INTRO TO ARTIFICIAL INTELLIGENCE

HOMEWORK - 4.

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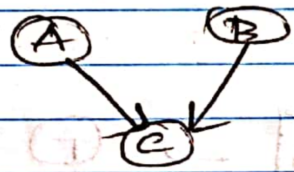
1) CONDITIONAL INDEPENDENCE

a) $A \perp\!\!\!\perp B$ → YES



→ INACTIVE PATH.

only way to reach from A to B is via C. Since it is inactive, we can guarantee that A and B are independent

b) $A \perp\!\!\!\perp F \mid E$ → YES

paths 1. A → C → D → E

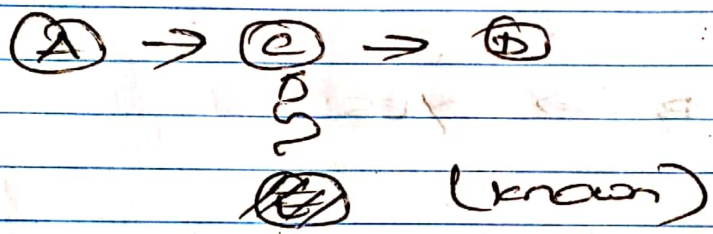
2. A → C → E → G ← F

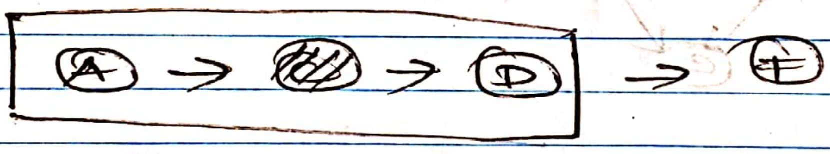
A → C → D → F → ACTIVE

ACTIVE

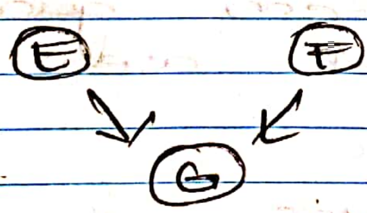
Since one of the path is active, we can't guarantee that A and F are independence given E

As E is known,





Inactive.

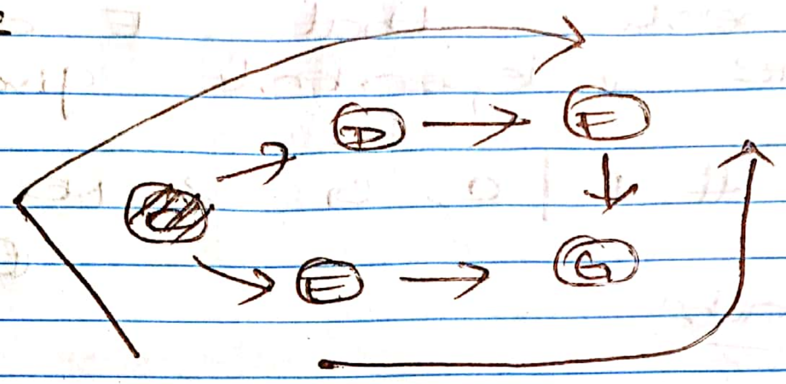


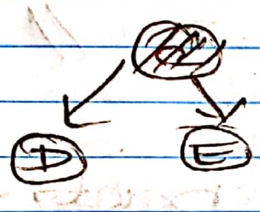
Inactive.

Thus we can guarantee that the A and F are independent given E.

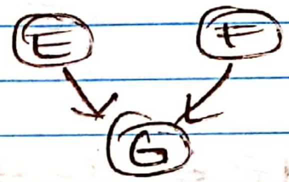
c) $E \perp\!\!\!\perp F \mid C \Rightarrow$ YES.

paths





(Inactive)



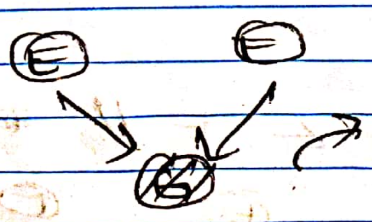
(Inactive)

Since both the paths are inactive, we can guarentee that E and F are conditionally independence given C.

d) $E \perp\!\!\!\perp F \mid G \Rightarrow$ NO,

paths $\boxed{E \rightarrow \boxed{C \rightarrow D} \rightarrow F}$. both are active.

