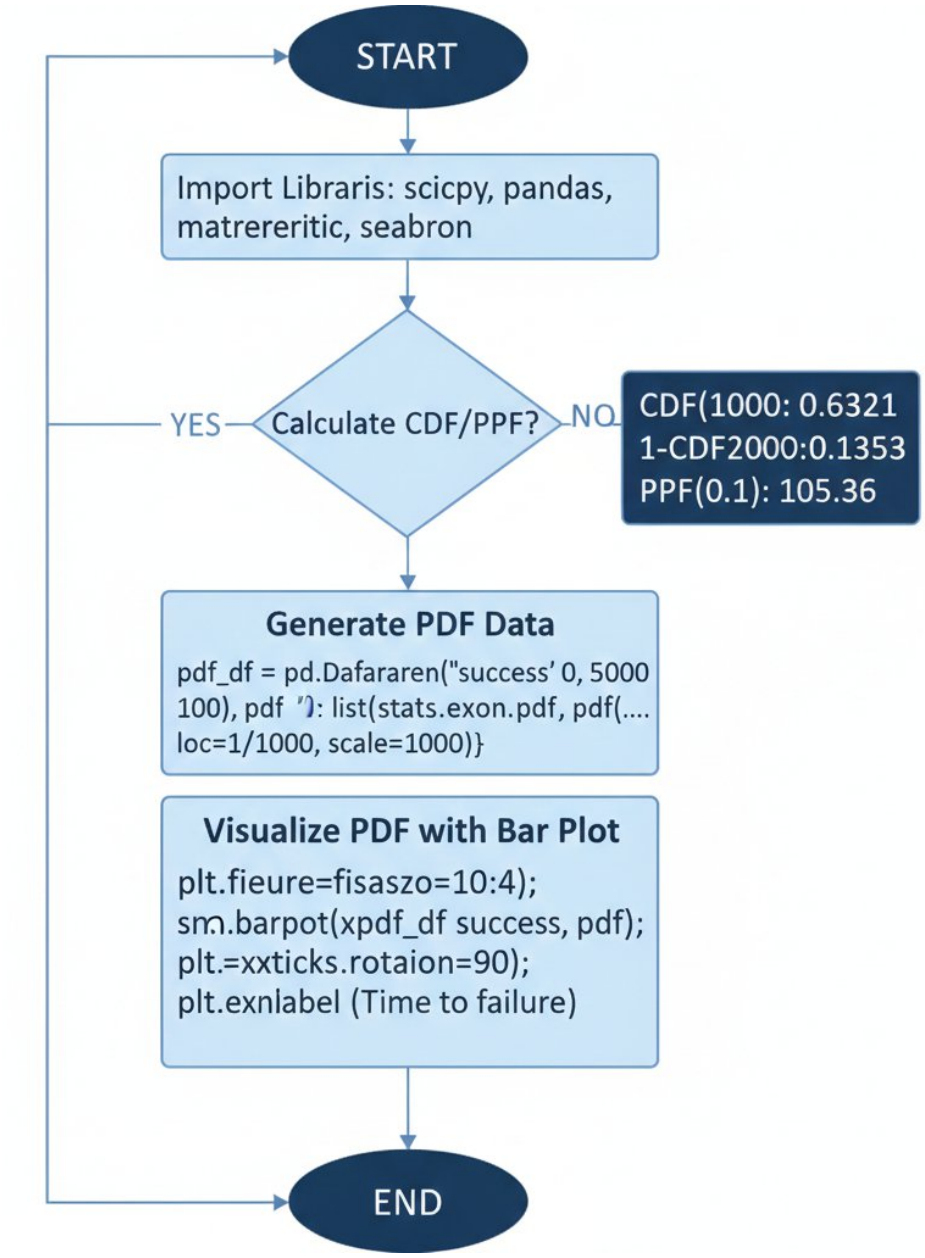
Experiment No - 1

Objective: To Study Exponential Distribution function with different dataset.

