

K-Pop Data Analysis

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March 24, 2025

Starting in 2024.

Executive Summary

Write something here

Disclaimer

This manuscript is written solely by the author, not by ChatGPT or any other generative AI. The opinions and views expressed in this manuscript are those of the author, and do not necessarily state or reflect those of any institution or government entity.

1 Introduction

Important: Write about why K-pop music is so popular across the globe.

K-pop music has emerged popularity worldwide since the early 2010's (Khiun, 2013; Sun, 2022).

Then write about the author's motivation

The author became interested in K-pop music (Korean pop music) from the debut of Tzuyu (Chou Tzu-Yu, 周子瑜).¹ Tzuyu is originally from Taiwan, the country in which the author grew up. In 2015, Tzuyu participated in the South Korean reality television show *SIXTEEN*,² and eventually got added to the newly-formed girl group *TWICE*.³ In early 2016, Tzuyu was forced to apologize after she raised the Taiwan flag in a Korean entertainment show.⁴ The flag controversy incident made headline news in Taiwan,⁵ and it was estimated to bring in 500,000 votes for the 2016 Taiwan presidential election.⁶

¹<https://en.wikipedia.org/wiki/Tzuyu>

²[https://en.wikipedia.org/wiki/Sixteen_\(TV_program\)](https://en.wikipedia.org/wiki/Sixteen_(TV_program))

³<https://en.wikipedia.org/wiki/Twice>

⁴<https://bit.ly/3DOcNIP>

⁵<https://bit.ly/4k5j7ps>

⁶<https://bit.ly/3CUQWsK>

Unfinished below

Then in 2017, another Taiwanese girl, Snowbaby (蔡瑞雪),⁷ joined the Korean live reality show *Idol School* (偶像學校).⁸ At the end, the show would select nine winners to form the girl group *fromis_9*.⁹ This also generated lots of discussion in the Mandarin-speaking community.¹⁰ Although Snowbaby was eliminated in the middle of the show, she still deserves praise for her courage to participate as an international contestant.¹¹ Since Snowbaby graduated from the same high school as the author did,¹² Snowbaby's experience motivated the author to learn more about K-pop.

Survivorship bias is prevalent in the entertainment industry, and the K-pop genre is no exception (Lockwood, 2021). To become a K-pop idol in Korea, aspiring kids usually start as a trainee at an entertainment company in their early teens (Lee and Jin, 2019). The trainees take vocal and dance lessons, and the training process is intense and extremely competitive (Kang, 2017; Lee, 2024). (No wonder the K-pop artist performances are beautiful and well-rehearsed (Kim et al., 2021).) Very few trainees can eventually get selected to debut and perform on stage as the company's official group (Han and Pothong, 2021), and even fewer K-pop performers can achieve iconic status (Min, 2024). While a performing group enjoys the spotlight and fame, the group typically lasts only a few years before the contract ends (Cho et al., 2023).

K-pop overcrowded market (Liu, 2025).

(a lot more content here)

Need a transition paragraph to explain what we are doing in this analysis

Important: Write about the K-pop scandal revealed in 2019 and later.

In 2019, the author stopped following the shows produced by Mnet because ...

We focus on the ratings directly given by the vocal and dance instructors, rather than the published number of audience votes.

https://en.wikipedia.org/wiki/Mnet_vote_manipulation_investigation

A K-pop vote manipulation scandal was surprisingly revealed in 2019, starting with the *Produce X 101*¹³ and the mysterious 29,978 number.¹⁴ After the producer Mnet¹⁵ published the number of votes each contestant received, people calculated the difference between rankings and noticed a strange pattern of the numbers. The difference was exactly 29,978 votes for five intervals among the rankings from 1st to 10th. The pattern seemed generated by some mathematical function, and it was nearly impossible to be a coincidence. Hence people suspected that the voting results were manipulated by Mnet.¹⁶

Finally, Mnet admitted to manipulating the votes in the *Produce 101* series and the subsequent reality shows, including *Idol School*.¹⁷ The show producers rigged the votes in return for financial favors, resulting in not only unfair competition but also employment fraud (Lee and Zhang, 2021). These entertainment agency representatives were charged with bribery, fraud, and sabotage (Yoshimitsu, 2020).

