Marketing Analytics

Homework 1

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```
options(warn = -1)
library(ggplot2)
library(dplyr)
library(knitr)
library(kableExtra)
```

Assignment Overview

Every year, *Time* magazine publishes a list of the top 100 innovations of that year. For this assignment, you will:

1. Choose an innovation from the list

The link to the 2024 innovations list is here. Once you select a product from the list, add its link.

Added - here

2. Identify a similar innovation from the past. Reflect on an innovation that resembles the one you've chosen. In 1–2 paragraphs, justify your choice by comparing both innovations in terms of their functionality, technology, or market impact.

I will compare it to Tinder(2012) which is a swipe-to-match dating app.

The product I have chosen takes dating apps on the next level. It helps its users to write texts and understand each others behaviours - in order to give them appropriate and well thought responses. Both products are

intended to improve romantic interactions, but at different stages.

- **Technology**

Tinder's role was making it easier for people to find matches by introducing mutual-opt-in matching and a mobile-first UI. What Rizz does it uses ChatGPT trained by professional dating coaches to provide suggested responses and other messaging guidances.Tinder was primarily a UX + network effects breakthrough, whereas Rizz is a generative AI/NLP breakthrough layered on today's dating platforms.

- **Functionality**

Tinder solved the discovery problem, it matches two strangers via swipe-based system (mutually agreed). Rizz solved the next challenge - the conversation itself.

- **Market Impact**

Tinder had 100 million + downloads in Play Store (App store downloads are not public), whereas Rizz had 5 million + downloads in Play Store(App store downloads are not public). Tinder became a huge, worldwide dating marketplace with strong effects. Rizz is much newer, with a smaller share, but In my opinion, it has a huge potential if it works as marketed.

3. Find historical data

Use **Statista** (the university provides access through AUA Wi-Fi) or another reliable resource to find a **time series** that matches your look-alike innovation.
Provide the **reference for the data source**.

I used **Business of Apps** as the primary source for Tinder figures (Business of Apps, 2025),
and **DemandSage** as a secondary compilation that reproduces those figures (DemandSage, 2025).
Subscription-rate medians for our N proxy come from **RevenueCat** (RevenueCat, 2025).

Note. DemandSage reproduces figures from Business of Apps;Business of Apps is treated as the primary source and DemandSage as a secondary compilation.

4. Estimate Bass Model parameters

Using the time series data for your look-alike innovation, estimate the **Bass diffusion model parameters**:

- Coefficient of innovation (p)
- Coefficient of imitation (q)
- Market potential (M)

```r
df <- read.csv("data/tinder_subscribers.csv")

df$t <- seq_len(nrow(df))

bass_cum <- function(t, p, q, M) {
  M * (1 - exp(-(p + q) * t)) / (1 + (q/p) * exp(-(p + q) * t))
}

fit <- nls(
  subscribers_millions ~ bass_cum(t, p, q, M),
  data = df,
  # M should be > max(df$subscribers_millions), so I will set it to 12. Values
  # of p and q are just starting initial guesses
  start = list(p = 0.02, q = 0.6, M = 12)
```

```
)
summary(fit)
```

```
##
## Formula: subscribers_millions ~ bass_cum(t, p, q, M)
##
## Parameters:
##   Estimate Std. Error t value Pr(>|t|)
## p  0.02761    0.01042   2.649   0.0455 *
## q  0.76304    0.16136   4.729   0.0052 **
## M 11.52983    0.77626  14.853  2.5e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5394 on 5 degrees of freedom
##
## Number of iterations to convergence: 6
## Achieved convergence tolerance: 2.999e-06
```

We can see from here that p=0.0276 - meaning that each year, a non adopter has 2.76% baseline chance to adopt even if nobody else has adopted. Also q=0.763, meaning that adoption chance increases with the share already adopted. 11.53 for M is 11.53 million estimated market potential.

5. Predict the diffusion of the chosen innovation

Based on the **Bass Model**, predict the diffusion path of the chosen innovation.
Ensure your predictions are **supported with relevant data**.

Baseline and scenarios So we will be using the parameters we got from Tinder data, in order to make assumptions about Rizz app. As a starting point I decided to choose **N0 = 0.105**, since Rizz does not disclose how many of its users are paid users and I had to use some rough estimates:

- in website https://www.revenuecat.com/state-of-subscription-apps-2025/ we have that paid medians are around **1.5% (low-priced apps)** and **2.7% (high-priced apps)**
- we will use midpoint **2.1%**
- **5000000 (Play Store) $\times$ 0.021 = 105000**

Lets test 3 scenarious for **M** taking **100 million** as the global ceiling.

- **Conservative:** M = 25 million (Rizz ends up a niche tool)
- **Base:** M = 50 million (Rizz wins meaningful share of daters)
- **Ambitious:** M = 100 million (Rizz becomes the go-to dating assistant for most daters)

