In [1]:
```
import pandas as pd
df=pd.read_csv('iris.csv')

df.head()
```

Out[1]:

	sepal length	sepal width	petal length	petal width	species
0	5.1	3.5	1.4	0.2	1
1	4.9	3.0	1.4	0.2	1
2	4.7	3.2	1.3	0.2	1
3	4.6	3.1	1.5	0.2	1
4	5.0	3.6	1.4	0.2	1

In [4]:
```
X=df.values[: , : -1]
Y=df.values[: , -1]
X
```

Out[4]:
```
array([[5.1, 3.5, 1.4, 0.2],
       [4.9, 3. , 1.4, 0.2],
       [4.7, 3.2, 1.3, 0.2],
       [4.6, 3.1, 1.5, 0.2],
       [5. , 3.6, 1.4, 0.2],
       [5.4, 3.9, 1.7, 0.4],
       [4.6, 3.4, 1.4, 0.3],
       [5. , 3.4, 1.5, 0.2],
       [4.4, 2.9, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [5.4, 3.7, 1.5, 0.2],
       [4.8, 3.4, 1.6, 0.2],
       [4.8, 3. , 1.4, 0.1],
       [4.3, 3. , 1.1, 0.1],
       [5.8, 4. , 1.2, 0.2],
       [5.7, 4.4, 1.5, 0.4],
       [5.4, 3.9, 1.3, 0.4],
       [5.1, 3.5, 1.4, 0.3],
       [5.7, 3.8, 1.7, 0.3],
```

In [11]:
```
import numpy as np
X_standard= X - X.mean()
X_standard
```

Out[11]:
```
array([[ 1.6355,  0.0355, -2.0645, -3.2645],
       [ 1.4355, -0.4645, -2.0645, -3.2645],
       [ 1.2355, -0.2645, -2.1645, -3.2645],
       [ 1.1355, -0.3645, -1.9645, -3.2645],
       [ 1.5355,  0.1355, -2.0645, -3.2645],
       [ 1.9355,  0.4355, -1.7645, -3.0645],
       [ 1.1355, -0.0645, -2.0645, -3.1645],
       [ 1.5355, -0.0645, -1.9645, -3.2645],
       [ 0.9355, -0.5645, -2.0645, -3.2645],
       [ 1.4355, -0.3645, -1.9645, -3.3645],
       [ 1.9355,  0.2355, -1.9645, -3.2645],
       [ 1.3355, -0.0645, -1.8645, -3.2645],
       [ 1.3355, -0.4645, -2.0645, -3.3645],
       [ 0.8355, -0.4645, -2.3645, -3.3645],
       [ 2.3355,  0.5355, -2.2645, -3.2645],
       [ 2.2355,  0.9355, -1.9645, -3.0645],
       [ 1.9355,  0.4355, -2.1645, -3.0645],
       [ 1.6355,  0.0355, -2.0645, -3.1645],
       [ 2.2355,  0.3355, -1.7645, -3.1645],
```

In [12]:
```
Y_standard= Y
Y_standard
```

Out[12]:
```
array([1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1.,
       1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1.,
       1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 2.,
       2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2.,
       2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2.,
       2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 2., 3., 3.,
       3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3.,
       3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3.,
       3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3., 3.])
```

In [14]:
```
cov=np.cov(X.T)
print("Covariance matix is: \n",cov)
```

```
Covariance matix is:
 [[ 0.68569351 -0.042434    1.27431544  0.51627069]
 [-0.042434    0.18997942 -0.32965638 -0.12163937]
 [ 1.27431544 -0.32965638  3.11627785  1.2956094 ]
 [ 0.51627069 -0.12163937  1.2956094   0.58100626]]
```

In [15]:
```
from numpy import linalg as LA
lambdas , vs=LA.eig(cov)
```

In [16]:
```
lambdas
```

Out[16]:
```
array([4.22824171, 0.24267075, 0.0782095 , 0.02383509])
```

In [17]:
```
vs
```

Out[17]:
```
array([[ 0.36138659, -0.65658877, -0.58202985,  0.31548719],
       [-0.08452251, -0.73016143,  0.59791083, -0.3197231 ],
       [ 0.85667061,  0.17337266,  0.07623608, -0.47983899],
       [ 0.3582892 ,  0.07548102,  0.54583143,  0.75365743]])
```

In [19]:
```
sorted_index=np.argsort(lambdas)[::-1]
sorted_index
```

Out[19]:
```
array([0, 1, 2, 3], dtype=int64)
```

In [20]:
```
sorted_values=lambdas[sorted_index]
sorted_values
```

Out[20]:
```
array([4.22824171, 0.24267075, 0.0782095 , 0.02383509])
```

In [21]:
```
sorted_vectors=vs[:,sorted_index]
sorted_vectors
```

Out[21]:
```
array([[ 0.36138659, -0.65658877, -0.58202985,  0.31548719],
       [-0.08452251, -0.73016143,  0.59791083, -0.3197231 ],
       [ 0.85667061,  0.17337266,  0.07623608, -0.47983899],
       [ 0.3582892 ,  0.07548102,  0.54583143,  0.75365743]])
```

