In [1]:

```
1  import pandas as pd
2  import numpy as np
```

In [2]:

```
1  #read Cleveland Heart Disease data
2  data = pd.read_csv('heart.csv')
3  data = data.replace('?',np.nan)
4  #display the data
5  print('Sample instances from the dataset are given below')
6  print(data.head())
7  #display the Attributes names and datatyes
8  print('\n Attributes and datatypes')
9  print(data.dtypes)
10
```

```
Sample instances from the dataset are given below
   age  sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  slop
e  \
0   63    1   1       145   233    1        2      150      0      2.3
3
1   67    1   4       160   286    0        2      108      1      1.5
2
2   67    1   4       120   229    0        2      129      1      2.6
2
3   37    1   3       130   250    0        0      187      0      3.5
3
4   41    0   2       130   204    0        2      172      0      1.4
1

   ca thal  heartdisease
0   0    6             0
1   3    3             2
2   2    7             1
3   0    3             0
4   0    3             0

 Attributes and datatypes
age               int64
sex               int64
cp                int64
trestbps          int64
chol              int64
fbs               int64
restecg           int64
thalach           int64
exang             int64
oldpeak         float64
slope             int64
ca               object
thal             object
heartdisease      int64
dtype: object
```

In [3]:

```python
from pgmpy.estimators import MaximumLikelihoodEstimator
from pgmpy.models import BayesianModel
from pgmpy.inference import VariableElimination
```

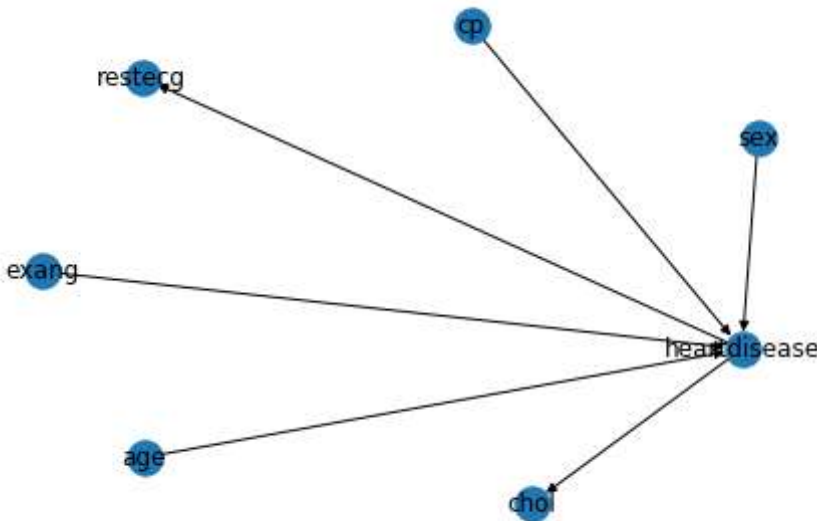In [4]:

```python
#Creat Model- Bayesian Network
## Defining the model structure. We can define the network by just passing a list of ed
model =BayesianModel([('age','heartdisease'),('sex','heartdisease'),
                      ('exang','heartdisease'),('cp','heartdisease'),
                      ('heartdisease','restecg'),('heartdisease','chol')])
import networkx as nx
import matplotlib.pyplot as plt
nx.draw(model, with_labels = True);
plt.show()
```


In [5]:

```python
#Learning CPDs using Maximum Likelihood Estimators for all the variables
print('\n Learning CPD using Maximum likelihood estimators')
model.fit(data,estimator=MaximumLikelihoodEstimator)

#print(model.get_cpds('cp'))

# Inferencing with Bayesian Network
print('\n Inferencing with Bayesian Network:')
infer = VariableElimination(model)
```

Learning CPD using Maximum likelihood estimators

Inferencing with Bayesian Network:

In [6]:

```python
#computing the Probability of HeartDisease given restecg
print('\n 1.Probability of HeartDisease given evidence=restecg :1')
q1=infer.query(variables=['heartdisease'],evidence={'restecg':1})
print(q1)

#computing the Probability of HeartDisease given cp
print('\n 2.Probability of HeartDisease given evidence= cp:2 ')
q2=infer.query(variables=['heartdisease'],evidence={'cp':2})
print(q2)
```

```
Finding Elimination Order: : 100%|
                       | 5/5 [00:00<?, ?it/s]
Eliminating: age: 100%|
               | 5/5 [00:00<00:00, 63.20it/s]


 1.Probability of HeartDisease given evidence=restecg :1
+-----------------+---------------------+
| heartdisease    |   phi(heartdisease) |
+=================+=====================+
| heartdisease(0) |              0.1012 |
+-----------------+---------------------+
| heartdisease(1) |              0.0000 |
+-----------------+---------------------+
| heartdisease(2) |              0.2392 |
+-----------------+---------------------+
| heartdisease(3) |              0.2015 |
+-----------------+---------------------+
| heartdisease(4) |              0.4581 |
+-----------------+---------------------+

 2.Probability of HeartDisease given evidence= cp:2


Finding Elimination Order: : 100%|
               | 5/5 [00:00<00:00, 624.86it/s]
Eliminating: age: 100%|
               | 5/5 [00:00<00:00, 124.97it/s]

+-----------------+---------------------+
| heartdisease    |   phi(heartdisease) |
+=================+=====================+
| heartdisease(0) |              0.3610 |
+-----------------+---------------------+
| heartdisease(1) |              0.2159 |
+-----------------+---------------------+
| heartdisease(2) |              0.1373 |
+-----------------+---------------------+
| heartdisease(3) |              0.1537 |
+-----------------+---------------------+
| heartdisease(4) |              0.1321 |
+-----------------+---------------------+
```

In [ ]:

```
1
```