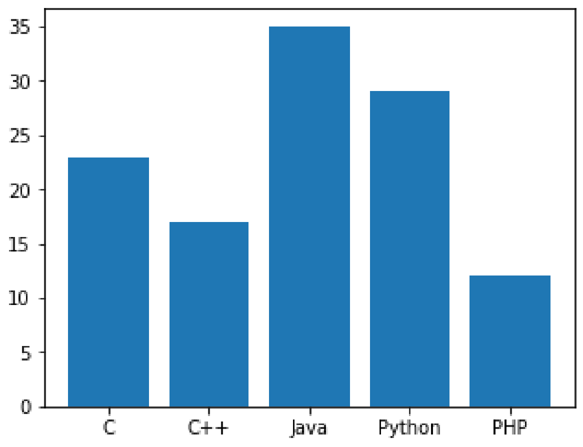
Ans 2.) Different plots using matplotlib library

1. Bar Plot: A bar chart or bar graph is a chart or graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent. The bars can be plotted vertically or horizontally.

In [12]:

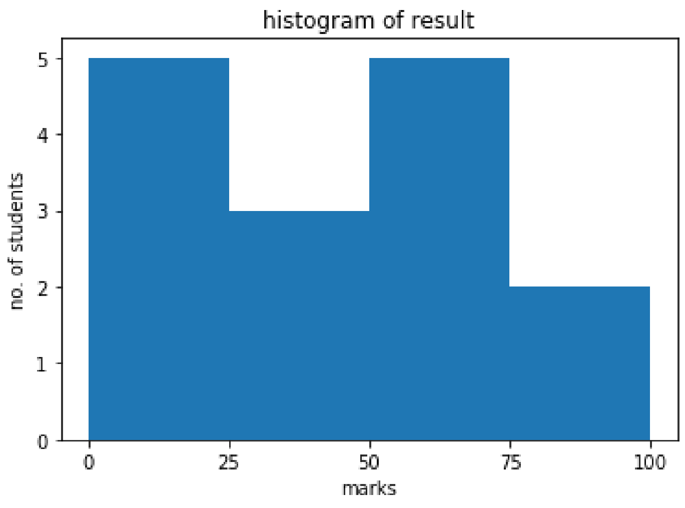
```
import matplotlib.pyplot as plt
fig=plt.figure(figsize=(4, 3))
ax=fig.add_axes([0,0,1,1])
langs=['C', 'C++', 'Java', 'Python', 'PHP']
students=[23,17,35,29,12]
ax.bar(langs,students)
plt.show()
```



2. Histogram: A histogram is an accurate representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable. It is a kind of bar graph.

In [2]:

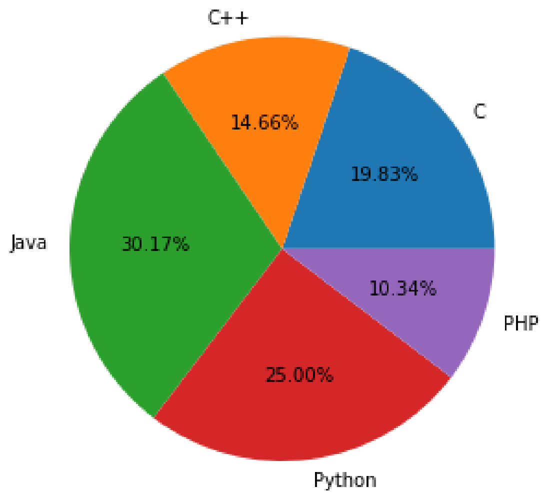
```
import numpy as np
fig,ax=plt.subplots(1,1)
a = np.array([22,87,5,43,56,73,55,54,11,20,51,5,79,31,27])
ax.hist(a, bins = [0,25,50,75,100])
ax.set_title("histogram of result")
ax.set_xticks([0,25,50,75,100])
ax.set_xlabel('marks')
ax.set_ylabel('no. of students')
plt.show()
```



3. Pie Chart: A Pie Chart can only display one series of data. Pie charts show the size of items (called wedge) in one data series, proportional to the sum of the items. The data points in a pie chart are shown as a percentage of the whole pie.

