TI35_DSBDA_5th_HeartDisease

January 30, 2025

[1]:
```
import pandas as pd
```

[3]:
```
df=pd.read_csv("/home/bcl07/heart_disease.csv")
```

[4]:
```
df
```

[4]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0
…	…	…	..	…	…	…	…	…	…	…	…	..	…	…
1020	59	1	1	140	221	0	1	164	1	0.0	2	0	2	1
1021	60	1	0	125	258	0	0	141	1	2.8	1	1	3	0
1022	47	1	0	110	275	0	0	118	1	1.0	1	1	2	0
1023	50	0	0	110	254	0	0	159	0	0.0	2	0	2	1
1024	54	1	0	120	188	0	1	113	0	1.4	1	1	3	0

[1025 rows x 14 columns]

[5]:
```
df.columns
```

[5]:
```
Index(['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach',
       'exang', 'oldpeak', 'slope', 'ca', 'thal', 'target'],
      dtype='object')
```

[6]:
```
df.isnull().sum()
```

[6]:
```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

[8]:
```
df=df.drop_duplicates()
```

[9]:
```
df.describe()
```

[9]:

	age	sex	cp	trestbps	chol	fbs
count	302.00000	302.000000	302.000000	302.000000	302.000000	302.000000
mean	54.42053	0.682119	0.963576	131.602649	246.500000	0.149007
std	9.04797	0.466426	1.032044	17.563394	51.753489	0.356686
min	29.00000	0.000000	0.000000	94.000000	126.000000	0.000000
25%	48.00000	0.000000	0.000000	120.000000	211.000000	0.000000
50%	55.50000	1.000000	1.000000	130.000000	240.500000	0.000000
75%	61.00000	1.000000	2.000000	140.000000	274.750000	0.000000
max	77.00000	1.000000	3.000000	200.000000	564.000000	1.000000

	restecg	thalach	exang	oldpeak	slope	ca
count	302.000000	302.000000	302.000000	302.000000	302.000000	302.000000
mean	0.526490	149.569536	0.327815	1.043046	1.397351	0.718543
std	0.526027	22.903527	0.470196	1.161452	0.616274	1.006748
min	0.000000	71.000000	0.000000	0.000000	0.000000	0.000000
25%	0.000000	133.250000	0.000000	0.000000	1.000000	0.000000
50%	1.000000	152.500000	0.000000	0.800000	1.000000	0.000000
75%	1.000000	166.000000	1.000000	1.600000	2.000000	1.000000
max	2.000000	202.000000	1.000000	6.200000	2.000000	4.000000

	thal	target

```
count  302.000000  302.000000
mean     2.314570    0.543046
std      0.613026    0.498970
min      0.000000    0.000000
25%      2.000000    0.000000
50%      2.000000    1.000000
75%      3.000000    1.000000
max      3.000000    1.000000
```

[10]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 302 entries, 0 to 878
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       302 non-null    int64
 1   sex       302 non-null    int64
 2   cp        302 non-null    int64
 3   trestbps  302 non-null    int64
 4   chol      302 non-null    int64
 5   fbs       302 non-null    int64
 6   restecg   302 non-null    int64
 7   thalach   302 non-null    int64
 8   exang     302 non-null    int64
 9   oldpeak   302 non-null    float64
 10  slope     302 non-null    int64
 11  ca        302 non-null    int64
 12  thal      302 non-null    int64
 13  target    302 non-null    int64
dtypes: float64(1), int64(13)
memory usage: 35.4 KB
```

[11]:
```
df.isna().sum()
```

[11]:
```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
```

```
thal        0
target      0
dtype: int64
```

[12]:
```
df.head()
```

[12]:
```
   age  sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  slope  \
0   52    1   0       125   212    0        1      168      0      1.0      2
1   53    1   0       140   203    1        0      155      1      3.1      0
2   70    1   0       145   174    0        1      125      1      2.6      0
3   61    1   0       148   203    0        1      161      0      0.0      2
4   62    0   0       138   294    1        1      106      0      1.9      1

   ca  thal  target
0   2     3       0
1   0     3       0
2   0     3       0
3   1     3       0
4   3     2       0
```

