bass model
##
## Parameters:
##     Estimate p-value
## m 12761.7577      NA
## p     0.0586      NA
## q     0.1032      NA
##
## sigma: 28.1386
```