```
p  <- 0.0276
q  <- 0.763
N0 <- 0.105

forecast_years <- 8
scenarios <- c(Conservative = 25, Base = 50, Ambitious = 100)  # M in millions

make_path <- function(M, p, q, N0, horizon){
  out <- data.frame(year = 0:horizon,
```

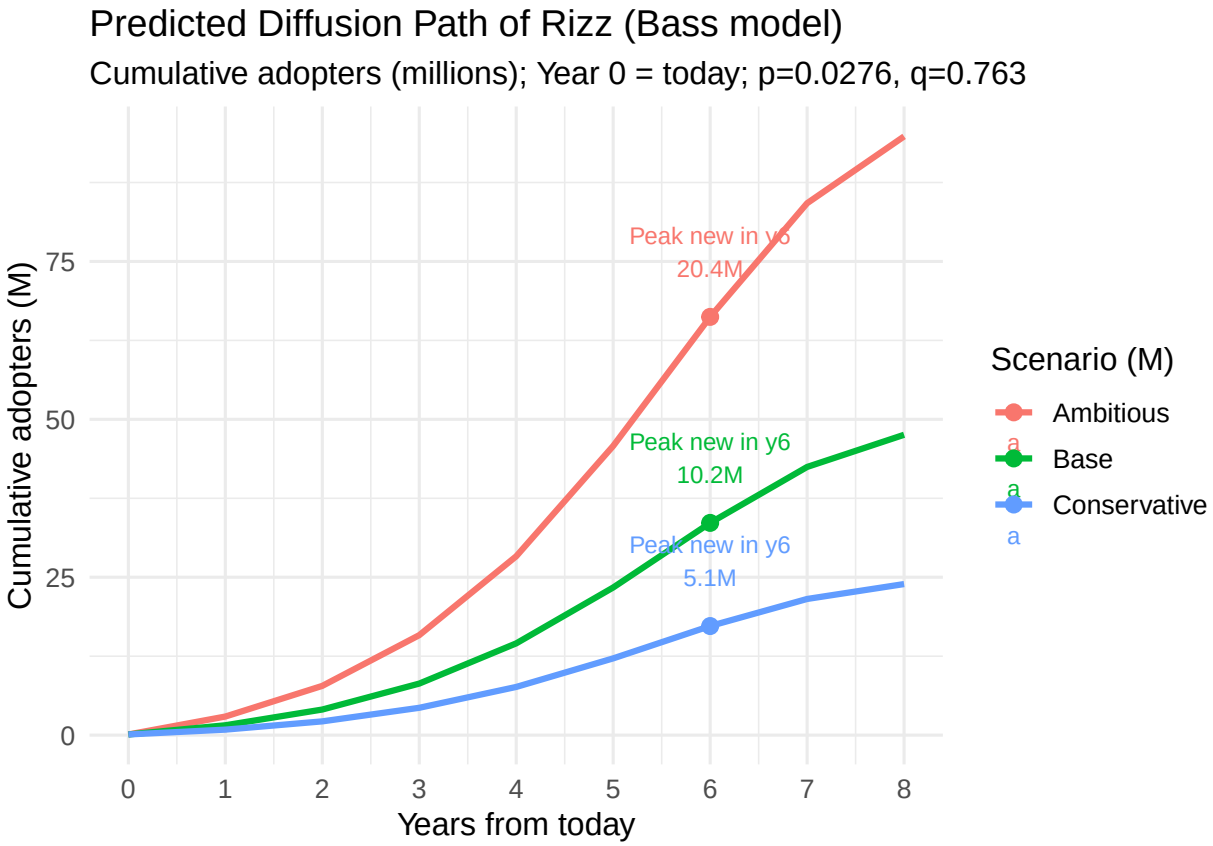
```
                    new  = rep(NA_real_, horizon + 1),
                    cum  = rep(NA_real_, horizon + 1))
  out$cum[1] <- N0
  for (t in 2:nrow(out)) {
    Nprev      <- out$cum[t - 1]
    out$new[t] <- (p + q * (Nprev / M)) * (M - Nprev)
    out$cum[t] <- Nprev + out$new[t]
  }
  out$M <- M
  out
}

paths <- do.call(rbind, lapply(names(scenarios), function(nm){
  Mval <- as.numeric(scenarios[[nm]])
  df   <- make_path(M = Mval, p = p, q = q, N0 = N0, horizon = forecast_years)
  df$scenario <- nm
  df
}))

paths_round <- paths %>%
  mutate(cum = as.numeric(cum),
         new = as.numeric(new))

peaks <- paths_round %>%
  group_by(scenario) %>%
  slice_max(new, n = 1, with_ties = FALSE)

