```
# Import required libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from datetime import datetime
```

Part 1: Data Loading and Preparation

```
# Load the Excel file
file_path = 'HrData.xlsx'
xls = pd.ExcelFile(file_path)

# Read necessary sheets
employee_df = pd.read_excel(xls, sheet_name='Employee')
performance_df = pd.read_excel(xls, sheet_name='PerformanceRating')
df_satisfaction = pd.read_excel(xls, sheet_name='SatisfiedLevel')

# Convert date columns to datetime
employee_df['HireDate'] = pd.to_datetime(employee_df['HireDate'])
performance_df['ReviewDate'] =
pd.to_datetime(performance_df['ReviewDate'])

# Verify data loading (optional)
print("Employee Data Sample:")
print(employee_df.head())
print("\nPerformance Rating Data Sample:")
print(performance_df.head())
```

```
Employee Data Sample:
  EmployeeID   FirstName LastName      Gender  Age BusinessTravel  \
0  3012-1A41    Leonelle    Simco      Female   30    Some Travel
1  CBCB-9C9D     Leonerd    Aland        Male   38    Some Travel
2  95D7-1CE9       Ahmed    Sykes        Male   43    Some Travel
3  47A0-559B  Ermentrude   Berrie  Non-Binary   39    Some Travel
4  42CC-040A       Stace   Savege      Female   29    Some Travel

        Department  DistanceFromHome State
Ethnicity  ...  \
0            Sales                27    IL
White  ...
1            Sales                23    CA
White  ...
2  Human Resources                29    CA  Asian or Asian
American  ...
3       Technology                12    IL
White  ...
4  Human Resources                29    CA
White  ...
```

```
   MaritalStatus  Salary StockOptionLevel OverTime   HireDate
Attrition  \
0       Divorced  102059                1       No 2012-01-03
No
1         Single  157718                0      Yes 2012-01-04
No
2        Married  309964                1       No 2012-01-04
No
3        Married  293132                0       No 2012-01-05
No
4         Single   49606                0       No 2012-01-05
Yes

  YearsAtCompany YearsInMostRecentRole YearsSinceLastPromotion  \
0             10                     4                       9
1             10                     6                      10
2             10                     6                      10
3             10                    10                      10
4              6                     1                       1

   YearsWithCurrManager
0                     7
1                     0
2                     8
3                     0
4                     6

[5 rows x 23 columns]

Performance Rating Data Sample:
  PerformanceID EmployeeID ReviewDate  EnvironmentSatisfaction  \
0          PR01  79F7-78EC 2013-02-01                        5
1          PR02  B61E-0F26 2013-03-01                        5
2          PR03  F5E3-48BB 2013-03-01                        3
3          PR04  0678-748A 2013-04-01                        5
4          PR05  541F-3E19 2013-04-01                        5

   JobSatisfaction  RelationshipSatisfaction
TrainingOpportunitiesWithinYear  \
0                4                         5
1
1                4                         4
1
2                4                         5
3
3                3                         2
2
4                2                         3
1
```

```
   TrainingOpportunitiesTaken  WorkLifeBalance  SelfRating
ManagerRating  \
0                           0                4           4
4
1                           1                4           4
3
2                           2                3           5
4
3                           0                2           3
2
4                           0                4           4
3

  DataQualityStatus
0             Valid
1             Valid
2             Valid
3             Valid
4             Valid
```

