Collaboration vs Solo Songs – Popularity Analysis

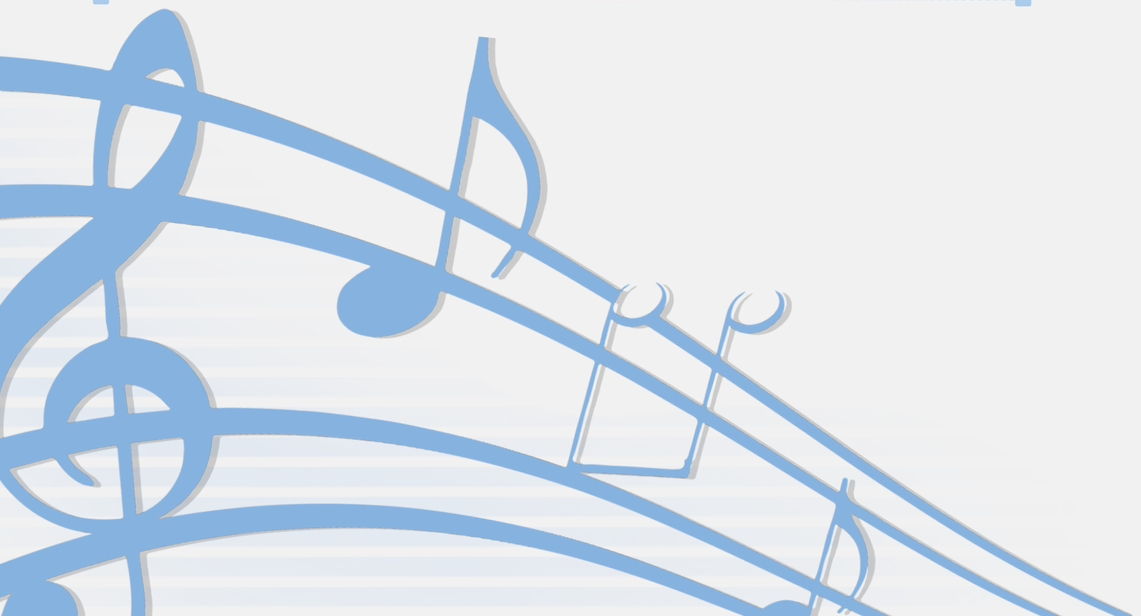
By Zixu Xing

Research Question:

- Are collaboration songs more popular than solo songs?

Measures of popularity:

- Average log(Streams)
- Probability of charting (charted = 1 if in_spotify_charts > 0)



Data Cleaning and Preparation:

- **Goal:** create an analysis-ready dataset (df2)

- **Main steps:**
  1. Made a working copy: `df2 <- df`
  2. Converted streams from character to numeric: `streams_num`
  3. Removed rows with invalid numeric conversion (1 row removed)
  4. Created group labels:
     a. solo if `artist_count == 1`
     b. collab if `artist_count > 1`
  5. Created `log_streams = log(streams_num)`
  6. Created `charted:`
     a. 1 if `in_spotify_charts > 0`
     b. 0 otherwise

- **Final sample sizes:**
  - collab: 366
  - solo: 586
  - charted = 1: 548
  - charted = 0: 404

Mean Popularity(t-test on log-streams)

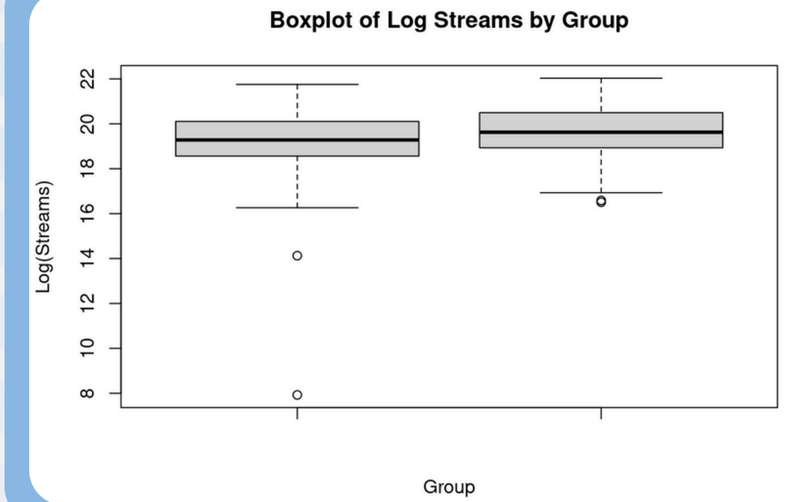
- **Method**: Welch two-sample t-test
- H0: μ_collab - μ_solo ≤ 0
- H1: μ_collab - μ_solo > 0
- **Key results**:
- Mean log-streams:
  - collab: 19.29
  - solo: 19.64
- p-value: 1
- **Conclusion**: Fail to reject H0

(no evidence collab songs are higher)

```
> x <- df2$log_streams[df2$group == 'collab']
> y <- df2$log_streams[df2$group == 'solo']
> t.test(x, y, alternative = 'greater')

        Welch Two Sample t-test

data:  x and y
t = -4.4329, df = 696.78, p-value = 1
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 -0.4741073        Inf
sample estimates:
mean of x mean of y
 19.29387  19.63954
```



Charting Probability (2-proportion test)

- **Question:** Are collab songs more likely to chart than solo songs?
- **Method: 2-sample test for proportions**
  - H0: p_collab ≤ p_solo
  - H1: p_collab > p_solo
- **Counts (charted = 1):**
  - collab: 218 / 366 = 0.5956
  - solo: 330 / 586 = 0.5631
- **Key results:**
  - p-value: 0.179
  - Conclusion: Fail to reject H0 (no significant evidence collab chart more)

(Optional mini-table to show the 2×2 counts)

```
> prop.test(c(218, 330), c(366, 586), alternative = 'greater')

        2-sample test for equality of proportions with continuity correction

data:  c out of c218 out of 366330 out of 586
X-squared = 0.84499, df = 1, p-value = 0.179
alternative hypothesis: greater
95 percent confidence interval:
 -0.02373351  1.00000000
sample estimates:
   prop 1    prop 2
0.5956284 0.5631399
```

Power + Overall Conclusion

- **Power goal:** detect a true 10% difference in charting rates with 80% detection chance at α = 0.05
- **Assumption:** p1 = 0.60 vs p2 = 0.50 (difference = 0.10)

Power result (from R):

- Required n per group: 388

```
> power.prop.test(p1 = 0.6, p2 = 0.5, power = 0.80, sig.level = 0.05)

     Two-sample comparison of proportions power calculation

              n = 387.3385
             p1 = 0.6
             p2 = 0.5
      sig.level = 0.05
          power = 0.8
    alternative = two.sided

NOTE: n is number in *each* group
```

- **Compare to dataset:**
  - solo: 586 (enough)
  - collab: 366 (slightly below required)
- **Overall conclusion:**
  - Collab songs did not show higher mean log-streams than solo songs
  - Collab songs had slightly higher chart rate, but not statistically significant
  - Dataset may be slightly underpowered to detect a 10% chart-rate difference for collabs
- **Limitations (1–2 bullets):**
  - Observational data, not causal
  - Popular-song dataset may not represent all Spotify songs