ggplot(paths_round, aes(x = year, y = cum, color = scenario)) +
  geom_line(linewidth = 1.1) +
  geom_point(data = peaks, aes(x = year, y = cum), size = 2.5) +
  geom_text(
    data = peaks,
    aes(label = paste0("Peak new in y", year, "\n", round(new,1), "M")),
    vjust = -0.8, size = 3
  ) +
  labs(
    title = "Predicted Diffusion Path of Rizz (Bass model)",
    subtitle = "Cumulative adopters (millions); Year 0 = today; p=0.0276, q=0.763",
    x = "Years from today",
    y = "Cumulative adopters (M)",
    color = "Scenario (M)"
  ) +
  scale_x_continuous(breaks = 0:max(paths_round$year)) +
  theme_minimal(base_size = 12)
```



- Conservative (M=25 million)

We see it peaks after 6 years, reaching around 5 million customer increase in 1 year(visible also in later tables). Then, as new adopter numbers start to decline, we finally reach 24 million cumulative users by the end of year 8

- Base (M=50 million)

We see it peaks after 6 years, reaching around 10 million customer increase in 1 year(visible also in later tables). Then, as new adopter numbers start to decline, we reach 47.5 million cumulative users by the end of year 8

- Ambitious (M=100 million)

We see it peaks after 6th year with around 20 million new users increase in 1 year(visible also in later tables). Then, as new adopter numbers starts to decline, as the market gets saturated, by year 8 we approach around 95 million cumulative users.**

6. Choose a scope (global or country-specific)

Decide whether to analyze the diffusion **worldwide** or within a **specific country**.
Justify your choice with **references or data**.

Global

Rizz targets users **across all dating platforms**, not a single market, and **Tinder scaled globally** as well. Therefore, we **model diffusion worldwide** and test **different market potential (M) scenarios** reflecting alternative global ceilings.

Primary evidence for Tinder's global scale comes from Business of Apps (2025); a secondary compilation that reproduces those figures is DemandSage (2025).

7. Estimate the number of adopters by period

Using your Bass model parameters, estimate the **number of adopters** of the innovation over time. If necessary, use **Fermi's logic** to make rough estimations in the absence of concrete data.

```
colnames_to_use <- c("Year","New (M)","Cumulative (M)","M (M)","Scenario")
paths %>%
  filter(scenario == "Conservative") %>%
  kbl(caption = "Conservative", digits = 2, align = "c", row.names = FALSE, col.names = colnames_to_use
  kable_styling(latex_options = c("striped","hold_position"))
```

Table 1: Conservative

Year	New (M)	Cumulative (M)	M (M)	Scenario
0	NA	0.10	25	Conservative
1	0.77	0.87	25	Conservative
2	1.31	2.18	25	Conservative
3	2.15	4.33	25	Conservative
4	3.30	7.63	25	Conservative
5	4.52	12.15	25	Conservative
6	5.12	17.27	25	Conservative
7	4.29	21.56	25	Conservative
8	2.36	23.92	25	Conservative

```
paths %>%
  filter(scenario == "Base") %>%
  kbl(caption = "Base Scenario", digits = 2, align = "c", row.names = FALSE, col.names = colnames_to_us
  kable_styling(latex_options = c("striped","hold_position"))
```

Table 2: Base Scenario

Year	New (M)	Cumulative (M)	M (M)	Scenario
0	NA	0.10	50	Base
1	1.46	1.56	50	Base
2	2.49	4.05	50	Base
3	4.11	8.16	50	Base
4	6.37	14.53	50	Base
5	8.84	23.37	50	Base
6	10.23	33.61	50	Base
7	8.86	42.47	50	Base
8	5.09	47.56	50	Base

```
paths %>%
  filter(scenario == "Ambitious") %>%
  kbl(caption = "Ambitious Scenario", digits = 2, align = "c", row.names = FALSE, col.names = colnames_
  kable_styling(latex_options = c("striped","hold_position"))
```

Table 3: Ambitious Scenario

Year	New (M)	Cumulative (M)	M (M)	Scenario
0	NA	0.10	100	Ambitious
1	2.84	2.94	100	Ambitious
2	4.86	7.80	100	Ambitious
3	8.03	15.83	100	Ambitious
4	12.49	28.32	100	Ambitious
5	17.47	45.79	100	Ambitious
6	20.44	66.23	100	Ambitious
7	18.00	84.22	100	Ambitious
8	10.57	94.80	100	Ambitious

References

Business of Apps. (2025). *Tinder: Revenue and usage statistics 2025*. https://www.businessofapps.com/data/tinder-statistics/

DemandSage. (2025). *Tinder statistics 2025*. https://demandsage.com/tinder-statistics/

RevenueCat. (2025). *State of subscription apps 2025*. https://www.revenuecat.com/state-of-subscription-apps-2025/