Sri Raghavendra Educational Institutions Society(R)

Sri Krishna Institute of Technology

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka Affiliated to V.T U., Belagavi)
#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bangalore- 560090

LABORATORY MANUAL

Data Visualization with Python

[BCS358D]

Name of the Student:	
USN:	
Branch/Semester:	
Academic Year:	

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GENERAL INSTRUCTIONS

1. Write clear and concise code with meaningful variable and method names.
2. Test your code thoroughly with different inputs to ensure correctness.
3. Comment your code to explain complex logic and improve readability.
4. Use an IDE to write, compile, and run your Python programs efficiently.
5. Ask for help if you're stuck, but ensure you understand the solution.
6. Follow python naming conventions
7. Avoid plagiarism, write your own code and understand each line.
8. Approach problems methodically, breaking them into smaller tasks.
9. Maintain observation book.
10. Neatly write your record and submit it for each lab.

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LIST OF EXPERIMENTS

SL#	**PART A – List of problems for which student should develop program and execute in the Laboratory**
1.	a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user. b) Develop a Python program to check whether a given number is palindrome or not andalso count the number of occurrences of each digit in the input number.
2.	a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed. b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions.
3.	a) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. b) Write a Python program to find the string similarity between two given strings **Sample Output: Sample Output:** Original string: Original string: Python Exercises Python Exercises Python Exercises Python Exercise Similarity between two said strings: Similarity between two said strings:1.0 0.967741935483871
4.	a) Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib. b) Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib.
5.	a) Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib. b) Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib.
6.	a) Write a Python program to illustrate Linear Plotting using Matplotlib. b) Write a Python program to illustrate liner plotting with line formatting using Matplotlib.
7.	Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions.
8.	a) Write a Python program to explain working with bokeh line graph using Annotations and Legends. b) Write a Python program for plotting different types of plots using Bokeh.
9.	Write a Python program to draw 3D Plots using Plotly Libraries.
10.	a) Write a Python program to draw Time Series using Plotly Libraries. b) Write a Python program for creating Maps using Plotly Libraries.

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Department of Computer Science and Engineering

Vision

"To be in the frontier of Computer Science & Engineering and to create technically competent graduates with ethical, moral values committed to meet Industry and Societal needs."

Mission

M1: To produce ethical, motivated, and skilled engineers through theoretical knowledge and practical applications.
M2: Inculcate problem solving and team building skills and promote lifelong learning with a sense of societal responsibilities.
M3: To facilitate functional ambience for research, consultancy and entrepreneurship.

Program Outcomes	
a.	**Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
b.	**Problem Analysis: Identify,** formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
c.	**Design/ Development of Solutions**: Design solutions for complex engineeringproblems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societaland environmental considerations.
d.	**Conduct investigations of complex problems** using research-based knowledge and research methods including design of experiments, analysis andinterpretation of data and synthesis of information to provide valid conclusions.
e.	**Modern Tool Usage**: Create, select and apply appropriate techniques, resourcesand modern engineering and IT tools including prediction and modeling to Complex engineering activities with an under- standing of the limitations.
f.	**The Engineer and Society**: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and theConsequent responsibilities relevant to professional engineering practice.
g.	**Environment and Sustainability**: Understand the impact of professionalEngineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
h.	**Ethics**: Apply ethical principles and commit to professional ethics andResponsibilities and norms of engineering practice.
i.	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
j.	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions**.**
k.	**Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.
l.	**Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in Multi-disciplinary environments.
Program Specific Outcomes	
m.	**PSO1:** Model computational problems by applying mathematical concepts and design solutions using suitable data structures & algorithmic techniques.
n.	**PSO2:** Demonstrate basic knowledge of computer science in efficient design of problem solutions of varying complexity.
o.	**PSO3:** Create career path to become a successful computer science professional, entrepreneur and relish for higher studies.

1a. Write a python program to find the best of two test average marks out of three test's marks accepted from the user.

```
m1 = int (input("Enter the marks in the first test: "))
m2 = int (input("Enter the marks in second test: "))
m3 = int (input("Enter the marks in third test: "))

if (m1 > m2):
   if (m2 > m3):
      total = m1 + m2
   else:
      total = m1 + m3
elif (m1 > m3):
   total = m1 + m2
else:
   total = m2 + m3

Avg = total / 2
print ("The average of the best two test marks is: ",Avg)
```

OUTPUT

```
Enter the marks in the first test: 25
Enter the marks in second test: 25
Enter the marks in third test: 23
The average of the best two test marks is:  25.0
```

1b. Develop a Python program to check whether a given number is palindrome or not andalso count the number of occurrences of each digit in the input number.

```
def palindrome(n):
   n=str(n)
   if n==n[::-1]:
      print("The given is Palindrome")
   else:
      print("The given number is Not a apalindrome")

def digit_count(n):
   n=str(n)
   udigit = set(n)
   for ele in udigit:
      print(ele, "occurs", n.count(ele), "times")

n=int(input("Enter the number"))
palindrome(n)
digit_count(n)
```

