H.W1

Q) 2.1)

a) $P(E=1 \mid A=1)$

$$= \frac{P(E, A)}{P(A)}$$

$$= \frac{P(A \mid E)\, P(E)}{P(A)} \quad \text{— (3)}$$

Now,

$$P(A \mid E) = \sum_b P(A, B{=}b \mid E) \quad \because \text{Marginalizn.}$$

$$= \sum_b P(A=1, B=b \mid E=1)$$

$$= \sum_b P(A=1 \mid B=b, E=1)\; P(B=b) \quad \because \text{Prod. rule}$$

$$= P(A=1 \mid B=0, E=1) \times P(B=0)$$
$$+ \; P(A=1 \mid B=1, E=1) \times P(B=1)$$

$$= 0.29 \times 0.999$$
$$+ \; 0.95 \times 0.001$$

$$P(A \mid E) = 0.29066 \quad \text{— (1)}$$

Now to find $P(A)$:-

$$P(A) = \sum_b \sum_e P(A=1, B=b, E=e) \quad \because \text{Marginilzn.}$$

$$= \sum_b \sum_e P(B=b)\; P(E=e \mid B=b)\; P(A=1 \mid E=e, B=b)$$

$$= \sum_b \sum_e P(B=b)\; P(E=e)\; P(A=1 \mid E=e, B=b)$$

$$\because P(E \mid B) = P(E)$$

$\because$ Marginal independence from the graph.

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$$= P(B=0)P(E=0)P(A=1|B=0,E=0)$$
$$+ P(B=1)P(E=0)P(A=1|B=1,E=0)$$
$$+ P(B=0)P(E=1)P(A=1|B=0,E=1)$$
$$+ P(B=1)P(E=1)P(A=1|B=1,E=1)$$

$$= 0.999 \times 0.998 \times 0.001$$
$$+ 0.001 \times 0.998 \times 0.94$$
$$+ 0.999 \times 0.002 \times 0.29$$
$$+ 0.001 \times 0.002 \times 0.95$$

$$= 0.0025 \quad — (2)$$

From (1) & (2) in (3),

$$P(E=1|A=1)$$
$$= \frac{0.29066 \times P(E=1)}{0.0025}$$
$$= \frac{0.29066 \times 0.002}{0.0025}$$
$$= 0.232528$$

v) $P(E=1 \mid A=1, B=0) = ?$

Now,
$P(A,B,E) = P(B)\; P(A \mid B)\; P(E \mid A,B)$

$\therefore P(E \mid A,B) = \dfrac{P(A,B,E)}{P(B)\; P(A \mid B)}$ — (1)

Now,
$P(A,B,E)$
$= P(B=0) \times P(E=1 \mid B=0)\; P(A=1 \mid E=1, B=0)$ $\because$ Prod rule

Now, $P(E=1 \mid B=0) = P(E=1)$
$\because$ Marginal independence

$\therefore P(\overset{=1}{A}, \overset{=0}{B}, E=1)$
$= 0.999 \times 0.002 \times 0.29$

$= 0.00057942$ — (2)

Now, $P(A \mid B) = \sum_e P(A, E=e \mid B)$ $\because$ Marginaliz^n

$= \sum_e P(A \mid E=e, B)\; P(E=e)$ $\because$ Prod rule

$= \sum_e P(A=1 \mid E=e, B=0)\; P(E=e)$

$= 0.001 \times 0.998$
$+ 0.29 \times 0.002$
$= 0.001578$ — (3)

Now, (3) & (2) in (1) :-
$\therefore P(E=1 \mid \overset{=1}{A}, \overset{=0}{B}) = \dfrac{0.00057942}{0.999 \times 0.001578}$

$= 0.36755386$

c) $P(A=1 \mid M=1)$

$$= \frac{P(M \mid A)\ P(A)}{P(M)} \quad \text{-③}$$ ∵ Bayes rule

Now,
$P(A=1) = 0.0025$ from ⓐ eqⁿ ② -①

Now, $P(M=1) = \sum_a P(M=1, A=a)$ ∵ Marginalizⁿ

$$= \sum_a P(M=1 \mid A=a)\ P(A=a)$$ ∵ prod. rule.

$$= 0.70 \times 0.0025 + 0.01 \times (1-0.0025)$$

$$= 0.011725 \quad \text{-②}$$

Now using ① & ② in ③,

$$= \frac{P(M=1 \mid A=1)\ P(A=1)}{P(M=1)}$$

$$= \frac{0.70 \times 0.0025}{0.011725}$$

$$= 0.14925373$$

d) $P(A=1 \mid M=1, J=0)$

$$= \frac{P(M, J \mid A)\, P(A)}{P(M, J)} \quad \because \text{Bayes rule}$$

$$= \frac{P(M \mid A)\, P(J \mid A)\, P(A)}{P(M, J)} \quad - \text{②} \quad \because M, J \text{ Cond. independence given } A \text{ by graph.}$$

$\Rightarrow$ Now, $P(M, J)$

$$= \sum_a P(M, J, A=a)$$

$$= \sum_a P(M, J \mid A=a)\, P(A=a) \quad \because \text{Prod. rule.}$$

$$= \sum_a P(M \mid A=a)\, P(J \mid A=a)\, P(A=a)$$

$$= \sum_a P(M=1 \mid A=a)\, P(J=0 \mid A=a)\, P(A=a)$$

$$= 0.01 \times 0.95 \times 0.9975 + 0.70 \times 0.1 \times 0.0025$$

$$= 0.0096512 5 \quad - \text{①}$$

$\Rightarrow$ Using ① in ②,

$$= \frac{0.7 \times 0.1 \times 0.0025}{0.00965125}$$

$\therefore P(A=1 \mid M=1, J=0) = 0.01813236$

e) $P(A=1 | M=0)$

$$= \frac{P(M=0 | A=1)\ P(A=1)}{P(M=0)}$$

$$= \frac{0.3 \times 0.0025}{(1 - 0.011725)}$$ $\because$ from ⓔ eq ② & from ⓐ eq ②.

$$= 7.5889 \times 10^{-4}$$

f) $P(A=1 \mid M=0, B=1)$

$$= \frac{P(M, B \mid A) \times P(A)}{P(M, B)} \quad \because \text{Bayes}$$

$$= \frac{P(M \mid A)\, P(B \mid A)\, P(A)}{P(M, B)} \quad -(2)$$

$\Rightarrow$ Now, $P(B \mid A) = \frac{P(A \mid B)\, P(B)}{P(A)}$ $\because$ Bayes $-(3)$

$\Rightarrow$ $P(A \mid B) = \sum_e P(A, E=e \mid B)$

$$= \sum_e P(A=1 \mid E=e, B=1)\, P(E=e) \quad \because \text{Prod rule.}$$

$$= 0.94 \times 0.998 + 0.95 \times 0.002$$

$$= 0.94002 \quad -(1)$$

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$\Rightarrow$ Using ① in ③ :-

$$P(\overset{=1}{B} | \overset{=1}{A}) = \frac{0.94002 \times 0.001}{0.0025}$$

$$= 0.376008 \quad -④$$

$\Rightarrow$ Using ④ in ② :-

$$\frac{P(M=0 | A=1)\ P(B=1 | A=1)\ P(A=1)}{P(M=0, B=1)} \quad -⑤$$

$$\Rightarrow \quad P(M,B) = \sum_a P(M, B, A=a)$$

$$= \cancel{\sum_a P(M | A=a, B)\ P(B | A=a)\ P(A=a)}$$

$$= \sum_a P(M | A=a, B)\ P(A=a | B)\ P(B)$$

Now, $P(M | A,B) = P(M | A)$

$\because$ Conditionally indep

$$\therefore P(M,B) = \sum_a P(M | A=a)\ P(A=a | B)\ P(B)$$

$$\therefore P(M=0, B=1) = P(M=0 | A=0)\ P(A=0 | B=1)\ P(B=1) + P(M=0 | A=1)\ P((A=1 | B=1))\ P(B=1)$$

$$= 0.99 \times (1-0.94002)\ 0.001 + 0.3 \times 0.94002 \times 0.001$$

$$= 3.4 \times 10^{-4} \quad -⑥$$

Using 6 in 5,

$$\frac{0.3 \times 0.376008 \times 0.0025}{3.4 \times 10^{-4}}$$

$$= 0.82942941$$

$$= 0.83$$

(Q.2)
a) $$r_k = \frac{P(D=0 \mid S_1=1, S_2=1, \dots, S_K=1)}{P(D=1 \mid S_1=1, S_2=1, \dots, S_K=1)}$$

