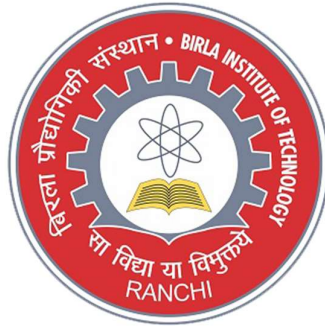


Birla Institute of Technology, Mesra,  
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ML-Assignment

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## **#Assignment-7**

**7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API**

**Theory:-**A Bayesian network is a directed acyclic graph in which each edge corresponds to a conditional dependency, and each node corresponds to a unique random variable. Bayesian network consists of two major parts: a directed acyclic graph and a set of conditional probability distributions. • The directed acyclic graph is a set of random variables represented by nodes. • The conditional probability distribution of a node (random variable) is defined for every possible outcome of the preceding causal node(s).

### **CODE:-**

```
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

heartDisease = pd.read_csv('heart.csv')
heartDisease = heartDisease.replace('?', np.nan)
```

```
print('Sample instances from the dataset are given below')
```

```
print(heartDisease.head())
```

```
print('\n Attributes and datatypes')
```

```
print(heartDisease.dtypes)
```

```
model=
```

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

```
print('\n Learning CPD using Maximum likelihood estimators')
```

```
model.fit(heartDisease,estimator=MaximumLikelihoodEstimator)
```

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

```
HeartDiseasetest_infer = VariableElimination(model)
```

```
print('\n 1. Probability of HeartDisease given evidence= restecg')
```

```
q1=HeartDiseasetest_infer.query(variables=['heartdisease'],evidence={'restecg':1})
```

```
print(q1)
```

```
print('\n 2. Probability of HeartDisease given evidence= cp ')
```

```
q2=HeartDiseasetest_infer.query(variables=['heartdisease'],evidence={'cp':2})
```

```
print(q2)
```

## OUTPUT:-

Learning CPD using Maximum likelihood estimators

Inferencing with Bayesian Network:

1. Probability of HeartDisease given evidence= restecg

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

heartdisease	phi(heartdisease)
heartdisease(0)	0.3610
heartdisease(1)	0.2159
heartdisease(2)	0.1373
heartdisease(3)	0.1537
heartdisease(4)	0.1321