In [1]:

```
#Pawar ved balasaheb(T512037)
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:

```
dataFrame=pd.read_csv('heart.csv')
```

In [5]:

```
dataFrame.shape
```

Out[5]:

```
(303, 15)
```

In [7]:

```
dataFrame.head()
```

Out[7]:

	Unnamed: 0	Age	Sex	ChestPain	RestBP	Chol	Fbs	RestECG	MaxHR	ExAng	C
0	1	63	1	typical	145	233	1	2	150	0	
1	2	67	1	asymptomatic	160	286	0	2	108	1	
2	3	67	1	asymptomatic	120	229	0	2	129	1	
3	4	37	1	nonanginal	130	250	0	0	187	0	
4	5	41	0	nontypical	130	204	0	2	172	0	

In [9]:

```
dataFrame.tail()
```

Out[9]:

	Unnamed: 0	Age	Sex	ChestPain	RestBP	Chol	Fbs	RestECG	MaxHR	ExAng
298	299	45	1	typical	110	264	0	0	132	0
299	300	68	1	asymptomatic	144	193	1	0	141	0
300	301	57	1	asymptomatic	130	131	0	0	115	1
301	302	57	0	nontypical	130	236	0	2	174	0
302	303	38	1	nonanginal	138	175	0	0	173	0

In [11]:

```
dataFrame=dataFrame.drop("Unnamed: 0",axis =1)
```

In [13]:

```
dataFrame.dtypes
```

```
Out[13]: Age            int64
         Sex            int64
         ChestPain     object
         RestBP         int64
         Chol           int64
         Fbs            int64
         RestECG        int64
         MaxHR          int64
         ExAng          int64
         Oldpeak      float64
         Slope          int64
         Ca           float64
         Thal          object
         AHD           object
         dtype: object
```

```
In [15]: dataFrame.describe()
```

Out[15]:

	Age	Sex	RestBP	Chol	Fbs	RestECG	Max
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.0000
mean	54.438944	0.679868	131.689769	246.693069	0.148515	0.990099	149.6072
std	9.038662	0.467299	17.599748	51.776918	0.356198	0.994971	22.8750
min	29.000000	0.000000	94.000000	126.000000	0.000000	0.000000	71.0000
25%	48.000000	0.000000	120.000000	211.000000	0.000000	0.000000	133.5000
50%	56.000000	1.000000	130.000000	241.000000	0.000000	1.000000	153.0000
75%	61.000000	1.000000	140.000000	275.000000	0.000000	2.000000	166.0000
max	77.000000	1.000000	200.000000	564.000000	1.000000	2.000000	202.0000

```
In [17]: dataFrame.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 14 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   Age        303 non-null    int64  
 1   Sex        303 non-null    int64  
 2   ChestPain  303 non-null    object 
 3   RestBP     303 non-null    int64  
 4   Chol       303 non-null    int64  
 5   Fbs        303 non-null    int64  
 6   RestECG    303 non-null    int64  
 7   MaxHR      303 non-null    int64  
 8   ExAng      303 non-null    int64  
 9   Oldpeak    303 non-null    float64
 10  Slope      303 non-null    int64  
 11  Ca         299 non-null    float64
 12  Thal       301 non-null    object 
 13  AHD        303 non-null    object 
dtypes: float64(2), int64(9), object(3)
memory usage: 33.3+ KB
```

In [19]:
```
dataFrame.Ca.value_counts()
```

Out[19]:
```
Ca
0.0    176
1.0     65
2.0     38
3.0     20
Name: count, dtype: int64
```

In [21]:
```
dataFrame.Sex.value_counts()
```

Out[21]:
```
Sex
1    206
0     97
Name: count, dtype: int64
```

In [23]:
```
dataFrame.isnull()
```

Out[23]:

	Age	Sex	ChestPain	RestBP	Chol	Fbs	RestECG	MaxHR	ExAng	Oldpeak	S
0	False	False	False	False	False	False	False	False	False	False	
1	False	False	False	False	False	False	False	False	False	False	
2	False	False	False	False	False	False	False	False	False	False	
3	False	False	False	False	False	False	False	False	False	False	
4	False	False	False	False	False	False	False	False	False	False	
...	...	...	...	...	...	...	...	...	...	...	
298	False	False	False	False	False	False	False	False	False	False	
299	False	False	False	False	False	False	False	False	False	False	
300	False	False	False	False	False	False	False	False	False	False	
301	False	False	False	False	False	False	False	False	False	False	
302	False	False	False	False	False	False	False	False	False	False	

303 rows × 14 columns

In [25]:
```
dataFrame.isnull().sum()
```

Out[25]:

```
Age          0
Sex          0
ChestPain    0
RestBP       0
Chol         0
Fbs          0
RestECG      0
MaxHR        0
ExAng        0
Oldpeak      0
Slope        0
Ca           4
Thal         2
AHD          0
dtype: int64
```

In [27]:

```
dataFrame.Age.mean()
```

Out[27]:

```
54.43894389438944
```

In [29]:

```
dataFrame.describe()
```

Out[29]:

	Age	Sex	RestBP	Chol	Fbs	RestECG	Max
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.0000
mean	54.438944	0.679868	131.689769	246.693069	0.148515	0.990099	149.6072
std	9.038662	0.467299	17.599748	51.776918	0.356198	0.994971	22.8750
min	29.000000	0.000000	94.000000	126.000000	0.000000	0.000000	71.0000
25%	48.000000	0.000000	120.000000	211.000000	0.000000	0.000000	133.5000
50%	56.000000	1.000000	130.000000	241.000000	0.000000	1.000000	153.0000
75%	61.000000	1.000000	140.000000	275.000000	0.000000	2.000000	166.0000
max	77.000000	1.000000	200.000000	564.000000	1.000000	2.000000	202.0000

In [31]:

```
dataFrame["Age"].mean(axis=0)
```

Out[31]:

```
54.43894389438944
```

In [33]:

```
var=dataFrame.loc[:,['Age','Sex','ChestPain','RestBP','Chol']]
```

In [35]:

```
var
```

Out[35]:

	Age	Sex	ChestPain	RestBP	Chol
0	63	1	typical	145	233
1	67	1	asymptomatic	160	286
2	67	1	asymptomatic	120	229
3	37	1	nonanginal	130	250
4	41	0	nontypical	130	204
...	...	...	...	...	...
298	45	1	typical	110	264
299	68	1	asymptomatic	144	193
300	57	1	asymptomatic	130	131
301	57	0	nontypical	130	236
302	38	1	nonanginal	138	175

303 rows × 5 columns

In [37]:

```
from sklearn.model_selection import train_test_split

X_train, X_test = train_test_split(var, test_size = 0.25, random_state = 42)
X_train.shape, X_test.shape
```

Out[37]:

```
((227, 5), (76, 5))
```

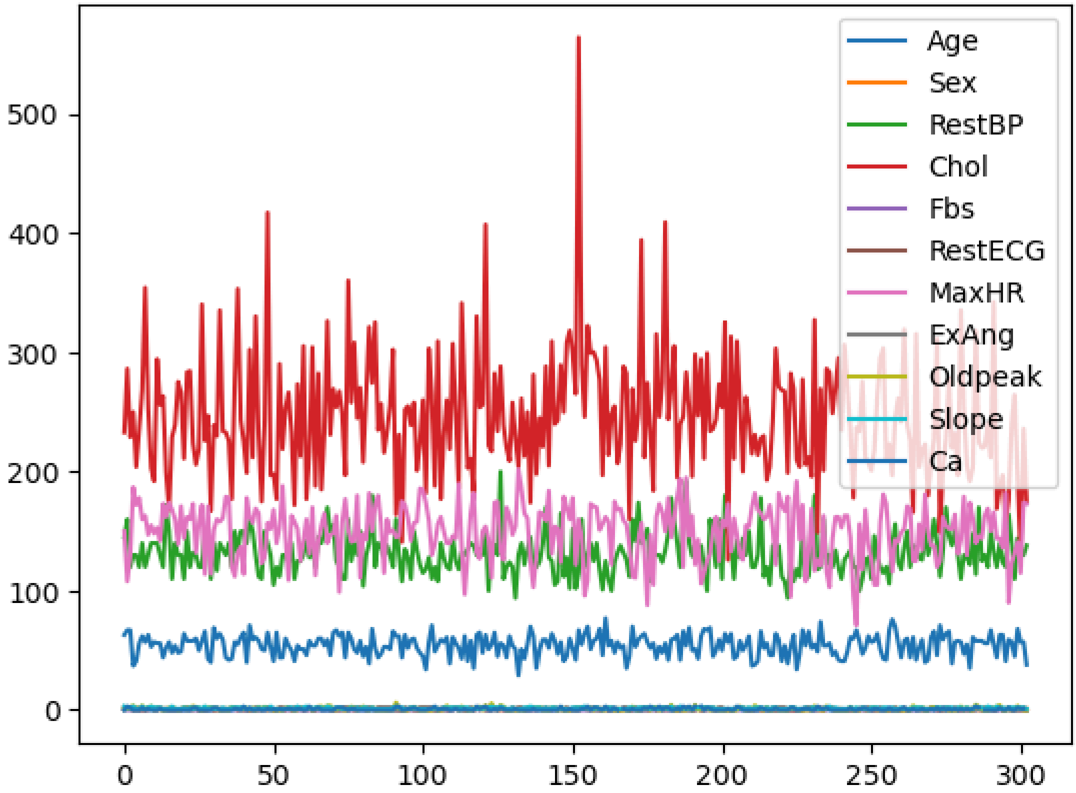
In [39]:

