Course: SMM
Assignment: 3

Team Members

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Question 1

Dataset

Raw dataset from: Kaggle — datascientist97/university-students-marks-sheet

Github

Repo: MuhammadRehanRasool/masters-smm-a3

In [50]:
```
# Load cleaned dataset
import pandas as pd

df = pd.read_csv('student_scores_clean.csv')

df.head()
```

Out[50]:

	attendance	quizzes	assignment	final	gpa	midterm
0	87.34	93.33	86.67	73.33	3.28	91.11
1	82.04	46.67	30.00	60.00	2.31	66.67
2	89.29	86.67	90.00	77.33	3.16	75.56
3	72.84	36.67	33.33	58.67	1.77	26.67
4	73.56	53.33	30.00	46.67	2.17	75.56

In [51]:
```
df.describe()
```

Out[51]:

	attendance	quizzes	assignment	final	gpa	midterm
count	224.000000	224.000000	224.000000	224.000000	224.000000	224.000000
mean	77.100893	53.471786	51.667143	50.485357	2.218393	65.680446
std	6.246707	24.219538	24.239325	27.334167	0.656790	21.364627
min	58.470000	0.000000	0.000000	0.000000	0.640000	24.440000
25%	73.277500	33.330000	30.000000	30.335000	1.727500	51.110000
50%	76.580000	51.665000	50.835000	50.490000	2.220000	66.670000
75%	81.125000	70.832500	66.670000	72.332500	2.755000	77.780000
max	92.510000	100.000000	100.000000	100.000000	3.530000	100.000000

In [52]:
```
df['assignment'].max()
```

Out[52]:
```
np.float64(100.0)
```

In [53]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 224 entries, 0 to 223
Data columns (total 6 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   attendance  224 non-null    float64
 1   quizzes     224 non-null    float64
 2   assignment  224 non-null    float64
 3   final       224 non-null    float64
 4   gpa         224 non-null    float64
 5   midterm     224 non-null    float64
dtypes: float64(6)
memory usage: 10.6 KB
```

In [54]:
```
import matplotlib.pyplot as plt
import numpy as np
```

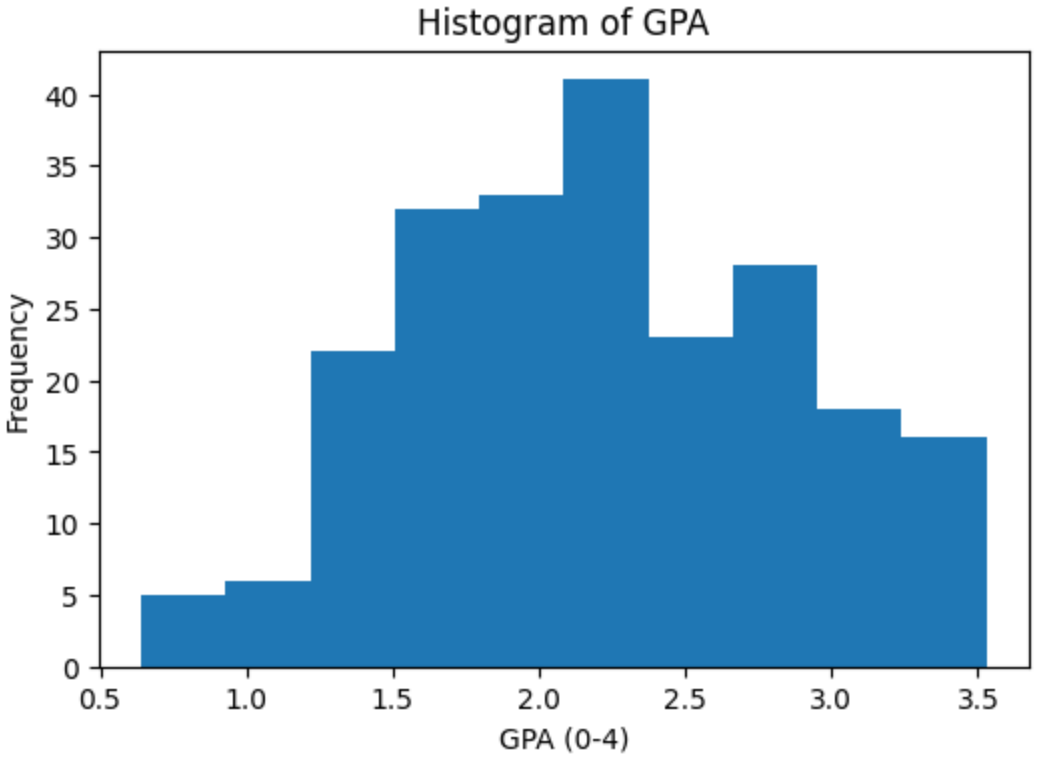
Task 1: What is the average performance of students in hybrid learning?

In [55]:
```
# Average of individual scores
print("Average Total Quiz Score (%):", (df["quizzes"].mean()).round(2))
print("Average Total Assigment Score (%):", (df["assignment"].mean()).round(2))
print("Average Final Score (%):", (df["final"].mean()).round(2))
print("Average GPA (0-4):", (df["gpa"].mean()).round(2))

totalmarks = (df["gpa"] / 4) * 150
print("Average Total Marks (%):", ((totalmarks.mean() / 150) * 100).round(2))
```

