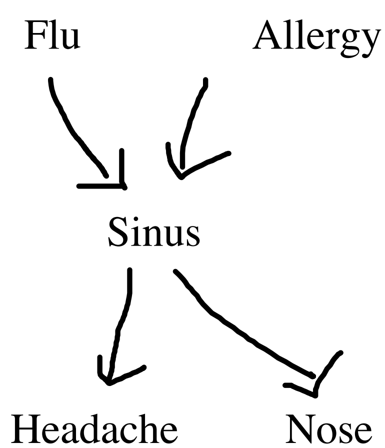
Quiz

1. (10 points)
   What is the Markov Assumption (aka Markov Property) in a Bayesian Network?

Ans:

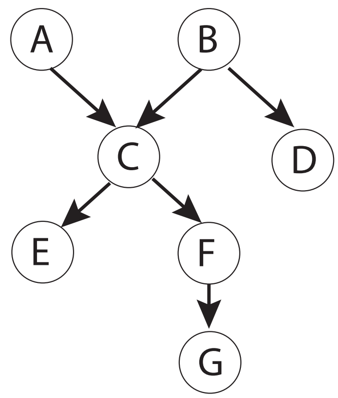
Markov hypothesis is an assumption made in Bayesian probability theory, that is, given its parent, each node in the Bayesian network is conditionally independent of its non-descendants. Loosely speaking, it is assumed that a node has no bearing on nodes which do not descend from it. In a DAG, this local Markov condition is equivalent to the global Markov condition, which states that d-separations in the graph also correspond to conditional independence relations. Two nodes X and Y are d-separated by a set Z if All paths between X and Y are blocked by Z. If X and Y are d-separated by Z, then $X \perp Y|Z$. By chaining together local independencies, one can infer global independencies. The general definition/algorithm is complex so we break it into pieces.

For example,



If you have no sinus infection, then flu has no influence on headache (flu causes headache but only through sinus)

2. (30 points)
   Consider the following Bayesian Network.



TRUE OR FALSE

A) A is d-separated from B, given D

FALSE

The path between A and B is active as they are connected by so even if there node D is inactive A and B remain to be connected to C.

b) F is d-separated from E, given D

FALSE

The path between E and F is active because of node C. Even if node D is made inactive E and F are dependent.

c) $F \perp A \mid C$
   (F is conditionally independent of A given C)

TRUE

Path between A and F is inactive when C is made inactive hence true.

d) $A \perp B$ |D
   (A is conditionally independent of B given D)

FALSE

Path between A and B is active because C is active, i.e if we make node D inactive, A will remain dependent on B

e) $A \perp B$ | C
(A is conditionally independent of B given C)

TRUE

Path between A and B is inactive because the path is broken at node C making A independent of B.