IMPORTING LIBRARIES

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

import matplotlib.pyplot as plt

import numpy as np

import seaborn as sns
```

IMPORTING DATASET

In [2]:
```
df = pd.read_csv("heart.csv")
```

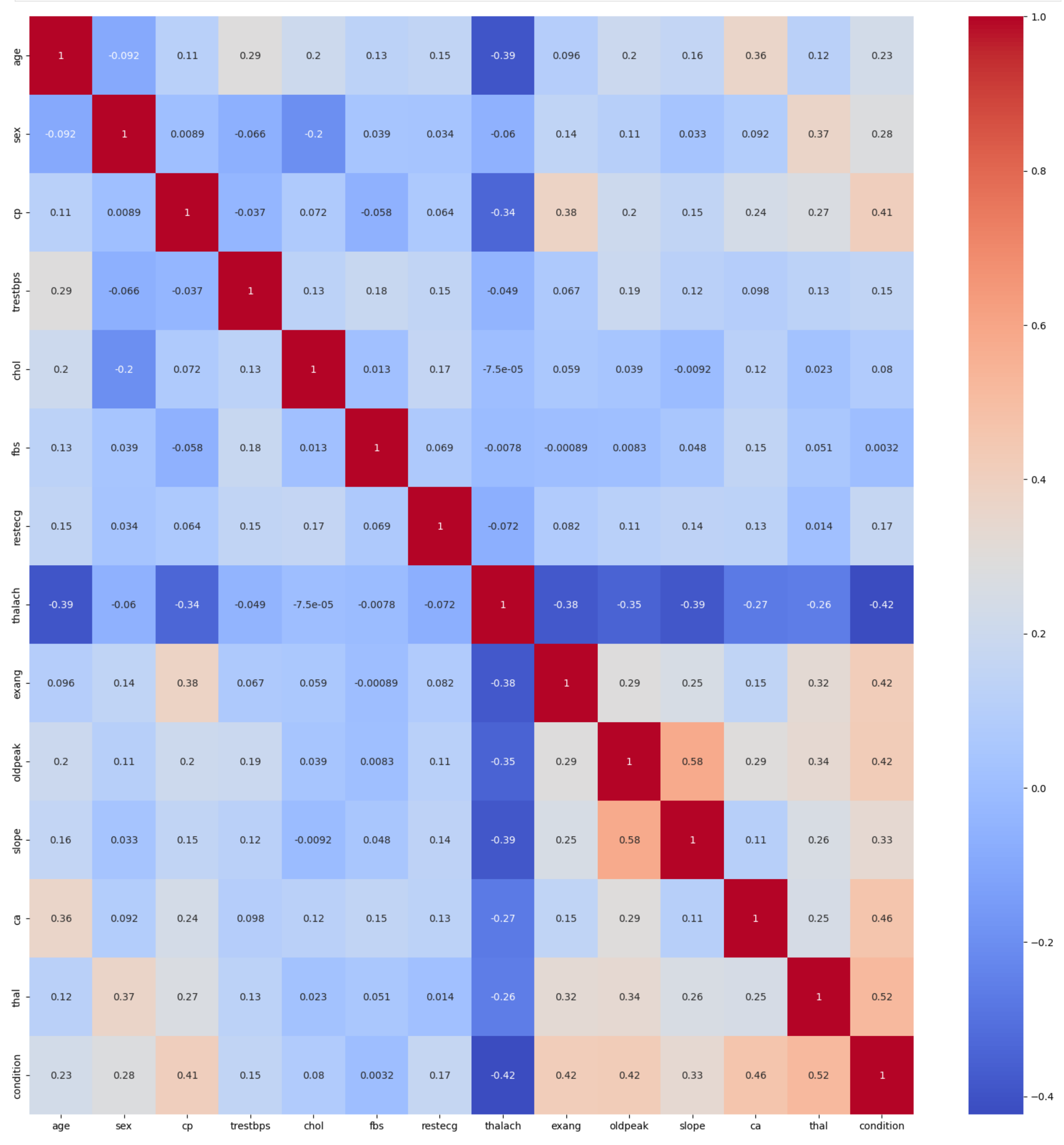
FEATURE ENGINEERING

In [3]:
```
df.isnull().sum()
```

Out[3]:
```
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
condition    0
dtype: int64
```

FEATURE SELECTION

In [4]:
```
plt.figure(figsize=(20,20))
d = sns.heatmap(df.corr(), cmap="coolwarm", annot= True)
```



FEATURE SCALING

In [5]:
```
from sklearn.preprocessing import StandardScaler
standardScaler = StandardScaler()
dataset = pd.get_dummies(df, columns = ['sex', 'cp', 'fbs', 'restecg', 'exang', 'slope', 'ca', 'thal'])
columns_to_scale = ['age', 'trestbps', 'chol', 'thalach', 'oldpeak']
dataset [columns_to_scale] = standardScaler.fit_transform(dataset [columns_to_scale])
```

In [6]:
```
dataset.head()
```

Out[6]:

	age	trestbps	chol	thalach	oldpeak	condition	sex_0	sex_1	cp_0	cp_1	...	slope_0	slope_1	slope_2	ca_0	ca_1	ca_2	ca_3	thal_0	thal_1	thal_2
0	1.600302	1.596266	-0.257179	-0.812095	-0.820813	0	False	True	True	False	...	False	True	False	False	True	False	False	True	False	False
1	1.600302	0.468418	-0.160859	0.061157	0.639470	0	True	False	True	False	...	True	False	False	False	False	True	False	True	False	False
2	1.268242	1.032342	-0.411292	-1.554358	1.326662	0	True	False	True	False	...	False	False	True	True	False	False	False	True	False	False
3	1.157555	0.355633	0.667499	1.065396	0.295874	1	False	True	True	False	...	False	True	False	False	True	False	False	True	False	False
4	1.046868	-1.223355	-0.700254	-0.244481	0.639470	0	False	True	True	False	...	False	True	False	True	False	False	False	True	False	False

5 rows × 29 columns

MODEL SELECTION

In [7]:
```
from sklearn.model_selection import cross_val_score
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score
```

In [8]:
```
x = df.drop('condition', axis=1)
```

In [9]:
```
y = df['condition']
```

In [10]:
```
from sklearn.model_selection import train_test_split
```

In [11]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y, test_size=0.2, random_state=42)
```

In [12]:
```
y_test
```

Out[12]:
```
167    1
211    1
63     0
154    0
5      0
77     0
183    1
158    1
9      0
139    0
285    0
78     0
92     0
101    0
42     0
222    1
283    1
33     1
263    1
148    0
245    1
45     1
60     0
46     0
278    0
237    1
175    1
234    1
17     0
279    1
111    0
219    1
24     0
82     0
7      1
75     1
108    0
84     0
90     0
73     0
116    0
126    1
233    0
59     0
195    1
208    1
97     0
185    1
176    0
124    0
93     1
294    1
182    1
275    0
192    1
292    1
25     0
224    1
6      0
181    1
Name: condition, dtype: int64
```

SUPPORT VECTOR MACHINE

In [13]:
```
from sklearn import svm
```

In [14]:
```
svm = svm.SVC()
```

In [15]:
```
svm.fit(x_train,y_train)
```

Out[15]:
```
▾ SVC
SVC()
```

In [16]:
```
y_pred2 = svm.predict(x_test)
```

In [17]:
```
accuracy_score (y_test,y_pred2)
```

Out[17]: 0.5666666666666667

LOGISTIC REGRESSION

In [18]:
```
from sklearn.linear_model import LogisticRegression
```

In [19]:
```
log = LogisticRegression()
log.fit(x_train,y_train)
```

```
C:\Users\Kethan\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\linear_model\_logistic.py:458: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Out[19]:
```
▾ LogisticRegression
LogisticRegression()
```

In [20]:
```
y_pred1 = log.predict(x_test)
```

In [21]:
```
from sklearn.metrics import accuracy_score
```

In [22]:
```
accuracy_score (y_test,y_pred1)
```

Out[22]: 0.7333333333333333

In [23]:
```
clf = LogisticRegression(max_iter=1000)  # You can increase the value if needed
clf.fit(x_train, y_train)
```

Out[23]:
```
▾ LogisticRegression
LogisticRegression(max_iter=1000)
```

GRADIENT BOOSTING CLASSIFIER

In [24]:
```
from sklearn.ensemble import GradientBoostingClassifier
```

In [25]:
```
gbc = GradientBoostingClassifier()
```

In [26]:
```
gbc.fit(x_train,y_train)
```

Out[26]:
```
▾ GradientBoostingClassifier
GradientBoostingClassifier()
```

In [27]:
```
y_pred6 = gbc.predict(x_test)
```

In [28]:
```
accuracy_score(y_test,y_pred6)
```

Out[28]: 0.7333333333333333

RANDOM FOREST CLASSIFIER

In [29]:
```
from sklearn. ensemble import RandomForestClassifier
```

In [30]:
```
rf = RandomForestClassifier()
```

In [31]:
```
rf.fit(x_train,y_train)
```

Out[31]:
```
▾ RandomForestClassifier
RandomForestClassifier()
```

In [32]:
```
y_pred5= rf.predict(x_test)
```

In [33]:
```
clf = RandomForestClassifier(n_estimators=100, random_state=42)
clf.fit(x_train, y_train)
```

Out[33]:
```
▾ RandomForestClassifier
RandomForestClassifier(random_state=42)
```

KNN

In [34]:
```
knn_classifier = KNeighborsClassifier (n_neighbors = 5)
```

In [35]:
```
knn_classifier.fit(x_train, y_train)
```

Out[35]:
```
▾ KNeighborsClassifier
KNeighborsClassifier()
```

In [36]:
```
score=cross_val_score (knn_classifier, x_train,y_train, cv=10)
```

In [37]:
```
y_pred_knn = knn_classifier.predict(x_test)
```

In [38]:
```
accuracy_score (y_test, y_pred_knn)
```

Out[38]: 0.5666666666666667

SAVE MODEL USING JOBLIB

In [39]:
```
import joblib
```

In [40]:
```
joblib.dump (rf, 'model_joblib_heart')
```

Out[40]: ['model_joblib_heart']

In [41]:
```
model = joblib.load('model_joblib_heart')
```

GUI

In [42]:
```
import tkinter as tk
from tkinter import ttk
```

In [43]:
```
# Create a function to predict heart disease
def predict_heart_disease():
    # Extract values from the input fields
    age = float(age_entry.get())
    sex = float(sex_entry.get())
    cp = float(cp_entry.get())
    trestbps = float(trestbps_entry.get())
    chol = float(chol_entry.get())
    fbs = float(fbs_entry.get())
    restecg = float(restecg_entry.get())
    thalach = float(thalach_entry.get())
    exang = float(exang_entry.get())
    oldpeak = float(oldpeak_entry.get())
    slope = float(slope_entry.get())
    ca = float(ca_entry.get())
    thal = float(thal_entry.get())

    # Make a prediction using the trained classifier
    input_data = [[age, sex, cp, trestbps, chol, fbs, restecg, thalach, exang, oldpeak, slope, ca, thal]]
    prediction = clf.predict(input_data)

    # Display the prediction result
    if prediction[0] == 0:
        result_label.config(text="No Heart Disease")
    elif prediction[0] == 1:
        result_label.config(text="Heart Disease")

# Create the tkinter GUI
root = tk.Tk()
root.title("Heart Disease Prediction")

mainframe = ttk.Frame(root, padding="10")
mainframe.grid(column=0, row=0, sticky=(tk.N, tk.W, tk.E, tk.S))
mainframe.columnconfigure(0, weight=1)
mainframe.rowconfigure(0, weight=1)

# Create input fields for various features
ttk.Label(mainframe, text="Age").grid(column=1, row=1)
ttk.Label(mainframe, text="Sex").grid(column=1, row=2)
ttk.Label(mainframe, text="Chest Pain Type (CP)").grid(column=1, row=3)
ttk.Label(mainframe, text="Resting Blood Pressure (trestbps)").grid(column=1, row=4)
ttk.Label(mainframe, text="Cholesterol (chol)").grid(column=1, row=5)
ttk.Label(mainframe, text="Fasting Blood Sugar (fbs)").grid(column=1, row=6)
ttk.Label(mainframe, text="Resting Electrocardiographic Results (restecg)").grid(column=1, row=7)
ttk.Label(mainframe, text="Maximum Heart Rate Achieved (thalach)").grid(column=1, row=8)
ttk.Label(mainframe, text="Exercise-Induced Angina (exang)").grid(column=1, row=9)
ttk.Label(mainframe, text="Oldpeak").grid(column=1, row=10)
ttk.Label(mainframe, text="Slope of the Peak Exercise ST Segment (slope)").grid(column=1, row=11)
ttk.Label(mainframe, text="Number of Major Vessels (ca)").grid(column=1, row=12)
ttk.Label(mainframe, text="Thalassemia (thal)").grid(column=1, row=13)

age_entry = ttk.Entry(mainframe)
age_entry.grid(column=2, row=1)
sex_entry = ttk.Entry(mainframe)
sex_entry.grid(column=2, row=2)
cp_entry = ttk.Entry(mainframe)
cp_entry.grid(column=2, row=3)
trestbps_entry = ttk.Entry(mainframe)
trestbps_entry.grid(column=2, row=4)
chol_entry = ttk.Entry(mainframe)
chol_entry.grid(column=2, row=5)
fbs_entry = ttk.Entry(mainframe)
fbs_entry.grid(column=2, row=6)
restecg_entry = ttk.Entry(mainframe)
restecg_entry.grid(column=2, row=7)
thalach_entry = ttk.Entry(mainframe)
thalach_entry.grid(column=2, row=8)
exang_entry = ttk.Entry(mainframe)
exang_entry.grid(column=2, row=9)
oldpeak_entry = ttk.Entry(mainframe)
oldpeak_entry.grid(column=2, row=10)
slope_entry = ttk.Entry(mainframe)
slope_entry.grid(column=2, row=11)
ca_entry = ttk.Entry(mainframe)
ca_entry.grid(column=2, row=12)
thal_entry = ttk.Entry(mainframe)
thal_entry.grid(column=2, row=13)

# Add a button to make predictions
predict_button = ttk.Button(mainframe, text="Predict", command=predict_heart_disease)
predict_button.grid(column=2, row=14)

# Add a label to display the result
result_label = ttk.Label(mainframe, text="")
result_label.grid(column=2, row=15)

root.mainloop()
```