In [3]:

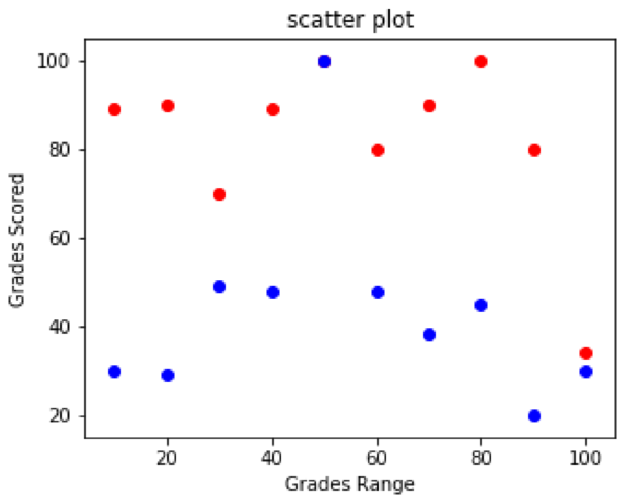
```
fig=plt.figure()
ax=fig.add_axes([0,0,1,1])
ax.axis('equal')
langs=['C', 'C++', 'Java', 'Python', 'PHP']
students=[23,17,35,29,12]
ax.pie(students, labels=langs,autopct='%1.2f%%')
plt.show()
```



4. Scatter plot: Scatter plots are used to plot data points on horizontal and vertical axis in the attempt to show how much one variable is affected by another. Each row in the data table is represented by a marker the position depends on its values in the columns set on the X and Y axes. A third variable can be set to correspond to the color or size of the markers, thus adding yet another dimension to the plot

In [13]:

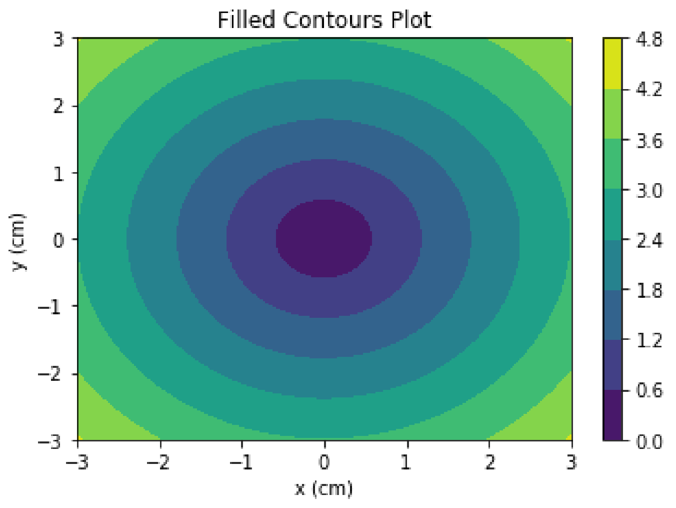
```
girls_grades = [89, 90, 70, 89, 100, 80, 90, 100, 80, 34]
boys_grades = [30, 29, 49, 48, 100, 48, 38, 45, 20, 30]
grades_range = [10, 20, 30, 40, 50, 60, 70, 80, 90, 100]
fig=plt.figure(figsize=(4, 3))
ax=fig.add_axes([0,0,1,1])
ax.scatter(grades_range, girls_grades, color='r')
ax.scatter(grades_range, boys_grades, color='b')
ax.set_xlabel('Grades Range')
ax.set_ylabel('Grades Scored')
ax.set_title('scatter plot')
plt.show()
```



5. Contour plot: Contour plots (sometimes called Level Plots) are a way to show a three-dimensional surface on a two-dimensional plane. It graphs two predictor variables X Y on the y-axis and a response variable Z as contours. A contour plot is appropriate if you want to see how alue Z changes as a function of two inputs X and Y, such that Z = f(X,Y). A contour line or isoline of a function of two variables is a curve along which the function has a constant value. The independent variables x and y are usually restricted to a regular grid called meshgrid. The numpy.meshgrid creates a rectangular grid out of an array of x values and an array of y values.

In [5]:

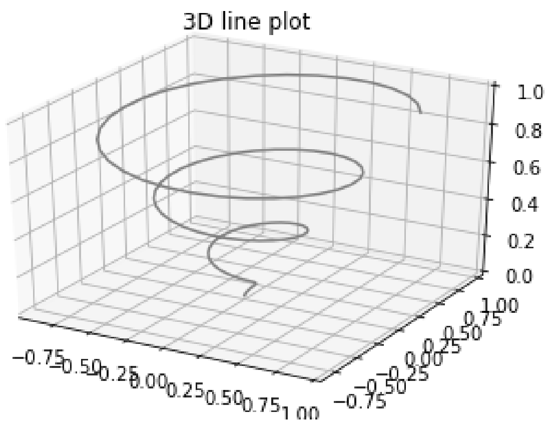
```
xlist = np.linspace(-3.0, 3.0, 100)
ylist = np.linspace(-3.0, 3.0, 100)
X, Y = np.meshgrid(xlist, ylist)
Z = np.sqrt(X**2 + Y**2)
fig,ax=plt.subplots(1,1)
cp = ax.contourf(X, Y, Z)
fig.colorbar(cp) # Add a colorbar to a plot
ax.set_title('Filled Contours Plot')
ax.set_xlabel('x (cm)')
ax.set_ylabel('y (cm)')
plt.show()
```



6. 3D plot: Three-dimensional plots are enabled by importing the mplot3d toolkit, included with the Matplotlib package. A three-dimensional axes can be created by passing the keyword projection='3d' to any of the normal axes creation routines.

In [6]:

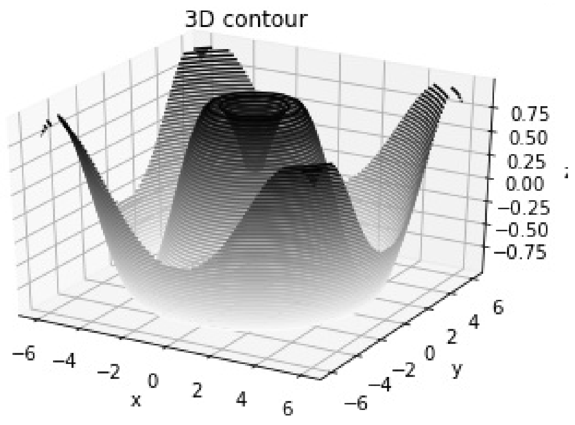
```
from mpl_toolkits import mplot3d
fig = plt.figure()
ax = plt.axes(projection='3d')
z = np.linspace(0, 1, 100)
x = z * np.sin(20 * z)
y = z * np.cos(20 * z)
ax.plot3D(x, y, z, 'gray')
ax.set_title('3D line plot')
plt.show()
```



7. 3D Contour Plot: **The ax.contour3D() function creates three-dimensional contour plot. It requires all the input data to be in the form of two-dimensional regular grids, with the Z-data evaluated at each point. Here, we will show a three-dimensional contour diagram of a threedimensional sinusoidal function.**

In [19]:

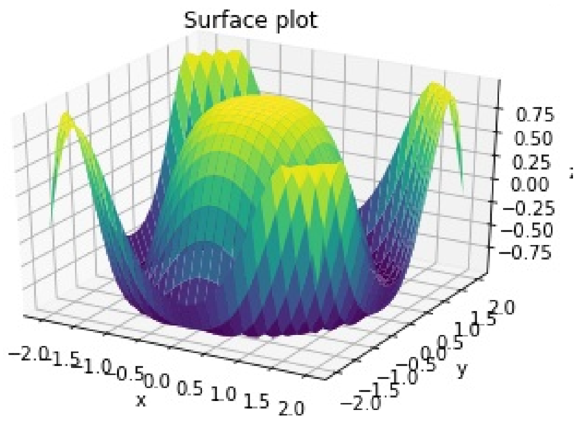
```
from mpl_toolkits import mplot3d
import numpy as np
import matplotlib.pyplot as plt
def f(x, y):
    return np.sin(np.sqrt(x ** 2 + y ** 2))
x = np.linspace(-6, 6, 30)
y = np.linspace(-6, 6, 30)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)
fig = plt.figure()
ax = plt.axes(projection='3d')
ax.contour3D(X, Y, Z, 50, cmap='binary')
ax.set_xlabel('x'),ax.set_ylabel('y'), ax.set_zlabel('z')
ax.set_title('3D contour')
plt.show()
```



8. 3D Surface Plot: **Surface plot shows a functional relationship between a designated dependent variable (Y), and two independent variables (X and Z). The plot is a companion plot to the contour plot. A surface plot is like a wireframe plot, but each face of the wireframe is a filled polygon. This can aid perception of the topology of the surface being visualized. The plot_surface() function x,y and z as arguments.**

In [18]:

```
x = np.outer(np.linspace(-2, 2, 30), np.ones(30))
y = x.copy().T # transpose
z = np.cos(x ** 2 + y ** 2)
fig = plt.figure()
ax = plt.axes(projection='3d')
ax.plot_surface(x, y, z,cmap='viridis', edgecolor='none')
ax.set_title('Surface plot')
ax.set_xlabel('x'),ax.set_ylabel('y'),ax.set_zlabel('z')
plt.show()
```


Surface plot
x
y