Analysis 1: KPI Analysis

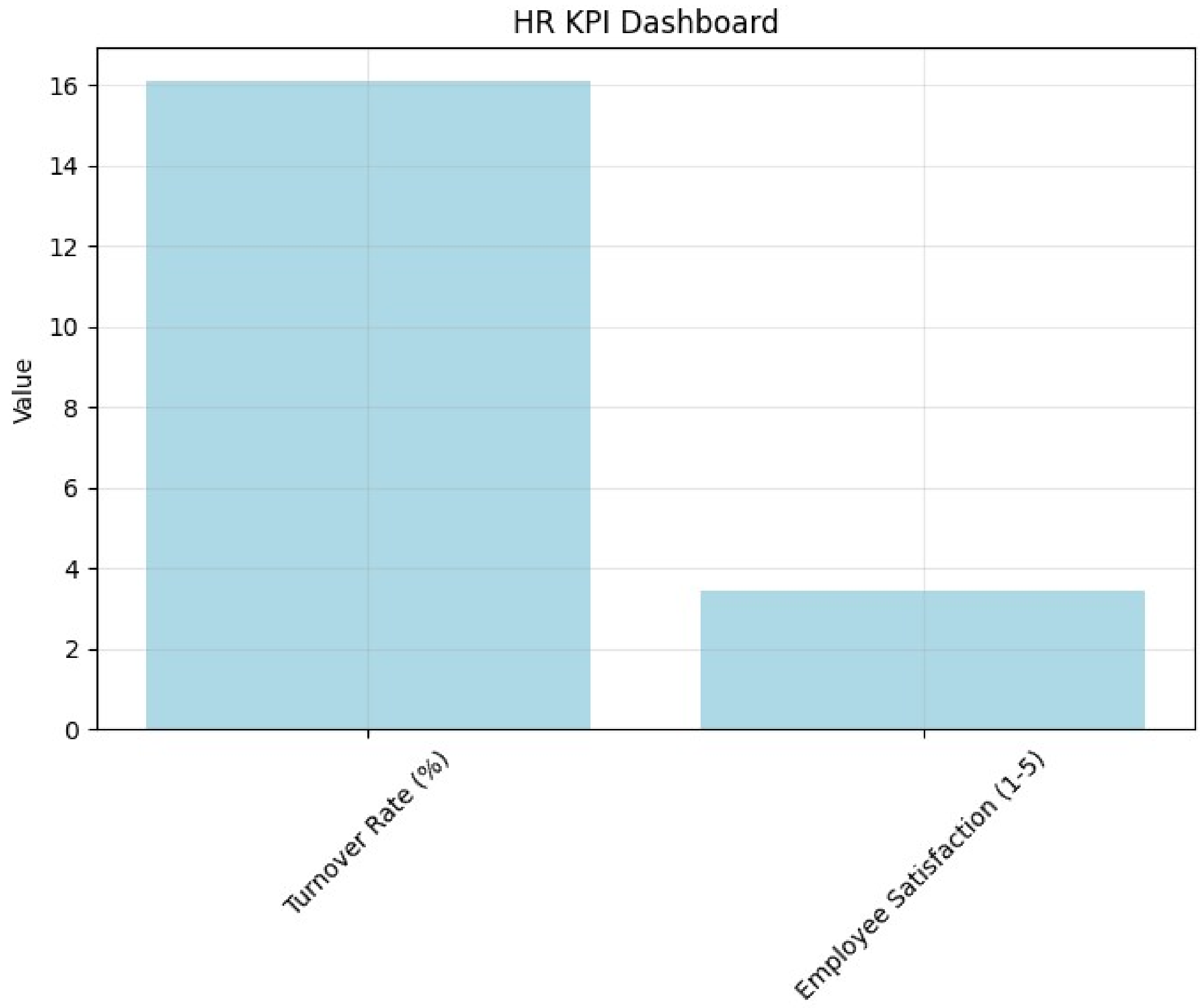
Objective: Measure HR performance through key performance indicators (KPIs):

- Employee Turnover Rate: Percentage of employees who left the company.
- Employee Satisfaction: Average satisfaction score across relevant metrics.
- Absenteeism Rate: Percentage of unplanned absences (placeholder, as data is not explicitly provided).
- Hiring Efficiency: Time to fill vacant positions (placeholder, as data is not explicitly provided).

```
# --- Turnover Rate ---
# Calculate the percentage of employees who left (Attrition = 'Yes')
turnover_rate = (employee_df['Attrition'] == 'Yes').mean() * 100
print(f"Employee Turnover Rate: {turnover_rate:.2f}%")

# --- Employee Satisfaction ---
# Get the latest performance review for each employee based on
ReviewDate
latest_performance =
performance_df.loc[performance_df.groupby('EmployeeID')
['ReviewDate'].idxmax()]

# Define columns to average for overall satisfaction
satisfaction_cols = ['EnvironmentSatisfaction', 'JobSatisfaction',
                     'RelationshipSatisfaction', 'WorkLifeBalance']

# Calculate overall satisfaction as the mean of satisfaction columns
```

```
latest_performance['OverallSatisfaction'] =
latest_performance[satisfaction_cols].mean(axis=1)
overall_satisfaction =
latest_performance['OverallSatisfaction'].mean()
print(f"Average Employee Satisfaction (1-5 scale):
{overall_satisfaction:.2f}")

# --- Visualization: KPI Dashboard ---
# Create a dictionary with the available KPIs
kpi_data = {
    'Turnover Rate (%)': turnover_rate,
    'Employee Satisfaction (1-5)': overall_satisfaction
}
# **Print Results**
print("=== KPIs Analysis ===")
for key, value in kpi_data.items():
    print(f"{key}: {value:.2f}")

# Plot the KPIs as a bar chart
plt.figure(figsize=(8, 5))
plt.bar(kpi_data.keys(), kpi_data.values(), color='lightblue')
plt.title('HR KPI Dashboard')
plt.ylabel('Value')
plt.xticks(rotation=45)
plt.grid(True, alpha=0.3)
plt.show()
```