[13]:
```
df.fbs.unique()
```

[13]:
```
array([0, 1])
```

[16]:
```
subSet1 = df[['age','cp','chol','thal']]
```

[18]:
```
subSet2 = df[['exang','slope','target']]
```

[19]:
```
merged_df = subSet1.merge(right=subSet2,how='cross')
merged_df.head()
```

[19]:
```
   age  cp  chol  thal  exang  slope  target
0   52   0   212     3      0      2       0
1   52   0   212     3      1      0       0
2   52   0   212     3      1      0       0
3   52   0   212     3      0      2       0
4   52   0   212     3      0      1       0
```

[20]:
```
df.columns
```

[20]:
```
Index(['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach',
       'exang', 'oldpeak', 'slope', 'ca', 'thal', 'target'],
      dtype='object')
```

[21]:
```
def remove_outliers(column):
    Q1 = column.quantile(0.25)
    Q3 = column.quantile(0.75)
```

```
    IQR = Q3 - Q1
    threshold = 1.5 * IQR
    outlier_mask = (column < Q1 - threshold) | (column > Q3 + threshold)
    return column[~outlier_mask]
```

[23]:
```
col_name = ['cp','thal','exang','oldpeak','slope','ca']
for col in col_name:
    df[col] = remove_outliers(df[col])
```

```
/tmp/ipykernel_10564/1228815343.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df[col] = remove_outliers(df[col])
/tmp/ipykernel_10564/1228815343.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
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docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df[col] = remove_outliers(df[col])
/tmp/ipykernel_10564/1228815343.py:3: SettingWithCopyWarning:
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Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df[col] = remove_outliers(df[col])
/tmp/ipykernel_10564/1228815343.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```
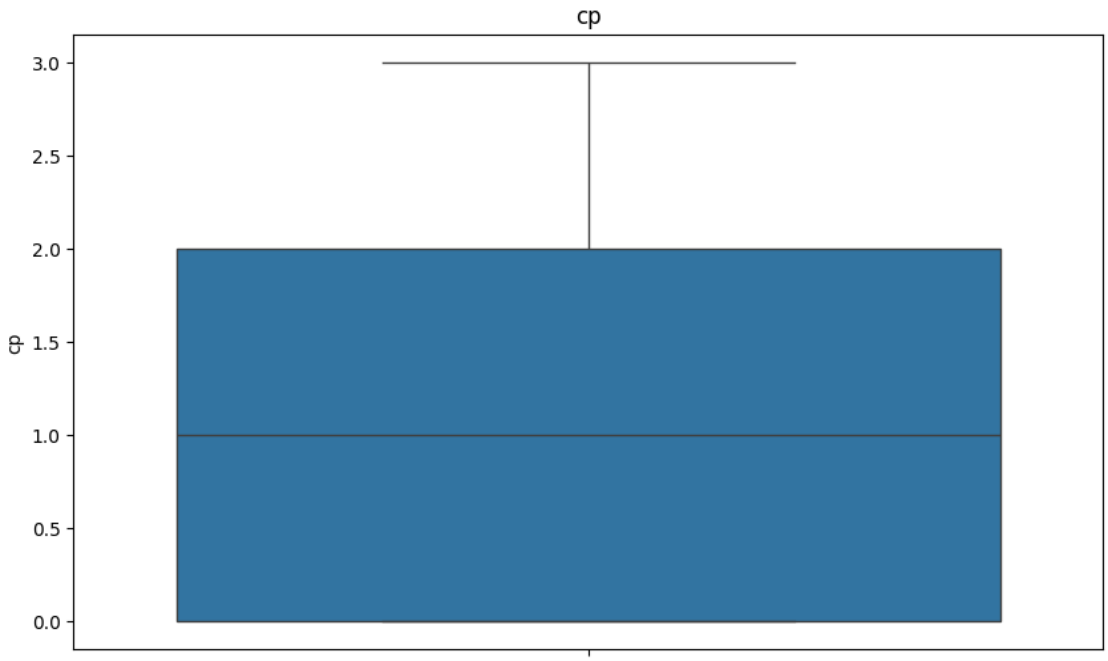
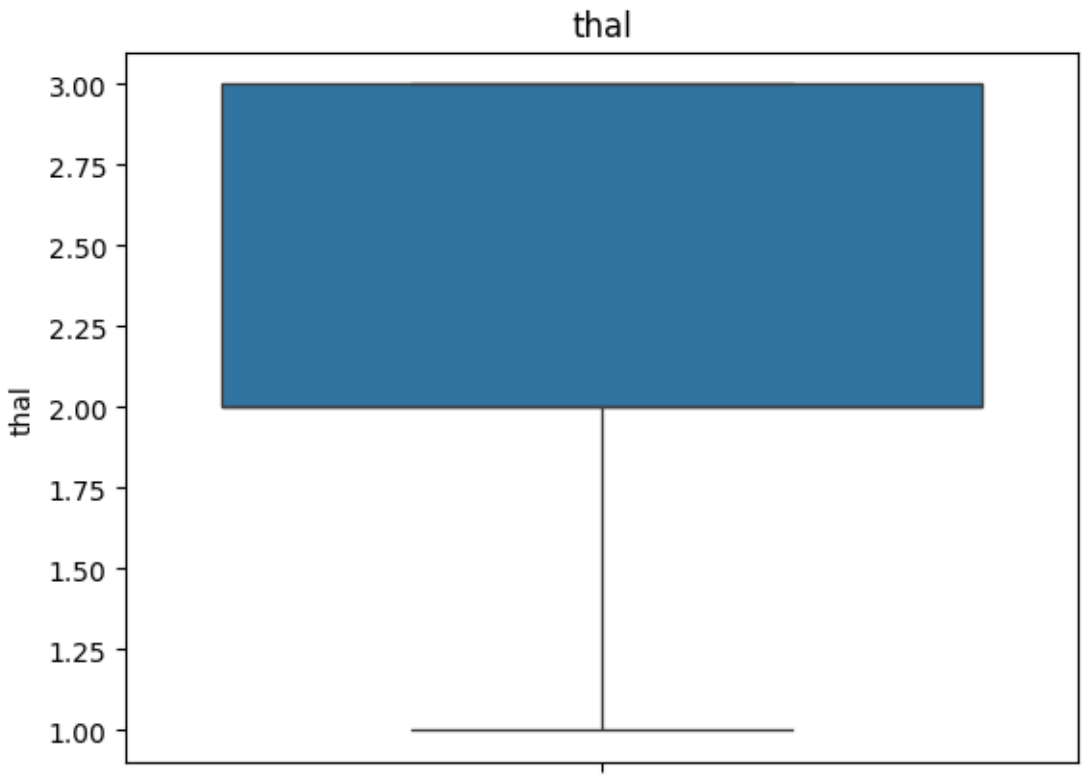
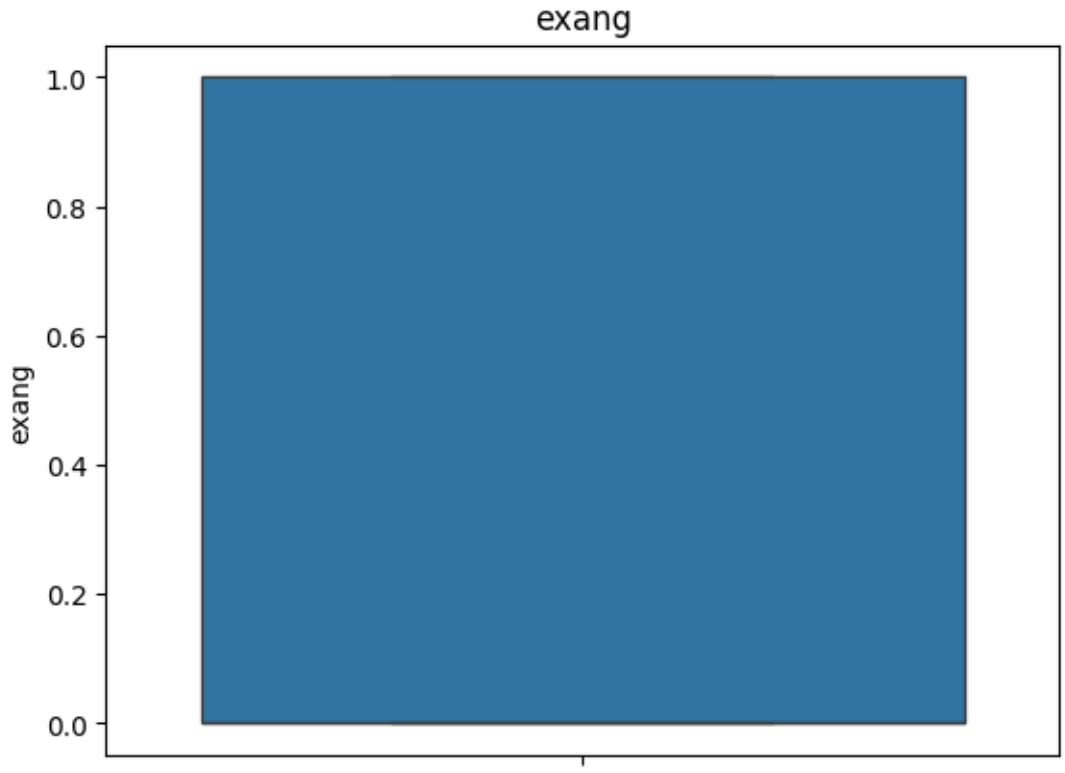