OUTPUT

```
Enter the number : 1221
The given is Palindrome
2 occurs 2 times
1 occurs 2 times
```

2a. Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.

```
def fibonacci(n):
    if n == 1:
        return 0
    elif n == 2:
        return 1
    else:
        return fibonacci(n-1) + fibonacci(n-2)

N = int(input("Enter a value for N:"))

if N <= 0:
    print("Error: N must be greater than 0.")
else:
    result=fibonacci(N)

print(f"The {N}th Fibonacci number is:{result}")
```

OUTPUT

```
Enter a value for N:10
The 10th Fibonacci number is:34
```

2b. Develop a python program to convert binary to decimal, octal to hexadecimal using functions.

```
#Function to convert binary to decimal
def binary_to_decimal(binary_no):
    decimal_no = int(binary_no, 2)
    print(f"Binary to Decimal: {binary_no} = {decimal_no}")

# Function to convert octal to hexadecimal
def octal_to_hexadecimal(octal_no):
    decimal_no = int(octal_no, 8)
    hexadecimal_no = hex(decimal_no)[2:]  # [2:] to remove the '0x' prefix
    print(f"Octal to Hexadecimal: {octal_no} = {hexadecimal_no}")

binary_no= input("Enter a binary number: ")
binary_to_decimal(binary_no)

octal_no = input("Enter an octal number: ")
octal_to_hexadecimal(octal_no)
```

OUTPUT

```
Enter a binary number: 1
Binary to Decimal: 1 = 1
Enter an octal number: 17
Octal to Hexadecimal: 17 = f
```

3a. Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters.

```
sentence= input("Enter a sentence: ")
word_count=digit_count=uppercase_count=lowercase_count=0

for char in sentence:
    if char.isalpha():
        # Check if the character is an alphabet letter
        if char.islower():
            lowercase_count += 1
        else:
            uppercase_count += 1
    elif char.isdigit():
        # Check if the character is a digit
        digit_count += 1

# Split the sentence into words and count them
words = sentence.split()
word_count = len(words)

print("Analysis of the sentence:")
print("Number of words:", word_count)
print("Number of digits:", digit_count)
print("Number of uppercase letters:", uppercase_count)
print("Number of lowercase letters:", lowercase_count)
```

OUTPUT

```
Enter a sentence: Welcome to Skit 560090
Analysis of the sentence:
Number of words: 4
Number of digits: 6
Number of uppercase letters: 2
Number of lowercase letters: 11
```

3b. Write a Python program to find the string similarity between two given strings

```
from difflib import SequenceMatcher

string1=input("Enter the string1: ")
string2=input("Enter the string2: ")

# Create a SequenceMatcher object
matcher = SequenceMatcher(None,string1, string2)
# Get the similarity ratio
similarity_ratio = matcher.ratio()
print("Similarity between two strings is = ",similarity_ratio)
```

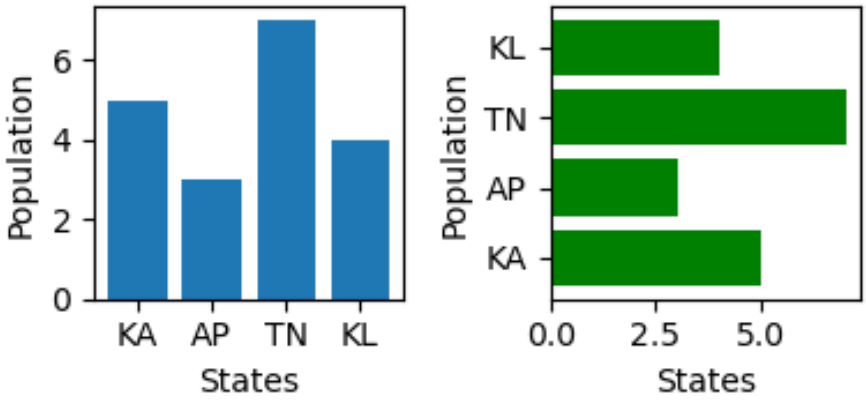
OUTPUT

```
Enter the string1: Python Exercises
Enter the string2: Python Exercises
Similarity between two strings is =  1.0

Enter the string1: Python Exercises
Enter the string2: Python Exercise
Similarity between two strings is =  0.967741935483871
```

4a. Write a Python program to demonstrate how to Draw a Bar Plot using Matplotlib.

```
import matplotlib.pyplot as plt

states=['KA','AP','TN','KL']
population=[5,3,7,4]

plt.figure(figsize=(4, 2))

plt.subplot(1,2,1)
plt.bar(states,population)
plt.xlabel('States')
plt.ylabel('Population')

plt.subplot(1,2,2)
plt.barh(states,population,color='g')
plt.xlabel('States')
plt.ylabel('Population')

plt.tight_layout()
plt.show()
```

