

# Notebook 3 - Final Product

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**Computing ID:** meu5cg

**Course:** DS 2023 - Communicating with Data

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## Purpose

Present the final infographic and document all project resources.

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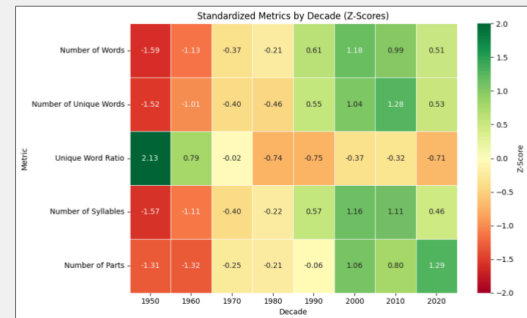
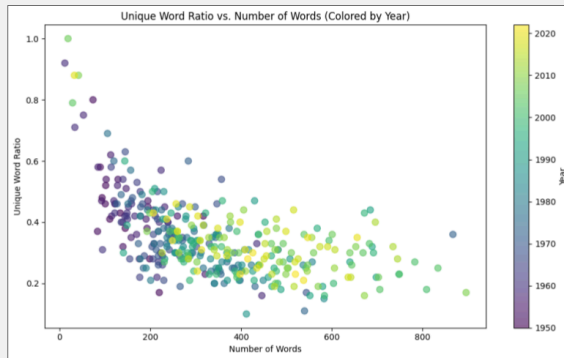
## Final Infographic

```
In [97]: from IPython.display import Image, display
import pandas as pd

# Display the final infographic
display(Image(filename='DSF Infographic (13).png'))
```

# Is Our Music Getting Dumber?

## An Analysis on Lyrical Complexity

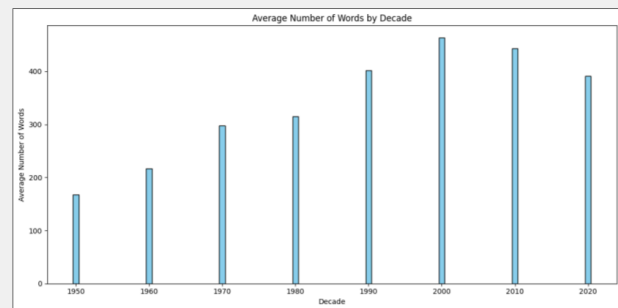


### Scatter Plot Interpretation

- Each dot represents one song
- Purple (1950s): Short songs with high vocabulary diversity
- Yellow (2020s): Long songs with low vocabulary diversity
- Notice the shift from top-left to bottom-right over time

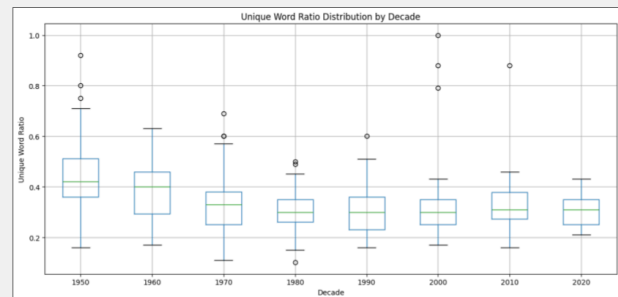
### Bar Plot Interpretation

- WORD COUNT IS INCREASING
- Average word count nearly TRIPLED
- KEY TRENDS:
  - Steady increase from 1950s-2000s
  - Peak in 2000s
  - Slight decline in 2010s-2020s



### Box Plot Interpretation

- VOCABULARY DIVERSITY DECLINING
- The 1950s had the highest median diversity. By 2020s, median dropped to ~0.3 – a large decrease despite using more words.
- KEY TRENDS:
  - Steepest decline: 1950s → 1980s
  - Stabilization: 1980s-2020s hover around ~0.3
- Notice: Box heights shrinking = less variation among songs.



2020s vs 1950s Songs:

- 133% MORE words
- 30% LESS unique vocabulary

Modern hits: More words but arguably more simple

**Data Source:**

BIMMuDa Dataset (Hamilton et al., 2024) 371 songs from • Dataset only includes top 5 songs from each year in Billboard charts, not all music is measured.  
Billboard Year-End Top 5 (1950-2022) Sample sizes: n=46-53 per full decade; 2020s: n=14 (limited to 2020-2022)

**Disclaimer:**

• Songs without lyrics are excluded from lyric-based metrics.  
• Lyrics and melodies were manually transcribed; small errors are possible.

