XII – COMPUTER SCIENCE - CHAPTER 16
DATA VISUALIZATION USING PYPLOT: LINE CHART, PIE CHART AND BAR CHART

PART-II

1. Define: Data Visualization.

- Data Visualization is the graphical representation of information and data.
- The objective of Data Visualization is to communicate information visually to users.

2. List the general types of data visualization.

- Charts
- Tables
- Graphs
- Maps
- Infographics
- Dashboards

3. List the types of Visualizations in Matplotlib.

- Line plot
- Scatter plot
- Histogram
- Box plot
- Bar chart and
- Pie chart

4. How will you install Matplotlib?

- You can install matplotlib using pip. Pip is a management software for installing python packages.
- To install matplotlib, type the following command in your command prompt:
- Python –m pip install –U matplotlib

5. Write the difference between the following functions: plt.plot([1,2,3,4]), plt.plot([1,2,3,4], [1,4,9,16]).

plt.plot([1,2,3,4])

- If you provide a single list or array to the plot () command, matplotlib assumes it is a sequence of y values, and automatically generates the x values for you.
- Since python ranges start with 0, the default x vector has the same length as y but starts with 0. Hence the x data are [0, 1, 2, 3].

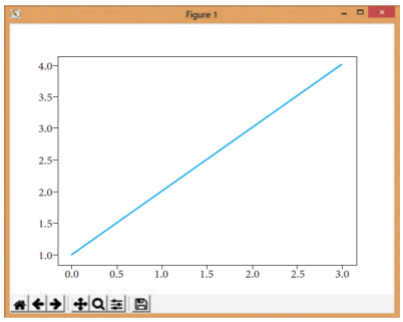
Example1:

```
import matplotlib.pyplot as plt
plt.plot([1,2,3,4])
```

plt.show()

Output:

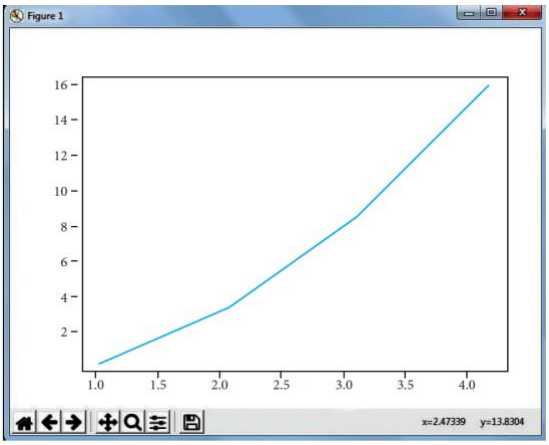
- This window is a matplotlib window, which allows you to see your graph.



plt.plot([1,2,3,4], [1,4,9,16]) :

- This plot takes many parameters, but the first two here are 'x' and 'y' coordinates.
- This means, you have 4 co-ordinates according to these lists: (1,1), (2,4), (3,9) and (4,16).
- **For example2, to plot x versus y, you can issue the command:**

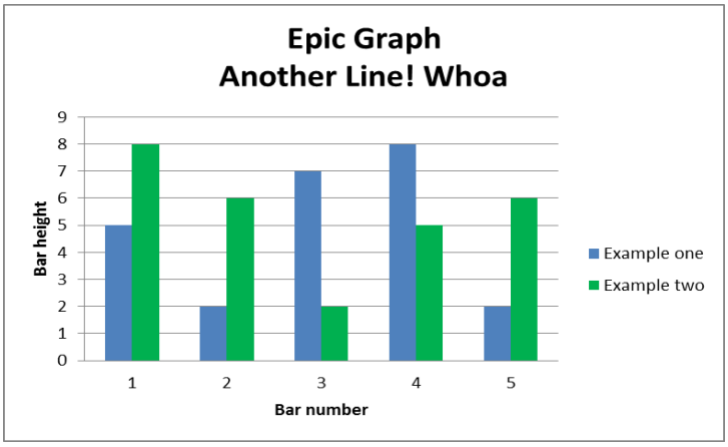
```
import matplotlib.pyplot as plt
plt.plot([1,2,3,4], [1,4,9,16])
plt.show()
```



PART - III

1. Draw the output for the following data visualization plot.

```
import matplotlib.pyplot as plt
plt.bar([1,3,5,7,9],[5,2,7,8,2], label="Example one")
plt.bar([2,4,6,8,10],[8,6,2,5,6], label="Example two", color='g')
plt.legend()
plt.xlabel('bar number')
plt.ylabel('bar height')
plt.title('Epic Graph\nAnother Line! Whoa')
plt.show()
```



2. Write any three uses of data visualization.

- Data Visualization help users to analyze and interpret the data easily.
- It makes complex data understandable and usable.
- Various Charts in Data Visualization helps to show relationship in the data for one or more variables.

