In [15]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn import preprocessing
from sklearn.preprocessing import LabelEncoder,OneHotEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.compose import ColumnTransformer
```

In [68]:

```
df = pd.read_csv("healthcare-dataset-stroke-data.csv")
```

In [69]:

```
df.head()
```

Out[69]:

	id	gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level	bmi	smok
0	9046	Male	67.0	0	1	Yes	Private	Urban	228.69	36.6	
1	51676	Female	61.0	0	0	Yes	Self-employed	Rural	202.21	NaN	nev
2	31112	Male	80.0	0	1	Yes	Private	Rural	105.92	32.5	nev
3	60182	Female	49.0	0	0	Yes	Private	Urban	171.23	34.4	
4	1665	Female	79.0	1	0	Yes	Self-employed	Rural	174.12	24.0	nev

Fill missing values

In [70]:

```
df.drop('id',axis=1,inplace=True)
```

In [71]:

```
bmi_mean = df['bmi'].mean()
df['bmi'].fillna(value=bmi_mean, inplace=True)
```

In [72]:

```
df.head()
```

Out[72]:

	gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level	bmi	smokin
0	Male	67.0	0	1	Yes	Private	Urban	228.69	36.600000	
1	Female	61.0	0	0	Yes	Self-employed	Rural	202.21	28.893237	never
2	Male	80.0	0	1	Yes	Private	Rural	105.92	32.500000	never
3	Female	49.0	0	0	Yes	Private	Urban	171.23	34.400000	
4	Female	79.0	1	0	Yes	Self-employed	Rural	174.12	24.000000	never

					employed				
gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level	bmi	smokin

Splitting into Dependent and Independent variables

In [73]:

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

Encoding

Label Encoding

In [74]:

```
le=LabelEncoder()
X[:,0]=le.fit_transform(X[:,0])
X[:,4]=le.fit_transform(X[:,4])
X[:,6]=le.fit_transform(X[:,6])
```

One hot encoding

In [75]:

```
ce=ColumnTransformer(transformers=[('encoder',OneHotEncoder(),[5,9])],remainder='passthro
ugh')
X=np.array(ce.fit_transform(X))
```

In [76]:

```
X
```

Out[76]:

```
array([[0.0, 0.0, 1.0, ..., 1, 228.69, 36.6],
       [0.0, 0.0, 0.0, ..., 0, 202.21, 28.893236911794673],
       [0.0, 0.0, 1.0, ..., 0, 105.92, 32.5],
       ...,
       [0.0, 0.0, 0.0, ..., 0, 82.99, 30.6],
       [0.0, 0.0, 1.0, ..., 0, 166.29, 25.6],
       [1.0, 0.0, 0.0, ..., 1, 85.28, 26.2]], dtype=object)
```

PCA Extraction

In [77]:

```
from sklearn.decomposition import PCA

pca = PCA(n_components=2)
x = pca.fit_transform(X)
```

Test Train Split

In [78]:

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size = 0.2, random_state
= 42)
```

Visualization

In [79]:

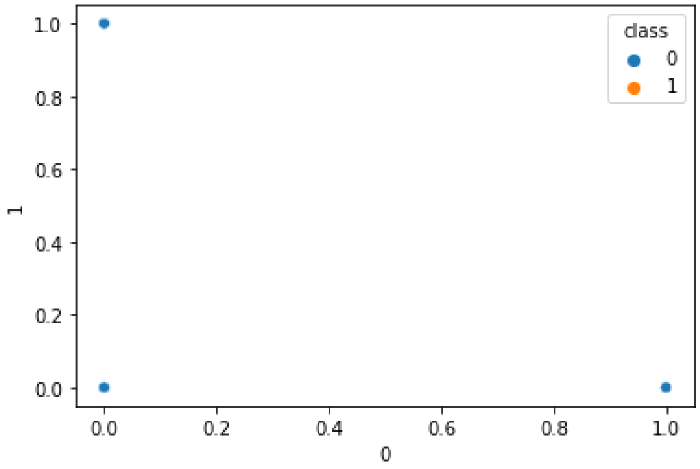
```
Xdf = pd.DataFrame(X)
Xdf["class"] = Y
```

In [81]:

```
sns.scatterplot(data=Xdf, x=0, y=1, hue="class")
```

Out[81]:

```
<AxesSubplot:xlabel='0', ylabel='1'>
```



Perceptron prediction from scratch

prediction function

In [82]:

```
def isCKD(row, weights):
  #loading bias first
  activation = weights[0]
  for i in range(len(row)-1):
    activation += weights[i+1]*row[i] #product of weights and the features
  if activation >= 0:
    return 1
  return 0
```

In [85]:

```
def generate_weights(data, rate, epoch):
 weights = [0.0 for i in range(len(data[0]))] #initialize weights to 0
 for epoch in range(epoch):
  sum_error = 0.0
  for row in data:
   prediction = isCKD(row, weights)
   error = row[-1] - prediction
   sum_error += error**2
   weights[0] = weights[0] + rate * error
   for i in range(len(row)-1):
    weights[i + 1] = weights[i + 1] + rate * error * row[i] #adjusting the weights
  print('epoch=%d error=%d' % (epoch, sum_error))
 return weights
```

Calculating using only 2 features

In [86]:

```
x = Xdf[[1,2,"class"]].values
weights = generate_weights(data=x,rate=1,epoch=4)
y_pred = []
y_actual = []
for row in x:
  prediction = isCKD(row, weights)
  y_actual.append(row[-1])
  y_pred.append(prediction)
print()
print("The score is",accuracy_score(y_actual,y_pred))
```

```
epoch=0 error=1
epoch=1 error=3
epoch=2 error=4
epoch=3 error=4

The score is 0.9512720156555773
```

Calculating with all features

In [87]:

```
x = Xdf.values
weights = generate_weights(data=x,rate=1,epoch=4)
y_pred = []
y_actual = []
for row in x:
  prediction = isCKD(row, weights)
  y_actual.append(row[-1])
  y_pred.append(prediction)
print()
print("The score is",accuracy_score(y_actual,y_pred))
```

```
epoch=0 error=1
epoch=1 error=3
epoch=2 error=3
epoch=3 error=4

The score is 0.9512720156555773
```

Perceptron using library

In [88]:

```
from sklearn.linear_model import Perceptron
clf = Perceptron(tol=1e-3, random_state=0)
clf.fit(X,Y)
clf.score(X,Y)
```

Out[88]:

```
0.861839530332681
```