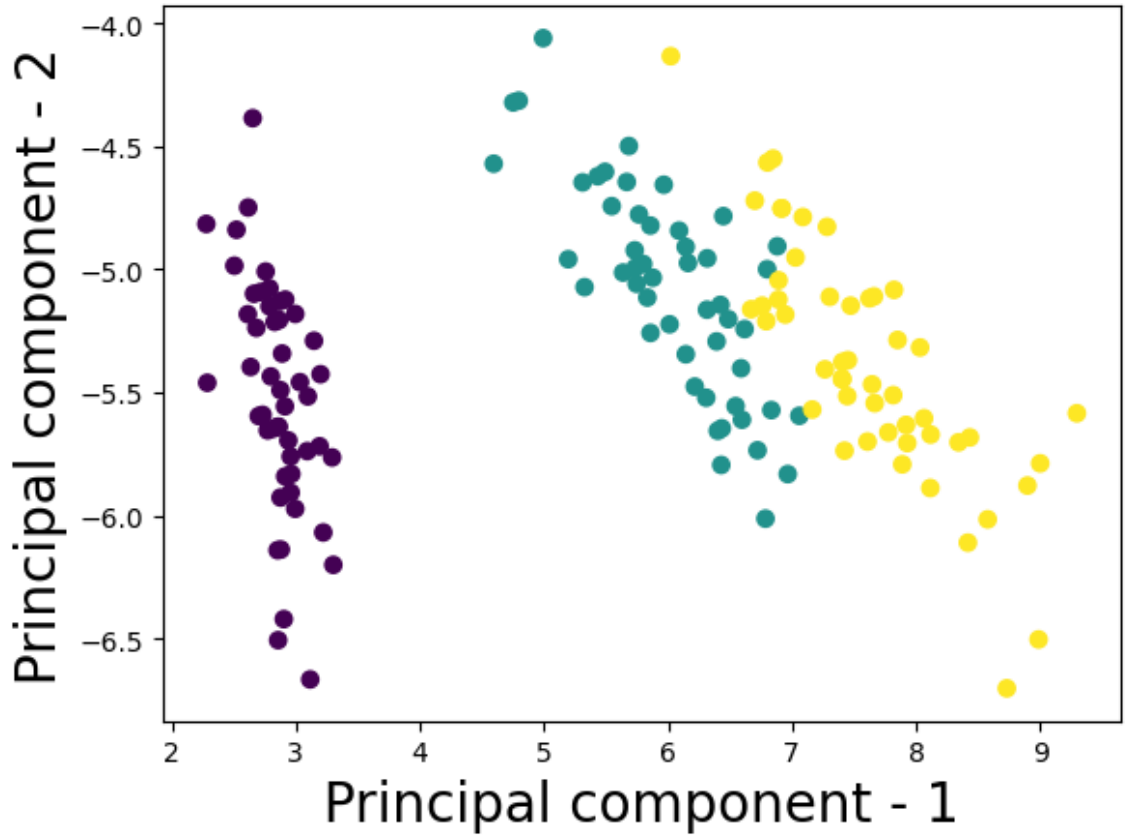
In [22]:
```
n_components=2
vector_subset=sorted_vectors[:,0:n_components]
vector_subset
```

Out[22]:
```
array([[ 0.36138659, -0.65658877],
       [-0.08452251, -0.73016143],
       [ 0.85667061,  0.17337266],
       [ 0.3582892 ,  0.07548102]])
```

In [23]:
```
X_reduced=np.dot(vector_subset.transpose(),X.transpose()).transpose()
X_reduced
```

Out[23]:
```
array([[ 2.81823951, -5.64634982],
       [ 2.78822345, -5.14995135],
       [ 2.61337456, -5.18200315],
       [ 2.75702228, -5.0086536 ],
       [ 2.7736486 , -5.65370709],
       [ 3.2215055 , -6.06828303],
       [ 2.68182738, -5.23749119],
       [ 2.87622016, -5.49033754],
       [ 2.6159824 , -4.74864082],
       [ 2.82960933, -5.21317833],
       [ 2.99541804, -5.97202148],
       [ 2.8896099 , -5.34168252],
       [ 2.71625587, -5.09184058],
       [ 2.27856139, -4.81555799],
       [ 2.85761474, -6.50571721],
       [ 3.1163261 , -6.66501491],
       [ 2.87883726, -6.13763209],
       [ 2.85406843, -5.63880172],
       [ 3.30254481, -6.19979162],
```

In [26]:
```
import matplotlib.pyplot as plt
plt.xlabel('Principal component - 1',fontsize=20)
plt.ylabel('Principal component - 2',fontsize=20)
plt.scatter(X_reduced[:,0:1],X_reduced[:,-1],c=Y)
plt.show()
```



In [ ]: