Práctica M 28

In [17]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import make_pipeline
from numpy import linalg as LA
```

In [18]:
```
df = pd.read_csv('C:/Users/Isaac/Desktop/IHD/EBAC DT/CIENCIA DE DATOS\M28 DS/iris.csv')
df.head()
```

Out[18]:

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

In [19]:
```
df.set_index('variety', inplace = True)
df.head()
```

Out[19]:

variety	sepal.length	sepal.width	petal.length	petal.width
Setosa	5.1	3.5	1.4	0.2
Setosa	4.9	3.0	1.4	0.2
Setosa	4.7	3.2	1.3	0.2
Setosa	4.6	3.1	1.5	0.2
Setosa	5.0	3.6	1.4	0.2

In [20]:
```
index = df.index
renglones = len(index)
renglones
```

Out[20]: 150

In [21]:
```
# estandarizamos las variables

df2 = StandardScaler().fit_transform(df)
df2
```

Out[21]:
```
array([[-9.00681170e-01,  1.01900435e+00, -1.34022653e+00,
        -1.31544430e+00],
       [-1.14301691e+00, -1.31979479e-01, -1.34022653e+00,
        -1.31544430e+00],
       [-1.38535265e+00,  3.28414053e-01, -1.39706395e+00,
        -1.31544430e+00],
       [-1.50652052e+00,  9.82172869e-02, -1.28338910e+00,
        -1.31544430e+00],
       [-1.02184904e+00,  1.24920112e+00, -1.34022653e+00,
        -1.31544430e+00],
       [-5.37177559e-01,  1.93979142e+00, -1.16971425e+00,
        -1.05217993e+00],
       [-1.50652052e+00,  7.88807586e-01, -1.34022653e+00,
        -1.18381211e+00],
       [-1.02184904e+00,  7.88807586e-01, -1.28338910e+00,
        -1.31544430e+00],
       [-1.74885626e+00, -3.62176246e-01, -1.34022653e+00,
        -1.31544430e+00],
       [-1.14301691e+00,  9.82172869e-02, -1.28338910e+00,
```

In [22]:
```
# calculamos la matriz de correlacion para la matriz transformada
A = (1/renglones) * np.dot(df.T, df2)
A
```

Out[22]:
```
array([[ 0.82530129, -0.09703049,  0.71945952,  0.67504787],
       [-0.0510736 ,  0.43441097, -0.18611908, -0.15904912],
       [ 1.53376714, -0.75379926,  1.75940407,  1.69406935],
       [ 0.62138384, -0.27814317,  0.73148177,  0.75969263]])
```

In [24]:
```
# entrenamos el modelo PCA con escalacdo de datos

pca_pipe = make_pipeline(StandardScaler(), PCA())
pca_pipe.fit(df)

modelo_pca = pca_pipe.named_steps['pca']

print('Eigenvalores')
results = LA.eigvals(A)
results
```

```
Eigenvalores
```

Out[24]:
```
array([3.19944857, 0.44280359, 0.11208376, 0.02447304])
```

In [25]:
```
# porcentaje de varianza explicada por cada nuevo componente

print('Porcentaje de varianza explicada por cada nuevo componente')
print(modelo_pca.explained_variance_ratio_)
```

```
Porcentaje de varianza explicada por cada nuevo componente
[0.72962445 0.22850762 0.03668922 0.00517871]
```

In [27]:
```
# calculo de eigenvectores

print('Eigenvectores (por renglon)')
pd.DataFrame(data = modelo_pca.components_,
             columns =  df.columns,
             index = ['PC1','PC2','PC3','PC4'])
```

```
Eigenvectores (por renglon)
```

Out[27]:

	sepal.length	sepal.width	petal.length	petal.width
PC1	0.521066	-0.269347	0.580413	0.564857
PC2	0.377418	0.923296	0.024492	0.066942
PC3	-0.719566	0.244382	0.142126	0.634273
PC4	-0.261286	0.123510	0.801449	-0.523597

In [29]:
```
# proyecciones de los componentes

