

## **Smt. Indira Gandhi College of Engineering**

Ghansoli – Navi Mumbai

## **Computer Engineering Department**

Academic Year 2022-23 (Even Sem)

**Student Name:** Sanket Phadtare **Roll No:** 71 **Class:** TE Sem: VI

Course Name: Artificial Intelligence Lab

Course Code: CSL604

## Experiment No. 08

**Experiment Title:** IMPLEMENTING BAYESIAN NETWORK: BURGLARY ALARM PROBLEM

			Ma	rks	(10			
Date of Performance	Date of Submission	A	В	C	D	E	Sign / Remark	
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		7	     Tota	ıl M	[ark	KS		

**A:** On Time Submission **B:** Understanding C: Analytical Skill

**D:** Critical Thinking **E:** Presentation

Date:

	Date	Experiment No-08 Signature
4.4		Title: Implementing Bayesian
	4.	
	i i	AIARM PRIBLEM
ie.		1 - 19 m M mark to the first the second seco
	Him: W	AP to Implement Bayesian Network : BURGLA
a contract		IARM PROBLEM
1		and the second throw to be a side
C94.44	Theory :	
-		the state of the s
4	Examble :	Harry installed a new burglax alarm at
		to detect buoglasy The alasm reliably
		at detecting a busylesy but also responds
		earthquaker : Harry has two neighbors
		d Sophia, who have taken a responsibility
		Harry at work when they hear the
William A		avid always calls havey when he heaves the
		, but sometimes he got confused with the
	bhas x	inging and calls at that time too - On the
	ather hand	, sophia likes to listen to high music.
	Sousome	times she misses to hear the glasm - Here
	مدا عدا	uld to compute the probability of Burglasy
	Alaon.	
	Problem:	Calculate the probability that probability
	that alo	my has Sounded, but their is neither
	a husal	an , how an earthgrater accured, and David
		nia both called the Harry.

Date:\_\_\_\_\_

	the street is an interior of the second with the second and the second of the second o
Hill May	Salu-lion :
	The Bayesian network for the above problem is
The second secon	given below. The naturage Storeton is showing
The state of the s	the burglary and parthquake is the parent node
The state of the s	of the alam and directly affecting the probability
	of algon's going off , but David and Sophia's
Carlox E	Calle append on glam probability
_	The network is representing that one assumptions
	do not directly perceive the burglary and also
	do not notice the minor parthquake and they
	also not confee before Calling.
	The Conditionals distributions for each node are given
A. Herri	as Conditional probabilities table or CPT.
### w −1:,	Fach row in the CPT must be som to I because
	all the entoies in the table represents an
	exhautive set of cases for the variable.
	In CPT, a boolean variable with to boolean
1. 4,11.	parents Contain 2k propabilities - Hence it
9.6	there are two parents, then CPT will contain
ait i	4 as probability and values the Marie Marie
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	and it would either a be sugar
10.57	list of all events occurring in this petarock:
W. Ta	Broglany (B)
	Egrothquake (E)
	Alam (A)
	David Calls CD) earl
A A SHAPE OF BUILDING	Suphia malls (2) manner of male
	and a harring adought or the tast of scale starting to
	the state of the s