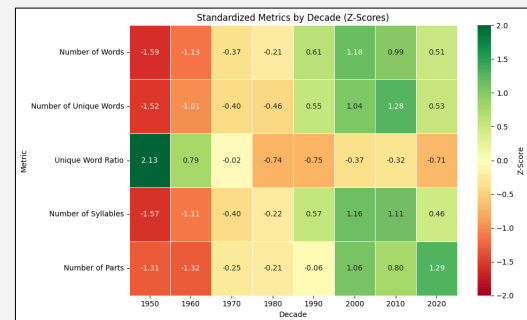
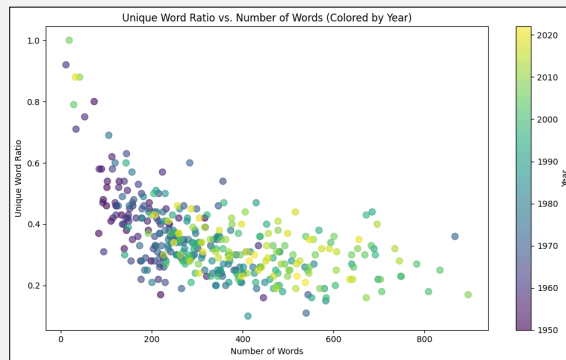
**Analysis:**

Kavan Wills | DS 2023 | University of Virginia  
Computing ID: meu5cg

```
In [96]: from IPython.display import SVG, display  
display(SVG(filename="DSF Infographic (11).svg"))
```

# Is Our Music Getting Dumber?

## An Analysis on Lyrical Complexity

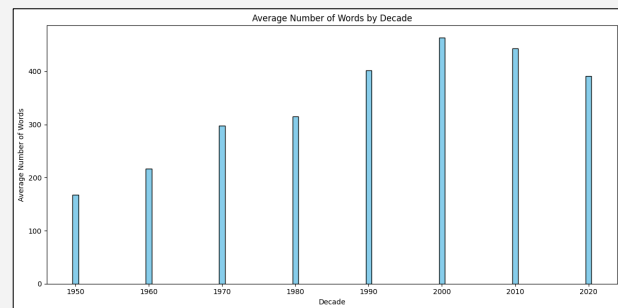


### Scatter Plot Interpretation

- Each dot represents one song
- Purple (1950s): Short songs with high vocabulary diversity
- Yellow (2020s): Long songs with low vocabulary diversity
- Notice the shift from top-left to bottom-right over time

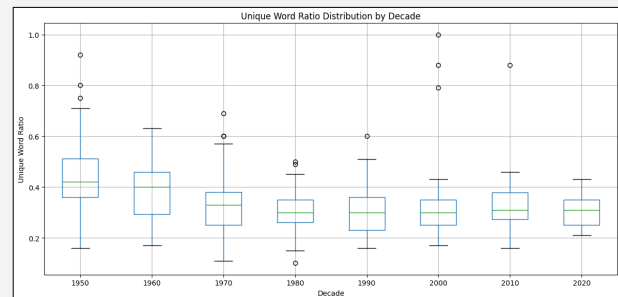
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#### Analysis:

Kavan Wills | DS 2023 | University of Virginia  
Computing ID: meu5cg

# Title of Final Product

## "Is Our Music Getting Dumber? An Analysis on Lyrical Complexity"

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### Description of Final Product

This infographic explores the paradox of modern popular music: while songs have gained more words (133% more words than songs from the 1950s), they have simultaneously become more simple, with a 30% decrease in vocabulary diversity. The 1950s averaged 168 words per song with a 0.44 unique word ratio, while the 2020s average 391 words with only a 0.31 ratio (calculations below).

### Visual Story:

The infographic uses a 24" x 36" poster format to tell a data-driven story through:

1. **Scatter Plot (Top Left)**

Shows individual songs plotted by word count vs. unique word ratio

Color-coded by year (purple = 1950s, yellow = 2020s)

Reveals the clustering pattern: older songs (short & diverse) vs. modern songs (long & repetitive)

2. **Heatmap (Top Right)**

Shows all metrics across decades in a color-coded matrix

Colors show how each decade compares to the average for that metric.