Date of experiment: 08/01/2026

Date of Completion: 08/01/2026

Flowchart:



Source Code

```
from scipy import stats

stats.expon.cdf(1000,loc=1/1000,scale=1000)

1 - stats.expon.cdf(2000,loc=1/1000,scale=1000)

stats.expon.ppf(0.1,loc=1/1000,scale=1000)
```

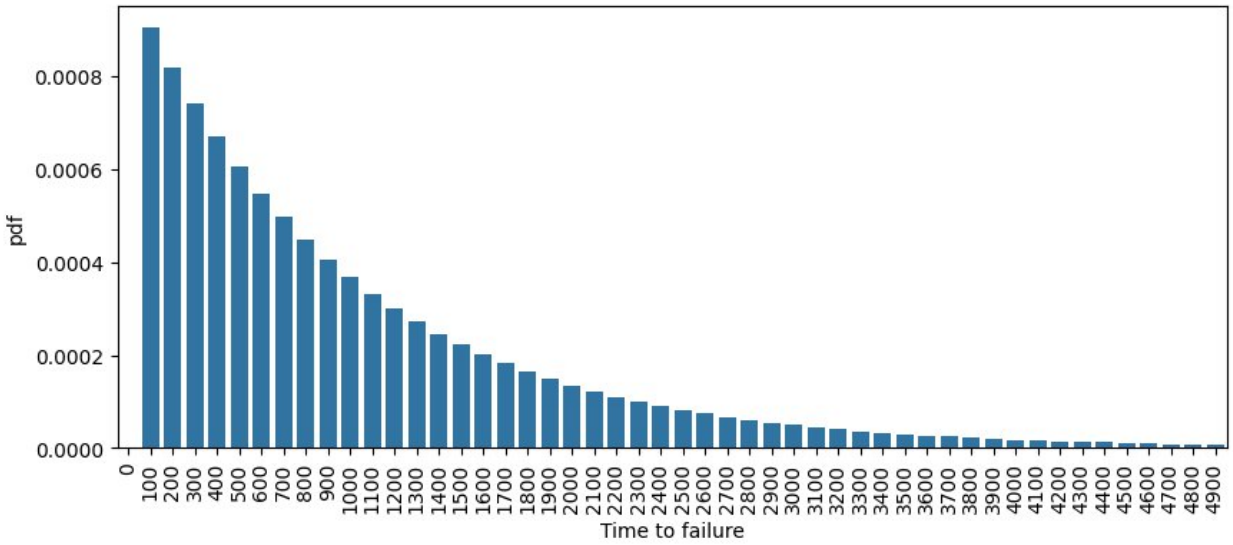
```
import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sn


pdf_df = pd.DataFrame ({'success': range (0,5000, 100),'pdf':list
(stats.expon.pdf (range (0, 5000, 100),loc = 1/1000,scale = 1000))})

plt.figure (figsize=(10,4))

sn.barplot (x = pdf_df. success, y = pdf_df.pdf)

plt.xticks (rotation=90);

plt.xlabel('Time to failure');
```

Dataset

The notebook does not use an external CSV or database. Instead, it utilizes a **simulated dataset** based on a specific real-world scenario:

- **Context**: The analysis models the **time-to-failure of an avionic system**.
- **Parameter**: The system is defined by a Mean Time Between Failures (MTBF) of **1,000 hours**.
- **Rate (λ)**: Consequently, the rate of occurrence (λ) is set to **1/1000**.
- **Visualization Data**: To visualize the distribution, a range of time-to-failure values from **0 to 5,000 hours** (in increments of 100) was generated to calculate and plot the Probability Density Function (PDF).

Result



Conclusion

The analysis concludes with several practical findings regarding the reliability of the avionic system:

- System Failure Probabilities:
  - There is a 63.21% probability that the system will fail before reaching its mean life of 1,000 hours.
  - The probability that the system will survive (not fail) up to 2,000 hours is approximately 13.53%.
- Reliability Benchmark (P10 Life): The "P10 life" calculation indicates that 10% of the systems will fail by 105.36 hours.
- Statistical Insight: The notebook demonstrates that the exponential distribution effectively models processes where events (like electronic component failures) occur continuously and independently at a constant average rate.