In [4]:

```
import numpy as np
import pandas as pd
import csv
from pgmpy.estimators import MaximumLikelihoodEstimator
from pgmpy.models import BayesianModel
from pgmpy.inference import VariableElimination



#read Cleveland Heart Disease data
heartDisease = pd.read_csv('heart.csv')
heartDisease = heartDisease.replace('?',np.nan)

#display the data
print('Sample instances from the dataset are given below')
print(heartDisease.head())

#display the Attributes names and datatyes
print('\n Attributes and datatypes')
print(heartDisease.dtypes)

#Creat Model- Bayesian Network

model=BayesianModel([('age','heartdisease'),('sex','heartdisease'),('exang','heartdisease'),
('cp','heartdisease'),('heartdisease','restecg'),('heartdisease','chol')])

#Learning CPDs using Maximum Likelihood Estimators
print('\n Learning CPD using Maximum likelihood estimators')
model.fit(heartDisease,estimator=MaximumLikelihoodEstimator)

# Inferencing with Bayesian Network
print('\n Inferencing with Bayesian Network:')

HeartDiseasetest_infer = VariableElimination(model)


#computing the Probability of HeartDisease given restecg
print('\n 1.Probability of HeartDisease given evidence=restecg :1')
q1=HeartDiseasetest_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=HeartDiseasetest_infer.query(variables=['heartdisease'],evidence={'cp':2})
print(q2)
```

```
Sample instances from the dataset are given below
   age  sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  slope  \
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

 Learning CPD using Maximum likelihood estimators
Finding Elimination Order: :   0%|                                                                                | 0/5 [00:00<?, ?it/
s]
  0%|                                                                                                            | 0/5 [00:00<?, ?it/
s]
```

```
Finding Elimination Order: : 100%|████████████████████████████████████████████| 5/5 [00:00<00:00, 222.89it/
s]
 Inferencing with Bayesian Network:

 1.Probability of HeartDisease given evidence=restecg :1

Eliminating: cp:  20%|████████████                                              | 1/5 [00:00<00:00,  9.61it/
s]
Eliminating: age:  20%|████████████                                             | 1/5 [00:00<00:00,  9.61it/
s]
Eliminating: exang:  20%|████████████                                            | 1/5 [00:00<00:00,  9.61it/
s]
Eliminating: chol:  20%|████████████                                             | 1/5 [00:00<00:00,  9.61it/
s]
Eliminating: sex: 100%|████████████████████████████████████████████████████████| 5/5 [00:00<00:00, 35.55it/
s]
+-----------------+---------------------+
| 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: :   0%|                                                | 0/5 [00:00<?, ?it/
s]
  0%|                                                                            | 0/5 [00:00<?, ?it/
s]
Eliminating: age:   0%|                                                          | 0/5 [00:00<?, ?it/
s]
Eliminating: chol:   0%|                                                         | 0/5 [00:00<?, ?it/
s]
Eliminating: exang:   0%|                                                        | 0/5 [00:00<?, ?it/
s]
Eliminating: restecg:   0%|                                                      | 0/5 [00:00<?, ?it/
s]
```

```
Eliminating: sex: 100%|████████████████████████████████████████████████████████| 5/5 [00:00<00:00, 156.25it/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 [ ]:

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