3. Write the coding for the following:

a. To check if PIP is Installed in your PC.

C:\Python>Python –m pip install –U pip

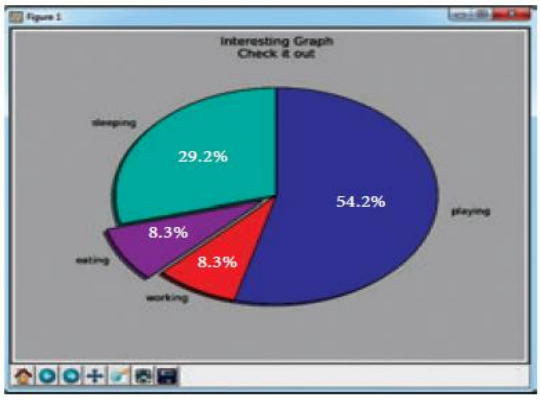
b. To Check the version of PIP installed in your PC.

C:\Python>pip --version

c. To list the packages in matplotlib.

C:\Python>pip list

4. Write the plot for the following pie chart output.



Program Coding:

```
import matplotlib.pyplot as plt
sizes = [29.2, 8.3, 8.3, 54.2]
labels = [“sleeping”, "eating", "working", "playing"]
plt.pie (sizes, labels = labels, autopct = "%.1f ")
plt.title(“Interesting Graph \n Check it out”)
plt.show()
```

PART - IV

1. Explain in detail the types of pyplots using Matplotlib.

Line Chart:

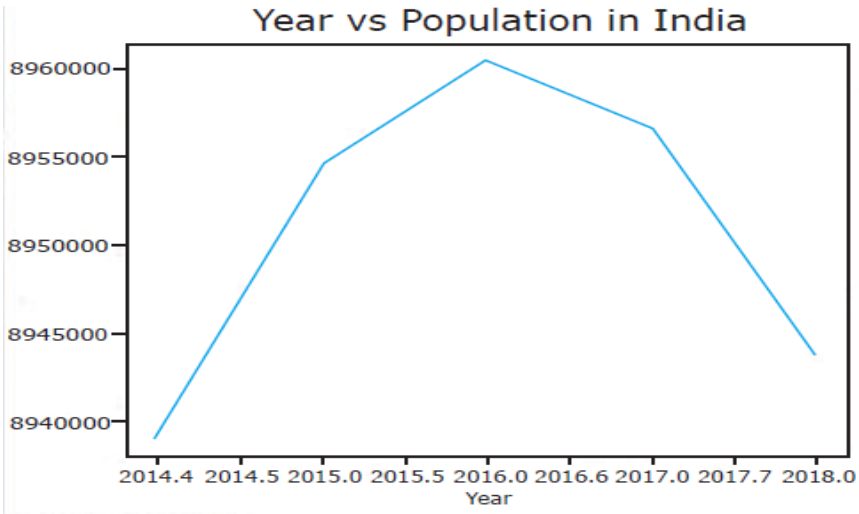
- A Line Chart is a type of chart which displays information as a series of data points called 'markers' connected by straight line segments.
- A Line Chart is often used to visualize a trend in data over intervals of time – a time series – thus the line is often drawn chronologically.
- **Example: Line plot:**

```
import matplotlib.pyplot as plt
years = [2014, 2015, 2016, 2017, 2018]
total_populations = [8939007, 8954518, 8960387, 8956741, 8943721]
plt.plot (years, total_populations)
plt.title ("Year vs Population in India")
plt.xlabel ("Year")
plt.ylabel ("Total Population")
plt.show()
```

In this program,

Plt.title() → specifies title to the graph
Plt.xlabel() → specifies label for X-axis
Plt.ylabel() → specifies label for Y-axis

OUTPUT:

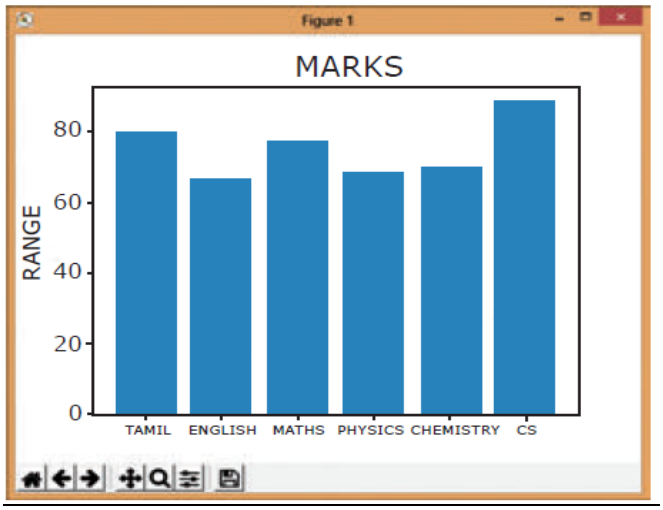


Bar Chart:

- A Bar Chart is one of the most common type of plot.
- It shows the relationship between a numerical variable and a categorical variable.
- Bar chart represents categorical data with rectangular bars.
- Each bar has a height corresponds to the value it represents.
- The bars can be plotted vertically or horizontally.
- It's useful when we want to compare a given numeric value on different categories.
- To make a bar chart with Matplotlib, we can use the plt.bar() function.
- **Example:**

```
import matplotlib.pyplot as plt
labels = ["TAMIL", "ENGLISH", "MATHS", "PHYSICS", "CHEMISTRY", "CS"]
usage = [79.8, 67.3, 77.8, 68.4, 70.2, 88.5]
y_positions = range (len(labels))
plt.bar (y_positions, usage)
plt.xticks (y_positions, labels)
plt.ylabel ("RANGE")
plt.title ("MARKS")
plt.show()
```

Output:



- The above code represents the following:
- Labels → Specifies labels for the bars.
- Usgae → Assign values to the labels specified.
- Xticks → Display the tick marks along the x-axis at the values represented. Then specify the label for each tick mark.
- Range → Create sequence of numbers.

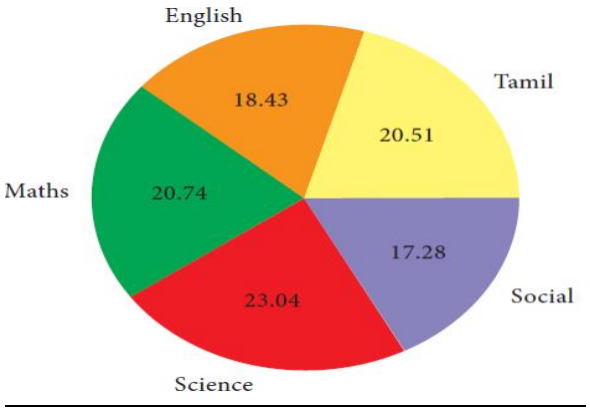
Pie Chart:

- Pie Chart is probably one of the most common type of chart.
- It is a circular graphic which is divided into slices to illustrate numerical proportion.
- The point of a pie chart is to show the relationship of parts out of a whole.
- To make a Pie Chart with Matplotlib, we can use the ***plt.pie()*** function.
- The autopct parameter allows us to display the percentage value using the Python string formatting.
- **Example:**

```
import matplotlib.pyplot as plt
sizes = [89, 80, 90, 100, 75]
```

```
labels = ["Tamil", "English", "Maths", "Science", "Social"]
plt.pie (sizes, labels = labels, autopct = "%.2f ")
plt.axes().set_aspect ("equal")
plt.show()
```