Now, $P(D=0 \mid S_1=1, S_2=1, \dots, S_K=1)$

Bayes rule :-

$$\frac{P(S_1=1, S_2=1, \dots, S_K=1 \mid D=0)\ P(D=0)}{P(S_1=1, S_2=1, \dots, S_K=1)} \quad - \text{②}$$

Now, $P(S_1=1, S_2=1, \dots, S_K=1 \mid D=0)$

$$= P(S_1=1 \mid D=0)\,P(S_2=1 \mid D=0) \cdots P(S_K=1 \mid D=0)$$

$\because$ From graph, All S are CI given D by case 2

$$= 1 \times \prod_{i=2}^{k} (S_i=1 \mid D=0)$$

$\because P(S_1=1 \mid D=0)=1$ given.

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$$\therefore \prod_{k=2}^{k} P(S_i = 1 \mid D=0)$$

$$= \frac{f(1)}{\cancel{f(2)}} \times \frac{\cancel{f(2)}}{\cancel{f(3)}} \times \frac{\cancel{f(3)}}{\cancel{f(4)}} \times \cdots \frac{\cancel{f(k-2)}}{\cancel{f(k-1)}} \times \frac{\cancel{f(k-1)}}{f(k)}$$

$$= \frac{f(1)}{f\,k} = \frac{2^1 + (-1)^1}{2^k + (-1)^k}$$

$$= \frac{2-1}{2^k + (-1)^k} = \frac{1}{2^k + (-1)^k} \quad -(1)$$

$\therefore$ (1) in (2),

$$\frac{1/(2^k + (-1)^k) \times 1/2}{P(S_1 = 1, S_2 = 1 \ldots S_k = 1)} \quad -(4)$$

Now,

$$P(S_1 = 1, S_2 = 1, \ldots S_k = 1)$$

$$= \sum_d P(D = d, S_1 = 1 \ldots S_k = 1) \quad \because \text{Marginalizn}$$

$$= \sum_d P(D=d)\, P(S_1 = 1 \ldots S_k = 1 \mid D = d)$$

$$= P(D=0)\, P(S_1 = 1 \cdots S_k = 1 \mid D = 0) + P(D=1)\, P(S_1 = 1 \cdots S_k = 1 \mid D = 1)$$

$$= 0.5 \times \frac{1}{2^k + (-1)^k} + 0.5 \times \frac{1}{2^k} \quad -(3)$$

- from (1)

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Using (3) in (4) :-

$$\frac{1/[2^k+(-1)^k] \times \cancel{\frac{1}{2}}}{\cancel{\frac{1}{2}}\left(\frac{1}{2^k+(-1)^k}+\frac{1}{2^k}\right)} \quad - (5)$$

Now, $P(D=1 \mid S_1=1, S_2=1 \cdots S_k=1)$

Bayes :-

$$\frac{P(S_1=1, \cdots S_k=1 \mid D=1) \times P(D=1)}{P(S_1=1, \cdots S_k=1)}$$

$$\therefore \quad \frac{1/2^k \times \cancel{1/2}}{\cancel{\frac{1}{2}} \times \left(\frac{1}{2^k+(-1)^k}+\frac{1}{2^k}\right)} \quad \text{- from (3)}$$

$- (6)$

Combing (5) & (6) for r_k,

$$r_k = \frac{\left(1/(2^k+(-1)^k)\right)}{\cancel{\frac{1}{2^k+(-1)^k}+\frac{1}{2^k}}} \times \frac{\cancel{\frac{1}{2^k+(-1)^k}+\frac{1}{2^k}}}{\frac{1}{2^k}}$$

$$= \frac{1}{2^k+(-1)^k} \times 2^k$$

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$$\therefore r_k = \frac{2^k}{2^k + (-1)^k}$$

For $k = 1$,

$$r_1 = \frac{2}{2-1} = 2 > 1 \quad \therefore D = 0$$

For $k = 2$,

$$r_2 = \frac{4}{4+1} = \frac{4}{5} < 1 \quad \therefore D = 1$$

For $k = 3$

$$r_3 = \frac{8}{8-1} = \frac{8}{7} > 1 \quad \therefore D = 0$$

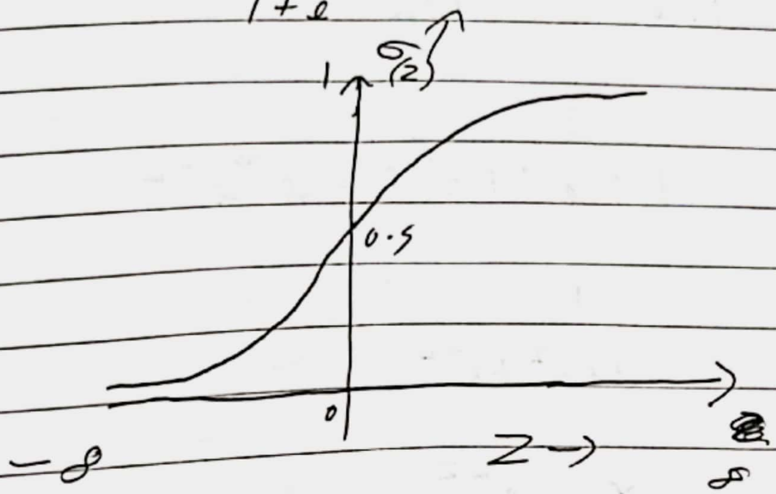
$\vdots$

$\therefore$ By reading the trend,
the doc will identify $D=0$ on odd days
and $D=1$ on even days.

b) Again, noticing the trend as k increases,
the value keeps getting closer & closer
to '1'.
Hence the higher the k, the more uncertainty
will increase.
i.e. When $r_k \to 1$
$D \overset{?}{=} 0,1$

Q.2.3)

$$\sigma(z) = \frac{1}{1+e^{-z}}$$



a) $\sigma'(z) = \sigma(z)\,\sigma(-z)$

RHS :-

$$\frac{1}{1+e^{-z}} \times \frac{1}{1+e^{z}}$$

$$\frac{1}{1+e^{z}+e^{-z}+}$$

LHS:- $\frac{d}{dz}\frac{1}{1+e^{-z}} = \frac{d}{dz}(1+e^{-z})^{-1}$

$$= -(1+e^{-z})^{-2}\frac{d}{dz}(1+e^{-z})$$

$$= -(1+e^{-z})^{-2}\left(e^{-z}\frac{d}{dz}(-z)\right)$$

$$= \frac{+e^{-z}}{(1+e^{-z})^{2}} = \frac{e^{-z}}{1+e^{-2z}+2e^{-z}}$$

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RHS:-

$\sigma(z)\ \sigma(-z)$

$\frac{1}{1+e^{-z}} \times \frac{1}{1+e^{z}}$

$\frac{1}{1+e^{z}+e^{-z}+e^{z}e^{-z}}$

$\frac{1}{2+e^{2}+e^{-2}}$

$\times\ e^{-z}$

$\therefore \frac{e^{-z}}{2e^{-z}+e^{z}e^{-z}+e^{-2z}}$

$\frac{e^{-z}}{2e^{-z}+1+e^{-2z}}$

$= LHS$

HP

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h) $\sigma(-z) + \sigma(z) = 1$

LHS

$$\frac{1}{1+e^{-z}} + \frac{1}{1+e^{z}}$$

$$\frac{1+e^{z} + 1+e^{-z}}{2+e^{z}+e^{-z}}$$

$$\frac{2+\cancel{e^{z}+e^{-z}}}{2+\cancel{e^{z}+e^{-z}}}$$

$= 1$

$= RHS$

HP

i) $L(\sigma(z)) = z$

$$\log_e\left(\frac{1}{1+e^{-z}} \div \left(1-\frac{1}{1+e^{-z}}\right)\right)$$

$$\log_e\left(\frac{1}{1+e^{-z}} \div \frac{1+e^{-z}-1}{1+e^{-z}}\right)$$

$$\log_e\left(\frac{1}{\cancel{1+e^{-z}}} \times \frac{\cancel{1+e^{-z}}}{e^{-z}}\right)$$