Demonstrates the inverse relationship: word count rising while diversity declining

3. **Bar Chart (Middle Right)**

Average word count by decade showing steady increase from 1950s to 2000s

Peak at 2000s with slight decline in 2020s

4. **Box Plot (Bottom Right)**

Distribution of lyrical diversity across decades

Shows declining median from 1950s-1980s, then stabilization at lower levels

### Supporting Elements:

- **Key Statistics Callout Box** (center): "2020s songs: 133% MORE words (168→391), 30% LOWER diversity (0.44→0.31)"
- **Annotations** by each plot explaining trends and key insights

### Design Approach:

#### Color Scheme:

- **Temporal gradient (Scatter plot):** Purple (1950s) to yellow (2020s) shows progression over time
- **Intensity heatmap:** Bright green (high values) to dark red (low values) shows metric magnitude
- **Consistent blue:** Bar and box plots use blue for clean, professional appearance
- **Neutral background:** White/light gray for maximum readability

### Layout:

- 2x2 grid arrangement with four plots
- Key statistic callout centered for emphasis
- Annotations positioned directly below/beside each plot
- Hierarchical flow: title → visuals → interpretation → source

### Typography:

- Bold headers for section titles and key statistics
- 14-16pt body text in annotations for readability
- Clear axis labels with appropriate font sizing
- Sans-serif font (Arial/similar) for modern, clean look

### Annotations:

- Text boxes with borders for visual separation
- Bullet points for scannability
- Arrows connecting annotations to relevant plot features
- Emoji icons (📈📉🔥) to enhance visual interest and guide attention

### Target Audience:

Music enthusiasts and data visualization students.

### Main Message:

Modern music production prioritizes number of words over unique word ratio, which likely means more repetitiveness and arguably more simple songs.

```
In [88]: # Calculate exact statistics for infographic claims
import pandas as pd

df = pd.read_csv('bimmuda_per_song_full.csv')
df_clean = df[df['Number of Words'] > 0].copy()
df_clean['Decade'] = (df_clean['Year'] // 10) * 10

# Get 1950s and 2020s averages
stats_1950s = df_clean[df_clean['Decade'] == 1950].agg({
    'Number of Words': 'mean',
```

```

    'Unique Word Ratio': 'mean'
})

stats_2020s = df_clean[df_clean['Decade'] == 2020].agg({
    'Number of Words': 'mean',
    'Unique Word Ratio': 'mean'
})

# Calculate percentage changes
word_increase = ((stats_2020s['Number of Words'] - stats_1950s['Number of Words']) / stats_1950s['Number of Words'] * 100)

ratio_decrease = ((stats_1950s['Unique Word Ratio'] - stats_2020s['Unique Word Ratio']) / stats_1950s['Unique Word Ratio'] * 100)

print(f"1950s: {stats_1950s['Number of Words']:.1f} words, {stats_1950s['Unique Word Ratio']:.1f} ratio")
print(f"2020s: {stats_2020s['Number of Words']:.1f} words, {stats_2020s['Unique Word Ratio']:.1f} ratio")
print(f"\nWord count increase: {word_increase:.1f}%")
print(f"Diversity decrease: {ratio_decrease:.1f}%")

```

1950s: 167.9 words, 0.44 ratio

2020s: 391.4 words, 0.31 ratio

Word count increase: 133.0%

Diversity decrease: 29.7%

```

In [89]: df_clean = df[df["Number of Words"] > 0].copy()

df_clean["Decade"] = (df_clean["Year"] // 10) * 10

decade_summary = (
    df_clean
    .groupby("Decade")
    .agg(
        mean_words=("Number of Words", "mean"),
        mean_unique_words=("Number of Unique Words", "mean"),
        mean_unique_ratio=("Unique Word Ratio", "mean"),
        mean_syllables=("Number of Syllables", "mean"),
    )
)

decade_summary = decade_summary.round({
    "mean_words": 1,
    "mean_unique_words": 1,
    "mean_unique_ratio": 2,
    "mean_syllables": 1,
})

decade_summary.loc[[1950, 2020]]

```

Out [89]:                    mean\_words   mean\_unique\_words   mean\_unique\_ratio   mean\_syllables

