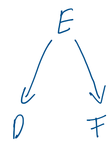
Paths and associations

21.04.21 08:52

Types of paths:

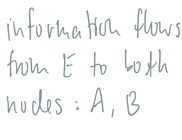
Fork: $D \leftarrow E \rightarrow F$ think of it as a fork



Chain: $D \rightarrow E \rightarrow F$ think of a chain reaction (flow in one direction)

Inverted fork: $D \rightarrow E \leftarrow F$

- association btw. two nodes A, B which are located at the end of a path:
  is association iff information flows to both nodes

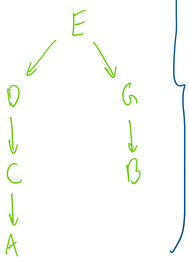


⇒ A and B are not independent (bc E affects both of them)

⇓

there is an association (info. flow) btw. A and B due to E

Similarly:



A and B are associated with each other via path:

$A \leftarrow C \leftarrow D \leftarrow E \rightarrow G \rightarrow B$

Example for association btw. A and B through chain:

$A \rightarrow G \rightarrow D$ OR $A \rightarrow G \rightarrow D \rightarrow F \rightarrow B$

Paths which do not induce association between A and B:

- association btw. 2 nodes exists, if we can propagate information from a DAG node to both nodes of interest (A, B)

} choose E to propagate the info to both nodes A and B.

$A \rightarrow E \rightarrow B$ } choose A to propagate the info to both nodes A and B.

Counter example DAG w/o association for (A, B) pair:

$A \rightarrow G \leftarrow B$ } if we choose A, info stuck at G node.
if we choose B, info stuck at G node.
if we choose G, no info flow at all, stuck at G node.

Collider node

Here, info from A and B collide (get stuck) at G.

⇓

Thus, we call G a "collider".

→ with: $A \rightarrow G \leftarrow B$ we get that $A \perp\!\!\!\perp B$ (iff this is the only path btw. A and B in the DAG).

Add. example: $A \rightarrow G \leftarrow D \leftarrow B$ G is a collider.

collision at node G. Thus no association btw. A and B. Thus, $A \perp\!\!\!\perp B$ on this path of the DAG.