proyec = np.dot(modelo_pca.components_, df2.T)
proyec = pd.DataFrame(proyec, index = ['PC1','PC2','PC3','PC4'])
proyec = proyec.transpose().set_index(df.index)
proyec
```

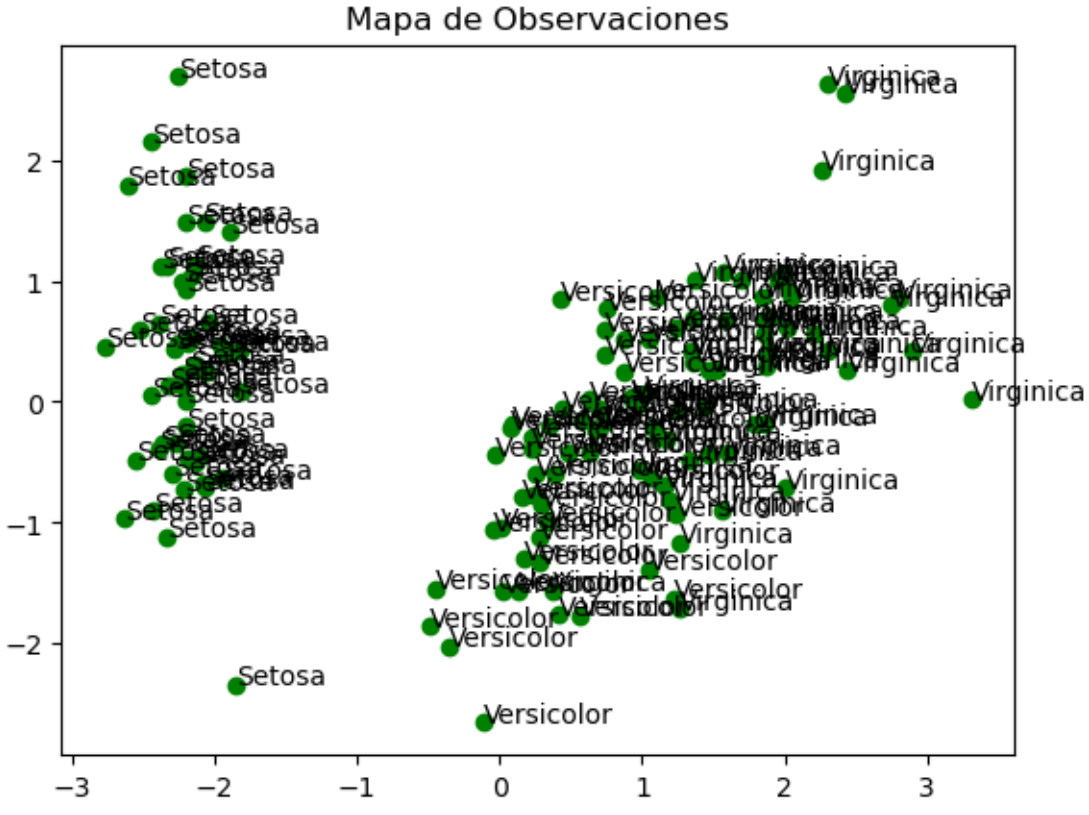
Out[29]:

	PC1	PC2	PC3	PC4
variety				
Setosa	-2.264703	0.480027	-0.127706	-0.024168
Setosa	-2.080961	-0.674134	-0.234609	-0.103007
Setosa	-2.364229	-0.341908	0.044201	-0.028377
Setosa	-2.299384	-0.597395	0.091290	0.065956
Setosa	-2.389842	0.646835	0.015738	0.035923
...	...	...	...	...
Virginica	1.870503	0.386966	0.256274	-0.389257
Virginica	1.564580	-0.896687	-0.026371	-0.220192

150 rows x 4 columns

In [36]:
```
x = proyec.iloc[:,0]
y = proyec.iloc[:,1]
z = df.index

# convertimos x y y en un arreglo para poder graficar

x = x.to_numpy()
y = y.to_numpy()

# graficamos

plt.figure(dpi = 100)
fig, ax = plt.subplots()
ax.set_title('Mapa de Observaciones')
ax.scatter(x, y, c = 'green')

# agregamos etiquetas a cada punto

for i, txt in enumerate(z):
    ax.annotate(txt, (x[i], y[i]))
```

```
<Figure size 640x480 with 0 Axes>
```



In [43]:
```
componentes2 = pd.DataFrame(data = modelo_pca.components_,
                            columns = df.columns,
                            index = ['PC1','PC2','PC3','PC4'])
componentes2
```

Out[43]:

	sepal.length	sepal.width	petal.length	petal.width
PC1	0.521066	-0.269347	0.580413	0.564857
PC2	0.377418	0.923296	0.024492	0.066942
PC3	-0.719566	0.244382	0.142126	0.634273
PC4	-0.261286	0.123510	0.801449	-0.523597

In [44]:
```
# mostramos solo los 2 primeros renglones con todas las columnas

