LAB 5: Develop a program to implement k-Nearest Neighbour(KNN) Algorithm to classify the randomly generated 100 values of x in the range of [0,1].

Perform the following based on dataset generated.

1. Label the first 50 points {x1,……,x50} as follows: if (xi ≤ 0.5), then xi ε Class1, else xi ε Class2.

2. Classify the remaining points, x51,……,x100 using KNN. Perform this for k=1,2,3,4,5,20,30.

```python
import numpy as np
from collections import Counter


# Generate 100 random values in [0, 1]
np.random.seed(42)
data = np.random.rand(100)


# Split into training (first 50) and test (last 50)
train_x = data[:50]
test_x  = data[50:]


# Label training data
train_y = ['Class1' if x <= 0.5 else 'Class2' for x in train_x]


def knn_predict(train_x, train_y, test_val, k):
    distances = np.abs(train_x - test_val)
    sorted_idx = np.argsort(distances)
```

```
      nearest_labels = np.array(train_y)[sorted_idx][:k]

      return Counter(nearest_labels).most_common(1)[0][0]


k_values = [1, 2, 3, 4, 5, 20, 30]


for k in k_values:
    print(f"--- For k = {k} ---")
    predictions = []
    for i, x in enumerate(test_x, start=51):
        pred = knn_predict(train_x, train_y, x, k)
        predictions.append(pred)
        print(f"Point x{i}: {x:.4f} -> Predicted: {pred}")
    counts = Counter(predictions)
    print(f"Summary for k = {k}: Class1 = {counts['Class1']}, Class2 = {counts['Class2']}\n")
```

Output:

--- For k = 1 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class1

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 1: Class1 = 25, Class2 = 25

--- For k = 2 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class1

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 2: Class1 = 25, Class2 = 25

--- For k = 3 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class2

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 3: Class1 = 24, Class2 = 26

--- For k = 4 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class2

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 4: Class1 = 24, Class2 = 26

--- For k = 5 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class2

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 5: Class1 = 24, Class2 = 26

--- For k = 20 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class2

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 20: Class1 = 24, Class2 = 26

--- For k = 30 ---

Point x51: 0.9696 -> Predicted: Class2

Point x52: 0.7751 -> Predicted: Class2

Point x53: 0.9395 -> Predicted: Class2

Point x54: 0.8948 -> Predicted: Class2

Point x55: 0.5979 -> Predicted: Class2

Point x56: 0.9219 -> Predicted: Class2

Point x57: 0.0885 -> Predicted: Class1

Point x58: 0.1960 -> Predicted: Class1

Point x59: 0.0452 -> Predicted: Class1

Point x60: 0.3253 -> Predicted: Class1

Point x61: 0.3887 -> Predicted: Class1

Point x62: 0.2713 -> Predicted: Class1

Point x63: 0.8287 -> Predicted: Class2

Point x64: 0.3568 -> Predicted: Class1

Point x65: 0.2809 -> Predicted: Class1

Point x66: 0.5427 -> Predicted: Class2

Point x67: 0.1409 -> Predicted: Class1

Point x68: 0.8022 -> Predicted: Class2

Point x69: 0.0746 -> Predicted: Class1

Point x70: 0.9869 -> Predicted: Class2

Point x71: 0.7722 -> Predicted: Class2

Point x72: 0.1987 -> Predicted: Class1

Point x73: 0.0055 -> Predicted: Class1

Point x74: 0.8155 -> Predicted: Class2

Point x75: 0.7069 -> Predicted: Class2

Point x76: 0.7290 -> Predicted: Class2

Point x77: 0.7713 -> Predicted: Class2

Point x78: 0.0740 -> Predicted: Class1

Point x79: 0.3585 -> Predicted: Class1

Point x80: 0.1159 -> Predicted: Class1

Point x81: 0.8631 -> Predicted: Class2

Point x82: 0.6233 -> Predicted: Class2

Point x83: 0.3309 -> Predicted: Class1

Point x84: 0.0636 -> Predicted: Class1

Point x85: 0.3110 -> Predicted: Class1

Point x86: 0.3252 -> Predicted: Class1

Point x87: 0.7296 -> Predicted: Class2

Point x88: 0.6376 -> Predicted: Class2

Point x89: 0.8872 -> Predicted: Class2

Point x90: 0.4722 -> Predicted: Class1

Point x91: 0.1196 -> Predicted: Class1

Point x92: 0.7132 -> Predicted: Class2

Point x93: 0.7608 -> Predicted: Class2

Point x94: 0.5613 -> Predicted: Class2

Point x95: 0.7710 -> Predicted: Class2

Point x96: 0.4938 -> Predicted: Class1

Point x97: 0.5227 -> Predicted: Class2

Point x98: 0.4275 -> Predicted: Class1

Point x99: 0.0254 -> Predicted: Class1

Point x100: 0.1079 -> Predicted: Class1

Summary for k = 30: Class1 = 25, Class2 = 25