```
tp=90
fp=11
fn=19
tn=40
acc=(tp+tn)/(tp+fp+fn+tn)
pre=tp/(tp+fp)
rec=tp/(tp+fn)
print("Accuracy is : {}".format(acc))
print("Precision is : {}".format(pre))
print("Recall is : {}".format(rec))
print("F1-Score is : {}".format((2*pre*rec)/(pre+rec)))
```

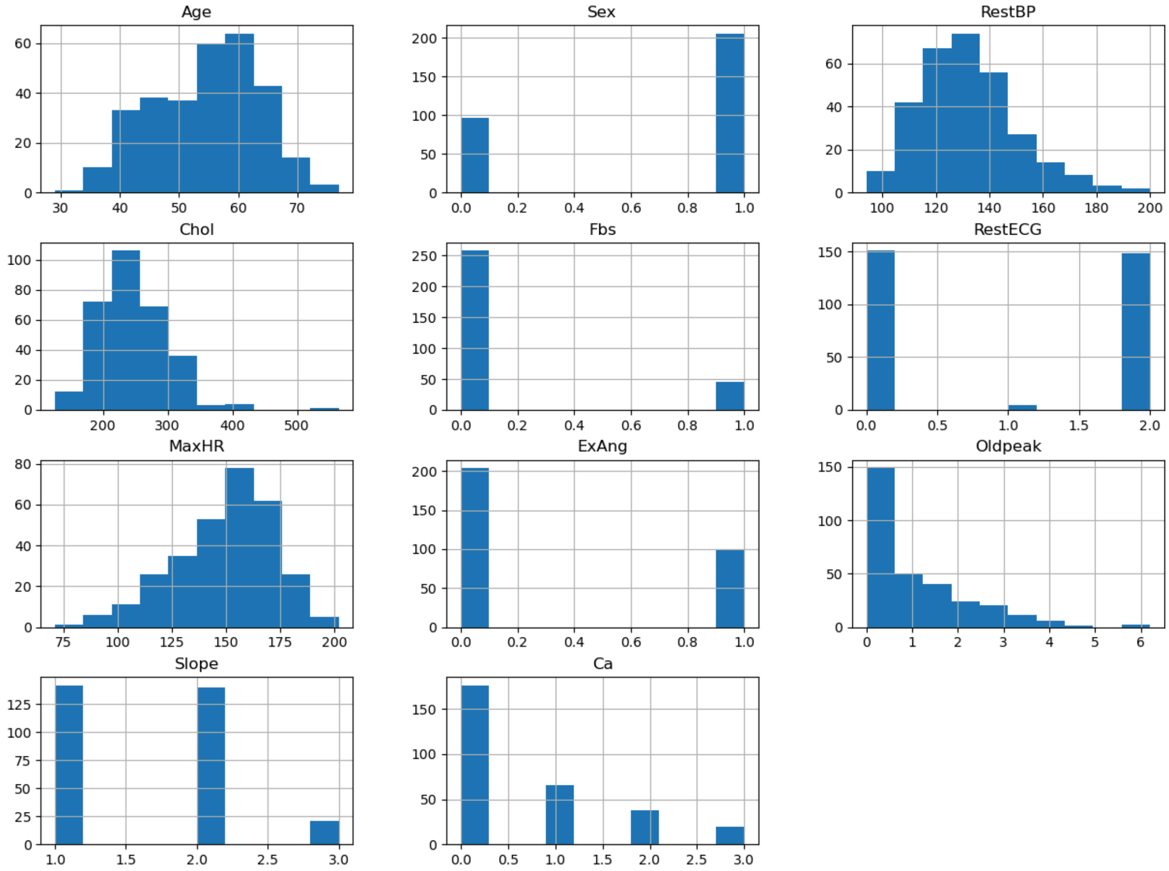
```
Accuracy is : 0.8125
Precision is : 0.8910891089108911
Recall is : 0.8256880733944955
F1-Score is : 0.8571428571428572
```

In [43]:

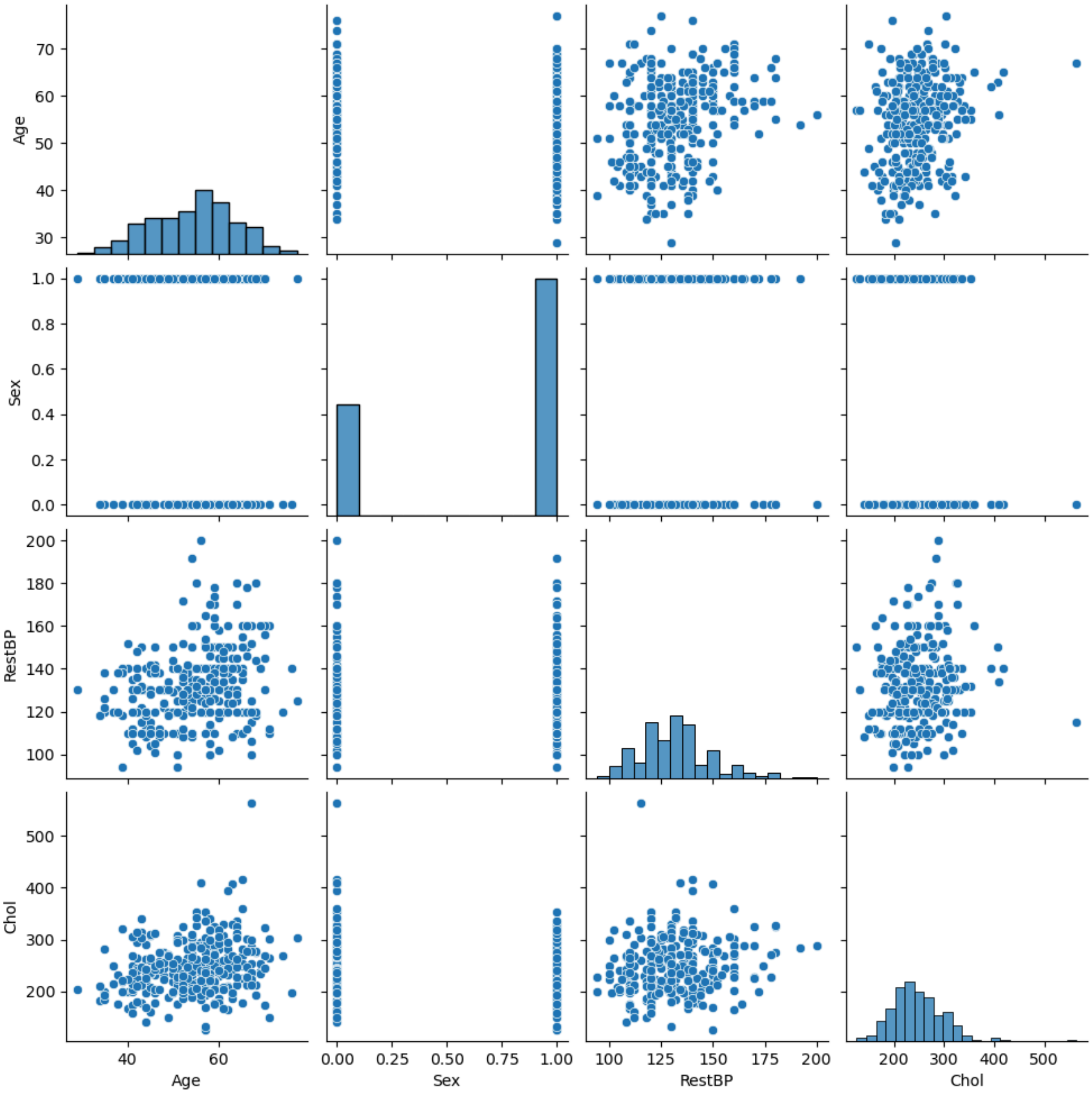