```
See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df[col] = remove_outliers(df[col])
```

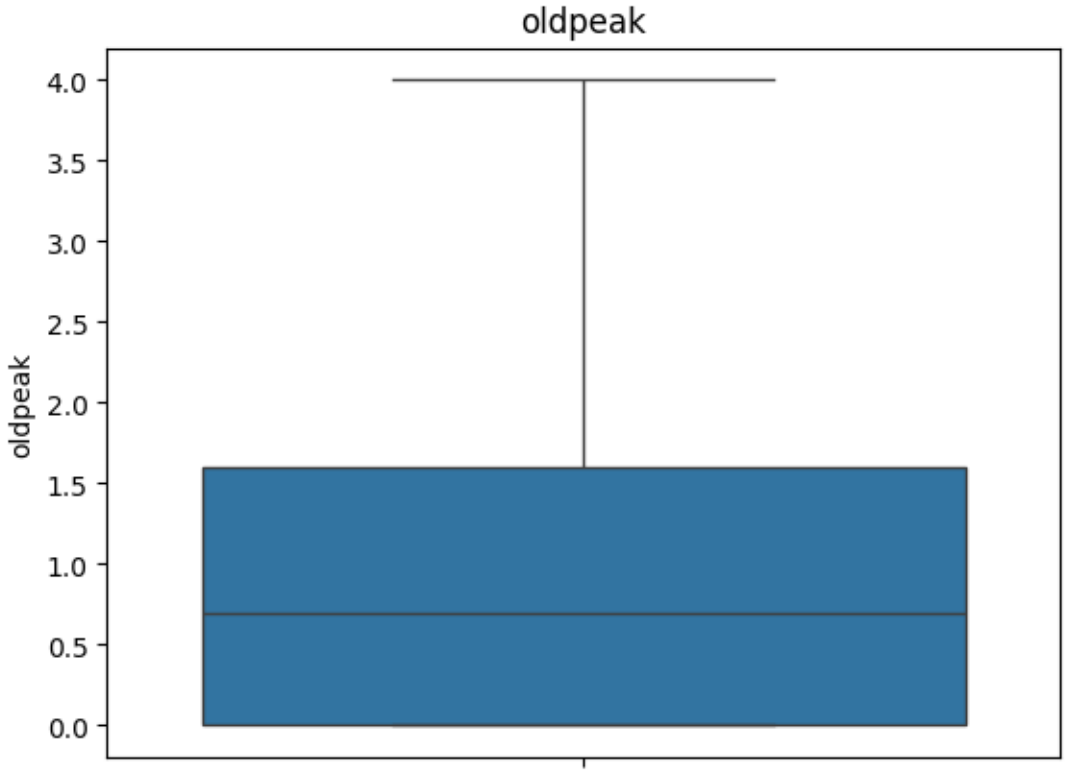
[28]:
```
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import accuracy_score,confusion_matrix
from sklearn.linear_model import LogisticRegression
import seaborn as sns
import matplotlib.pyplot as plt
```

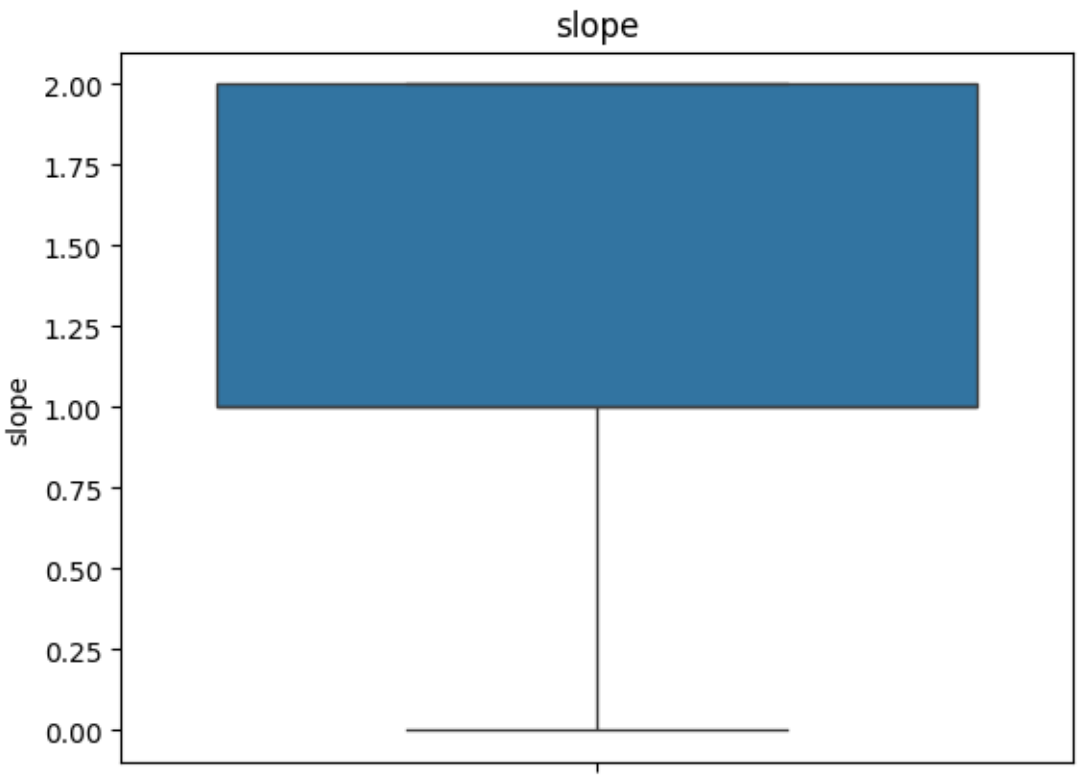
[29]:
```
plt.figure(figsize=(10, 6))  # Adjust the figure size if needed