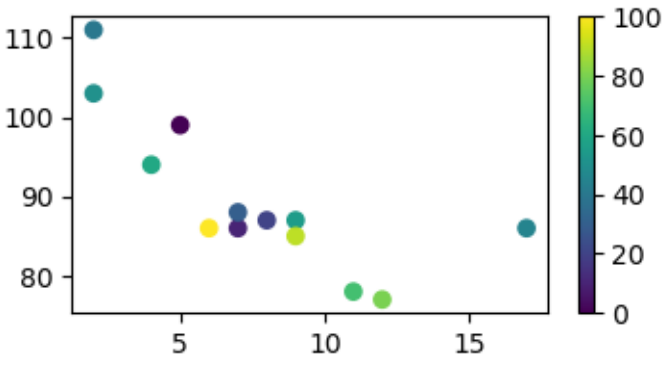
OUTPUT



4b. Write a Python program to demonstrate how to draw a Scatter Plot using Matplotlib.

```
import matplotlib.pyplot as plt
x = [5,7,8,7,2,17,2,9,4,11,12,9,6]
y = [99,86,87,88,111,86,103,87,94,78,77,85,86]
colors = [0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100]
plt.figure(figsize=(4, 2))
plt.scatter(x, y, c=colors, cmap='viridis')
plt.colorbar()
plt.show()
```

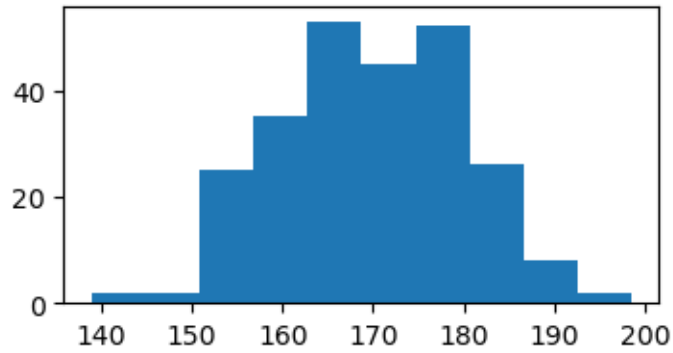
OUTPUT



5a. Write a Python program to demonstrate how to draw a Histogram Plot using Matplotlib.

```
import matplotlib.pyplot as plt
import numpy as np
plt.figure(figsize=(4,2))
x = np.random.normal(170, 10, 250)

plt.hist(x)
plt.show()
```

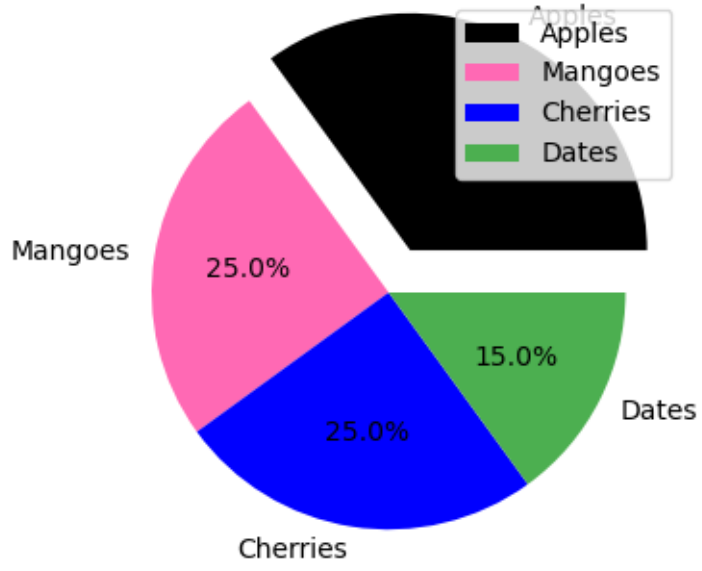
OUTPUT



5b. Write a Python program to demonstrate how to draw a Pie Chart using Matplotlib.

```
import matplotlib.pyplot as plt
y = [35, 25, 25, 15]
mylabels = ["Apples", "Mangoes", "Cherries", "Dates"]
plt.figure(figsize=(4,4))
myexplode = [0.2, 0, 0, 0]
mycolors = ["black", "hotpink", "b", "#4CAF50"]
plt.pie(y,labels = mylabels,explode=myexplode,colors = mycolors, shadow = True
,autopct='%1.1f%%')
plt.legend(mylabels)
plt.show()
```

