

```
!pip install pgmpy
```

```
Collecting pgmpy
```

```
  Downloading https://files.pythonhosted.org/packages/a3/0e/d9fadbf3aa35e010c04d43acd1
```

```
    | 337kB 16.7MB/s
```

```
Requirement already satisfied: joblib in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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```
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: statsmodels in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: pyparsing in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: scikit-learn in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: torch in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: networkx in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: patsy>=0.4.0 in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: decorator<5,>=4.3 in /usr/local/lib/python3.7/dist-packages (from pgmpy)
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Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from pgmpy)
```

```
Installing collected packages: pgmpy
```

```
Successfully installed pgmpy-0.1.14
```

```
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
```

```
/usr/local/lib/python3.7/dist-packages/statsmodels/tools/_testing.py:19: FutureWarning
```

```
import pandas.util.testing as tm
```

```
heartDisease = pd.read_csv('/content/heart_disease.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)
```

```
↳ Sample instances from the dataset are given below
```

	age	sex	cp	trestbps	chol	...	oldpeak	slope	ca	thal	Heartdisease
0	63	1	1	145	233	...	2.3	3	0	6	0
1	67	1	4	160	286	...	1.5	2	3	3	2
2	67	1	4	120	229	...	2.6	2	2	7	1
3	37	1	3	130	250	...	3.5	3	0	3	0
4	41	0	2	130	204	...	1.4	1	0	3	0

```
[5 rows x 14 columns]
```

```

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

```

```

model= BayesianModel([('age','Heartdisease'),('sex','Heartdisease'),('exang','Heartdisease
print('\nLearning CPD using Maximum likelihood estimators')
model.fit(heartDisease,estimator=MaximumLikelihoodEstimator)

```

Learning CPD using Maximum likelihood estimators

```

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)

```

```

Finding Elimination Order: : 100%|██████████| 5/5 [00:00<00:00, 728.15it/s]
Eliminating: exang: 100%|██████████| 5/5 [00:00<00:00, 103.21it/s]
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

```

Finding Elimination Order: : 100%|██████████| 5/5 [00:00<00:00, 1441.74it/s]

```

```
Eliminating: restecg: 100%|██████████| 5/5 [00:00<00:00, 188.63it/s]+-----
| Heartdisease      | phi(Heartdisease) |
+=====+=====+
| Heartdisease(0) |          0.3610 |
+-----+-----+
| Heartdisease(1) |          0.2159 |
+-----+-----+
| Heartdisease(2) |          0.1373 |
+-----+-----+
| Heartdisease(3) |          0.1537 |
+-----+-----+
| Heartdisease(4) |          0.1321 |
+-----+-----+
```