for col in col_name:
    sns.boxplot(data=df[col])
    plt.title(col)
    plt.show()
```

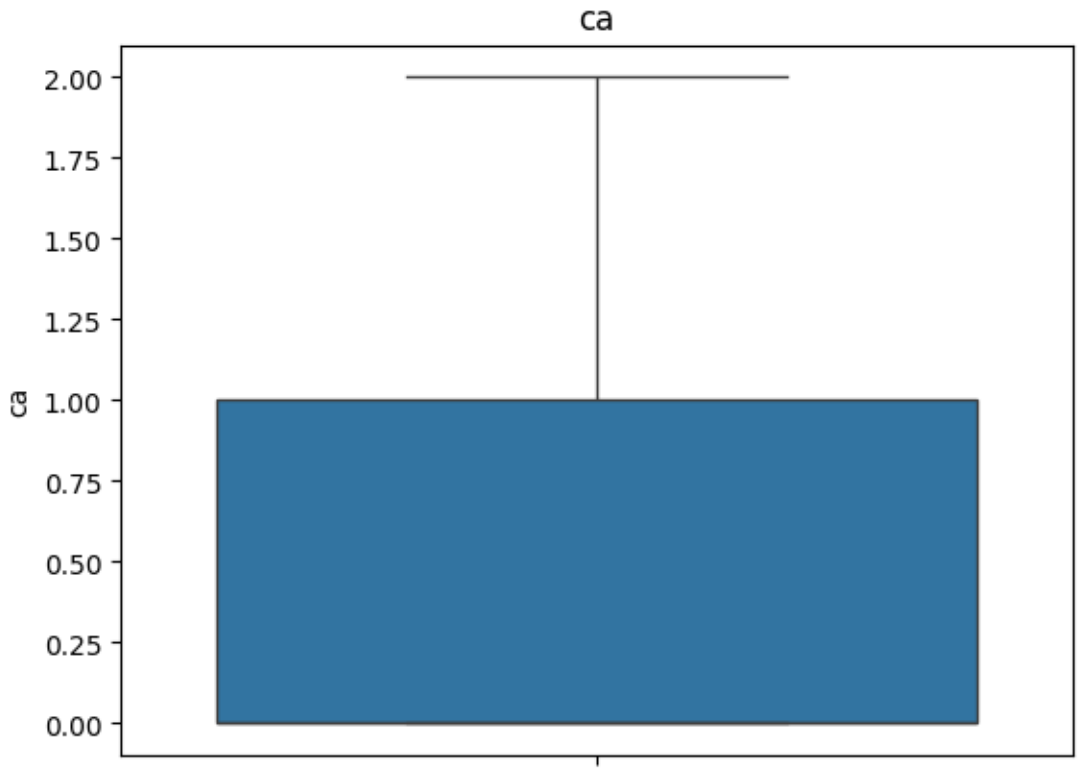



thal
thal
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00


exang
exang
1.0
0.8
0.6
0.4
0.2
0.0


oldpeak
oldpeak
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0