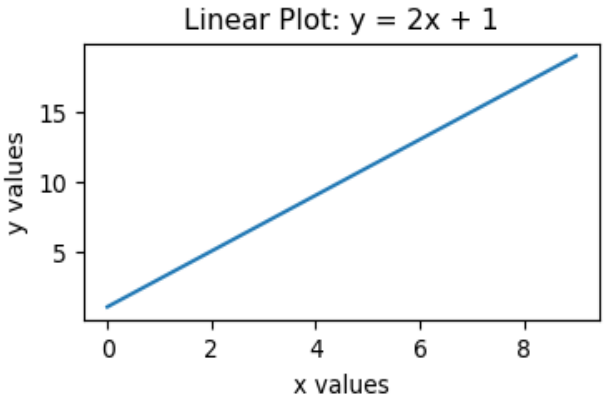
OUTPUT



6a. Write a Python program to illustrate Linear Plotting using Matplotlib.

```
import matplotlib.pyplot as plt

x_values = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
y_values = [2 * x + 1 for x in x_values]
label='y = 2x + 1'
plt.figure(figsize=(4, 2))

plt.plot(x_values, y_values)

plt.title('Linear Plot: y = 2x + 1')
plt.xlabel('x values')
plt.ylabel('y values')

plt.show()
```

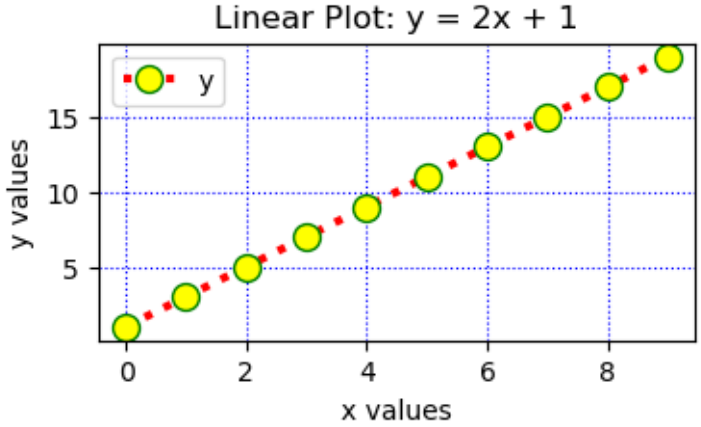
OUTPUT



6b. Write a Python program to illustrate liner plotting with line formatting using Matplotlib.

```
import matplotlib.pyplot as plt

x_values = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
y_values = [2 * x + 1 for x in x_values]
label='y = 2x + 1'
plt.figure(figsize=(4, 2))  # Set te size of the figure

plt.plot(x_values, y_values, marker='o',mec='g',mfc='yellow',ms=10,ls=':', lw=3,color='r')

plt.title('Linear Plot: y = 2x + 1')
plt.xlabel('x values')
plt.ylabel('y values')

plt.legend(label)
plt.grid(color="blue",ls="dotted")
# Show the plot
plt.show()
```

