In [84]:
```
import numpy as np
import pandas as pd
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import cross_val_score
from sklearn.preprocessing import MinMaxScaler
from sklearn.ensemble import ExtraTreesClassifier
from sklearn.feature_selection import SelectKBest
from sklearn.feature_selection import chi2, f_classif,mutual_info_classif
import matplotlib.pyplot as plt
```

In [85]:
```
card_df = pd.read_csv("CardiologyN-Wekat.csv")
card_df['class'].value_counts()
```

Out[85]:
```
1    165
0    138
Name: class, dtype: int64
```

In [86]:
```
col = card_df.columns
scaler = MinMaxScaler()
scaler.fit(card_df)
scaled_np = scaler.transform(card_df)
scaled_df = pd.DataFrame(scaled_np)
scaled_df.columns = col
scaled_df
```

Out[86]:

	age	sex	chest-pain-type	blood-pressure	cholesterol	Fasting-blood-sugar<120	resting-ecg	maximum-heart-rate	angina
0	0.645833	1.0	1.000000	0.339623	0.182648	0.0	1.0	0.465649	1.0
1	0.416667	1.0	0.333333	0.339623	0.319635	0.0	0.0	0.763359	0.0
2	0.729167	1.0	0.000000	0.150943	0.194064	0.0	1.0	0.557252	1.0
3	0.708333	1.0	1.000000	0.339623	0.292237	0.0	1.0	0.580153	0.0
4	0.500000	1.0	1.000000	0.433962	0.175799	1.0	1.0	0.641221	1.0
...	...	...	...	...	...	...	...	...	...
298	0.395833	1.0	0.666667	0.283019	0.294521	1.0	0.0	0.793893	0.0
299	0.583333	1.0	1.000000	0.358491	0.184932	0.0	0.0	0.740458	1.0
300	0.416667	1.0	0.666667	0.226415	0.052511	0.0	1.0	0.419847	0.0
301	0.937500	0.0	0.333333	0.245283	0.326484	0.0	1.0	0.381679	1.0
302	0.520833	0.0	0.666667	0.622642	0.171233	0.0	0.0	0.702290	0.0

303 rows × 14 columns

In [87]:
```
y= scaled_df['class']
X = scaled_df.drop(['class'], axis = 1)
clf = DecisionTreeClassifier(random_state = 0)
val_score = cross_val_score(clf, X, y, cv= 10)
print(val_score.mean(),val_score.std())
```

```
0.7284946236559139 0.09198577508953756
```

In [88]:
```
forest = ExtraTreesClassifier(n_estimators = 25,random_state=0)
val_score = cross_val_score(forest, X, y, cv= 10)
print(val_score.mean(),val_score.std())
```

```
0.8216129032258065 0.07214316581733367
```

In [89]:
```
X_new = SelectKBest(chi2, k=7).fit_transform(X,y)
#X_new.shape
X_new
```

Out[89]:
```
array([[1.        , 1.        , 1.        , ..., 0.5       , 0.66666667,
        1.        ],
       [1.        , 0.33333333, 0.        , ..., 0.        , 0.        ,
        0.        ],
       [1.        , 0.        , 1.        , ..., 0.5       , 0.        ,
        0.        ],
       ...,
       [1.        , 0.66666667, 0.        , ..., 0.        , 1.        ,
        0.        ],
       [0.        , 0.33333333, 1.        , ..., 0.        , 0.33333333,
        0.        ],
       [0.        , 0.66666667, 0.        , ..., 0.        , 0.33333333,
        0.        ]])
```

In [90]:
```
val_score = cross_val_score(clf, X_new, y, cv= 10)
print(val_score.mean(),val_score.std())
```

```
0.7518279569892472 0.09677275984601073
```

In [91]:
```
val_score = cross_val_score(forest, X_new, y, cv= 10)
print(val_score.mean(),val_score.std())
```

```
0.8082795698924732 0.07172623342257498
```

In [92]:

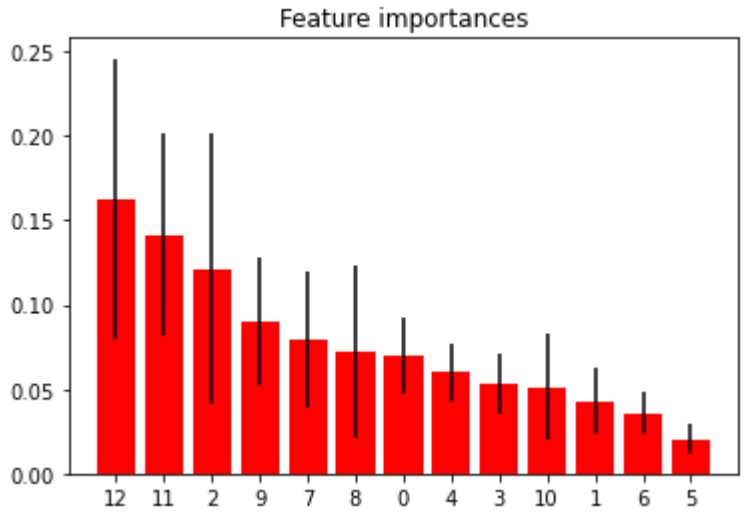
```
forest.fit(X, y)
importances = forest.feature_importances_
std = np.std([tree.feature_importances_ for tree in forest.estimators_],
             axis=0)
indices = np.argsort(importances)[::-1]

# Print the feature ranking
print("Feature ranking:")

for f in range(X.shape[1]):
    print("%d. feature %s (%f)" % (f + 1, X.columns[indices[f]], importances[

# Plot the impurity-based feature importances of the forest
plt.figure()
plt.title("Feature importances")
plt.bar(range(X.shape[1]), importances[indices],
        color="r", yerr=std[indices], align="center")
plt.xticks(range(X.shape[1]), indices)
plt.xlim([-1, X.shape[1]])
plt.show()
```

```
Feature ranking:
1. feature thal (0.162457)
2. feature #colored-vessels (0.141236)
3. feature chest-pain-type (0.121296)
4. feature peak (0.090071)
5. feature maximum-heart-rate (0.079244)
6. feature angina (0.072200)
7. feature age (0.069743)
8. feature cholesterol (0.059903)
9. feature blood-pressure (0.053414)
10. feature slope (0.051281)
11. feature sex (0.042853)
12. feature resting-ecg (0.035848)
13. feature Fasting-blood-sugar<120 (0.020455)
```



In [93]:
```
X.columns
```

Out[93]:
```
Index(['age', 'sex', 'chest-pain-type', 'blood-pressure', 'cholesterol',
       'Fasting-blood-sugar<120', 'resting-ecg', 'maximum-heart-rate',
       'angina', 'peak', 'slope', '#colored-vessels', 'thal'],
      dtype='object')
```

In [94]:
```
X_new = X[['thal','#colored-vessels','chest-pain-type','peak','maximum-heart-
X_new
```

Out[94]:

	thal	#colored-vessels	chest-pain-type	peak	maximum-heart-rate	angina	age
0	1.0	0.666667	1.000000	0.387097	0.465649	1.0	0.645833
1	0.0	0.000000	0.333333	0.096774	0.763359	0.0	0.416667
2	0.0	0.000000	0.000000	0.290323	0.557252	1.0	0.729167
3	1.0	0.333333	1.000000	0.225806	0.580153	0.0	0.708333
4	1.0	0.000000	1.000000	0.500000	0.641221	1.0	0.500000
...	...	...	...	...	...	...	...
298	0.0	0.666667	0.666667	0.000000	0.793893	0.0	0.395833
299	1.0	0.000000	1.000000	0.000000	0.740458	1.0	0.583333
300	0.0	1.000000	0.666667	0.129032	0.419847	0.0	0.416667
301	0.0	0.333333	0.333333	0.032258	0.381679	1.0	0.937500
302	0.0	0.333333	0.666667	0.000000	0.702290	0.0	0.520833

303 rows × 7 columns

In [95]:
```
val_score = cross_val_score(clf, X_new, y, cv= 10)
print(val_score.mean(),val_score.std())
```

```
0.725268817204301 0.08965478943988954
```

In [96]:
```
val_score = cross_val_score(forest, X_new, y, cv= 10)
print(val_score.mean(),val_score.std())
```

```
0.8216129032258064 0.09095839958127996
```

In [ ]:
```
#Extra trees Classifier is best
```