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	We	can way	te the	events	dord to	len	State	ment	
	in	the form	of pro	bability :	P(D,	A Z	, B, E]	, Can	
	8600 y	te the	above b	robability	Statement	<u>us</u>	ing jo	ìnt	
	poop	pability d	istorbution	Maria de la compansión	Lateral de la				
		( 1)		the second secon	The state of the s	1. 1. 1.	1		
1.4.	PP	DIS, A, R	FJ = P	A ,2 [0]	B.FJ-P	[ s,	A, B, F	<u> </u>	
5. Very 1. 100	= 19	LDISTA	B, E.J.	PISIAR	79 Can	A, B	(F)	1	
	* 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PEDIAJ.	A 12 79	RIEJ- F	CA, B,EJ	4"	1. 1.		
	11	CAID] 9	- P [ SIX	4 ] 9 - [F	IB, EJ-P	[B)	ΕJ		
		CAI d ] 9	- P[S]A	J. P[A]	RIEJ - P	LBI	- J - P [	F)	
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	1				Calls	Jan Jane			
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James of	Hlgonithm
	는 사고 있다면 있는데 보고 있는데, 그 사이를 내려 가는 중요하는데, 사람들이 사용하는데 그녀를 보고 있다면 하는데 바로 사람들이 되었다면 하는데 보고 있다면 되었다면 되었다면 되었다면 되었다면 되었다면 되었다면 되었다면 되었
,,,,	Identify the variables: Identify the variables that are relevant
	to the problem . In this case to the time the problem
	to the problem The this case the variables are burglary,  Parthquake, Alasm, Form Calls, and Sophia Calls.
	Define the relationships = Identity the casual relationships
Water and the	the variables for example the accurance
<u>A</u>	of a burglary or an earthquake can cause the alasm to go off David & sophia might call it
	alasm to go off David & Sophia might call it
1911	they hear the alasm
<u> </u>	Define the Conditional probability distributions (CPDs):
1.56	108 Hach Camable define It's CPD Given It's basels
erre : o	the probability of an clare acho
	appends on wheather there is history or
	the Easthquake similarly of David & Sulation Call
	appends on wheather they hear the day
<u> </u>	Construct the Bayesian Notwork: Using the P.
	gatherea in steps 1-3 construct the houseign
	The graph Consist of nodes
	sepresenting the variables and directed edges
	sepsesenting the Casual relationships between the
	vanables '?
	Hasign - initial probabilities : Assign prior probabilities
	to the variables. These parbabilities can be obtained
	From domain experts ore estimated from data.
	Update probabilities: Coiven new evidence update
	the probabilities of the variables using Baye's theorem.
	Make Predictions: Use the network to make predictions about the accurence of event given the accusence or
	Non-occusance of other variables.
	FIGURE OCCUBACION OF OTHER STREET

```
!pip install pgmpy
 1
    from pgmpy.models import BayesianModel
 2
    from pgmpy.inference import VariableElimination
    alarm model = BayesianModel([('Burglary', 'Alarm'),
 1
                                    ('Earthquake', 'Alarm'),
 2
                                    ('Alarm', 'DavidCalls'),
 3
                                    ('Alarm', 'SophiaCalls')])
 4
    from pgmpy.factors.discrete import TabularCPD
 2
 3
    cpd burglary = TabularCPD(variable='Burglary', variable card=2,
                           values=[[.998], [0.002]])
 4
    cpd earthquake = TabularCPD(variable='Earthquake', variable card=2,
 5
                            values=[[0.999], [0.001]])
 6
 7
    cpd alarm = TabularCPD(variable='Alarm', variable card=2,
                             values=[[0.94, 0.95, 0.06, 0.05],
 8
9
                                      [0.06, 0.05, 0.94, 0.95]],
                             evidence=['Burglary', 'Earthquake'],
10
                             evidence card=[2, 2])
11
    cpd davidcalls = TabularCPD(variable='DavidCalls', variable card=2,
12
13
                           values=[[0.95, 0.1], [0.05, 0.9]],
                           evidence=['Alarm'], evidence_card=[2])
14
    cpd sophiacalls = TabularCPD(variable='SophiaCalls', variable card=2
15
                           values=[[0.1, 0.7], [0.9, 0.3]],
16
                           evidence=['Alarm'], evidence card=[2])
17
18
 1 alarm model.add cpds(cpd burglary, cpd earthquake, cpd alarm, cpd davidcal)
 1 alarm model.check model()
    True
 1 alarm model.nodes()
    NodeView(('Burglary', 'Alarm', 'Earthquake', 'DavidCalls', 'SophiaCalls'))
 1 alarm_model.edges()
    OutEdgeView([('Burglary', 'Alarm'), ('Alarm', 'DavidCalls'), ('Alarm',
    'SophiaCalls'), ('Earthquake', 'Alarm')])
 1 alarm model.local independencies('Burglary')
    (Burglary ⊥ Earthquake)
```

## 1 alarm model.get independencies()

```
(SophiaCalls ⊥ DavidCalls, Burglary, Earthquake | Alarm)
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