```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.datasets import make_classification
from sklearn.linear_model import LogisticRegression, SGDClassifier
from mlxtend.plotting import plot_decision_regions
from sklearn.utils import shuffle
from sklearn.metrics import log_loss
```

https://drive.google.com/file/d/1FS-JXMl-PFGzA2ogy1xdBKVI6VbVDQMF/view?usp=sharing

```
!pip install --upgrade --no-cache-dir gdown
!gdown 1FS-JXMl-PFGzA2ogy1xdBKVI6VbVDQMF
```

```
Requirement already satisfied: gdown in /usr/local/lib/python3.10/dist-packages (4.7.3)
Collecting gdown
  Downloading gdown-5.0.1-py3-none-any.whl (16 kB)
Requirement already satisfied: beautifulsoup4 in /usr/local/lib/python3.10/dist-packages (from gdown) (4.11.2)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from gdown) (3.13.1)
Requirement already satisfied: requests[socks] in /usr/local/lib/python3.10/dist-packages (from gdown) (2.31.0)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (from gdown) (4.66.1)
Requirement already satisfied: soupsieve>1.2 in /usr/local/lib/python3.10/dist-packages (from beautifulsoup4->gdown) (2.5)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (3.3.2
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (2023.11.17)
Requirement already satisfied: PySocks!=1.5.7,>=1.5.6 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->gdown) (1.7.1)
Installing collected packages: gdown
  Attempting uninstall: gdown
    Found existing installation: gdown 4.7.3
    Uninstalling gdown-4.7.3:
      Successfully uninstalled gdown-4.7.3
Successfully installed gdown-5.0.1
Downloading...
From: https://drive.google.com/uc?id=1FS-JXMl-PFGzA2ogy1xdBKVI6VbVDQMF
To: /content/heart_disease_health_indicators.csv
100% 11.8M/11.8M [00:00<00:00, 43.0MB/s]
```

```
df = pd.read_csv('/content/heart_disease_health_indicators.csv')
```

```
df = df.rename(columns={'Income': 'HeartDiseaseorAttack', 'HeartDiseaseorAttack': 'Income'})
```

```
df['Income'], df['HeartDiseaseorAttack'] = df['HeartDiseaseorAttack'].copy(), df['Income'].copy()
```

```
# جدا کردن ویژگی‌ها و خروجی
features = df.iloc[:, :-1]  # ستون‌های ۲ تا آخر به عنوان ویژگی‌ها
output = df.iloc[:, -1]    # ستون اول به عنوان خروجی

# ایجاد دیتافریم جدید برای هر کلاس
class_0_samples = df[output == 0].head(100)
class_1_samples = df[output == 1].head(100)

# ادغام داده‌های دو کلاس در یک دیتافریم جدید
new_df = pd.concat([class_0_samples, class_1_samples], ignore_index=True)
```

```
shuffled_data = shuffle(new_df)
shuffled_data.to_csv('created_data.csv', index=False)
```

```
df1 = pd.read_csv('/content/created_data.csv')
df1
```

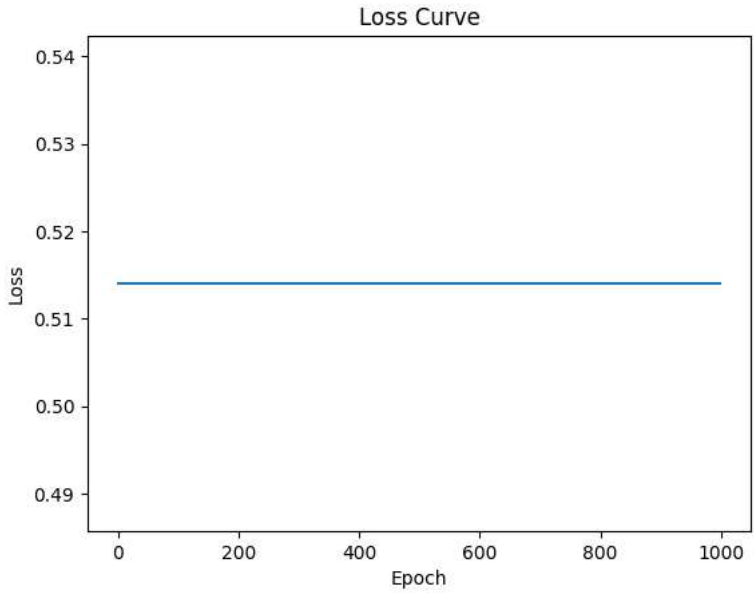
	Income	HighBP	HighChol	CholCheck	BMI	Smoker	Stroke	Diabetes	PhysActivity	Fruits	...	AnyHealthcare	NoDocbcCost	GenHlth
0	4	1	0	1	27	0	0	2	1	1	...	1	0	1
1	8	1	0	1	39	0	0	0	0	1	...	1	0	3
2	5	1	1	1	32	1	0	2	1	0	...	1	0	3
3	3	1	1	1	40	1	0	0	0	0	...	1	0	5
4	6	1	1	1	28	0	0	2	0	0	...	1	0	4
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
195	6	1	0	1	33	1	0	0	1	0	...	1	0	2
196	7	0	0	1	26	1	0	0	0	0	...	1	0	3
197	3	1	1	1	30	1	0	0	1	1	...	1	0	2
198	3	0	0	1	28	1	1	0	0	1	...	1	1	4
199	8	1	0	1	24	1	0	2	1	0	...	1	0	2