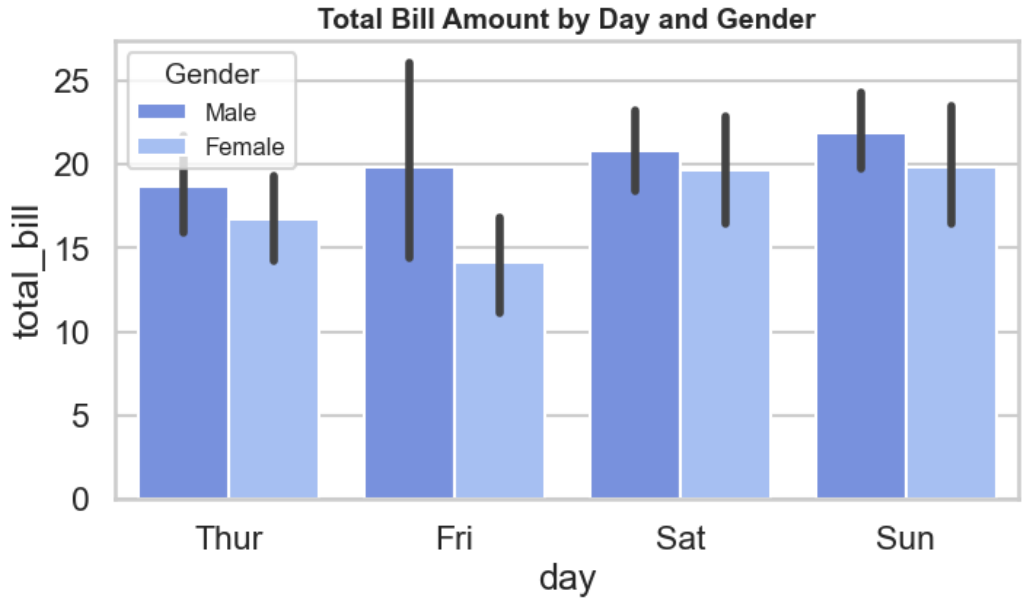
OUTPUT



7. Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions.

```
import seaborn as sns
import matplotlib.pyplot as plt

# Load the tips dataset
tips = sns.load_dataset('tips')

# Apply Aesthetic functions
sns.set_style("whitegrid")
sns.set_context("talk")
sns.set_palette("coolwarm")
sns.set_context("talk")
sns.despine(left=True, bottom=True)

# Create a bar plot
plt.figure(figsize=(8, 4))
sns.barplot(x="day", y="total_bill", hue="sex", data=tips)
plt.title("Total Bill Amount by Day and Gender", fontsize=14, fontweight='bold')

# Customize the legend
plt.legend(title="Gender",fontsize=12,title_fontsize=14)
plt.show()

print(tips)
```

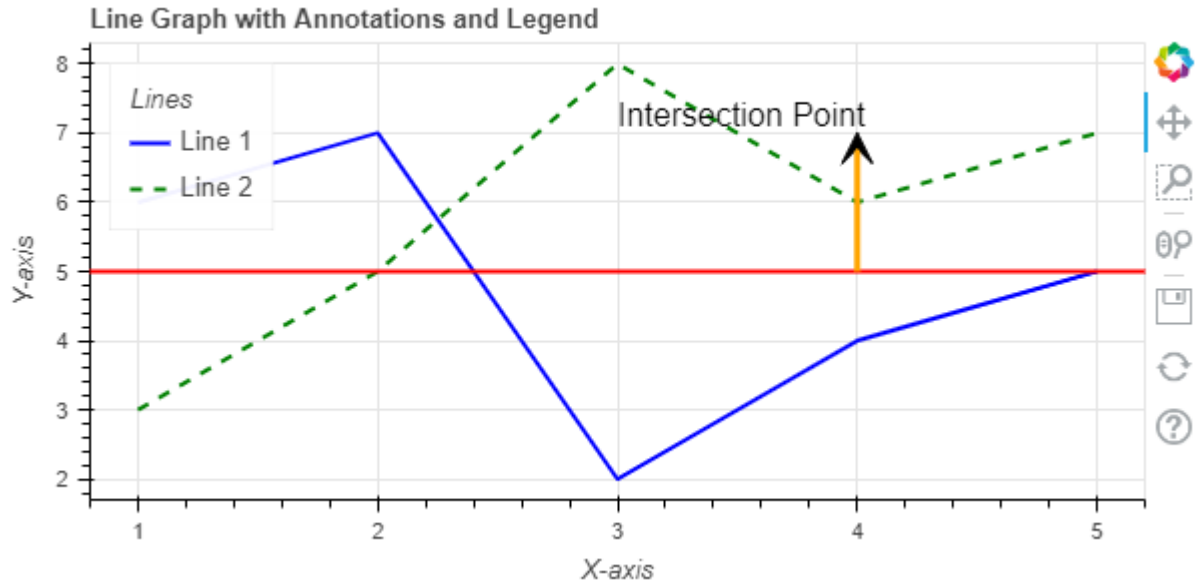
OUTPUT



8a. Write a Python program to explain working with bokeh line graph using Annotations and Legends.

```
from bokeh.plotting import figure, show
from bokeh.io import output_file
from bokeh.models import Span,Label,Arrow,VeeHead

# Output to a static HTML file
output_file("bokeh.html")

# Create a figure object
p = figure(title="Line Graph with Annotations and Legend",
        x_axis_label='X-axis', y_axis_label='Y-axis',
        plot_width=600, plot_height=300)

# Data for the plot
x1 = [1, 2, 3, 4, 5]
y1 = [6, 7, 2, 4, 5]
x2 = [1, 2, 3, 4, 5]
y2 = [3, 5, 8, 6, 7]

# Add lines to the figure with legends
p.line(x1, y1, line_width=2, color="blue",legend_label="Line 1")
p.line(x2, y2, line_width=2, color="green", line_dash="dashed",legend_label="Line 2")

# Add a Span annotation (horizontal line)
span = Span(location=5, dimension='width', line_color='red', line_width=2)
p.add_layout(span)

# Add a Label annotation (text)
label = Label(x=3, y=7, text="Intersection Point", text_color="black", text_font_size="12pt")
p.add_layout(label)

# Add an Arrow annotation
arrow = Arrow(end=VeeHead(size=15), x_start=4, y_start=5, x_end=4, y_end=7,
line_color="orange", line_width=3)
p.add_layout(arrow)

# Customize the legend
p.legend.title = "Lines"
p.legend.label_text_font_size = "10pt"
p.legend.location = "top_left"

# Show the plot
show(p)
```