$$\log_e\left(\frac{1}{e^{-z}}\right)$$

$\log_e e^{z}$

$= z$ //

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d) $w_i = L(p_i)$

RHS

$$p_i = P(Y=1 \mid x_i = 1, x_j = 0 \ \forall j \neq i)$$

$$w_i = L(p_i)$$

$$= L\left(P(Y=1 \mid x_i=1, x_j=0 \ \forall j \neq i)\right)$$

$$= L\left(\sigma\left(w_i x_i + w_j x_j\right)\right)$$

$$= L\left(\frac{1}{1+e^{-(w_i x_i + w_j x_j)}}\right)$$

$$= \log\left(\frac{p}{1-p}\right)$$

$$= \log\left(\frac{1}{1+e^{-(w_i x_i + w_j x_j)}} \div \left[1 - \frac{1}{1+e^{-(w_i x_i + w_j x_j)}}\right]\right)$$

$$= \log\left(\frac{1}{1+e^{-(w_i x_i + w_j x_j)}} \div \frac{e^{-(w_i x_i + w_j x_j)}}{1+e^{-(w_i x_i + w_j x_j)}}\right)$$

$$= \log\left(\frac{1}{\cancel{1+e^{-(w_i x_i + w_j x_j)}}} \times \frac{\cancel{1+e^{-(w_i x_i + w_j x_j)}}}{e^{-(w_i x_i + w_j x_j)}}\right)$$

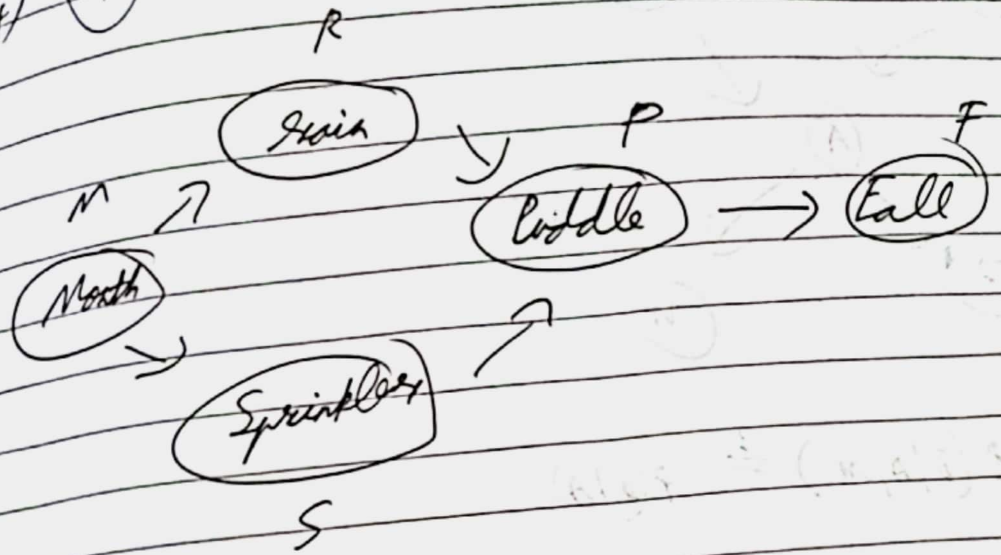
$$= \log\left(e^{w_i x_i + w_j x_j}\right)$$

$$= w_i x_i + w_j x_j$$

Now $x_i = 1$, $x_j = 0$

$$\therefore L(p_i) = w_i \times 1 + 0 = w_i = LHS \quad HP$$

Q.2(4) 7,



$\Rightarrow$ If we know M:-

1) $P(R \perp\!\!\!\perp S \mid M)$

$\Rightarrow$ ~~If we know R:-~~ F does not block every path.

2) $P(M \perp\!\!\!\perp P \mid R)$ ✗

$\Rightarrow$ ~~Given S:-~~ E does not block every path

3) $P(M \perp\!\!\!\perp P \mid S)$ ✗.