200 rows × 22 columns

```
X = df1.iloc[:, :-1]
y = df1.iloc[:, -1].values.reshape(-1,1)
X.shape,y.shape
```

```
((200, 21), (200, 1))
```

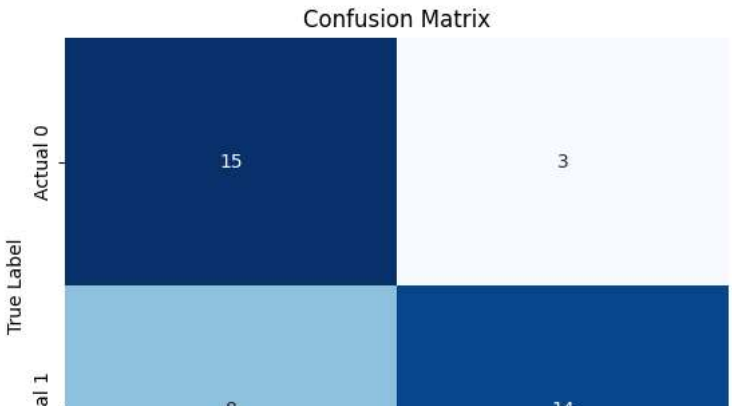
```
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2,random_state=42)
y_train = y_train.ravel()
y_test = y_test.ravel()
model = LogisticRegression(solver='liblinear', max_iter=1000, random_state=42)
# آموزش مدل و دریافت مقدار تابع اتلاف در هر تکرار
loss_history = [];

for epoch in range(1000):
    # آموزش مدل
    model.fit(x_train, y_train)

    # پیش‌بینی احتمالات
    y_prob = model.predict_proba(x_train);

    # محاسبه تابع اتلاف
    loss = -np.sum(np.log(y_prob[np.arange(len(y_prob)), y_train])) / len(y_train);

    loss_history.append(loss);


# نمایش نمودار تغییرات تابع اتلاف در هر تکرار
plt.plot(loss_history)
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.title('Loss Curve')
plt.show()
```




```
y_pred=model.predict(x_test)
import seaborn as sns
from sklearn.metrics import confusion_matrix, precision_score, recall_score
conf_matrix = confusion_matrix(y_test, y_pred)
print("Confusion Matrix:")
print(conf_matrix)
# محاسبه recall 0 برای کلاس
recall_class_0 = recall_score(y_test, y_pred, pos_label=0)
print(f"Recall for Class 0: {recall_class_0}")

# محاسبه precision 0 برای کلاس
precision_class_0 = precision_score(y_test, y_pred, pos_label=0)
print(f"Precision for Class 0: {precision_class_0}")

# محاسبه recall 1 برای کلاس
recall_class_1 = recall_score(y_test, y_pred, pos_label=1)
print(f"Recall for Class 1: {recall_class_1}")

# محاسبه precision 1 برای کلاس
precision_class_1 = precision_score(y_test, y_pred, pos_label=1)
print(f"Precision for Class 1: {precision_class_1}")
```

```
Confusion Matrix:
[[13  7]
 [ 3 17]]
Recall for Class 0: 0.65
Precision for Class 0: 0.8125
Recall for Class 1: 0.85
Precision for Class 1: 0.7083333333333334
```

```
conf_matrix = confusion_matrix(y_test, y_pred)

# رسم ماتریس درهم‌ریختگی با استفاده از سی‌بورن
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', cbar=False,
            xticklabels=['Predicted 0', 'Predicted 1'], yticklabels=['Actual 0', 'Actual 1'])

plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.title('Confusion Matrix')
plt.show()
```


Confusion Matrix
True Label
Actual 0
al 1
15
3