OUTPUT

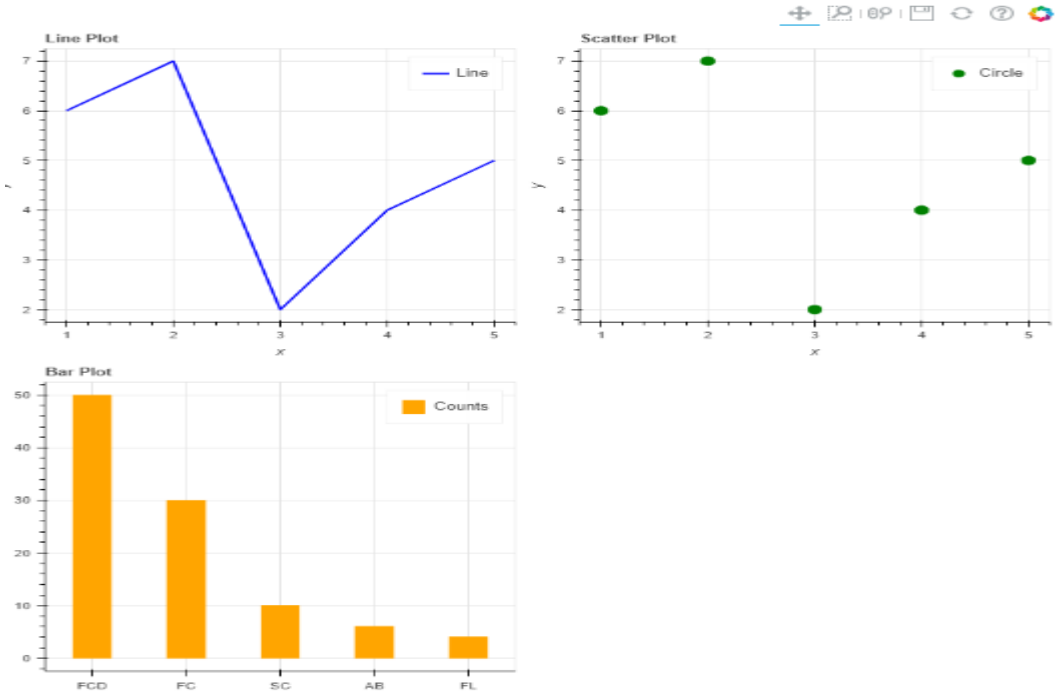


8b. Write a Python program for plotting different types of plots using Bokeh.

```
# Import necessary libraries from Bokeh
from bokeh.plotting import figure,show
from bokeh.io import output_file
from bokeh.layouts import gridplot
from bokeh.models import ColumnDataSource

# Output to an HTML file
output_file("bokeh_plots.html")

# Prepare data for the plots
x = [1, 2, 3, 4, 5]
y = [6, 7, 2, 4, 5]
results= ['FCD', 'FC', 'SC', 'AB', 'FL']
counts = [50, 30, 10, 6, 4]

# Create a Line Plot
line_plot = figure(title="Line Plot", x_axis_label='x', y_axis_label='y', width=400, height=400)
line_plot.line(x, y, legend_label="Line", line_width=2, color='blue')

# Create a Scatter Plot
scatter_plot = figure(title="Scatter Plot", x_axis_label='x', y_axis_label='y', width=400, height=400)
scatter_plot.circle(x, y, size=10, color="green", legend_label="Circle")

# Create a Bar Plot
bar_plot = figure(x_range=results, title="Bar Plot", width=400, height=400)
bar_source = ColumnDataSource(data=dict(results=results, counts=counts))
bar_plot.vbar(x='results', top='counts', width=0.4, source=bar_source, legend_label="Counts", color="orange")

# Arrange plots in a grid
```

```
grid = gridplot([[line_plot, scatter_plot], [bar_plot, None]])

# Show the result
show(grid)
```

OUTPUT

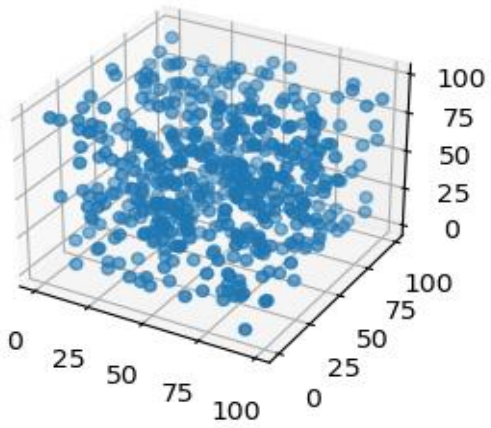


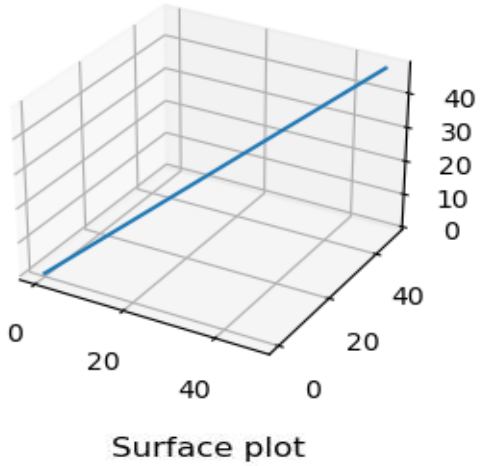
9. Write a Python program to draw 3D Plots using Plotly Libraries.