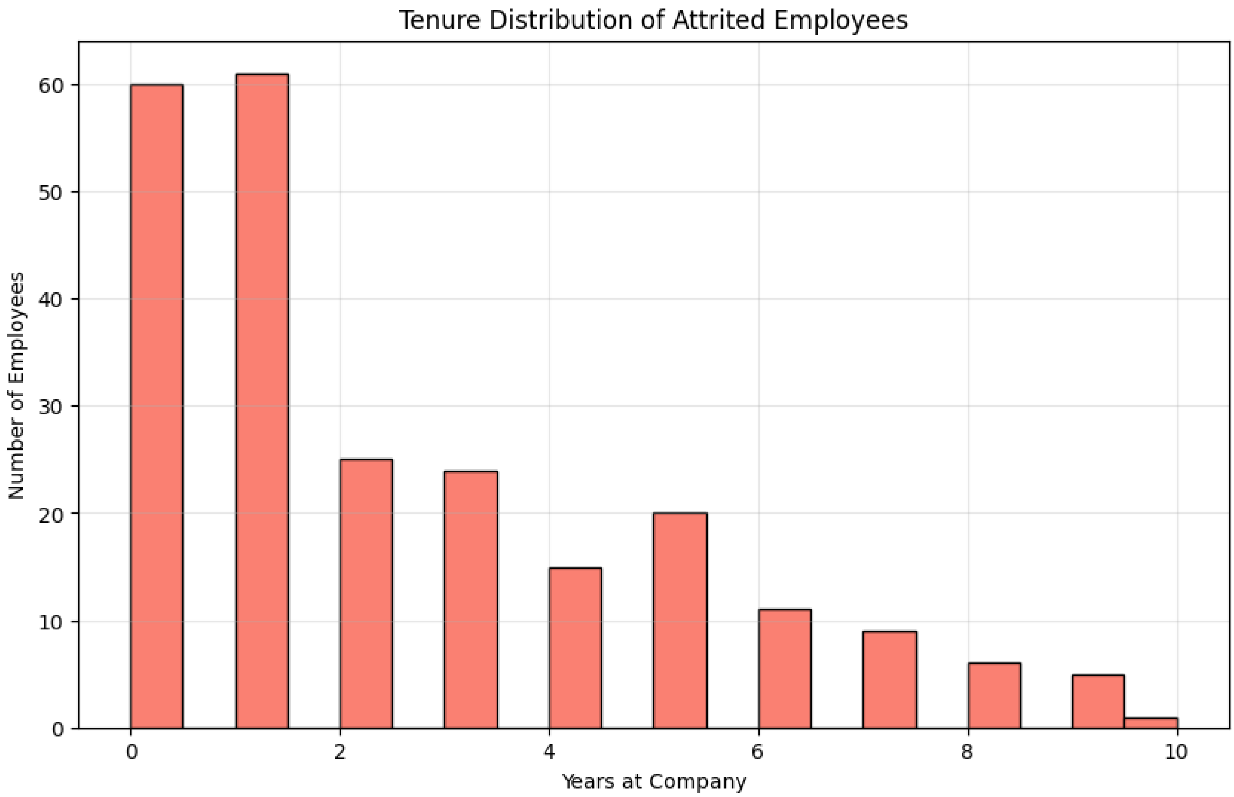
```
Employee Turnover Rate: 16.12%
Average Employee Satisfaction (1-5 scale): 3.46
=== KPIs Analysis ===
Turnover Rate (%): 16.12
Employee Satisfaction (1-5): 3.46
```



