**Code 5 (ANN)**

from google.colab import drive

drive.mount('/content/drive')

import warnings

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

path="/content/drive/MyDrive/Machine Learning (ML)/churn.csv"

df=pd.read\_csv(path)

df.head()

df.shape

df.columns

df.info()

df.describe()

df.isnull().any().any()

df.isnull().sum()

df[df.isnull().any(axis=1)]

X = df.iloc[:,3:-1]

X.shape

y=df.iloc[:,-1]

y.shape

X = pd.get\_dummies(X, dtype = int)

X.shape

print (X)

X.columns

from sklearn.model\_selection import train\_test\_split

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, train\_size = 0.7, test\_size = 0.25, random\_state = 42)

X\_train.shape,X\_test.shape

X\_train.head(5)

X\_test.head(5)

from sklearn.preprocessing import StandardScaler

sc = StandardScaler()

X\_train = sc.fit\_transform(X\_train)

X\_test = sc.transform(X\_test)

X\_train

X\_test

import tensorflow as tf

ann = tf.keras.models.Sequential()

ann.add(tf.keras.layers.Dense(units=6, activation='relu'))

ann.add(tf.keras.layers.Dense(units=6, activation='relu'))

ann.add(tf.keras.layers.Dense(units=1, activation='sigmoid'))

ann.compile(optimizer="adam",loss="binary\_crossentropy",metrics=['accuracy'])

ann.fit(X\_train,y\_train,batch\_size=32,epochs=100)

y\_pred = ann.predict(X\_test)

y\_pred = (y\_pred > 0.5)

y\_pred

from sklearn.metrics import accuracy\_score, classification\_report,confusion\_matrix

score = accuracy\_score(y\_pred, y\_test)

print(score)

print(classification\_report(y\_pred, y\_test))

cm = confusion\_matrix(y\_pred, y\_test)

print("Confusion Matrix:",confusion\_matrix(y\_pred, y\_test))

import seaborn as sns

import matplotlib.pyplot as plt

plt.figure(figsize=(6, 4))

sns.heatmap(cm, annot=True, cmap='Blues', fmt='g',

            xticklabels=['Yes', 'No'], yticklabels=['Yes', 'No'])

plt.xlabel('Predicted Values')

plt.ylabel('Actual Values')

plt.title('Confusion Matrix')

plt.show()