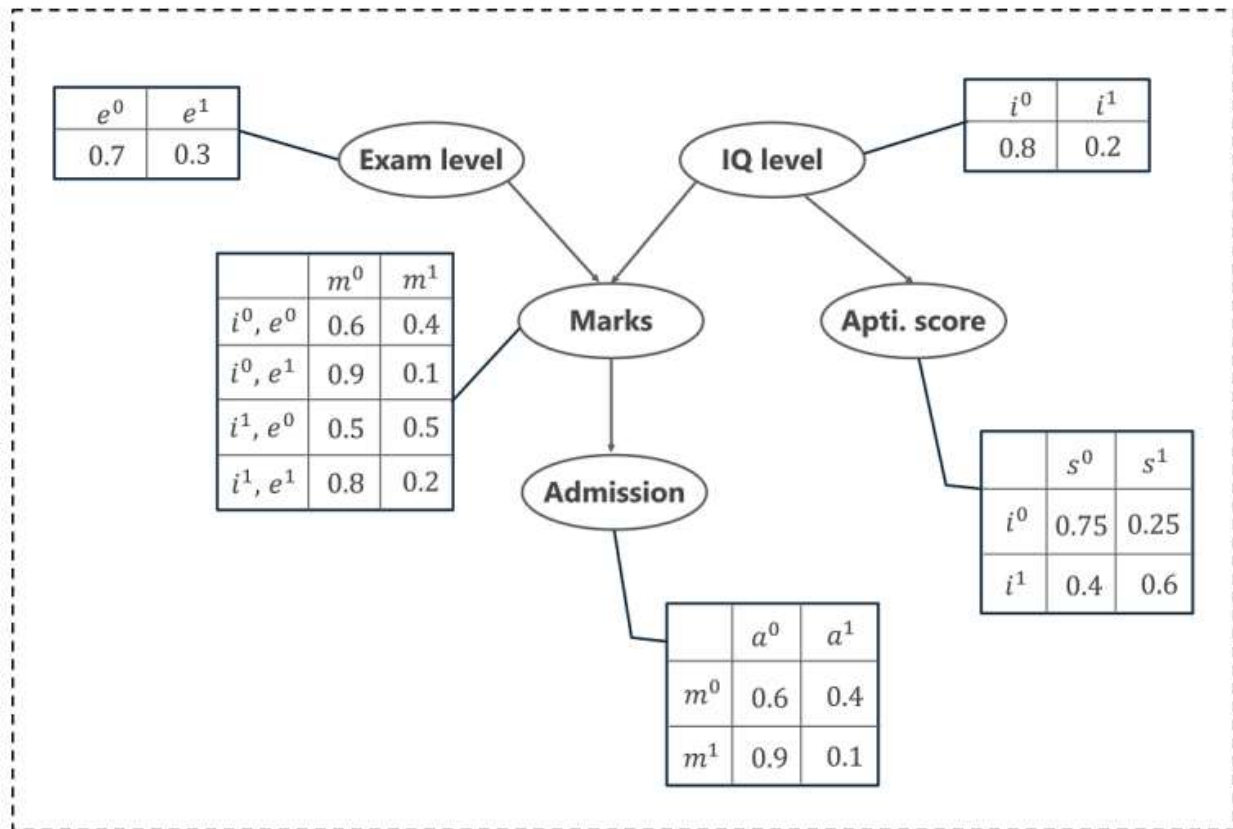


Exercise 8 – Inference using Bayesian Network - Joint Probability Distribution

Date: 10/11/2022

Aim:



To write functions for the following using Python:

1. Construct the given DAG representation using appropriate libraries.
2. Read and print the conditional probability values in Table Format for each variable.
3. Calculate the Joint Probability Distribution of the BN using 5 variables.

Code:

#Inference using Bayesian Network - Joint probability distribution

```
import networkx as nx
from matplotlib import pyplot as plt
```

```
#tables
ex_lv1 = [0.7,0.3]
iq = [0.8,0.2]
marks = [[0.6,0.4],[0.9,0.1],[0.5,0.5],[0.8,0.2]]
admission = [[0.60,0.40],[0.9,0.1]]
apt_score = [[0.75,0.25],[0.4,0.6]]
```

```
#print tables
print("\n EXAM LEVEL: \n")
print(" | e0 | e1 |")
print("+-----+")
for i in ex_lv1:
    print(" | ",i,end=" ")
print("|")
```

```
print("\n\n IQ LEVEL: \n")
print(" | i0 | i1 |")
print("+-----+")
for i in iq:
    print(" | ",i,end=" ")
print("|")
```

```
print( "\n\n MARKS: \n")
print(" | m0 | m1 |")
print("+-----+")
k=0
sl=["i0,e0","i0,e1","i1,e0","i1,e1"]
for i in marks:
    print(" | ",sl[k]," | ",i[0]," | ",i[1]," |")
    k+=1
```

```
print("\n\n ADMISSION: \n")
print(" | a0 | a1 |")
print("+-----+")
k=0
sl=["m0","m1"]
for i in admission:
    print(" | ",sl[k]," | ",i[0]," | ",i[1]," |")
    k+=1
```

```
print("\n\n APTITUDE SCORE: \n")
print(" | s0 | s1 |")
```

```
print("+-----+")
k=0
sl=["i0","i1"]
for i in apt_score:
    print("|",sl[k]," | {a:.2f} | {b:.2f} |".format(a=i[0],b=i[1]))
    k+=1

#DAG Representation
g1 = nx.DiGraph()
g1.add_edges_from([("Exam level","Marks"), ("IQ level","Marks"),("IQ level","Aptitude
score"),("Marks","Admission")])
plt.tight_layout()
nx.draw_networkx(g1, arrows=True)
plt.show()

#Formula
print("\n\nFormula:  $P[a=1, m=1, i=1, e=1, s=1] = P(a=1 | m=1) \cdot P(m=1 | i=1, e=1) \cdot P(i=1) \cdot P(e=1) \cdot P(s=1 | i=1)$ ")
print("\nP(a=1 | m=1) = {a:.2f}\nP(m=1 | i=1, e=1) = {b:.2f}\nP(i=1) = {c:.2f} \nP(e=1) = {d:.2f}\nP(s=1 | i=1) = {g:.2f}\n\nP[a=1, m=1, i=1, e=1, s=1] = ".format(a=admission[1][1],b=marks[3][1],c=iq[1],d=ex_lvl[1],g=apt_score[1][1]),end=" ")
print(round(admission[1][1]*marks[3][1]*iq[1]*ex_lvl[1]*apt_score[1][1],5))
```

Output:

```
~/AIwork$ python ex8prob.py
```

EXAM LEVEL:

	e0		e1	
+-----+				
	0.7		0.3	

IQ LEVEL:

	i0		i1	
+-----+				
	0.8		0.2	

MARKS:

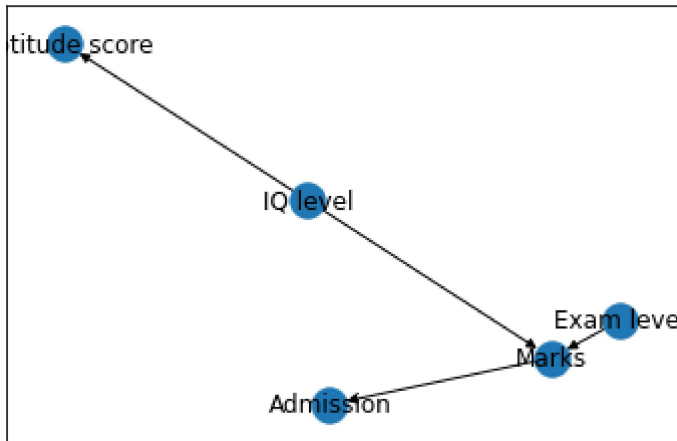
		m0		m1	
+-----+					
	i0,e0		0.6		0.4
	i0,e1		0.9		0.1
	i1,e0		0.5		0.5
	i1,e1		0.8		0.2

ADMISSION:

		a0		a1	
+-----+					
	m0		0.6		0.4
	m1		0.9		0.1

APTITUDE SCORE:

		s0		s1	
+-----+					
	i0		0.75		0.25
	i1		0.40		0.60



Formula: $P[a=1, m=1, i=1, e=1, s=1] = P(a=1 \mid m=1) \cdot P(m=1 \mid i=1, e=1) \cdot P(i=1) \cdot P(e=1) \cdot P(s=1 \mid i=1)$

$P(a=1 \mid m=1) = 0.10$

$P(m=1 \mid i=1, e=1) = 0.20$

$P(i=1) = 0.20$

$P(e=1) = 0.30$

$P(s=1 \mid i=1) = 0.60$

$P[a=1, m=1, i=1, e=1, s=1] = 0.00072$

~/AIwork\$ □