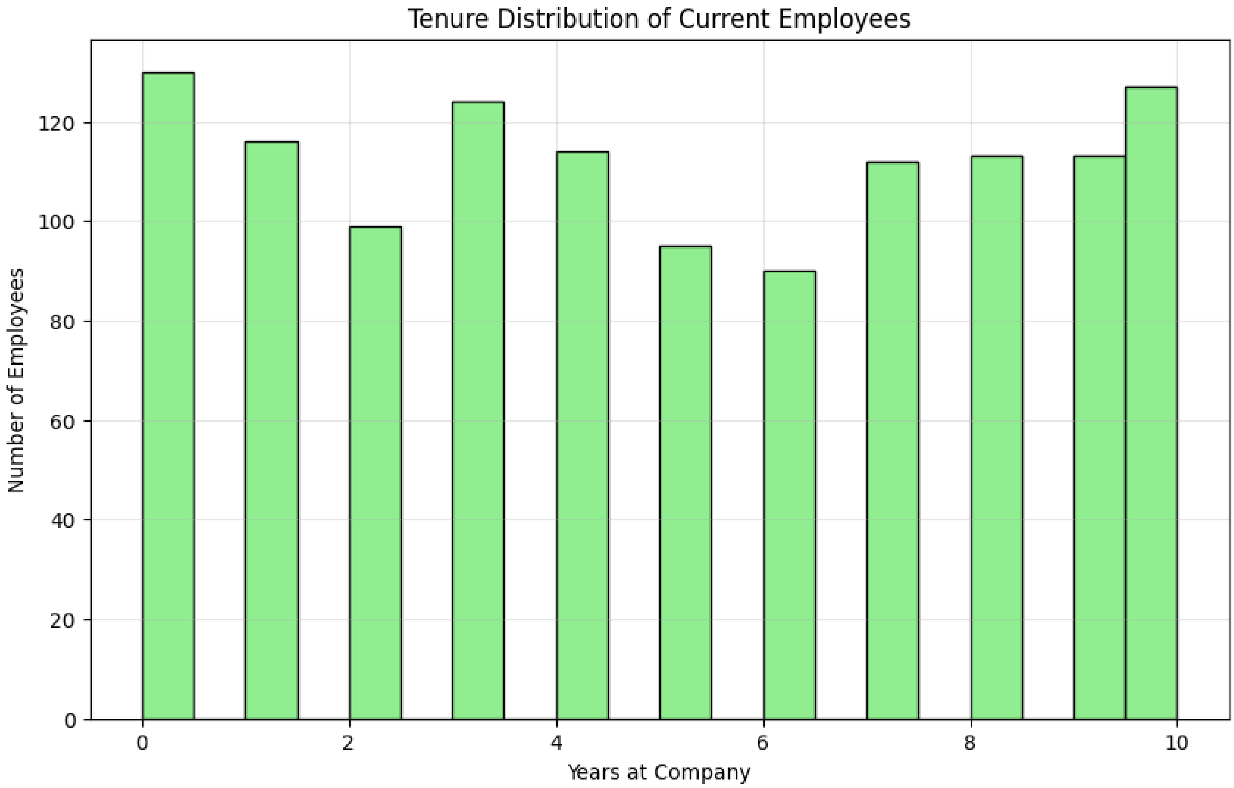
Analysis 2: Turnover Analysis

Objective Identify why employees leave the company and compare attrition patterns with recruitment and retention data. Specifically, determine if most employees leave within their first year, which could indicate onboarding or training issues.

```
# --- Filter Attrited Employees ---
attrited_df = employee_df[employee_df['Attrition'] == 'Yes'].copy()
attrited_df['Tenure'] = attrited_df['YearsAtCompany']

# --- Tenure Distribution of Attrited Employees ---
plt.figure(figsize=(10, 6))
plt.hist(attrited_df['Tenure'], bins=20, color='salmon',
edgecolor='black')
plt.title('Tenure Distribution of Attrited Employees')
plt.xlabel('Years at Company')
plt.ylabel('Number of Employees')
plt.grid(True, alpha=0.3)
plt.show()

# --- First-Year Attrition ---
first_year_attrition_pct = (attrited_df['Tenure'] <= 1).mean() * 100
print(f"Percentage of employees leaving within the first year:
{first_year_attrition_pct:.2f}%")

# --- Compare with Current Employees ---
current_df = employee_df[employee_df['Attrition'] == 'No'].copy()
current_df['Tenure'] = current_df['YearsAtCompany']

plt.figure(figsize=(10, 6))
plt.hist(current_df['Tenure'], bins=20, color='lightgreen',
edgecolor='black')
plt.title('Tenure Distribution of Current Employees')
plt.xlabel('Years at Company')
plt.ylabel('Number of Employees')
plt.grid(True, alpha=0.3)
plt.show()

# --- Average Tenure Comparison ---
avg_tenure_attrited = attrited_df['Tenure'].mean()
avg_tenure_current = current_df['Tenure'].mean()
print(f"Average tenure of attrited employees:
{avg_tenure_attrited:.2f} years")
print(f"Average tenure of current employees: {avg_tenure_current:.2f}
years")

# **Print Results**

print("\n=== Turnover Analysis ===")
for key, value in turnover_results.items():
    print(f"{key}: {value}")
# Displays the calculated KPIs and turnover insights in a structured
format.
```



```
Percentage of employees leaving within the first year: 51.05%
```



```
Average tenure of attrited employees: 2.43 years
Average tenure of current employees: 4.97 years

=== Turnover Analysis ===
Turnover by Department: {'Technology': 133, 'Sales': 92, 'Human
Resources': 12}
Median Salary of Ex-Employees: 50660.0
Median Experience of Ex-Employees (Years): 1.0
```