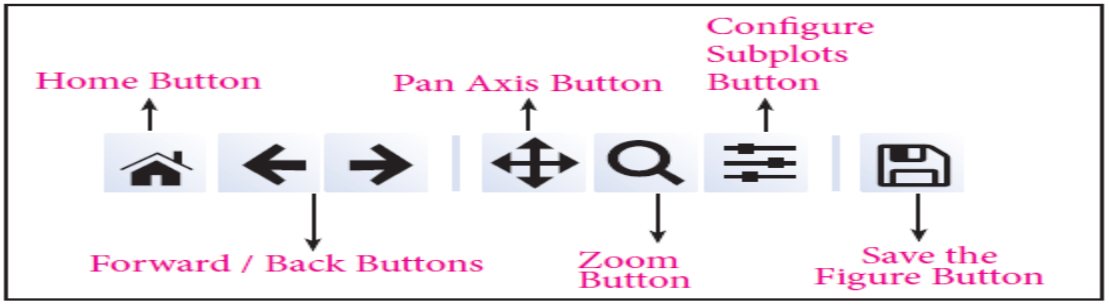
- **Output:**



2. Explain the various buttons in a matplotlib window.

Buttons in the output:

- In the output figure, you can see few buttons at the bottom left corner. Let us see the use of these buttons.
- **Home Button** → The Home Button will help once you have begun navigating your chart. If you ever want to return back to the original view, you can click on this.
- **Forward/Back buttons** → These buttons can be used like the Forward and Back buttons in your browser. You can click these to move back to the previous point you were at, or forward again.
- **Pan Axis** → This cross-looking button allows you to click it, and then click and drag your graph around.
- **Zoom** → The Zoom button lets you click on it, then click and drag a square that you would like to zoom into specifically. Zooming in will require a left click and drag. You can alternatively zoom out with a right click and drag.
- **Configure Subplots** → This button allows you to configure various spacing options with your figure and plot.
- **Save Figure** → This button will allow you to save your figure in various forms.



3. Explain the purpose of the following functions:

a. plt.xlabel - Specifies label for x-axis

b. plt.ylabel - Specifies label for y-axis

c. plt.title - Specifies the title to the graph

d. plt.legend() - To invoke the default legend for the graph

e. plt.show() - To display the graph

4. Key Differences Between Histogram and Bar Graph:

Histogram	Bar Graph
It refers to a graphical representation of data	It is a pictorial representation of data
It represents the frequency distribution of continuous variables.	It is a diagrammatic comparison of discrete variables
It presents numerical data	It shows categorical data
There is no gap between the bars	There is proper spacing between bars
It cannot rearrange the blocks	It is quite common to rearrange the blocks from highest to lowest
The width of rectangular blocks may or may not be same	The width of the bars are always same

EXTRA QUESTION ANSWER:

Infographics:

- An infographic (information graphic) is the representation of information in a graphic format.

Dashboard:

- A dashboard is a collection of resources assembled to create a single unified visual display.
- Data visualizations and dashboards translate complex ideas and concepts into a simple visual format.
- Patterns and relationships that are undetectable in text are detectable at a glance using dashboard.

Introduction to Matplotlib — Data Visualization in Python:

- Matplotlib is the most popular data visualization library in Python.
- It allows you to create charts in few lines of code.

Scatter plot:

- A scatter plot is a type of plot that shows the data as a collection of points.
- The position of a point depends on its two-dimensional value, where each value is a position on either the horizontal or vertical dimension.

Box plot:

- The box plot is a standardized way of displaying the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum.

Getting Started:

- After installing Matplotlib, we will begin coding by importing Matplotlib using the command:

  import matplotlib.pyplot as plt

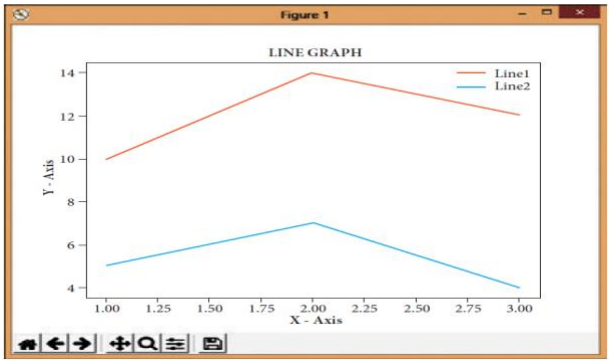
Plotting Two Lines:

To plot two lines, use the following code:

```
import matplotlib.pyplot as plt
x = [1,2,3]
y = [5,7,4]
x2 = [1,2,3]
y2 = [10,14,12]
plt.plot(x, y, label='Line 1')
plt.plot(x2, y2, label='Line 2')
plt.xlabel('X-Axis')
plt.ylabel('Y-Axis')
plt.title('LINE GRAPH')
plt.legend()
plt.show()
```

Output:

- With plt.xlabel and plt.ylabel, you can assign labels to those respective axis.
- Next, you can assign the plot's title with plt.title, and then you can invoke the default legend with plt. legend().



