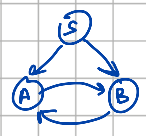
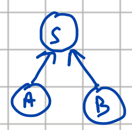
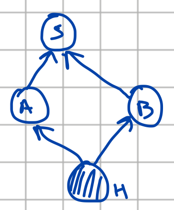
Q1.

a) 1)  2)  3) 

b) Yes ?.

c) No.

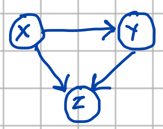
d) 

e) 

Here, H confounds A & B and could be something like "bad weather" or "cold season".

f) BNs are statistical tools that are used to model & infer joint probabilities efficiently. Causal BNs specify what happens under specific variable intervention. This is done using additional statistical assumptions (no confounders (ie, no hidden variables), etc).

g) $p(x,y,z) = p(z|x,y)\,p(y|x)\,p(x)$

h) 

$p(Y=1|do(X=x))$

Let $S = \{\phi\}$

1. $X, Y \notin S$
2. no element of S is decendant of X.
3. no back door paths from $X \to Y$ (incoming at X).

Thus, empty set is admissable for adjustment.

$\therefore\ p(Y=1|do(X=x)) = p(Y=1|x)$

Ans.

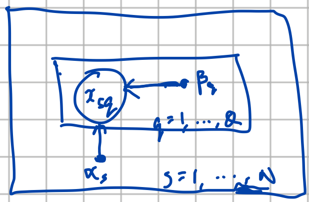
i) $$p(y|x,z) = \frac{p(z|x,y)\,p(y|x)}{p(z|x)} = \frac{p(z|x,y)\,p(y|x)}{\sum_y p(y,z|x)} = \frac{p(z|x,y)\,p(y|x)}{\sum_y p(z|x,y)\,p(y|x)}$$

Ans.

j)

Q2.

a)



b)

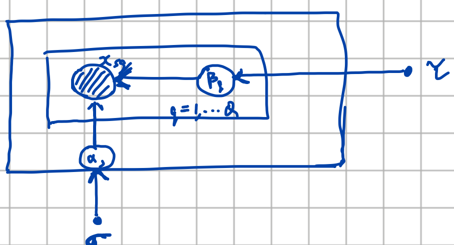
$$p(x|\alpha,\beta) = \prod_{s=1}^{N}\prod_{q=1}^{Q}\sigma(\alpha_s-\beta_q)^{x_{sq}}\,\sigma(\beta_q-\alpha_s)^{1-x_{sq}}$$

$$\log p(x|\alpha,\beta) = \sum_{s=1}^{N}\sum_{q=1}^{Q}\left[x_{sq}\log\sigma(\alpha_s-\beta_q) + (1-x_{sq})\log\sigma(\beta_q-\alpha_s)\right]$$

// Ans.

c)

d)



Stop studying!!
You will be where
they are soon
so enjoy!