$E \rightarrow G \leftarrow F$

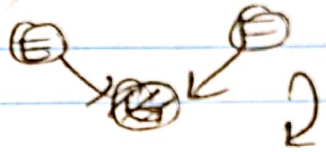


→ active.

(known)

As one of the path is active we cannot guarantee that E and F are independent given G.

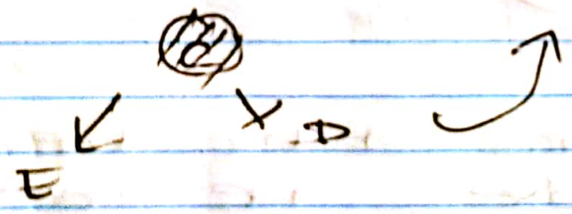
e) $E \perp\!\!\!\perp F \mid C, G \Rightarrow$ NO.



paths

$E \to G \leftarrow F$ // active

$E \leftarrow C \to D$ // inactive.

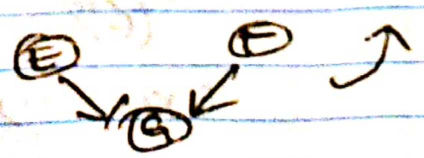


As one of the path is active we cannot guarantee the independence b/w E and F given C and G.

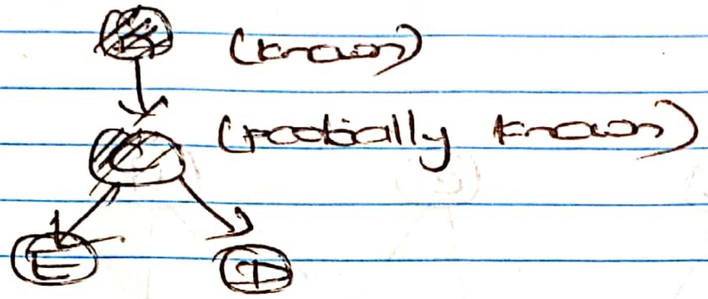
f) $E \perp\!\!\!\perp F \mid A \Rightarrow$ YES.

paths

$E \to G \leftarrow F$ // inactive.



$E \not\leftarrow C \rightarrow D \rightarrow F.$



(inactive)

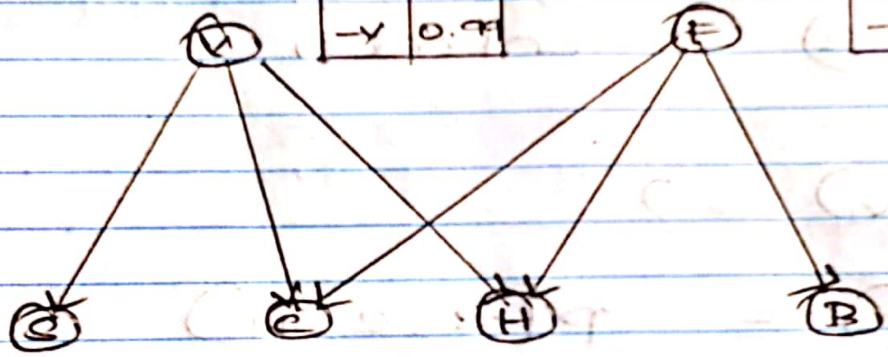
As both the paths are inactive, this conditional independence b/w E and F are guaranteed given A.