Choose the best answer (1 Marks):

1. Which is a python package used for 2D graphics?

a. matplotlib.pyplot

b. matplotlib.pip

c. matplotlib.numpy

d. matplotlib.plt

2. Identify the package manager for Python packages, or modules.

a. Matplotlib

b. PIP

c. plt.show()

d. python package

3. Read the following code: Identify the purpose of this code and choose the right option from the following.

C:\Users\YourName\AppData\Local\Programs\Python\Python36-32\Scripts>pip --version

a. Check if PIP is Installed

b. Install PIP

c. Download a Package

d. Check PIP version

4. Read the following code: Identify the purpose of this code and choose the right option from the following.

C:\Users\Your Name\AppData\Local\Programs\Python\Python36-32\Scripts>pip list

a. List installed packages

b. list command

c. Install PIP

d. packages installed

5. To install matplotlib, the following function will be typed in your command prompt. What does "-U"represents?

Python –m pip install –U pip

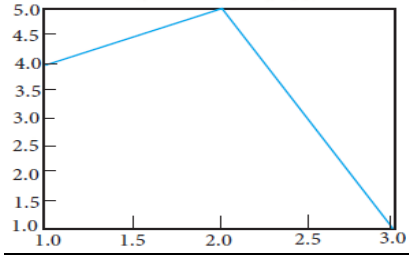
a. downloading pip to the latest version

b. upgrading pip to the latest version

c. removing pip

d. upgrading matplotlib to the latest version

6. Observe the output figure. Identify the coding for obtaining this output.



a. import matplotlib.pyplot as plt
plt.plot([1,2,3],[4,5,1])
plt.show()

b. import matplotlib.pyplot as plt
plt.plot([1,2],[4,5])
plt.show()

c. import matplotlib.pyplot as plt
plt.plot([2,3],[5,1])
plt.show()

d. import matplotlib.pyplot as plt
plt.plot([1,3],[4,1])
plt.show()

7. Read the code:

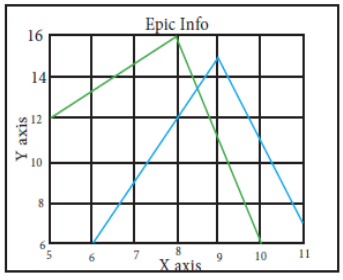
a. import matplotlib.pyplot as plt

b. plt.plot(3,2)

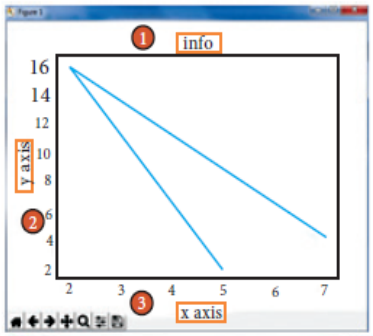
c. plt.show()

Identify the output for the above coding.

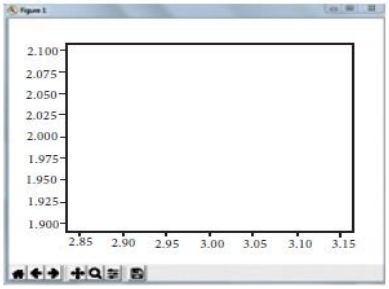
a.



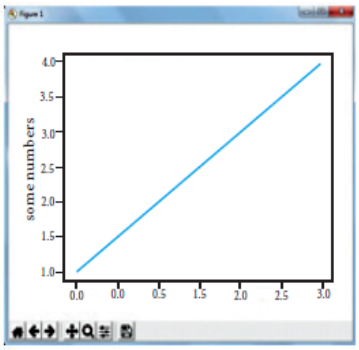
b.



c.



d.



8. Which key is used to run the module?

a. F6

b. F4

c. F3

d. F5

9. Identify the right type of chart using the following hints.

Hint 1: This chart is often used to visualize a trend in data over intervals of time.

Hint 2: The line in this type of chart is often drawn chronologically.

a. Line chart

b. Bar chart

c. Pie chart

d. Scatter plot

10. Read the statements given below. Identify the right option from the following for pie chart.

Statement A: To make a pie chart with Matplotlib, we can use the plt.pie() function.

