9975 ANKIT MAITY TE COMPS B

Q-1] Showing that Alice and Bob likely to disagree from factor $\phi(A,B)$, we can see that (a^0, b^0) has greater value that means that there is high chances that both will disagree, taking about (a^0, b^1) it state that Bob agrees and Alice disagree and contrary $(a^1 b^0)$ which state that Alice agree and Bob disagree taking about this $(a^0 b^1) > (a^1 b^0)$ its more means Bob weight of agree is more i.e B we can see from table them disagreeing of both has more weight than both being agreable i.e. $(a^0, b^0) > (a^1, b^1)$.

Q.2] → A markov network, also known as Markov Random Field is a probabilistic graphical model used in computer vision to represent the relation ship between pixels in an image, where neighbour pixels are more likely to similar values.

1] Image segmentation: By modelling the relationship between neighbouring pixel, markov network can effectly group pixel belonging to the same object.

2] Image Denoising: By incorporating local dependency, markov network can be used to smooth out noise while preserving image detail.

Q.3] Independence condition:

$P(X_1 = x_1, X_3 = x_3) = P(X_1 = x_1) \cdot P(X_3 = x_3)$

for all $x_1, x_3 \in \{0, 1\}$

8 configurations:

(0,0,0,0)	(0,0,0,1)
(1,0,0,0)	(0,0,1,1)
(1,1,0,0)	(0,1,1,1)
(1,1,1,0)	(1,1,1,1)

all configurations have $P = 1/8$, configurations, $P = 0$.

$P(X_1 = 0) = \frac{\text{no of lines } (X_1 = 0)}{\text{total configurations}} = \frac{4}{8} = \frac{1}{2}$

$P(X_1 = 1) = \frac{4}{8} = \frac{1}{2}$

$P(X_3 = 0) = \frac{4}{8} = \frac{1}{2}$, $P(X_3 = 1) = \frac{4}{8} = \frac{1}{2}$

$P(X_1 = 0, X_3 = 0) = \frac{\text{no of times } (X_1, X_3)}{\text{total configs}}$

$= \frac{2}{8} = \frac{1}{4}$

now,

$P(X_1 = 0, X_3 = 0) = 1/4$; $P(X_1 = 0) \cdot P(X_3 = 0) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$P(X_1 = 0, X_3 = 1) = 1/4$; $P(X_1 = 0) \cdot P(X_3 = 1) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$\because$ Condition holds true,

$\therefore X_1$ is independent of X_3

Q.4] For each variable X, markov blanket condition, $P(X \mid MB(X)) = P(X \mid \text{all other vars except } X)$

The distribution $P(a_1, b_1, c_1, d_1) = 0.5$ and $P(a_0, b_0, c_0, d_0) = 0.5$

This implies that the only possible configurations for (A, B, C, D) are $(1,1,1,1)$ and $(0,0,0,0)$ with each configuration having equal probability 0.5.

→ ∴ All variables are perfectly correlated.

→ ∴ Markov Blanket Condition.

$P(A \mid B, C, D)$; $B = C = D = 1$

$B = C = D = 0$, $A = 0$ with probability 1.

$P(A \mid B, C, D) = P(A \mid B, C, D) = P(A \mid MB(A))$

$X \in \{A, B, C, D\}$

Q.6] For calculating canonical energy function for a clique D is given as :-

$$\epsilon^{+}_{D}(d) = \sum_{Z \subseteq D} (-1)^{|D-Z|} e(d_Z, \xi^{*}_{-Z})$$

where sum is all subset of D

$d_{AB} = a^{\circ} b^{\circ}$ taking all subset

$\{A, B\}, \{A\}, \{B\}, \{\phi\}$

$$\epsilon(a^{\circ}, b^{\circ}) = e(a^{\circ}, b^{\circ}) - e(a^{\circ}, \xi_B) - e(\xi_A, b^{\circ}) + e(\xi_{A}$$

$$\varepsilon_{AB}(a^\circ, b^\circ) = \ln(80) - \ln(30) - \ln(30) + \ln(30)$$
$$= 0$$

$\varepsilon_{AB}(a^\circ, b^1) = 0$ (Similarly)

$\varepsilon_{AB}(a^1, b^\circ) = 0$

$\varepsilon_{AB}(a^1, b^1) = 4.09$

for $\varepsilon_{BC}(d_{BC})$ all subset $\{B\}, \{BY\}, \{Y\}$

$$\varepsilon_{BC}(b^\circ c^\circ) = e(b^\circ c^\circ) - e(b^\circ c^\circ)$$
$$= \ln(100) - \ln(100) = 0$$

$\varepsilon_{BC}(b^\circ c^1) = 0$

for $\varepsilon_A(A)$ $\varepsilon_B(B)$ $\varepsilon_C(C)$ $\varepsilon_D(D)$ $\varepsilon(\phi)$

$\varepsilon_A(A)$	$\varepsilon_B(B)$	$\varepsilon_C(C)$	$\varepsilon_D(D)$	$\varepsilon(\phi)$
$a_0 = 0$	$b_0 = 0$	$c_0 = 0$	$d_0 = 0$	-3.18
$a_1 = -8.01$	$b_1 = -6.4$	$c_1 = 0$	$d_1 = 0$	