2) BAYNES REPRESENTATION

a) GRAPH

V	P(V)
+V	0.01
-V	0.99

F	P(F)
+F	0.02
-F	0.98



P(V) | S, C, H			
+S	+C	+H	1
+S	+C	-H	0.44
+S	-C	+H	0.56
+S	-C	-H	0.44
-S	+C	+H	0.56
-S	+C	-H	0.44
-S	-C	+H	0.36
-S	-C	-H	0

P(F) | C H B			
+C	+H	+B	1
+C	+H	-B	0.48
+C	-H	+B	0.42
+C	-H	-B	0.44
-C	+H	+B	0.56
-C	+H	-B	0.58
-C	-H	+B	0.52
-C	-H	-B	0

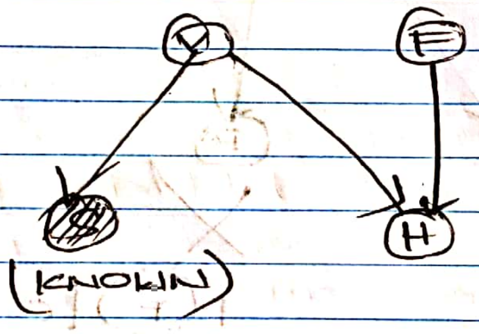
Scanned with CamScanner

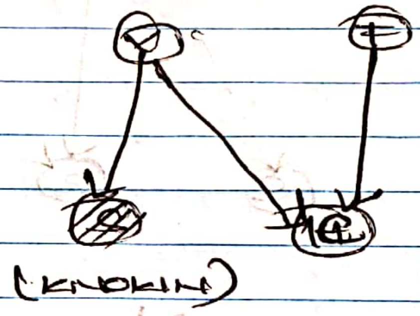
b) So Given S is V and F independent. $V \perp\!\!\!\perp F \mid S$

path

F – H – Y – S

F – G – Y – S





H ← V → S } ACTIVE

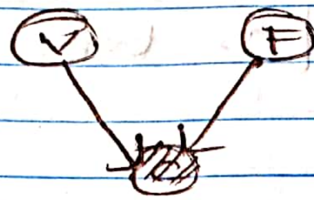
V ← H → F } INACTIVE

Thus the guarentee can ~~not~~ be given for the independence of V and F given S.

If the person who has the symptom S, who has flu will be diagnosed with COVID 19.

c) $V \perp\!\!\!\perp F \mid C$.

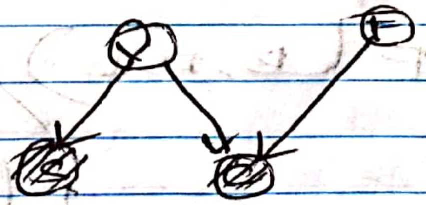
<u>path</u>



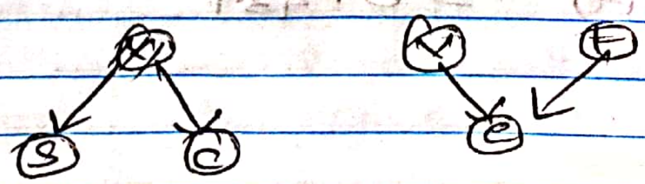
↪ ACTIVE.

since the path $V \to C \leftarrow F$ is active, we cannot guarantee independence between $V \perp\!\!\!\perp F \mid C$.

d) $V \perp\!\!\!\perp F \mid C, S$



As S confirms presence of (K) thus V is known.



IN ACTIVE

ACTIVE

so it is confirmed that presence of C & S guarantees independence.

Given

2a) patient as symptom C, and H and no symptom of S. did not ask about B.

$$p(v|c,H) = ?$$

$$= p(+v, +s, +c, +H)$$

$$= \frac{p(+v)\, p(+f)\, p(+s+c+H) \times p(+c+H-B)}{\sum_m p(+v)\, p(+E)\, p(+s+c+H) + p(+c/s)}$$

$$= \frac{0.01 * 0.02 \times 1 \times 0.48}{0.01 + 0.02 + 1 \times 0.48 + 0.56}$$

$$= \frac{\cancel{0.0096}}{\cancel{3.128}} \quad \frac{0.096}{0.032}$$

$$= 0.32$$

So the probablity that the patient who has symptom c and H has a covid-19 probablity of 0.32.

3) BAYES NETWORK & CONDITIONAL PROB:

a) $P(B = true \mid D = true, E = False)$

soln

$$P(B \mid D, E) = P(B, D, E) / P(D, E)$$

probablities can be computed by summing over A and C and A, B, C respectively

$$P(B \mid D, E) = P(B, D, E) / P(D, E)$$

$$P(B \mid D, E) = 0.437$$