slope
slope
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00


ca
ca
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00

[30]:
```
df = df.dropna()
```

[31]:
```
df.isna().sum()
```

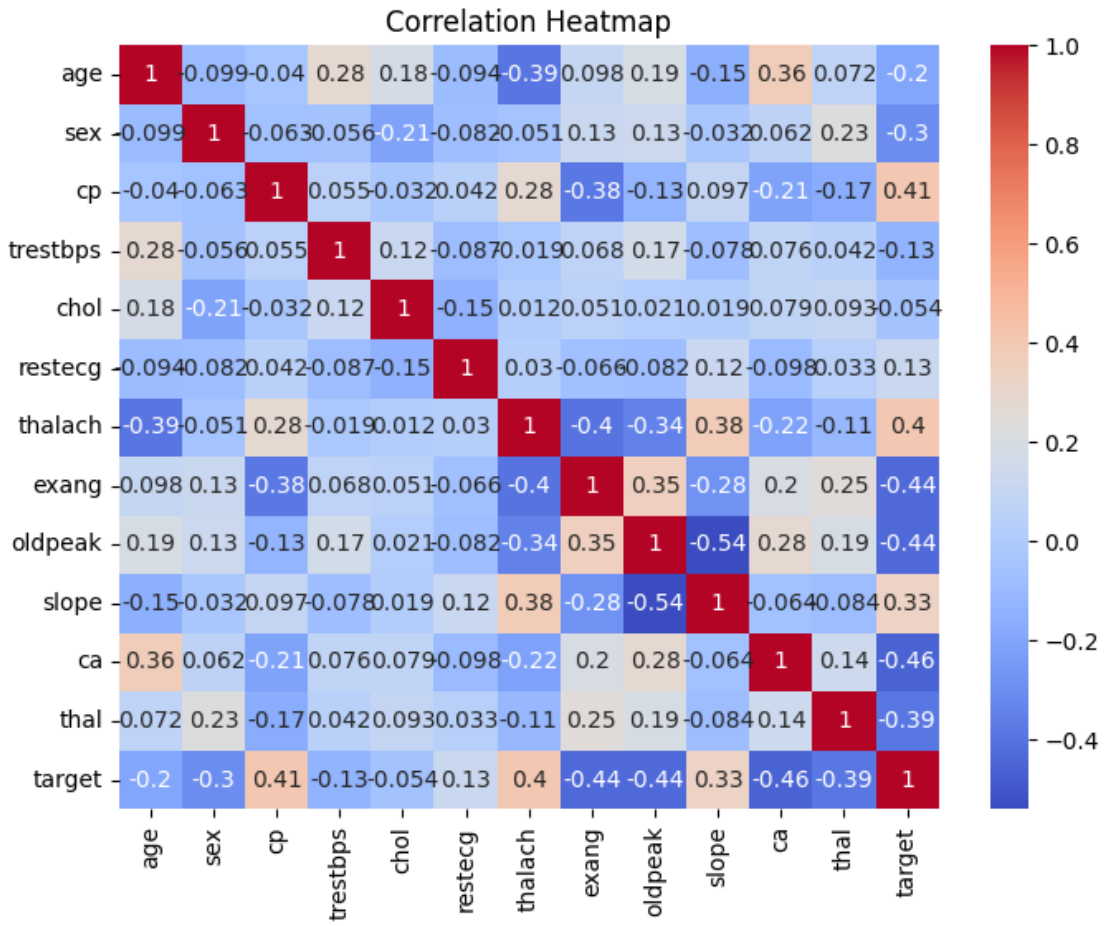
[31]:
```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

[32]:
```
df = df.drop('fbs',axis=1)
```

[34]:
```
correlations = df.corr()['target'].drop('target')

# Print correlations
print("Correlation with the Target:")
print(correlations)
print()

# Plot correlation heatmap
plt.figure(figsize=(8, 6))
sns.heatmap(df.corr(), annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')
plt.show()
```

```
Correlation with the Target:
age        -0.199970
sex        -0.300311
cp          0.408985
trestbps   -0.132882
chol       -0.053834
restecg     0.125710
thalach     0.398870
exang      -0.435511
oldpeak    -0.436247
```

```
slope       0.327420
ca         -0.459629
thal       -0.389514
Name: target, dtype: float64
```



[37]:
```
x = df[['cp','thal','exang','oldpeak','slope','ca']]
y = df.target
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=0)

x_train.shape,x_test.shape,y_train.shape,y_test.shape
```

[37]:
```
((219, 6), (55, 6), (219,), (55,))
```

[38]:
```
from sklearn.preprocessing import StandardScaler
```

[39]:
```
scaler = StandardScaler()
```

[40]:
```
x_train_scaled = scaler.fit_transform(x_train)
x_test_scaled = scaler.transform(x_test)
```

[42]:
```
import numpy as np
```

[43]:
```
y_train= np.array(y_train).reshape(-1, 1)
y_test= np.array(y_test).reshape(-1, 1)
```

[44]:
```
y_train.shape
```

[44]:
```
(219, 1)
```

[45]:
```
model = LogisticRegression()
model.fit(x_train_scaled, y_train)

# Make predictions on the test set
y_pred = model.predict(x_test_scaled)

# Evaluate the model's accuracy
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.8181818181818182

/home/bcl07/.local/lib/python3.8/site-packages/sklearn/utils/validation.py:1183:
DataConversionWarning: A column-vector y was passed when a 1d array was
expected. Please change the shape of y to (n_samples, ), for example using
ravel().
  y = column_or_1d(y, warn=True)
```

[46]:
```
#Classification model using Decision Tree
from sklearn.tree import DecisionTreeClassifier
tc=DecisionTreeClassifier(criterion='entropy')
tc.fit(x_train_scaled,y_train)
y_pred=tc.predict(x_test_scaled)

print("Training Accuracy Score :",accuracy_score(y_pred,y_test))
print("Training Confusion Matrix  :",confusion_matrix(y_pred,y_test))
```

```
Training Accuracy Score : 0.7454545454545455
Training Confusion Matrix  : [[21  5]
 [ 9 20]]
```

[ ]:
```

```