Statement B: The autopct parameter allows us to display the percentage value using the Python string formatting.

a. Statement A is correct

b. Statement B is correct

c. Both the statements are correct

d. Both the statements are wrong

11. **plot()** is a versatile command, and will take an arbitrary number of arguments.
12. **Matplotlib** allows you to create different kinds of plots ranging from histograms and scatter plots to bar graphs and bar charts.
13. A **Line Chart or Line Graph** is a type of chart which displays information as a series of data points called **'markers'** connected by straight line segments.
14. **Plt.title()** → specifies title to the graph
15. **Plt.xlabel()** → specifies label for X-axis
16. **Plt.ylabel()** → specifies label for Y-axis
17. To make a bar chart with Matplotlib, we can use the **plt.bar()** function.
18. **Labels** → Specifies labels for the bars.
19. **Usgae** → Assign values to the labels specified.
20. **Xticks** → Display the tick marks along the x-axis at the values represented. Then specify the label for each tick mark.
21. **Range** → Create sequence of numbers.
22. **Bar Graph and Histogram** are the two ways to display data in the form of a diagram.
23. To make a Pie Chart with Matplotlib, we can use the ***plt.pie()*** function
24. You can install the latest version of pip from your command prompt using the following command: **Python –m pip install –U pip** -U represents upgrading pip to the latest version.
25. To Check pip version: **pip --version**
26. To install matplotlib, type the following in your command prompt:
    Python –m pip install –U matplotlib
27. To view the list of installed packages on your system, use the List command: **pip list**
28. **Data Visualization** is the graphical representation of information and data
29. **Matplotlib** is the most popular data visualization library in Python
30. **Dashboard** is a collection of resources assembled to create a single unified visual display.

1. Which kind of data encoded visually communicates a quantitative message?

a. String

b. Numbers

c. Images

d. None of these

2. Which of the following is not a type of Data Visualization?

a. Graphs

b. Picture

c. Maps

d. Infographics

3. Which of the following is a collection of resources assembled to create a single unified visual display?

a. Infographics
b. Grphics
c. Dashboard
d. Charts
4. Which of the following is the representation of information in a graphic format?
a. Infographics
b. Grphics
c. Dashboard
d. Charts
5. The most popular data visualization library in Python is
a. matplotlib
b. pip
c. matinfolib
d. matpiplib
6. Matplotlib allows you to create a
a. Table
b. Charts
c. Maps
d. Infographics
7. Which of the following is a type of plot that shows the data as a collection of points?
a. Box plot
b. Chart plot
c. Line plot
d. Scatter plot
8. Which plot displays the distribution of data based on the five number summary?
a. Scatter plot
b. Line plot
c. Box Plot
d. Chart plot
9. Which of the following command is used to install matplotlib for coding?
a. import plt.matplotlib as plot
b. import plot.matplotlib as plt
c. import matplotlib.plt as plot
d. import matplotlib.pyplot as plt
10. Which of the following command will take an arbitrary number of arguments
a. show()
b. plot()
c. legend()
d. title()

11. Which button used to click and drag a graph around?

a. pan axis

b. home

c. zoom

d. drag

12. Which type of charts displays information as series of data points?

a. Bar

b. Pie

c. Line

d. Histogram

13. A line chart is type of chart which displays on formats as a data points called

a. series

b. markers

c. plot

d. lib

14. Which type of chart shows the relationship between a numerical variable and categorical variable?

a. line

b. bar

c. pie

d. x-y plot

15. Which refers to a graphical representation that displays data by way of bars to show the frequency of numerical data?

a. Bar chart

b. Line chart

c. Pie chart

d. Histogram

16. Which of the following chart represents a frequency distribution of continuous variables?

a. Bar chart

b. Line chart

c. Pie chart

d. Histogram

17. Which plot is a circular graphical representation of numerical data?

a. Histogram

b. xy plot

c. Bar plot

d. Pie chart

18. Which parameter used to display the percentage value using Python string formatting in pie chart?

a. percent
b. autopct
c. pct
d. percentage
19. Zoom in will require ____ and drag.
a. click
b. left click
c. double click
d. right click
20. Zoom out will require ____ and drag.
a. click
b. left click
c. double click
d. right click

***** Best of Luck *****