Decade				
1950	167.9	65.7	0.44	213.1
2020	391.4	118.3	0.31	473.9

```
In [90]: w_50 = decade_summary.loc[1950, "mean_words"]
w_20 = decade_summary.loc[2020, "mean_words"]
r_50 = decade_summary.loc[1950, "mean_unique_ratio"]
r_20 = decade_summary.loc[2020, "mean_unique_ratio"]

word_increase_pct = ((w_20 - w_50) / w_50) * 100
ratio_decrease_pct = ((r_50 - r_20) / r_50) * 100

print("Average words per song:")
print(f" 1950s: {w_50:.1f}")
print(f" 2020s: {w_20:.1f}")
print(f" Percent increase: {word_increase_pct:.1f}%")

print("\nAverage unique-word ratio:")
print(f" 1950s: {r_50:.2f}")
print(f" 2020s: {r_20:.2f}")
print(f" Percent decrease: {ratio_decrease_pct:.1f}%")
```

Average words per song:  
 1950s: 167.9  
 2020s: 391.4  
 Percent increase: 133.1%

Average unique-word ratio:  
 1950s: 0.44  
 2020s: 0.31  
 Percent decrease: 29.5%

## Design Process Documentation

### Paper Storyboard

Before creating the infographic digitally, I sketched the layout on paper to plan composition, plot arrangement, and visual hierarchy.

```
In [99]: from IPython.display import Image, display

# Display storyboard sketch
display(Image(filename='Infographic_rough_sketch.JPG'))
```



# Provocative Title

Scatter plot



Text

Heat map



Text

Text

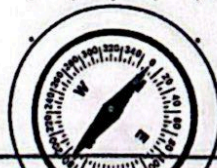


Bar plot

Text



Box plot



Take away



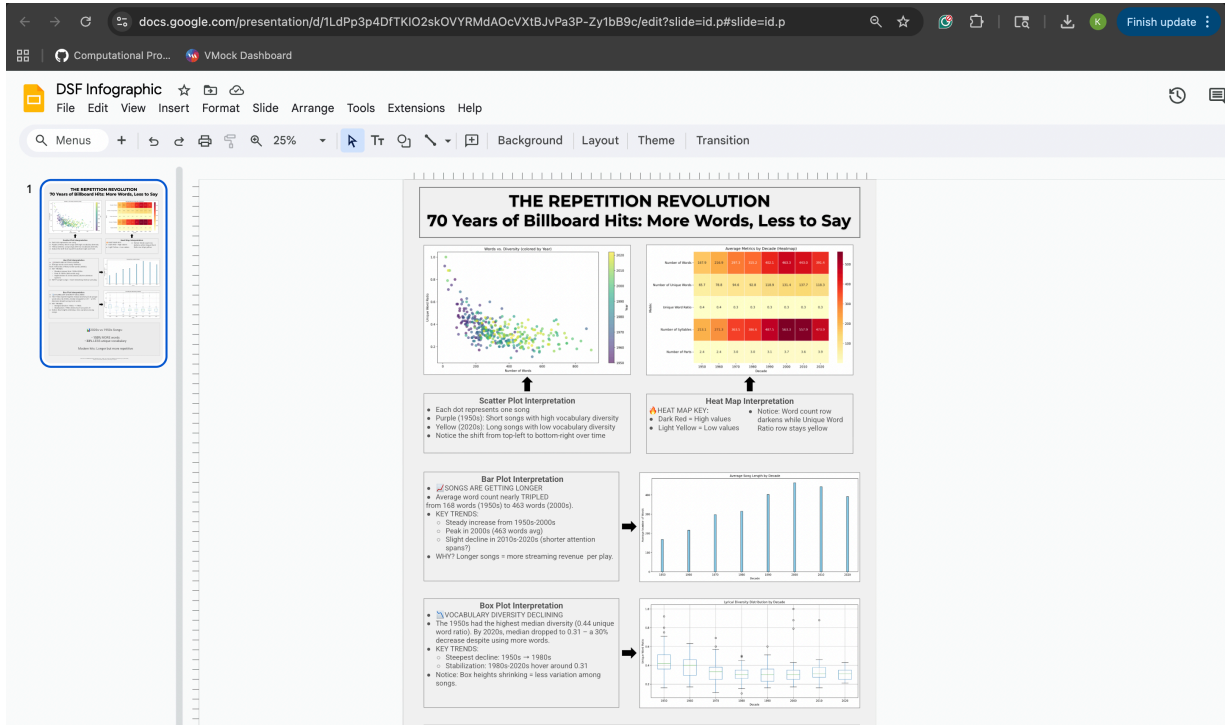
## Storyboard decisions:

- Positioned scatter plot top-left as primary focal point
- Placed heatmap top-right to show comprehensive metrics
- Bar and box plots middle-right and bottom-right to support main narrative
- Central key statistic box for immediate impact

## Design Tool: Google Slides

The infographic was created in Google Slides with custom dimensions (24" × 36").

In [92]: `display(Image(filename='DSF_googledriveediting.png'))`



## Project Manifest

```
In [105]: import pandas as pd

manifest_data = [
    # --- Core notebooks (source of analysis) ---
    {
        "Resource Name": "DFP_Notebook1.ipynb",
        "Type": "Jupyter Notebook",
        "Description": "Notebook 1 – project framing, BiMMuDa data description",
        "Link": "./DFP_Notebook1.ipynb"
    }
]
```

```

},
{
  "Resource Name": "DFP_Notebook2.ipynb",
  "Type": "Jupyter Notebook",
  "Description": "Notebook 2 – exploratory data analysis and visualization",
  "Link": "./DFP_Notebook2.ipynb"
},
{
  "Resource Name": "DFP_Notebook3.ipynb",
  "Type": "Jupyter Notebook",
  "Description": "Notebook 3 – final infographic, supporting statistics",
  "Link": "./DFP_Notebook3.ipynb"
},

# --- PDF exports (for easy viewing) ---
{
  "Resource Name": "DFP_Notebook1.pdf",
  "Type": "PDF Export",
  "Description": "PDF export of Notebook 1 for easier viewing/printing",
  "Link": "./DFP_Notebook1.pdf"
},
{
  "Resource Name": "DFP_Notebook2.pdf",
  "Type": "PDF Export",
  "Description": "PDF export of Notebook 2 for easier viewing/printing",
  "Link": "./DFP_Notebook2.pdf"
},
{
  "Resource Name": "DFP_Notebook3.pdf",
  "Type": "PDF Export",
  "Description": "PDF export of Notebook 3 for easier viewing/printing",
  "Link": "./DFP_Notebook3.pdf"
},

# --- Data file ---
{
  "Resource Name": "bimmuda_per_song_full.csv",
  "Type": "CSV Data File",
  "Description": "Per-song BiMMuDa dataset used in the project (379 rows)",
  "Link": "./bimmuda_per_song_full.csv"
},

# --- Final infographic & design artifacts ---
{
  "Resource Name": "DSF Infographic (13).png",
  "Type": "Image (PNG)",
  "Description": "Final infographic poster (PNG, 24\"x36\" canvas) for the project",
  "Link": "./DSF Infographic (13).png"
},
{
  "Resource Name": "DSF Infographic (11).svg",
  "Type": "Image (SVG)",
  "Description": "Final infographic poster (SVG, vector format) suitable for printing",
  "Link": "./DSF Infographic (11).svg"
},
{

```

```

        "Resource Name": "Infographic_rough_sketch.JPG",
        "Type": "Image (JPG)",
        "Description": "Hand-drawn rough sketch of the infographic layout cr
        "Link": "./Infographic_rough_sketch.JPG"
    },
    {
        "Resource Name": "DSF_googledriveediting.png",
        "Type": "Image (PNG)",
        "Description": "Screenshot of editing the infographic in Google Slic
        "Link": "./DSF_googledriveediting.png"
    },

# --- External resources ---
{
    "Resource Name": "Project GitHub Repository",
    "Type": "External Resource",
    "Description": "Public GitHub repository containing all project file
    "Link": "https://github.com/kavanwills/ds2023-final-bimmuda"
},
{
    "Resource Name": "Infographic Google Slides",
    "Type": "External Resource",
    "Description": "Google Slides file used to design and export the fir
    "Link": "https://docs.google.com/presentation/d/1LdPp3p4DfTKI02sk0VY
},
{
    "Resource Name": "BiMMuDa Paper (Hamilton et al., 2024)",
    "Type": "External Resource",
    "Description": "Research paper describing the construction of the Bi
    "Link": "https://transactions.ismir.net/articles/10.5334/tismir.168"
},
{
    "Resource Name": "BiMMuDa GitHub Repository",
    "Type": "External Resource",
    "Description": "GitHub repository containing BiMMuDa data and code r
    "Link": "https://github.com/madelinehamilton/BiMMuDa"
},
{
    "Resource Name": "BiMMuDa Documentation",
    "Type": "External Resource",
    "Description": "Online documentation / Google Doc describing the per
    "Link": "https://docs.google.com/document/d/17EyW-bA8oppRZ_3KloYB5Z-
}
]

manifest_df = pd.DataFrame(manifest_data)
manifest_df

```

Out [105...

	Resource Name	Type	Description	
0	DFP_Notebook1.ipynb	Jupyter Notebook	Notebook 1 – project framing, BiMMuDa data des...	./DF
1	DFP_Notebook2.ipynb	Jupyter Notebook	Notebook 2 – exploratory data analysis and vis...	./DF
2	DFP_Notebook3.ipynb	Jupyter Notebook	Notebook 3 – final infographic, supporting sta...	./DF
3	DFP_Notebook1.pdf	PDF Export	PDF export of Notebook 1 for easier viewing/pr...	./
4	DFP_Notebook2.pdf	PDF Export	PDF export of Notebook 2 for easier viewing/pr...	./I
5	DFP_Notebook3.pdf	PDF Export	PDF export of Notebook 3 for easier viewing/pr...	./I
6	bimmuda_per_song_full.csv	CSV Data File	Per-song BiMMuDa dataset used in the project (...)	./bimmuda
7	DSF Infographic (13).png	Image (PNG)	Final infographic poster (PNG, 24"x36" canvas)...	./DSF I
8	DSF Infographic (11).svg	Image (SVG)	Final infographic poster (SVG, vector format) ...	./DSF
9	Infographic_rough_sketch.JPG	Image (JPG)	Hand-drawn rough sketch of the infographic lay...	./Infographic
10	DSF_googledriveediting.png	Image (PNG)	Screenshot of editing the	./DSF_goc



	Resource Name	Type	Description	
			infographic in Googl...	
11	Project GitHub Repository	External Resource	Public GitHub repository containing all projec...	<a href="https://github.com/kavanwills">https://github.com/kavanwills</a>
12	Infographic Google Slides	External Resource	Google Slides file used to design and export t...	<a href="https://docs.google.com/presentation">https://docs.google.com/presentation</a>
13	BiMMuDa Paper (Hamilton et al., 2024)	External Resource	Research paper describing the construction of ...	<a href="https://transactions.ismir.net">https://transactions.ismir.net</a>
14	BiMMuDa GitHub Repository	External Resource	GitHub repository containing BiMMuDa data and ...	<a href="https://github.com/madelin">https://github.com/madelin</a>
15	BiMMuDa Documentation	External Resource	Online documentation / Google Doc describing t...	<a href="https://docs.google.com/document">https://docs.google.com/document</a>

## Project Summary

### Dataset

- **Name:** BiMMuDa (Billboard Melodic Music Dataset)
- **Songs:** 371 from Billboard year-end top 5 (1950-2022)
- **Focus:** Lyrical complexity trends

### Key Finding

**Modern Billboard hits use 133% more words than 1950s songs but have 30% less vocabulary diversity.**

### Methodology

1. Data establishment (Notebook 1)
2. Exploratory analysis with 17+ visualizations (Notebook 2)
3. Selection of best plots for infographic
4. Storyboard design on paper

5. Infographic in Google Slides (24×36 format)
6. Final export as PNG and PDF

## Tools Used

- **Analysis:** Python (pandas, matplotlib, seaborn)
  - **Design:** Google Slides
  - **Documentation:** Jupyter Notebooks
- 

## AI Usage Acknowledgement

Per course policy, I used **Claude (Anthropic)** and **ChatGPT (OpenAI)** as a learning aid for code examples, debugging, and conceptual clarification. All submitted work reflects my own understanding and reasoning. I can explain all aspects of this work without external assistance.

**Kavan Wills (meu5cg)**