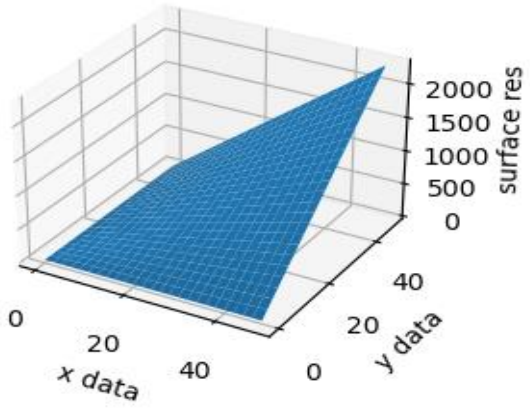
```
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
import numpy as np

plt.figure(figsize=(6, 3))

ax=plt.axes(projection="3d")
x=np.random.randint(0,100,(500,))
y=np.random.randint(0,100,(500,))
z=np.random.randint(0,100,(500,))
ax.scatter(x,y,z)

plt.figure(figsize=(6, 3))
ax=plt.axes(projection="3d")
x=np.arange(0,50,2)
y=np.arange(0,50,2)
z=np.arange(0,50,2)
ax.plot(x,y,z)

plt.figure(figsize=(6, 3))
ax=plt.axes(projection="3d")
x=np.arange(0,50,2)
```

```
y=np.arange(0,50,2)
x,y=np.meshgrid(x,y)
z=x*y
ax.plot_surface(x,y,z)
ax.set_title("Surface plot")
ax.set_xlabel("x data")
ax.set_ylabel("y data")
ax.set_zlabel("surface res")

plt.show()
```

