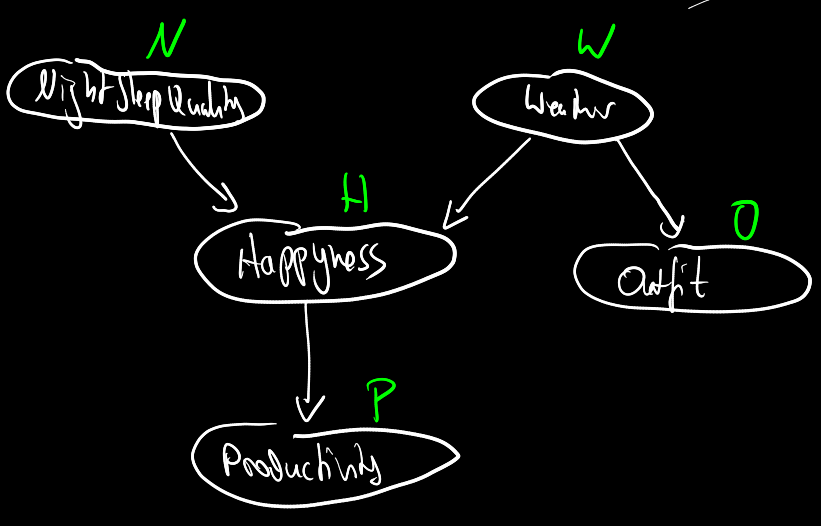
Directed Graphical Models

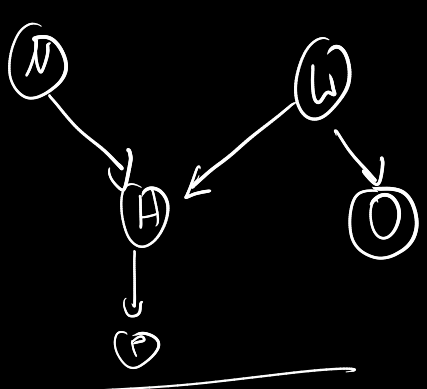
D-Separated | Conditional Independence

(latent & observed nodes)



DGM
↳ factorize the joint

Relations between nodes in the graph?



question: if we only observe (W)
can we say sth about relationships between other nodes

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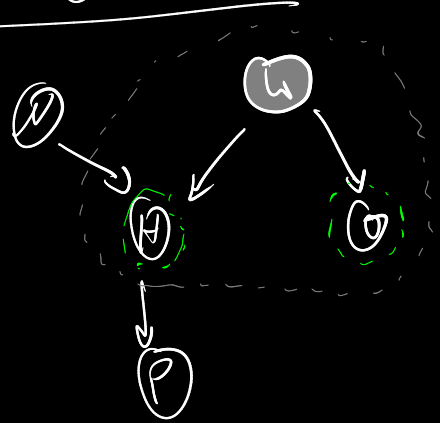
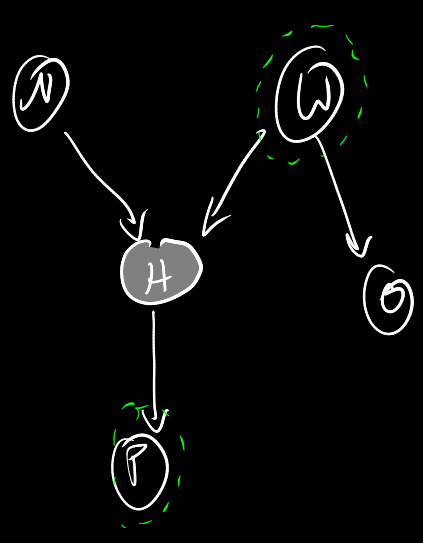
① 

$p(N,W,H,O,P)$ → marginalization

→ conditional independence between (H) and (O) given (W)
(→ d-separated)

$p(H,O|W) = p(H|W)\,p(O|W)$

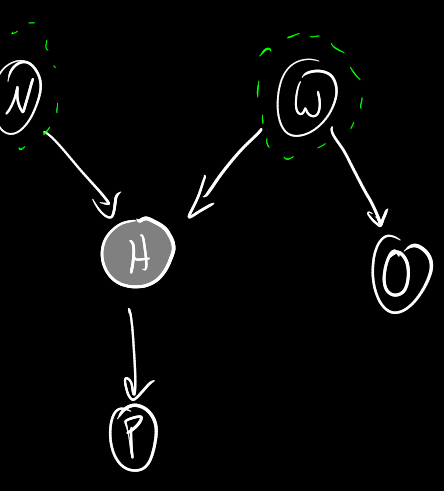
[not marginal independence
$p(H,O) \neq p(H)\,p(O)$]

② 

(W) is conditionally independent of (P) given (H)

$p(W,P|H) = p(W|H)\,p(P|H)$

expres by Bayes Rule

③ 

$p(N,W|H) \neq p(N|H)\,p(W|H)$

↳ Simpson's Paradoxon
(→ read wikipedia)

if we know the random variable caused by two other, then those two are no longer independent

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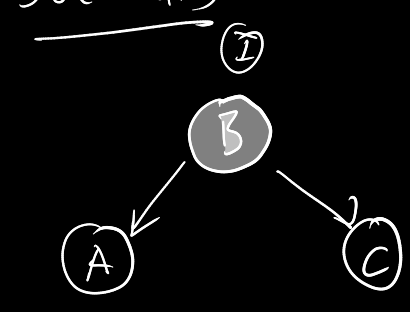
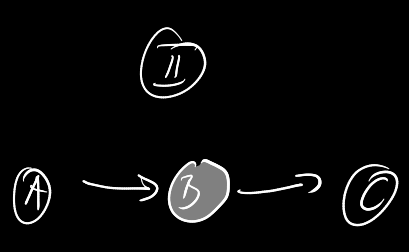
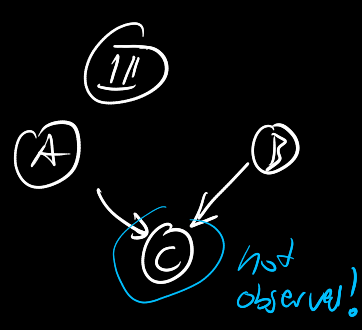
Basic Rules



$p(A,C|B) = p(A|B)\,p(C|B)$



$p(A,C|B) = p(A|B)\,p(C|B)$

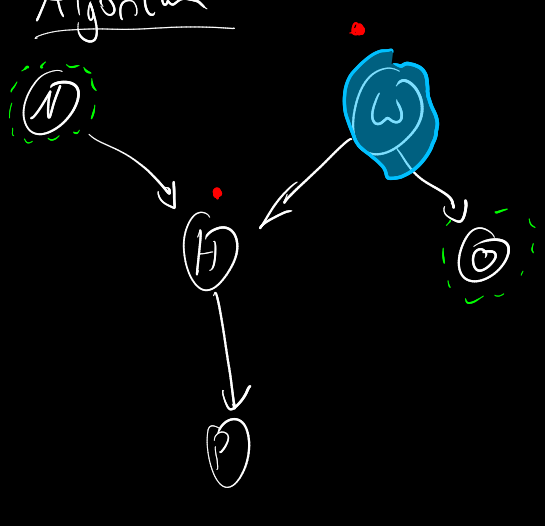


$p(A,C) = p(A)\,p(C)$

C no given

"both A & B are roots"

Algorithm



① Mark the givens
e.g. (W)

② Apply Basic rules to all triplets

③ check if there is a path between random variables that is not blocked (undirected)
e.g.: N & P are d-separated given (W)