$\Rightarrow$ Given P:-

4) $P(R \perp\!\!\!\perp F \mid P)$

5) $P(S \perp\!\!\!\perp F \mid P)$

6) $P(M \perp\!\!\!\perp F \mid P)$

$\Rightarrow$ Given R & P:-

7) $P(M \perp\!\!\!\perp F \mid R, P)$

8) $P(S \perp\!\!\!\perp F \mid R, P)$

$\Rightarrow$ Given S, P:-

9) $P(M \perp\!\!\!\perp F \mid S, P)$

10) $P(R \perp\!\!\!\perp F \mid S, P)$

$\Rightarrow$ Given R, S:-

11) $P(M \perp\!\!\!\perp P \mid R, S)$

12) $P(M \perp\!\!\!\perp F \mid R, S)$

$\Rightarrow$ Given R, S, P:-

13) $P(M \perp\!\!\!\perp F \mid R, S, P)$

$\Rightarrow$ Given M, R, P:-

14) $P(S \perp\!\!\!\perp F \mid M, R, P)$

$\Rightarrow$ Given M, S, P:-

15) $P(R \perp\!\!\!\perp F \mid M, S, P)$

$\Rightarrow$ Given R, S, F:-

16) $P(M \perp\!\!\!\perp P \mid R, S, F)$

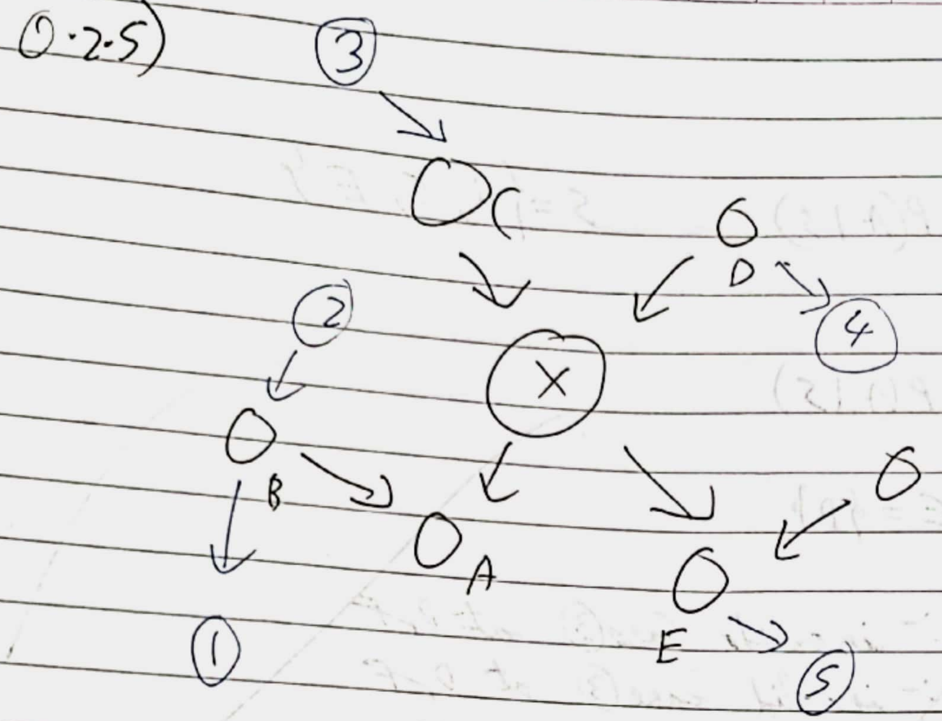
$\Rightarrow$ Given M, P:-

17) $P(R \perp\!\!\!\perp F \mid M, P)$

18) $P(S \perp\!\!\!\perp F \mid M, P)$

$\Rightarrow$ No, There does not exist a case where $E = \phi$:- No marginally ind exists

Q.2.5)



Case ① child of ~~parent~~ childs parent.

Ⓑ blocks path by Case ②

$\therefore$ CI.

Case ② parent of parent of ~~par~~ child

Ⓑ blocks ~~case~~ ①

$\therefore$ CI.

Case ③ :- P of P :-

Ⓒ blocks by case ①

$\therefore$ CI

Case ④ :- Child of P :-

Ⓓ blocks by case ② $\therefore$ CI.

Case ⑤ :- Child of P. Ⓔ blocks by case ① $\therefore$ CI.

Hence proved $P(X, Y \mid B_X) = P(X \mid B_X) P(Y \mid B_X)$

HW 2 cont.

Q. 2.6)

1) $P(B \mid G, C) \overset{?}{=} P(B \mid G)$

$E = \{G\}$

Path :-

1) B D G E C :-

At G :-

Case ③ invalid.

$\therefore$ does not blocks.

$\therefore$ False //

2) $P(F, G \mid D) \overset{?}{=} P(F \mid D)\, P(G \mid D)$

$E = \{D\}$

~~Path :- F D~~

~~G does not block,~~

Path :- 1) F D G

Case ② valid. ✓

Path :- 2) F D B A G

Case ① valid. ✓

$\therefore$ True. //

3) $P(A, C) \overset{?}{=} P(A)\, P(C)$

$E = \{\ \}$

Paths :-

1) A G E C :-

At G, Case ③ valid ✓

2) A B D G E C :-

At G, Case ③ valid ✓ True

$\therefore$ TRUE //

4) $P(D \mid B, F, G) \overset{?}{=} P(D \mid B, F, G, A)$

$\therefore E = \{B, F, G\}$

$D \to A$

Path :-

1) D G A :-

At G, Case ③ invalid

False

5) $P(F, H) \overset{?}{=} P(F)\, P(H)$

$\therefore E = \{\}$

Paths :-

1) F D G E H

At G, Case ③ valid.

2) F D B A G E H,

At G, case ③ valid.

True

6) $P(D, E \mid F, H) \overset{?}{=} P(D \mid F)\, P(E \mid H)$

This means, D & E are $\perp\!\!\!\perp$ given F & H.

Further D & H are $\perp\!\!\!\perp$ given F

& E & F are $\perp\!\!\!\perp$ given H.

Case 1 :- $D \perp\!\!\!\perp H \mid F$:- $E = \{F\}$

Path :- 1) D G E H, 2) D B A G E H

Case ③ valid at G.

Case 2 :- $(E \perp\!\!\!\perp F \mid H)$:- $E = \{H\}$

Path :- 1) E G A B D F 2) E G D F

Both Case ③ valid at G

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Now,

case ③ :-

$D \perp\!\!\!\perp E \mid F, H$:- $E = \{F, H\}$

Paths :- 1) D G E ; 2) D B A G E

Both case ③ valid at G.

∴ ① ② ③ valid,

True

7) $P(F, C \mid G) \overset{?}{=} P(F \mid G)\, P(C \mid G)$

$E = \{G\}$

$F \to C$

Paths :-

1) F D G E C, 2) F D B A G E C

Both case 3 invalid at G.

False

8) $P(D, E, G) \overset{?}{=} P(D)\, P(E)\, P(G \mid D, E)$

↳ $= P(D)\, P(E \mid D)\, P(G \mid D, E)$ ∵ Prod rule.

~~∴ E = { }~~ ~~Paths :-~~ ∴ $P(E \mid D) = P(E)$

∴ $E = \{\ \}$

∴ Paths :-

1) E G D 2) E G A B D

Both valid at G case ③.

Hence

True

9) $P(H|C) \overset{?}{=} P(H|A,B,C,D,F)$

$\therefore E = \{C\}$

Case ① $H \to A$:-

paths :- 1) H E G A 2) H E G D B A

valid at G case ③.

Case ② $H \to B$:-

similar to A, valid at G case ③

case ③ $H \to D$ } Valid at G case ③

case ④ $H \to F$

True

10) $P(H|A,C) \overset{?}{=} P(H|A,C,G)$

$\therefore E = \{A, C\}$

path :-

H E G

case 2 invalid,

False

Q.2.7)

1) $P(A|D) = P(A|S)$

Nothing satisfies

$\therefore \boxed{S = \{D\}}$ i.e. $P(A|D) = P(A|D)$

2) $P(A|B,D) = P(A|S)$

→ 1) A | B :-
E = {B}
A → D ✗

→ 2) A | D :-
E = {D}
A → E :- A D B E ✗

→ 3) E = {B D}

(C) Case (2) at B — A D B E C ✓
case (1) at D — A D F E C ✓

(E) case (2) B ✓
case (1) . D ✓

(F) Case (2) B ✓
Case (1) D ✓

$\therefore \boxed{S = \{B, D, C, E, F\}}$

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3) $P(B \mid D, E) = P(B \mid S)$

$\rightarrow B \mid D$

$E = \{D\}$

BE ✗

$\rightarrow B \mid E$

$E = \{E\}$

$B \rightarrow D$ ✗

$\rightarrow E = \{D, E\}$

A BDA ✗

C BEC ✗

F BEF ✓ } Case 1

BDF ✓

$$\boxed{\therefore S = \{D, E, F\}}$$

4) $P(E) = P(E \mid S)$

$E = \{\}$

A $EFDA$ } Case 3 ✓

$EBDA$

D ✗

$$\boxed{\therefore S = \{A\}}$$

5) $P(E|F) = P(E|S)$

$E = \{F\}$

$\times$

$\boxed{S = \{F\}}$

6) $P(E|D,F) = P(E|S)$

$\rightarrow E|D$

$E = \{D\}$

$\times$

$\rightarrow E|F$

$E = \{F\}$

$\times$

$E = \{D, F\}$

$\times$

$\therefore \boxed{S = \{D, F\}}$

7) $P(E|B,C) = P(E|S)$

$\rightarrow E|B$

$E = \{B\}$

$\times$

$\rightarrow E|C$

$E = \{C\}$

$\times$

$\rightarrow E = \{B, C\}$

(D) ✓ C 2 at B
C 3 at F

(A) ✓ $\therefore \boxed{S = \{B, C, A, D\}}$

8) $P(F) = P(F|S)$

$E = \{\}$

$\times$

$\therefore \boxed{S = \{\}}$

9) $P(F|D) = P(F|S)$

$E = \{D\}$

A $\times$

$\therefore \boxed{S = \{D\}}$

10) $P(F|D,E) = P(F|S)$

$\rightarrow F|D$

$E = \{D\}$

$\times$

$\rightarrow F|E$

$E = \{E\}$

$\times$

$\rightarrow E = \{D, E\}$

B ✓ C1, C2

D ✓

E ✓

$\therefore \boxed{S = \{D, E, B, C, A\}}$ //

Q.2.8)

a) <

b) <

c) <

d) <

e) =

f) >

g) < //

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Q.29) $P(C|ABD)$

a)
$$\frac{P(D|ABC)\;P(C|AB)}{P(D|AB)}$$

$$\cancel{\frac{P(D|AB)\;P(C|AB)}{P(D|AB)}}$$

$$\cancel{P(C|AB)}$$

$$\frac{P(D|BC)\;P(C|AB)}{P(D|AB)}$$

$$\frac{P(D|BC)\;P(C|A)}{P(D|AB)}$$

Now, $(D|AB) = \sum_c P(D, C=c|AB)$

$$P(C|AB)\;P(D|ABC)$$

$$= P(C=c|A)\;P(D|BC=c)$$

$$\therefore \frac{P(D|BC)\;P(C|A)}{\sum_c P(C=c|A)\;P(D|B,C=c)}$$

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h) $P(E \mid A, B, D)$

$\Sigma \; P(E, C=c \mid A, B, D)$

$P(C=c \mid ABD) \; P(E \mid C=c \; ABD)$

$P(C=c \mid ABD) \; P(E \mid C=c \; AB)$ c 3

$P \; E \mid C=c, A)$ c 3

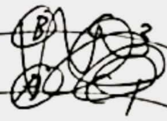
$P(E \mid C)$ c 1

c) $P(G|ABD)$

$\sum_{e} P(G, E=e\, ABD)$

$P(E=e|ABD) \quad P(G|ABD\, E=e)$

$P(G|ABE=e)$



E Case 1

$P(G|AE=e)$ C ③

$P(G|E=e)$ C ①

d) $P(F|ABDG)$

$\sum_{e} P(F,E|ABDG)$

$P(E|ABDG) \quad P(F|ABDGE)$

$\frac{P(E,A,B,D,G)}{P(A,B,D,G)} \qquad P(F|E,G)$ ....

$$\frac{\cancel{P(A)}\ P(\cancel{B|A})\ P(\cancel{D|}AB)\ P(E|ABD)\ P(G|ABDE)}{\cancel{P(A)}\ (\cancel{B|A})\ (\cancel{D|AB})\ (G|ABD)}$$

$$\frac{P(E|ABD)\ P(G|ABDE)}{P(G|ABD)}$$

$$= \frac{(b)\ P(G|E)}{(c)}$$

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$$(F \mid E\,G)$$

$$\frac{(F, E, G)}{(E, G)}$$

$$\frac{\cancel{P(E)}\ P(F \mid E)\ (G \mid E, F)}{\cancel{P(E)}\ (G \mid E)}$$

$$\frac{(h)}{(c)}\ P\cancel{(G \mid E)} \times \left[\frac{P(F)\ (G \mid E, F)}{\cancel{(G \mid E)}}\right]$$

e

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