# 120CS0124_AILab_BayesianNetwork

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[2]:
```
pip install pomegranate==v0.14.9
```

```
Collecting pomegranate==v0.14.9
  Downloading pomegranate-0.14.9.tar.gz (4.7 MB)
     4.7/4.7 MB
17.3 MB/s eta 0:00:00
  Installing build dependencies ... done
  Getting requirements to build wheel ... done
  Preparing metadata (pyproject.toml) ... done
Collecting cython<3.0.0,>=0.22.1 (from pomegranate==v0.14.9)
  Using cached Cython-0.29.36-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x8
6_64.manylinux_2_24_x86_64.whl (1.9 MB)
Requirement already satisfied: numpy>=1.20.0 in /usr/local/lib/python3.10/dist-
packages (from pomegranate==v0.14.9) (1.23.5)
Requirement already satisfied: joblib>=0.9.0b4 in
/usr/local/lib/python3.10/dist-packages (from pomegranate==v0.14.9) (1.3.2)
Requirement already satisfied: networkx>=2.4 in /usr/local/lib/python3.10/dist-
packages (from pomegranate==v0.14.9) (3.2)
Requirement already satisfied: scipy>=0.17.0 in /usr/local/lib/python3.10/dist-
packages (from pomegranate==v0.14.9) (1.11.3)
Requirement already satisfied: pyyaml in /usr/local/lib/python3.10/dist-packages
(from pomegranate==v0.14.9) (6.0.1)
Building wheels for collected packages: pomegranate
  Building wheel for pomegranate (pyproject.toml) ... done
  Created wheel for pomegranate:
filename=pomegranate-0.14.9-cp310-cp310-linux_x86_64.whl size=18331316
sha256=05f53ad1a7462a2b30b7fc38344c2efeb0a300e8dad4dd07355a7b4642b13294
  Stored in directory: /root/.cache/pip/wheels/14/e7/b2/189a2d351ac4ae073cfa17ce
9d56936d59af5712a18028fc31
Successfully built pomegranate
Installing collected packages: cython, pomegranate
  Attempting uninstall: cython
    Found existing installation: Cython 3.0.4
    Uninstalling Cython-3.0.4:
      Successfully uninstalled Cython-3.0.4
Successfully installed cython-0.29.36 pomegranate-0.14.9
```

[10]:
```
import math
from pomegranate import *

burglary = DiscreteDistribution({'1': 0.001, '0': 0.999})
earthquake = DiscreteDistribution({'1': 0.002, '0': 0.998})
```

[11]:
```
alarm = ConditionalProbabilityTable(
        [[ '0', '0', '1', 0.001 ],
         [ '0', '1', '1', 0.29 ],
         [ '1', '0', '1', 0.94 ],
         [ '1', '1', '1', 0.95 ],
         [ '0', '0', '0', 0.999 ],
         [ '0', '1', '0', 0.71 ],
         [ '1', '0', '0', 0.06 ],
         [ '1', '1', '0', 0.05 ]],[burglary,earthquake])
johncalls = ConditionalProbabilityTable(
        [[ '0', '0', 0.95 ],
         [ '0', '1', 0.05 ],
         [ '1', '0', 0.10 ],
         [ '1', '1', 0.90 ]],[alarm])
marrycalls = ConditionalProbabilityTable(
        [[ '0', '0', 0.99 ],
         [ '0', '1', 0.01 ],
         [ '1', '0', 0.30 ],
         [ '1', '1', 0.70 ]],[alarm])
```

[12]:
```
Burglary = State(burglary, name='Burglary')
Earthquake = State(earthquake, name='Earthquake')
Alarm = State(alarm, name='Alarm')
JohnCalls = State(johncalls, name='JohnCalls')
MarryCalls = State(marrycalls, name='MarryCalls')
```

[13]:
```
model = BayesianNetwork('Assignment1')
model.add_states(Burglary,Earthquake,Alarm,JohnCalls,MarryCalls)

model.add_edge(Burglary,Alarm)
model.add_edge(Earthquake,Alarm)
model.add_edge(Alarm,JohnCalls)
model.add_edge(Alarm,MarryCalls)

model.bake()
```

[22]:
```
# P(JC|A)
pja = model.predict_proba([{'Alarm':'1'}])[0][3].parameters[0]['1']
pja
```

[22]:
```
0.8999999999999998
```

[24]:
```
# P(A|~B,~E)
panbe = model.predict_proba([{'Burglary':'0','Earthquake':'0'}])[0][2].
 ↪parameters[0]['1']
panbe
```

[24]:
```
0.0010000000000006649
```

[25]:
```
# P(MC|A)
pma = model.predict_proba([{'Alarm':'1'}])[0][4].parameters[0]['1']
pma
```

[25]:
```
0.6999999999999998
```

[35]:
```
# P(JC,MC,A,~B,~E) = P(JC|A)*P(MC|A)*P(A|~B,~E)*P(~B)*P(~E)
pnb = model.predict_proba([{'Burglary':'0'}])[0][1].parameters[0]['0']
pne = model.predict_proba([{'Earthquake':'0'}])[0][0].parameters[0]['0']
ans = pja*pma*panbe*pnb*pne
ans
```

[35]:
```
0.0006281112600004167
```