Idol School: Vote Manipulation Investigation (2019)

<https://www.ptt.cc/bbs/KoreaStar/M.1624467107.A.D7F.html>

What was the penalty of these entertainment agency representatives?

<https://www.ptt.cc/bbs/KoreaStar/M.1680484737.A.28A.html>

⁷Snowbaby's YouTube channel: <https://www.youtube.com/@snowbaby>

⁸[https://en.wikipedia.org/wiki/Idol_School_\(2017_TV_series\)](https://en.wikipedia.org/wiki/Idol_School_(2017_TV_series))

⁹https://en.wikipedia.org/wiki/Fromis_9

¹⁰<https://www.epochtimes.com/b5/17/7/2/n9346573.htm>

¹¹<https://bit.ly/41p3pym>

¹²<https://bit.ly/424u3gv>

¹³https://en.wikipedia.org/wiki/Produce_X_101

¹⁴<https://www.koreaboo.com/news/produce-x-101-rigged-votes-final-members/>

¹⁵[https://en.wikipedia.org/wiki/Mnet_\(TV_channel\)](https://en.wikipedia.org/wiki/Mnet_(TV_channel))

¹⁶<https://bit.ly/4iWtPh0>

¹⁷<https://www.popdaily.com.tw/korea/846603>

Need academic citations, not just news links.

Impact on the K-pop industry

Impact on the trainees who lost the chance to debut

After the 2019 scandal, Mnet has been under controversy but is still actively producing K-pop dance survival shows.¹⁸ Recent works of Mnet include *Kingdom: Legendary War* (2021)¹⁹ and *Stage Fighter* (2024).²⁰

1.1 Technical Narrative

This manuscript is created using R Markdown (Allaire et al., 2024)²¹ for reproducible data analysis, just like our earlier technical report about the education in Taiwan (Chai, 2024). We have posted our code and data on GitHub,²² so readers can download the GitHub repository and play with the script themselves.

The rest of this manuscript is organized as follows.

e.g. Chapter 23 does something.

2 *Idol School* Dataset (2017)

Idol School (偶像學校) (2017)

Emphasize that *Idol School* did not require vocal or dance experience and was willing to train the participants from scratch. Despite the low barrier to entry, many participants in the reality show had previously trained under various entertainment companies.

In the live reality show *Idol School*, nine winners were selected to form the girl group *fromis_9*.²³ This girl group debuted in 2018 and remained active until the contract with Pledis Entertainment ended in 2024. In January 2025, five members of the group signed a new contract with ASND.²⁴

Need to write the data description

Wikipedia data: https://en.wikipedia.org/wiki/List_of_Idol_School_contestants

2.1 Read in the *Idol School* Dataset

We manually copy-pasted the contestant data from Wikipedia into a Microsoft Excel workbook (.xlsx), and used the R package `readxl` (Wickham and Bryan, 2023) to load the dataset. A main advantage of .xlsx over .csv is that we can have multiple data sheets in the same Excel file for consolidation. Moreover, Excel supports Chinese characters, so we can also include the Chinese names of each contestant. Since the English translation of Korean names look similar to each other (Kim, 2020), we also include the date of birth (DOB) to make it easier to uniquely identify each contestant. For those who are able to read Chinese, we put each contestant's name in Chinese characters as well.

Specify the column names we included, also the column names we printed here.

Add the metadata in the Excel file or the Appendix ?!

Currently I prefer adding the metadata in the Excel file for proximity to the data itself.

Show the first 10 records as a snapshot of the dataset.

¹⁸<https://www.ptt.cc/bbs/KoreaStar/M.1618588754.A.7C9.html>

¹⁹https://en.wikipedia.org/wiki/Kingdom:_Legendary_War

²⁰https://en.wikipedia.org/wiki/Stage_Fighter

²¹<https://rmarkdown.rstudio.com/>

²²<https://github.com/star1327p/K-Pop-Dataset>

²³https://en.wikipedia.org/wiki/Fromis_9

²⁴<https://kpop.fandom.com/wiki/ASND>

```
library(readxl)
idol_school = read_excel("UNFINISHED_Idol_School_Dataset.xlsx",
                        sheet="Idol_School_Dataset")

# Date of birth (DOB) should be date only, not a full timestamp.
idol_school$DOB = as.Date(idol_school$DOB)

columns_to_show = c("Name_Chn", "Name_Eng", "DOB",
                    "Vocal", "Dance", "Physical", "Overall")

idol_school[1:10, columns_to_show]
```

```
## # A tibble: 10 x 7
##   Name_Chn Name_Eng      DOB      Vocal Dance Physical Overall
##   <chr>    <chr>    <date>    <dbl> <dbl>    <dbl>    <dbl>
## 1 NATTY    NATTY      2002-05-30  9.8   8        8.1      8.63
## 2 劉怡伶    Tasha      1993-10-11   8     9.5      8        8.5
## 3 李采映    Lee Chae Young 2000-05-14  8.5   8.5      7.5      8.17
## 4 宋河英    Song Ha Young 1997-09-29  8.6   5.9      9.8      8.1
## 5 金恩書    Kim Eun Suh   2000-11-14  6.3   6.9     10       7.73
## 6 金明智    Kim Myong Ji  1997-10-09  5.5   7.9      8.2      7.2
## 7 張圭悧    Jang Gyuri    1997-12-27  7.2   7.1      7        7.1
## 8 朴宣      Park Sun      2004-05-25  9.5   6.1      5.5      7.03
## 9 李悠汀    Lee Yoo Jeong 1997-02-26  5.8   6.2      9        7
## 10 金娜妍    Kim Na Yeon   1996-05-15  8.3   6        6.4      6.9
```

Explain why we removed the 41st contestant whose scores were all zeros.

The 41st contestant, Som Hye In (慎惠仁), left the *Idol School* show due to health reasons. She was unable to complete the basic test, so her score was zero in all three categories (vocal, dance, and physical).

```
# UNFINISHED HERE
# We MUST remove the 41st contestant's scores (all zeros)!!
idol_school = idol_school[1:40,]
```

2.2 *Idol School*: Exploratory Data Analysis

Context: Write about how the vocal, dance, and physical scores were evaluated.

Physical testing contains a group exercise and an individual exercise.

Also mention the top performers in each category.

What changes did we make from the Wikipedia data?

Our presumption is that in each category, no two contestants should have the same score. However, after sorting the *Idol School* data by the physical scores, we found two 3.5's and two 1.2's. Especially that the two 3.5's belong to top-ranked contestants Bae Eun Yeong (裴恩英) and Park Ji Won (朴池原), this issue quickly caught our attention to make corrections to the data.

Physical: We found two 3.5's and two 1.2's after sorting the scores.

In the video clip, Park Ji Won (朴池原) and her partner were the first runner-up in the group physical exercise.²⁵ We are surprised that Ji Won's physical score was only 3.5. According to the video's score table

²⁵Screenshot of the group physical exercise: <https://bit.ly/4a7QT9m>

for contestants ranked 11th to 20th,²⁶ Ji Won's physical score should be 6.2. The Wikipedia table shows an inconsistency in Ji Won's overall score, i.e., the average across the three categories. Ji Won's vocal score was 7.9, and her dance score was 5. These numbers seem to be reasonable for Ji Won, because she is known for excellent singing and good dancing as a performer.²⁷ Therefore, we assume both scores to be correct. If the physical score had really been 3.5, then Ji Won's overall score would be 5.47, dropping her from 13th place to the 18th. If the overall score of 6.37 had been correct, then Ji Won's physical score should be 6.2. The second scenario is more likely to be true, given the evidence we found in the video clip. Hence we corrected Ji Won's physical score to 6.2.

Physical: We found additional two 1.2's after sorting the scores.

The two 1.2 scores are more difficult to check for the underlying values, probably because they occurred in two contestants of lower ranking.²⁸ The two contestants, Jessica Lee (李瑟) and Michelle White (懷特·米雪兒), ranked in the lower half of all 41 contestants in terms of the overall ability test. Both of them got eliminated in the first round, so they did not receive much attention in the show. With the help of Google Translate,²⁹ we were able to translate the image of Korean text to (readable) English. Finally, we discovered that Michelle White's physical score should be 1.3, not 1.2.

Idol School (2017): Videos with subtitles in Simplified Chinese are available on the Bilibili platform.³⁰

Screenshots saved:

https://github.com/star1327p/K-Pop-Dataset/tree/main/Idol_School_Rating_Screenshots

Still need to write the description

```
vocal_sorted = sort(idol_school$Vocal, decreasing = TRUE)
dance_sorted = sort(idol_school$Dance, decreasing = TRUE)
physical_sorted = sort(idol_school$Physical, decreasing = TRUE)

# UNFINISHED HERE
combined_all_three = cbind(vocal_sorted, dance_sorted, physical_sorted)
sorted_scores_df = as.data.frame(combined_all_three)
```

Test

```
sorted_scores_df[1:10,]
```

```
##      vocal_sorted dance_sorted physical_sorted
## 1           9.8           9.5           10.0
## 2           9.5           9.3           9.8
## 3           8.6           9.0           9.0
## 4           8.5           8.5           8.7
## 5           8.3           8.4           8.2
## 6           8.0           8.0           8.1
## 7           7.9           7.9           8.0
## 8           7.2           7.5           7.5
## 9           7.0           7.4           7.0
## 10          6.5           7.1           6.5
```

Test

²⁶<https://bit.ly/400KUhH>

²⁷Park Ji Won was the main vocalist in *fromis_9*. <https://bit.ly/402yCFI>

²⁸Physical scores of all contestants in *Idol School*: <https://bit.ly/3DRNK0Z>

²⁹<https://translate.google.com/>

³⁰<https://www.bilibili.com/video/BV1554y1C7wj/>

```
sorted_scores_df[31:40,]
```

```
##      vocal_sorted dance_sorted physical_sorted
## 31          2.5          3.6          1.6
## 32          2.2          3.5          1.5
## 33          2.1          3.3          1.3
## 34          2.0          3.2          1.2
## 35          1.5          3.1          1.0
## 36          1.4          3.0          0.9
## 37          1.3          2.6          0.8
## 38          1.2          2.2          0.7
## 39          1.1          2.0          0.6
## 40          1.0          1.0          0.4
```

Check for the mean and median of each category score

Look at the five-number summary ?!

http://en.wikipedia.org/wiki/Five-number_summary

Five numbers = min, 1st quartile, median, 3rd quartile, max.

Add: mean

```
# Combine all three summary tables
vocal_summary = summary(idol_school$Vocal)
dance_summary = summary(idol_school$Dance)
physical_summary = summary(idol_school$Physical)

score_summary = rbind(vocal_summary, dance_summary, physical_summary)
row.names(score_summary) = c("Vocal", "Dance", "Physical")
print(score_summary)
```

```
##      Min. 1st Qu. Median   Mean 3rd Qu. Max.
## Vocal   1.0   2.875   4.95 4.8850  6.425  9.8
## Dance   1.0   3.825   5.55 5.4850  7.025  9.5
## Physical 0.4   1.675   3.25 4.1925  6.425 10.0
```

Shall we create a **box plot** using ggplot2 to compare the three sets of scores?

<https://www.sthda.com/english/wiki/ggplot2-box-plot-quick-start-guide-r-software-and-data-visualization>

Correlation matrix

Need to explain the correlation coefficients and the K-pop context.

Diagonal elements are always exactly 1.

Create the scatterplots and/or correlation plots!

Use **ggplot** or not ?!

- Correlation between vocal and dance scores: 0.645
- Correlation between vocal and physical scores: 0.663
- Correlation between dance and physical scores: 0.509

The training at a K-pop entertainment company in Korea usually includes vocal and dance lessons (Padget, 2017), so it is reasonable to see a high correlation between vocal and dance scores. Theoretically dance and

physical should be highly correlated (Ngo et al., 2024), but in the Idol School dataset, we observed a slightly lower correlation in dance vs physical than in dance vs vocal. Physical strength is essential to dancing, but dance also includes other critical elements such as technique and aesthetic expression (Geukes et al., 2023).

Note that some contestants with a remarkably high score in dance but a low score in physical:

e.g. Bae Eun Yeong (裴恩英)

e.g. Lee Hae In (李海印)

Or because too many contestants did not do well in the physical part ?!

Evidence: Median in physical score is lower than the median in vocal or dance.

```
# UNFINISHED HERE
cor(idol_school[,c("Vocal", "Dance", "Physical")])
```

```
##           Vocal      Dance  Physical
## Vocal      1.0000000 0.6453742 0.6635910
## Dance      0.6453742 1.0000000 0.5086578
## Physical   0.6635910 0.5086578 1.0000000
```

Alternatively, we can also obtain the pairwise correlation of each category.

```
# UNFINISHED HERE
cor(idol_school$Vocal, idol_school$Dance)
```

```
## [1] 0.6453742
```

```
# UNFINISHED HERE
# Need to print all three pairs.
# cor(idol_school$Dance, idol_school$Physical)
# cor(idol_school$Vocal, idol_school$Physical)
```

2.3 Idol School: Additional Resources

Students who were eliminated from the show:

https://www.ptt.cc/bbs/fromis_9/M.1555819461.A.C73.html

In 2017, someone else used random forests to predict the final ranking:

<https://shavid.pixnet.net/blog/post/331691281>

But this task turned out to be meaningless because the participant rankings were manipulated by the organizers.

Idol School: Vote Manipulation Investigation (2019)

<https://www.ptt.cc/bbs/KoreaStar/M.1624467107.A.D7F.html>

3 Read in the *Produce 48* Dataset

Produce 48 dataset (2018)

Wikipedia data: https://en.wikipedia.org/wiki/Produce_48

Need to write the data description

Produce 48 featured 96 contestants primarily from South Korea and Japan.

Footnote: Korea may include other countries, and the Korea-Japan split is not 1-1.

Some former contestants in *Idol School* tried again in the *Produce 48* reality show in 2018.

A total of 12 contestants were eventually selected from *Produce 48* to create the time-limited girl group *IZ*ONE*,³¹ which was active during 2018-2021 in both Korea and Japan.

```
library(readxl)
produce_48_data = read_excel("UNFINISHED_Idol_School_Dataset.xlsx",
                           sheet="Produce_48_Dataset")

# Date of birth (DOB) should be date only, not a full timestamp.
produce_48_data$DOB = as.Date(produce_48_data$DOB)

columns_to_show = c("Name_Chn", "Name_Eng", "DOB",
                    "First_Eval", "Second_Eval", "Final_Rank")

produce_48_data[1:20, columns_to_show]
```

```
## # A tibble: 20 x 6
##   Name_Chn Name_Eng      DOB      First_Eval Second_Eval Final_Rank
##   <chr>    <chr>      <date>    <chr>        <chr>        <dbl>
## 1 張員瑛    Jang Won Young 2004-08-31 B           B             1
## 2 宮脇咲良  Miyawaki Sakura 1998-03-19 A           A             2
## 3 曹柔理    Jo Yuri        2001-10-22 A           F             3
## 4 崔叡娜    Choi Ye Na     1999-09-29 A           B             4
## 5 安俞真    An Yu Jin      2003-09-01 B           A             5
## 6 矢吹奈子  Yabuki Nako    2001-06-18 F           A             6
## 7 權恩妃    Kwon Eun Bi    1995-09-27 A           C             7
## 8 姜惠元    Kang Hye Won   1999-07-05 F           F             8
## 9 本田仁美  Honda Hitomi   2001-10-06 C           A             9
## 10 金采源    Kim Chae Won   2000-08-01 B           B            10
## 11 金玟周    Kim Min Ju     2001-02-05 D           C            11
## 12 李彩演    Lee Chae Yeon  2000-01-11 A           A            12
## 13 韓霄瑗    Han Cho Won    2002-09-16 D           B            13
## 14 李佳恩    Lee Ka Eun     1994-08-20 A           A            14
## 15 宮崎美穗  Miyazaki Miho  1993-07-30 D           D            15
## 16 高橋朱里  Takahashi Juri 1997-10-03 B           A            16
## 17 竹内美宥  Takeuchi Miyu  1996-01-12 A           B            17
## 18 下尾美羽  Shitao Miu     2001-04-03 D           D            18
## 19 朴海允    Park Hae Yoon  1996-01-10 A           D            19
## 20 白間美瑠  Shiroma Miru   1997-10-14 B           D            20
```

Data entry complete for all contestants in *Produce 48*, including those who left in the middle of the show.

Create a matrix for the two sets of ratings.

For each rating, also check how many contestants are from Korea and how many are from Japan.

Jo Yuri (曹柔理): $A \rightarrow F$

What about other participants?

³¹https://en.wikipedia.org/wiki/Iz*One


```
# UNFINISHED HERE
```

```
produce_48_data[81:96, columns_to_show]
```

```
## # A tibble: 16 x 6
```

	Name_Chn	Name_Eng	DOB	First_Eval	Second_Eval	Final_Rank
	<chr>	<chr>	<date>	<chr>	<chr>	<dbl>
## 1	克利絲汀	Alex Christine	1996-12-09	B	C	82
## 2	栗原紗英	Kurihara Sae	1996-06-20	F	D	83
## 3	趙英燕	Cho Yeong In	2001-10-31	B	C	84
## 4	淺井裕華	Asai Yuuka	2003-11-10	F	D	85
## 5	安藝媛	Ahn Ye Won	2001-02-10	F	F	86
## 6	內木志	Naiki Kokoro	1997-04-06	D	C	87
## 7	金有彬	Kim Yu Bin	2003-02-27	B	D	88
## 8	趙思朗	Cho Sa Rang	2003-09-05	B	F	89
## 9	崔韶恩	Choi So Eun	2001-09-19	B	C	90
## 10	篠崎彩奈	Shinozaki Ayana	1996-01-08	F	F	91
## 11	元書妍	Won Seo Yeon	2000-05-23	C	F	92
## 12	月足天音	Tsukiashi Amane	1999-10-26	F	F	100
## 13	田中美久	Tanaka Miku	2001-09-12	F	C	100
## 14	梅山戀和	Umeyama Kokona	2003-08-07	F	X	100
## 15	植村梓	Uemura Azusa	1999-02-04	F	X	100
## 16	松井珠理奈	Matsui Jurina	1997-03-08	B	B	100

Nationality

```
# UNFINISHED HERE
```

```
table(produce_48_data$Country)
```

```
##
```

```
## China Japan Korea USA
```

```
## 2 39 54 1
```

First Evaluation

```
table(produce_48_data$First_Eval, dnn="First_Eval")
```

```
## First_Eval
```

```
## A B C D F
```

```
## 15 25 22 15 19
```

Second Evaluation

```
table(produce_48_data$Second_Eval, dnn="Second_Eval")
```

```
## Second_Eval
```

```
## A B C D F X
```

```
## 14 20 22 16 22 2
```