```
Average Total Quiz Score (%): 53.47
Average Total Assigment Score (%): 51.67
Average Final Score (%): 50.49
Average GPA (0-4): 2.22
Average Total Marks (%): 55.46
```

Task 2: Are the grades normally distributed?

In [56]:
```
# Display historgram for GPA

plt.figure(figsize=(6,4))
plt.hist(df['gpa'])
plt.title(f"Histogram of GPA")
plt.xlabel("GPA (0-4)")
plt.ylabel("Frequency")
plt.show()
```



Answer: Yes, the GPA is normally distributed as shown in the histogram above.

Task 3: Which component (quizzes, assignments, or exams) shows the most variability?

In [57]:
```
# Standard deviation of individual columns
print("Standard Deviation of Scores:")
```

```
df[["quizzes","assignment","final"]].std()
```

```
Standard Deviation of Scores:
```

Out[57]:
```
quizzes       24.219538
assignment    24.239325
final         27.334167
dtype: float64
```

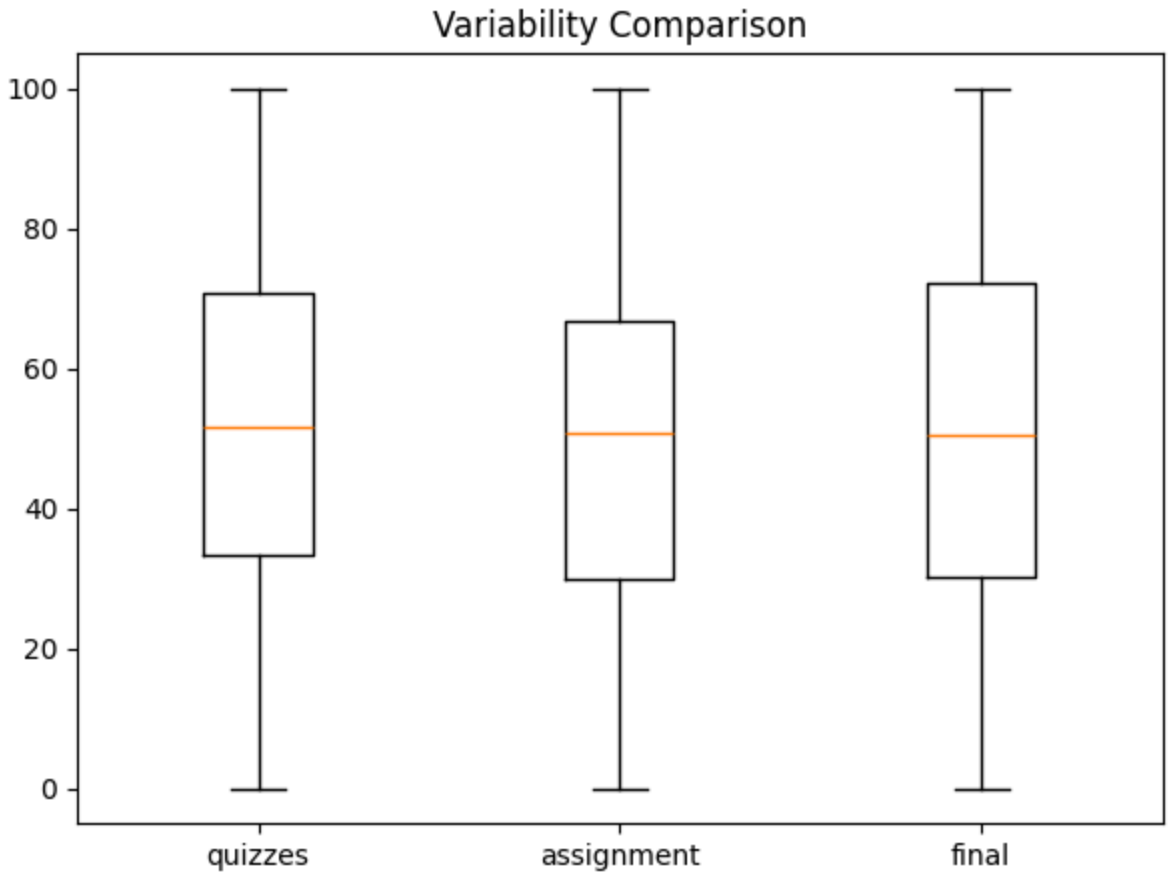
In [58]:
```
# Variance of individual columns
print("Variance of Scores:")
df[["quizzes","assignment","final"]].var()
```

```
Variance of Scores:
```

Out[58]:
```
quizzes       586.586006
assignment    587.544899
final         747.156688
dtype: float64
```

In [59]:
```
plt.figure(figsize=(7,5))
plt.boxplot([df["quizzes"], df["assignment"], df["final"]], labels=["quizzes", "ass
plt.title("Variability Comparison")
plt.show()
```