```
dataFrame.plot();
```



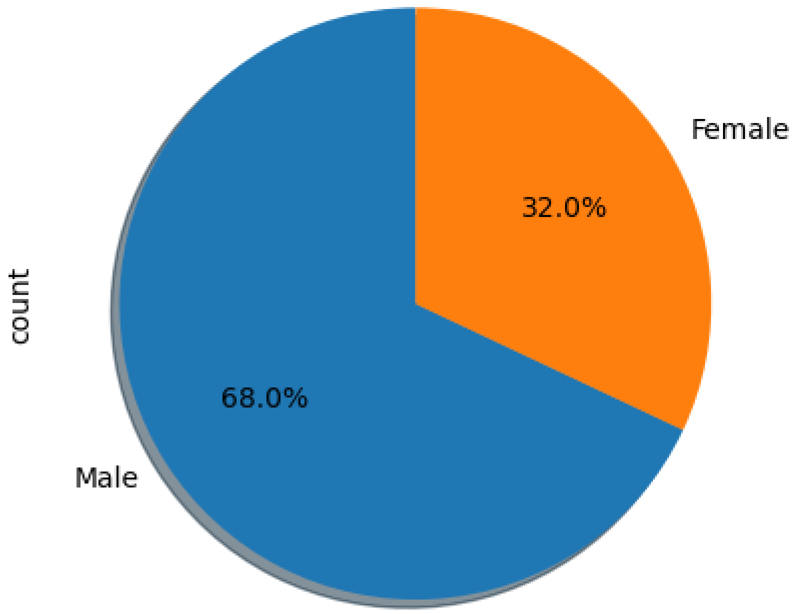
In [45]:
```
dataFrame.hist(bins = 10,figsize = (15,11));
```



In [47]:
```
sns.pairplot(var);
```

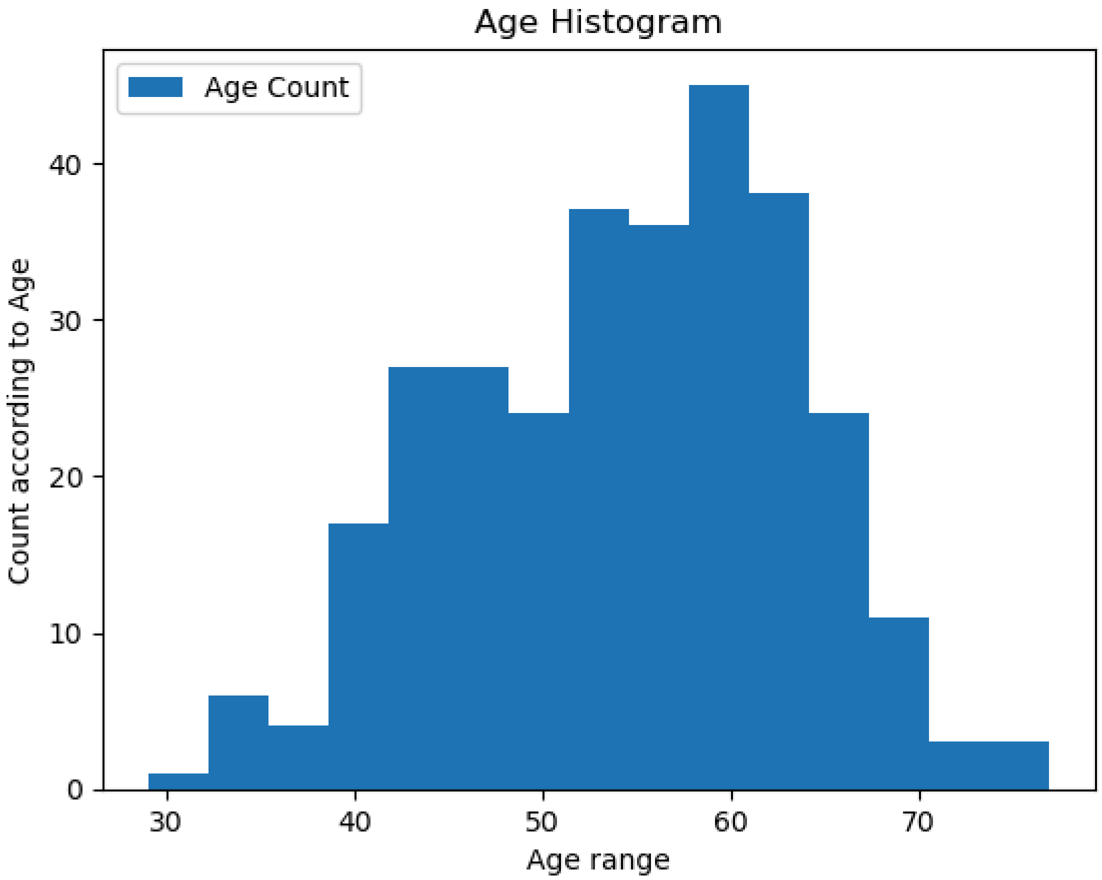


In [49]:
```