Cross-table: **First_Eval** as row, and **Second_Eval** as column

```
table(produce_48_data$First_Eval, produce_48_data$Second_Eval,
      dnn=c("First_Eval", "Second_Eval"))
```

```
##           Second_Eval
## First_Eval A B C D F X
##           A 6 3 4 1 1 0
##           B 4 8 5 5 3 0
##           C 3 6 4 3 6 0
##           D 0 3 5 3 4 0
##           F 1 0 4 4 8 2
```

4 Tentative Placeholders

Write something here

4.1 Test for Non-English Characters

CJK = Chinese, Japanese, Korean

Chinese example

RStudio 有辦法打中文嗎？

```
print(" 大家好，很高興能認識你們！")
```

```
## [1] "大家好，很高興能認識你們！"
```

Japanese example

思い出にするにはまだ早すぎる

```
print(" みやわき さくら")
```

```
## [1] "みやわき さくら"
```

```
print(" 宮脇 咲良")
```

```
## [1] "宮脇 咲良"
```

This template does not support Korean characters yet.

4.2 R Markdown Narrative

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed      dist
##  Min.   : 4.0    Min.    : 2.00
## 1st Qu.:12.0    1st Qu.: 26.00
##  Median :15.0    Median : 36.00
##   Mean  :15.4    Mean     : 42.98
## 3rd Qu.:19.0    3rd Qu.: 56.00
##   Max.  :25.0    Max.     :120.00
```

4.3 Including Plots

You can also embed plots, for example in Figure 1:

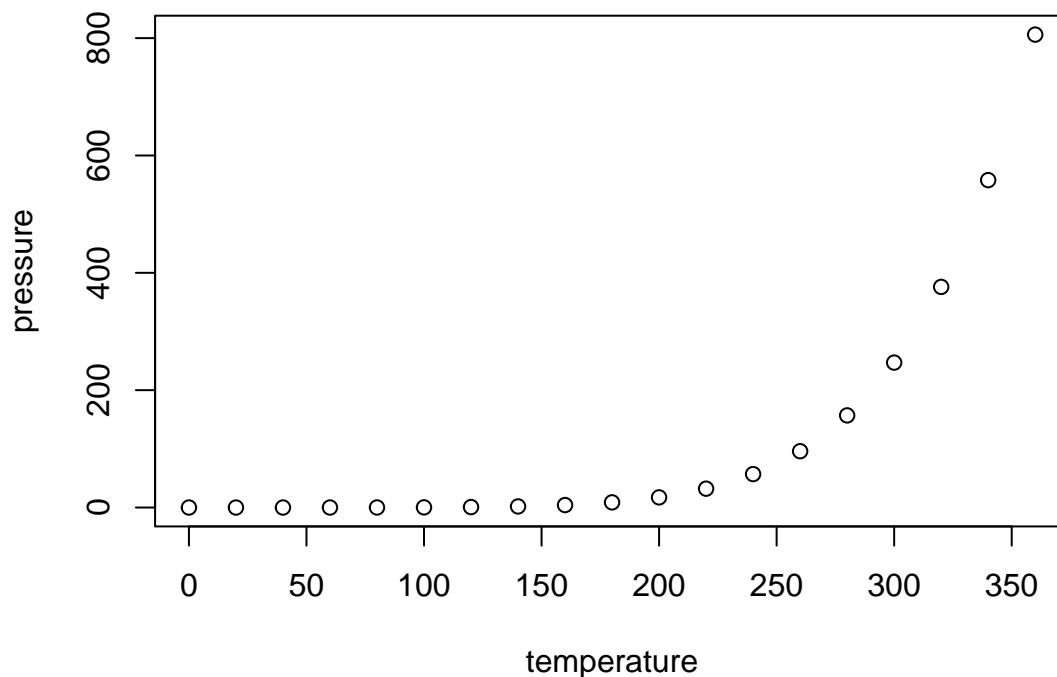


Figure 1: Test Plot

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

Acknowledgments

The author is immensely grateful to her significant other, Hugh Hendrickson, for providing his support in the author's professional development.

Technical discussions: Cheng-Shun (Adson) Liu and Chih-Kuang (Kevin) Lee.

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