```
C:\Users\muham\AppData\Local\Temp\ipykernel_18624\1109605332.py:2: MatplotlibDepreca
tionWarning: The 'labels' parameter of boxplot() has been renamed 'tick_labels' sinc
e Matplotlib 3.9; support for the old name will be dropped in 3.11.
  plt.boxplot([df["quizzes"], df["assignment"], df["final"]], labels=["quizzes", "as
signment", "final"])
```



Answer: The final exam shows the most variability among quizzes, assignments, and final exams as indicated by the boxplot above.

Task 4: Are there any outliers in GPA scores?

In [60]:
```
# Replace random outlier in GPA for testing
df.loc[5, 'gpa'] = 10.0  # Uncomment to test outlier detection
df.loc[13, 'gpa'] = 0.0  # Uncomment to test outlier detection
df.loc[20, 'gpa'] = 6.0  # Uncomment to test outlier detection
```

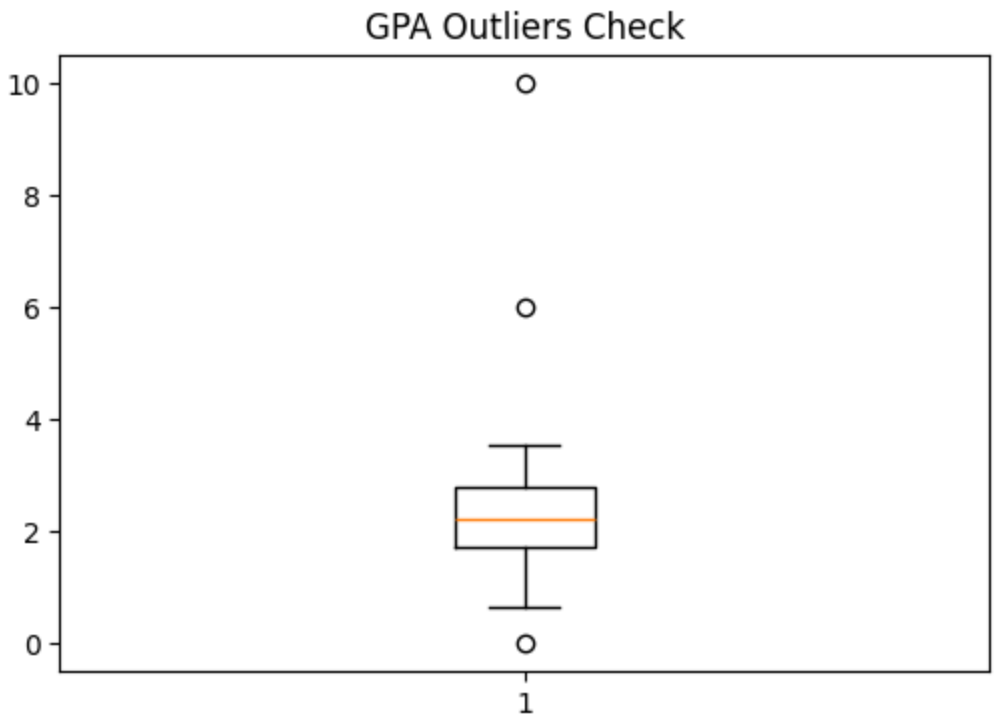
In [61]:
```
df['gpa'].max()
```

Out[61]:
```
np.float64(10.0)
```

In [62]:
```
# GPA outlier detection using IQR method

q1 = df["gpa"].quantile(0.25)
q3 = df["gpa"].quantile(0.75)
iqr = q3 - q1
lower = q1 - 1.5 * iqr
upper = q3 + 1.5 * iqr
outliers = df[(df["gpa"] < lower) | (df["gpa"] > upper)]
print("GPA Outliers Count:", len(outliers))
print(outliers.head())
```

```
GPA Outliers Count: 3
    attendance  quizzes  assignment  final   gpa  midterm
5        78.09    90.00       23.33  60.00  10.0    73.33
13       70.07    23.33       30.00  74.67   0.0    24.44
20       74.55    66.67       16.67   2.67   6.0   100.00
```

In [63]:
```
# Using BoxPlot

plt.figure(figsize=(6,4))
plt.boxplot(df["gpa"])
plt.title("GPA Outliers Check")
plt.show()
```



Answer: Dataset contains no outlier in GPA but after applying simulation technique, we found some outliers in GPA scores as shown in the histogram above.

In [64]:
```
print("Average Scores:")
print(df[["attendance", "quizzes", "assignment", "final", "gpa"]].mean())

# Simple interpretation logic
avg_gpa = df["gpa"].mean()
```

```
Average Scores:
attendance    77.100893
quizzes       53.471786
assignment    51.667143
final         50.485357
gpa            2.262500
dtype: float64
```

Recommendation: Hybrid learning may be affecting performance negatively.