OUTPUT



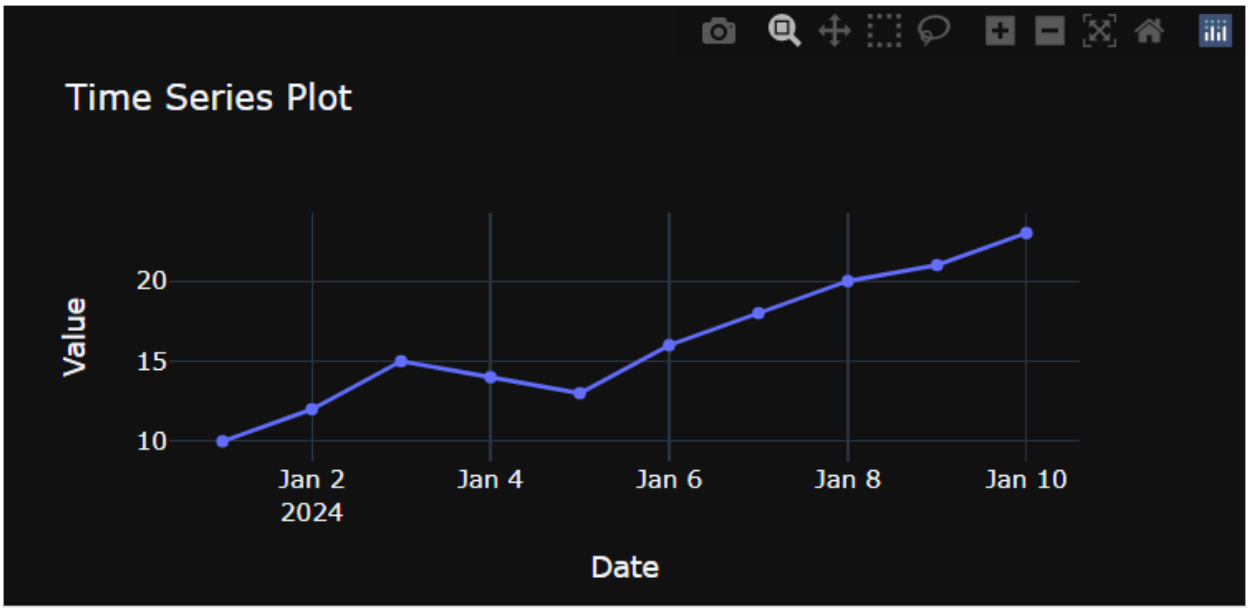




10a. Write a Python program to draw Time Series using Plotly Libraries.

```
# Importing necessary libraries
import plotly.graph_objs as go
import pandas as pd

# Sample data for the time series
data = {
    'Date': pd.date_range(start='2024-01-01', periods=10, freq='D'),
    'Value': [10, 12, 15, 14, 13, 16, 18, 20, 21, 23]
}

# Converting data into a DataFrame
df = pd.DataFrame(data)

# Creating a time series plot
fig = go.Figure()

# Adding a line chart for the time series
fig.add_trace(go.Scatter(x=df['Date'], y=df['Value'], mode='lines+markers', name='Value'))

# Updating layout to add titles and labels
fig.update_layout(
    title="Time Series Plot",
    xaxis_title="Date",
    yaxis_title="Value",
    template="plotly_dark"  # Optional: to use a dark theme
)
# Show the plot
fig.show()
```

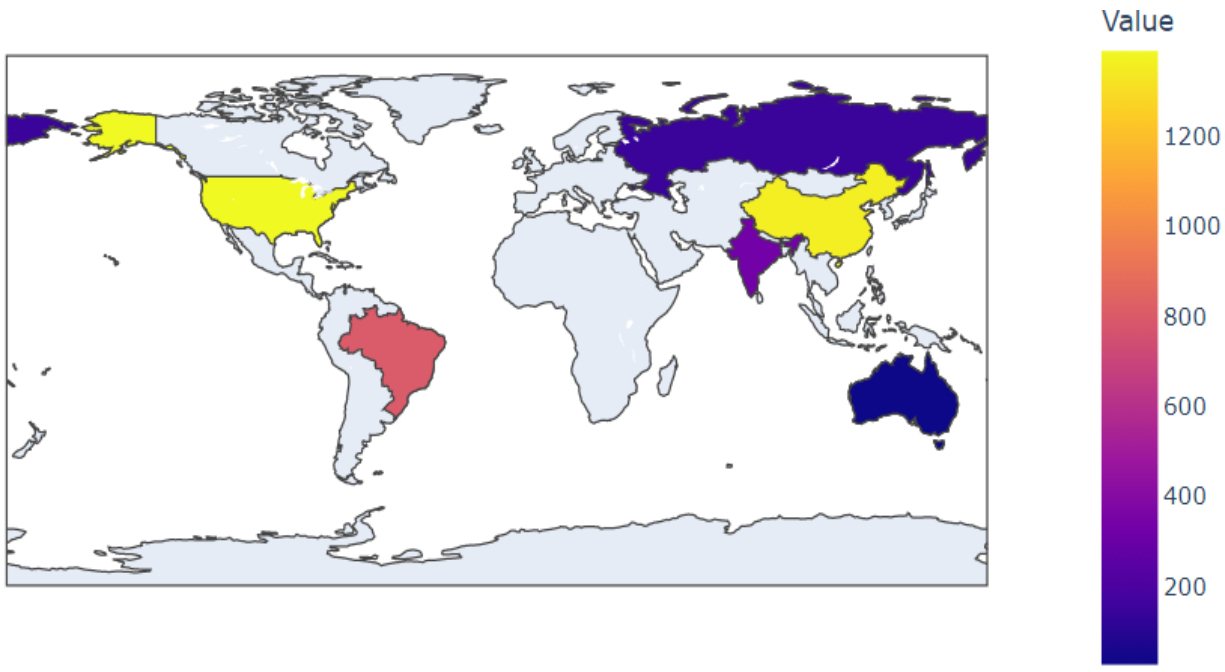
OUTPUT



10b. Write a Python program for creating Maps using Plotly Libraries.

```
# Import necessary libraries
import plotly.express as px
import pandas as pd

# Sample data: Country names and corresponding values (e.g., population, GDP, etc.)
data = {
    'Country': ['India', 'Brazil', 'Russia', 'China', 'United States', 'Australia'],
    'Value': [331, 800, 146, 1360, 1391, 26]  # Values in millions, e.g., population
}

# Convert the data into a pandas DataFrame
df = pd.DataFrame(data)

# Create a choropleth map using Plotly Express
fig = px.choropleth(
    df,
    locations="Country",           # The name of the country column
    locationmode="country names",  # Match locations by country names
    color="Value",                 # Data to use for color-coding
    hover_name="Country",          # Data to display when hovering over a country
    color_continuous_scale=px.colors.sequential.Plasma,  # Color scale
    title="World Map - Population in Millions"
)

# Display the map
fig.show()
```

OUTPUT



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Vision of the Institute

"To create a community of knowledgeable and competent engineers to embody global standards of excellence and drive innovation and progress in industries, businesses, and research organizations around the world."

Mission of the Institute

"To facilitate an inclusive and supportive learning environment that fosters collaboration, creativity, and the pursuit of excellence in engineering."