Part II

1

$$\begin{tikzcd} & A \arrow[dl] \arrow[dr] & \\ B \arrow[dr] & & C \arrow[dl] \\ & D & \end{tikzcd}$$

$p(C \wedge D)$

$$= \sum_{a,b} P(C \wedge D).$$

$$= \sum_{a,b} P(A=a) \,.\, P(B=b \mid A=a) \left[P(C=1 / A=a) \,.\, P(D=1 / C=1, B=b) \right]$$

$$= (0.8 \times 0.6 \times 0.4 \times 0.8) + (0.8 \times 0.6 \times 0.6 \times 0.6)$$
$$+ (0.2 \times 0.9 \times 0.2 \times 0.8) + (0.2 \times 0.1 \times 0.2 \times 0.6)$$

$$= 0.3576$$

2

Given :-

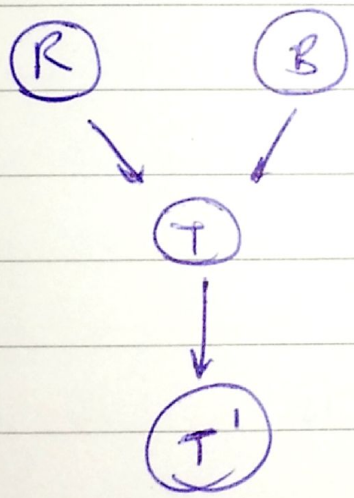
Actual \ Test	+	−
HIV +	.98	.02
HIV −	.03	.97

HIV+ among population = .005

Required : P(Test+, HIV+)

$= .98 \times .005 = 0.0049$

3



(a) R ⫫ B

T is a convergent type node. No evidence given for T. Hence R & B are independent.

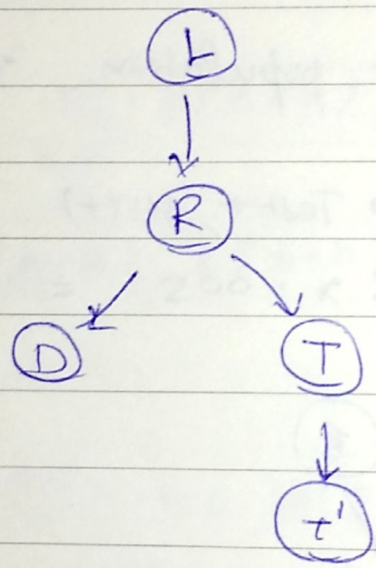
(b) R ⫫ B / T

Similar to above, evidence present for T hence conditionally dependent.

(c) $R \perp\!\!\!\perp B \mid T'$

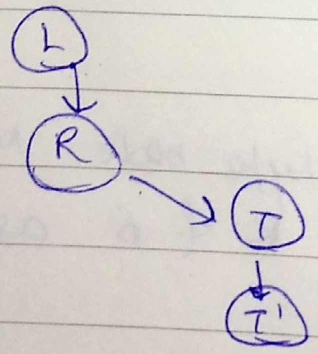
If evidence present for T', then evidence also present for T. Hence conditionally not independent.

4



(a) $L \perp\!\!\!\perp T' \mid T$

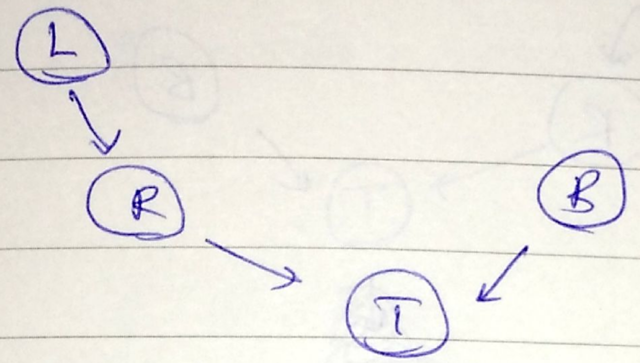
Path followed is:



Since T is known, L & T' are conditionally Independent.

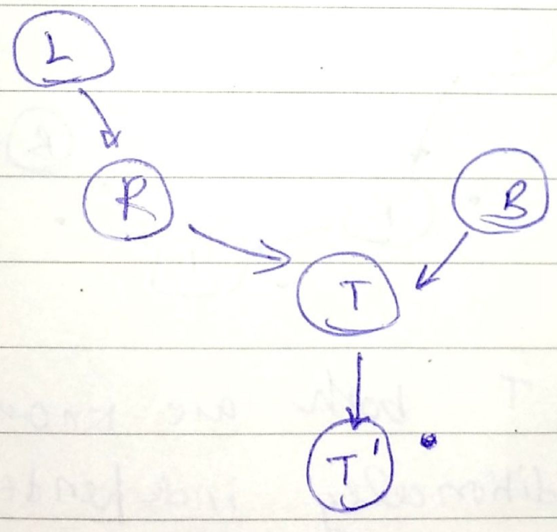
Scanned by CamScanner

(b) $L \perp\!\!\!\perp B$.



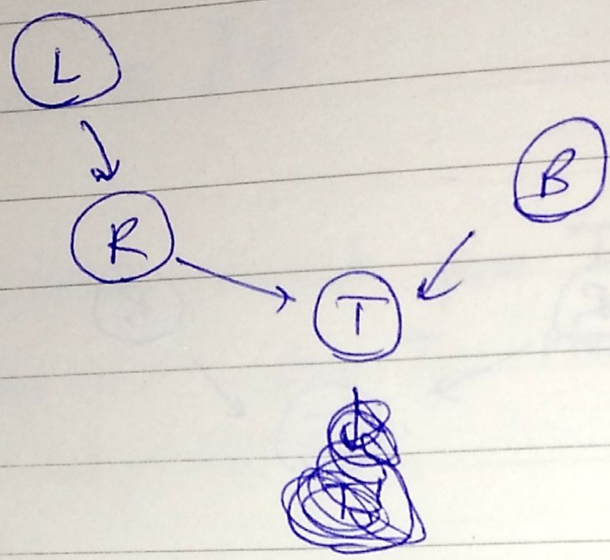
T is of convergent type & no evidence is given, hence L & B are conditionally independent.

(d) $L \perp\!\!\!\perp B \mid T'$



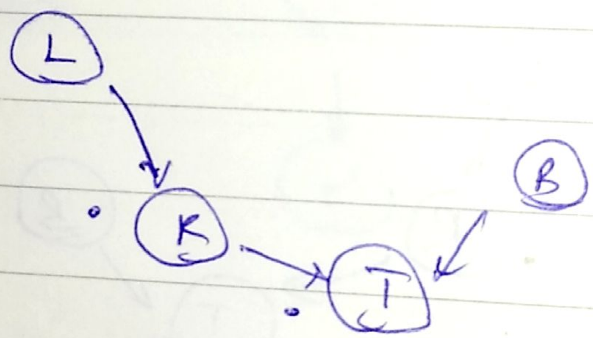
Given T', we have evidence for T, hence L & B are not conditionally independent.

(c) $L \perp\!\!\!\perp B \mid T^*$



As T is given L & B are not conditionally independent.

(e) $L \perp\!\!\!\perp B \mid T, R$



As R & T both are known, L & B are conditionally independent.

5 a

(a) $n = 20$ & $m = 2$, $ans = 2^{20}$

(b) $n = 20$ & $m = 5$, $ans = 5^{20}$

~~(c) n = 500~~

(c) $n=500$ & $m=10$, ans $= 10^{500}$

5b

(a) $n=20$ & $m=2$,

Size of conditional table is

$1\times2^1 + 1\times2^2 + 2\times2^3 + 16\times2^4$

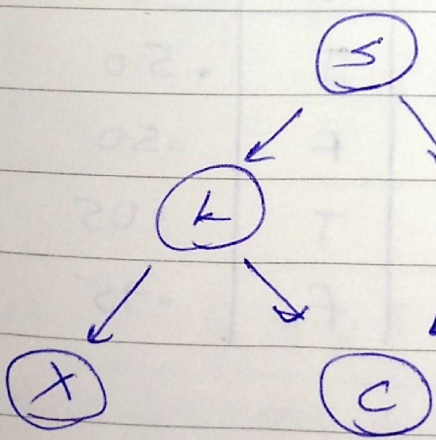
(b) $n=20$, $m=5$

Size is $1\times5^1 + 1\times5^2 + 2\times5^3 + 16\times5^4$

(c) $n=500$ & $m=10$,

Size is $1\times10^1 + 1\times10^2 + 2\times10^3 + 496\times10^4$

6



(a) S is known :

(L, B)

(b) L is known :

(S, X) , (X, C)

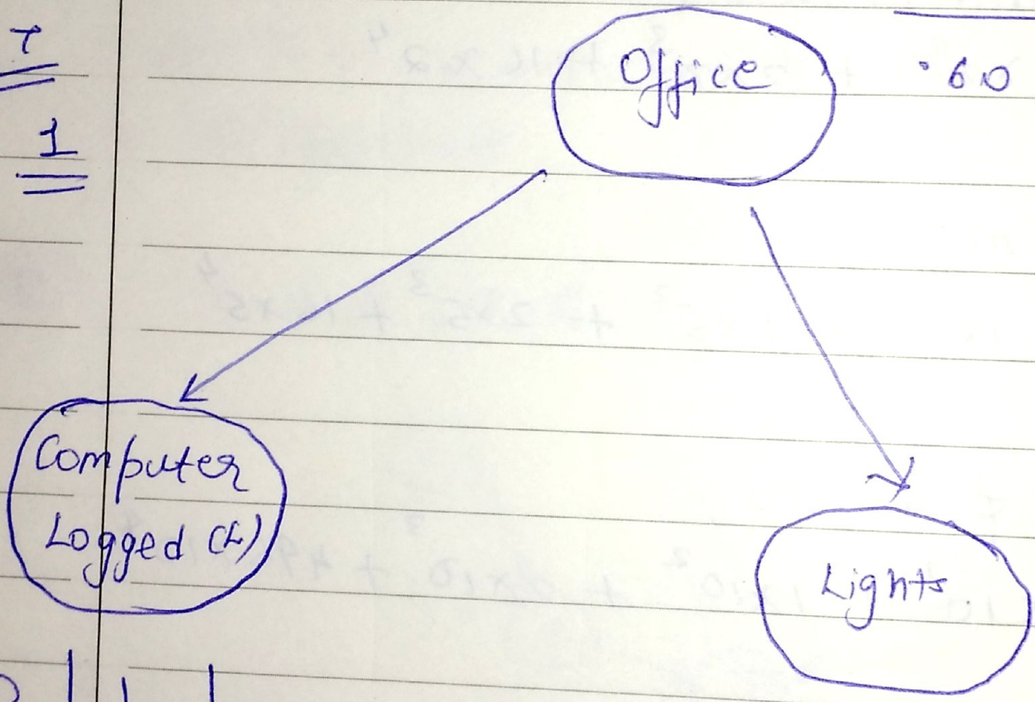
(c) {L, B} are known :

(S, X) , (S, C) , (X, C) .

T

1

	T	F
Office	.60	.40



O	L	
T	T	.80
T	F	.20
F	T	.10
F	F	.90

O	L	
T	T	.50
T	F	.50
F	T	.05
F	F	.95

2)

$$P(\text{Lights}=T \mid \text{Logged}=T)$$

$$= \frac{P(\text{Lights}=T, \text{Logged}=T)}{P(\text{Logged}=T)}$$

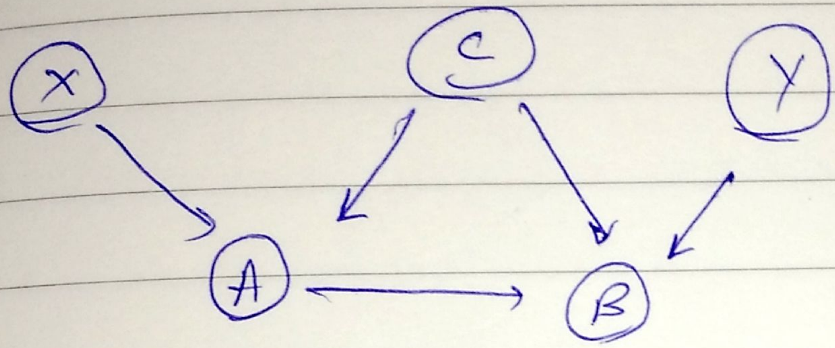
$$= \frac{\sum_{\text{office} \in O} P(\text{office}=o, \text{Lights}=T, \text{Logged}=T)}{\sum_{\substack{\text{office} \in O \\ \text{Lights} \in L}} P(\text{logged}=T, \text{lights}=l, \text{office}=o)}$$

$$= \frac{\sum_{\text{office}=o} P(\text{office}=o) \times P(\text{Lights}=T \mid \text{office}=o) \times P(\text{Logged}=T \mid \text{office}=o)}{\sum_{\substack{\text{Lights}=l \\ \text{office}=o}} P(\text{office}=o) \times P(\text{Logged}=T \mid \text{office}=o) * P(\text{Lights}=l \mid \text{office}=o)}$$

$$= \frac{0.6 \times 0.5 \times 0.8 + 0.4 \times 0.05 \times 0.1}{0.6 \times 0.8 \times 0.5 + 0.6 \times 0.8 \times 0.5 + 0.4 \times 0.1 \times 0.05 + 0.4 \times 0.1 \times 0.95}$$

$$= \frac{0.242}{0.52} = 0.466$$

8



1 Assume value 1 denotes presence of evidence & 0 denotes absence of evidence.

A	B	C	X → Y
1	0	0	Independent
1	0	1	Independent
1	1	0	Dependent
1	1	1	Independent
0	0	0	Independent
0	0	1	Independent.
0	1	0	Dependent
0	1	1	Dependent