componentes2 = componentes2.iloc[0:2, :]
componentes2
```

Out[44]:

	sepal.length	sepal.width	petal.length	petal.width
PC1	0.521066	-0.269347	0.580413	0.564857
PC2	0.377418	0.923296	0.024492	0.066942

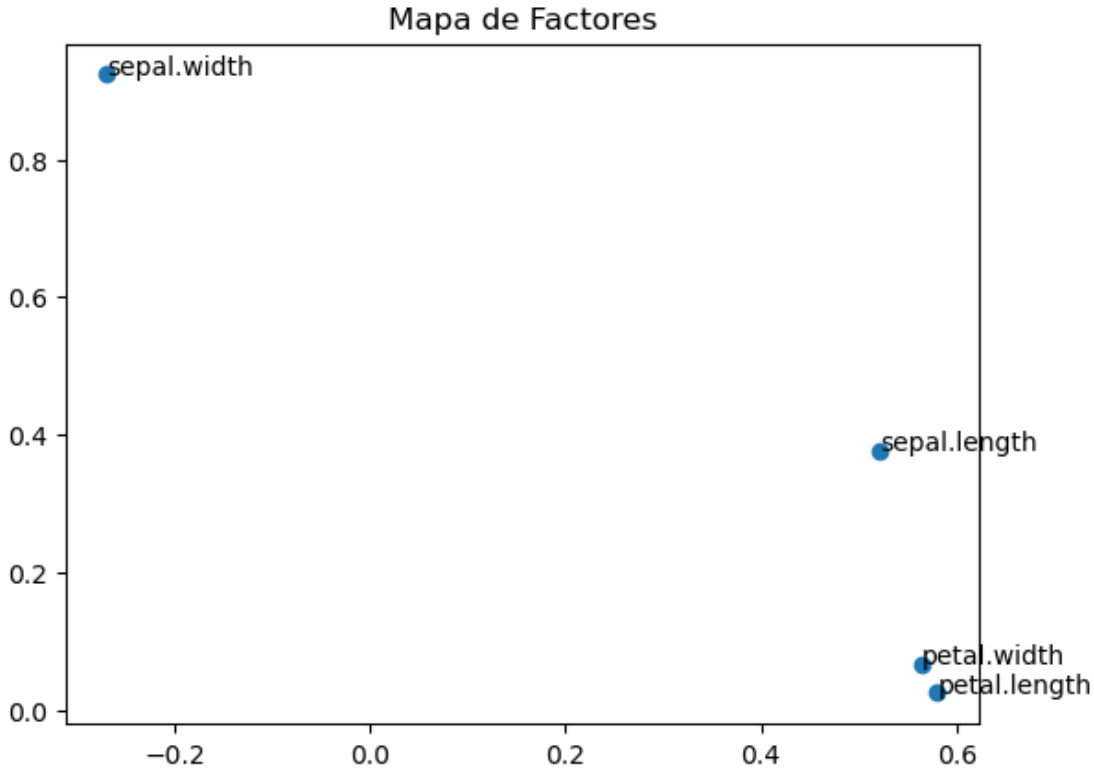
In [45]:
```
componentes2 = componentes2.T
componentes2
```

Out[45]:

	PC1	PC2
sepal.length	0.521066	0.377418
sepal.width	-0.269347	0.923296
petal.length	0.580413	0.024492
petal.width	0.564857	0.066942

In [46]:
```
# graficamos componentes2

x = componentes2.iloc[:,0]
y = componentes2.iloc[:,1]
z = componentes2.index

# convertimos x y y en un arreglo para poder graficar

x = x.to_numpy()
y = y.to_numpy()

# graficamos

plt.figure(dpi = 100)
fig, ax = plt.subplots()
ax.set_title('Mapa de Factores')
ax.scatter(x, y,)

# agregamos etiquetas a cada punto

for i, txt in enumerate(z):
    ax.annotate(txt, (x[i], y[i]))
```

```
<Figure size 640x480 with 0 Axes>
```



In [47]:
```
# procedimineto para obtener la matriz estandarizada original

original = np.dot(modelo_pca.components_.T, proyec.T)
original = original.T
original
```

Out[47]:
```
array([[-9.00681170e-01,  1.01900435e+00, -1.34022653e+00,
        -1.31544430e+00],
       [-1.14301691e+00, -1.31979479e-01, -1.34022653e+00,
        -1.31544430e+00],
       [-1.38535265e+00,  3.28414053e-01, -1.39706395e+00,
        -1.31544430e+00],
       [-1.50652052e+00,  9.82172869e-02, -1.28338910e+00,
        -1.31544430e+00],
       [-1.02184904e+00,  1.24920112e+00, -1.34022653e+00,
        -1.31544430e+00],
       [-5.37177559e-01,  1.93979142e+00, -1.16971425e+00,
        -1.05217993e+00],
       [-1.50652052e+00,  7.88807586e-01, -1.34022653e+00,
        -1.18381211e+00],
       [-1.02184904e+00,  7.88807586e-01, -1.28338910e+00,
        -1.31544430e+00],
       [-1.74885626e+00, -3.62176246e-01, -1.34022653e+00,
        -1.31544430e+00],
```