labels=['Male','Female']
dataFrame.Sex.value_counts().plot(kind= "pie",labels =labels,startangle=90,shadc
                                  explode=(0,0),autopct='%1.1f%%' );
```



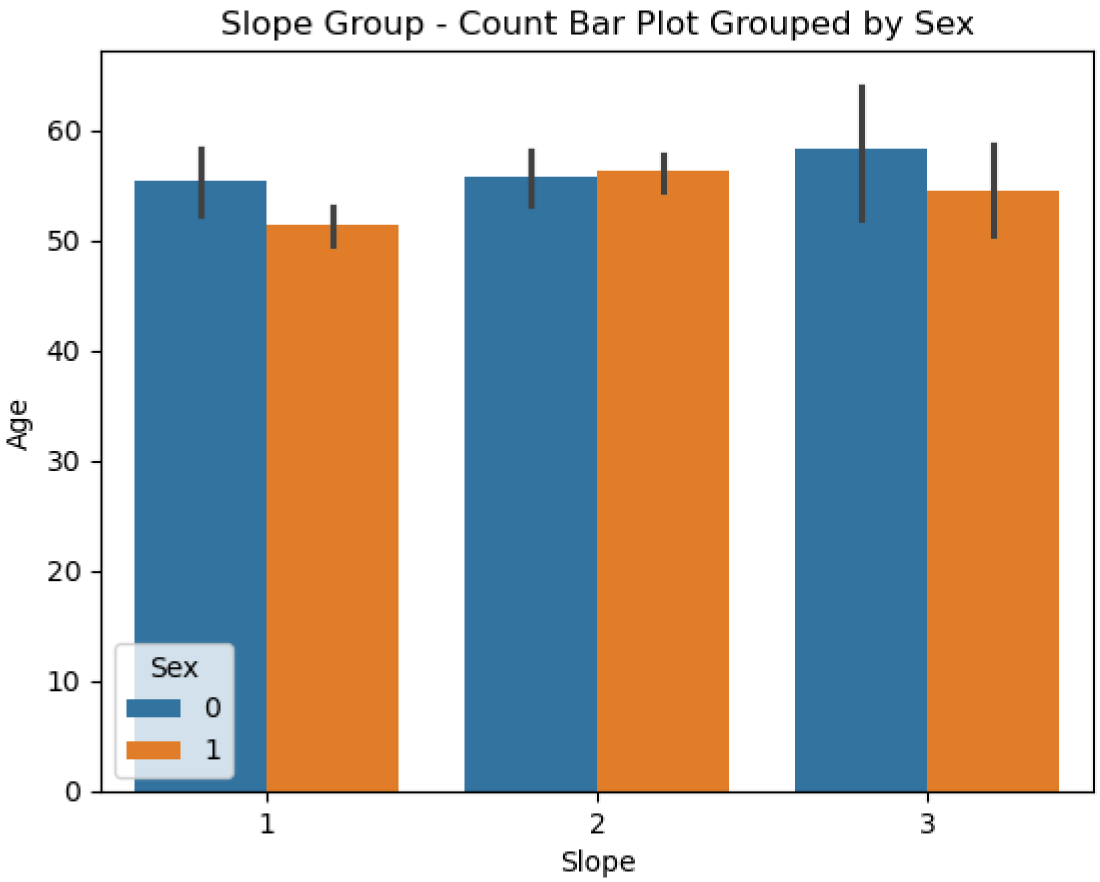
In [51]:

```
plt.hist(dataFrame["Age"],bins=15,label="Age Count")
plt.title("Age Histogram")
plt.xlabel("Age range")
plt.ylabel("Count according to Age")
plt.legend(loc="upper left");
```

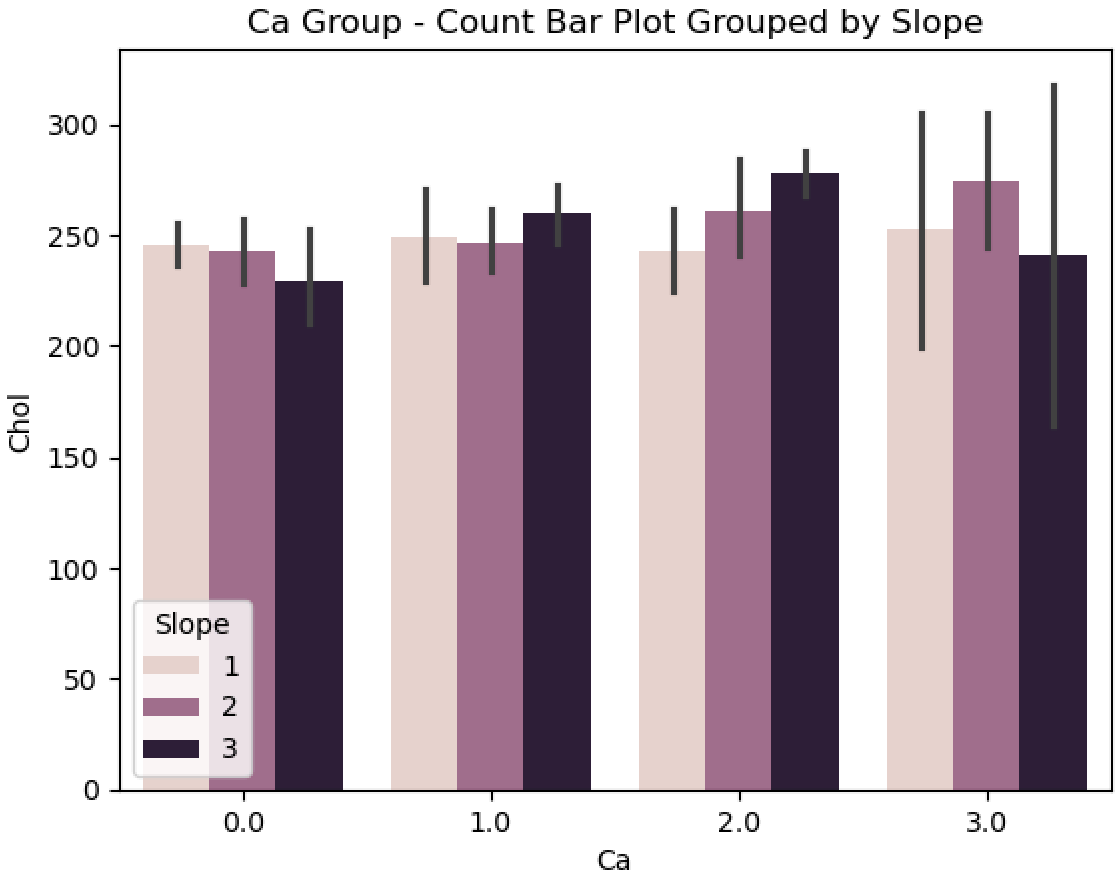


In [53]:

```
sns.barplot(x = "Slope", y = "Age", hue = "Sex", data = dataFrame)
plt.title("Slope Group - Count Bar Plot Grouped by Sex")
plt.show()
```

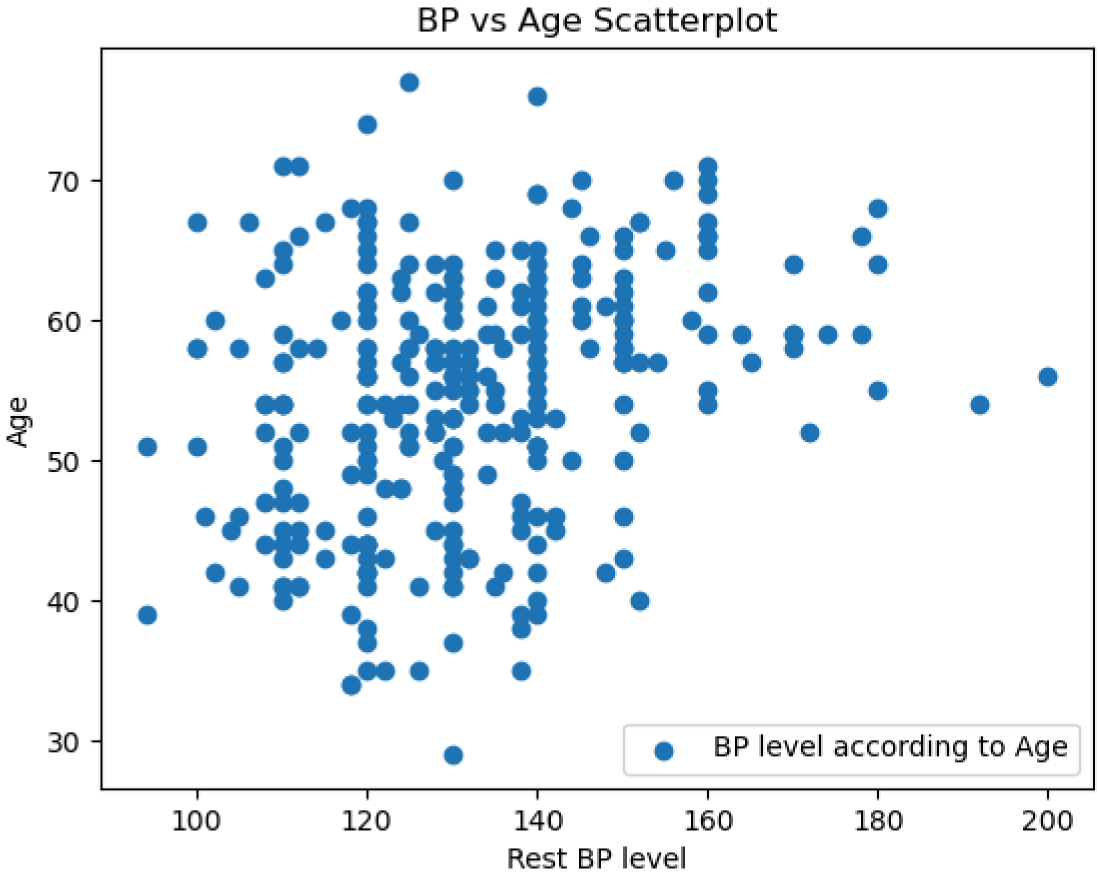


In [55]:
```
sns.barplot(x = "Ca", y = "Chol", hue = "Slope", data = dataFrame)
plt.title("Ca Group - Count Bar Plot Grouped by Slope")
plt.show()
```



In [57]:

```
plt.scatter(dataFrame["RestBP"],dataFrame["Age"],label="BP level according to Ag
plt.title("BP vs Age Scatterplot")
plt.xlabel("Rest BP level")
plt.ylabel("Age")
plt.legend(loc="lower right");
```



In [ ]: