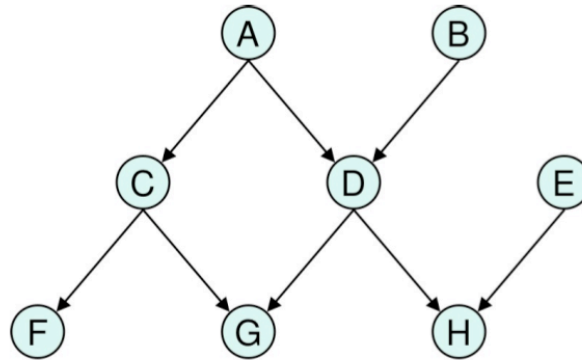


Artificial Intelligence (CS 131)
Bayes Nets Exercises

[1] (from *S. Zilberstein*) Consider the following Bayes Net:



- a. Suppose that all the variables are Boolean. How many parameters (real numbers) are needed to specify an arbitrary joint probability distribution over 8 variables? How many parameters are needed to define the joint probability distribution using the above Bayesian network?
- b. Which of the following probabilistic relations are (or are not) implied by the structure of the above Bayesian network?
- i. $P(E \mid G) = P(E)$
 - ii. $P(C \mid D) = P(C)$
 - iii. $P(C \mid D, A) = P(C \mid A)$
 - iv. $P(B \mid A, C) = P(B \mid A)$
 - v. $P(C, D \mid E) = P(C, D)$
 - vi. $P(F \mid A, E, H) = P(F \mid A)$
 - vii. $P(A, C \mid D, E, H) = P(A, C \mid D)$

[2] (*from D. Precup*) Data the android has been captured by an alien species and is trying to escape. He observes that 8 out of the 10 aliens with whom he comes in contact are wearing some kind of weapon. He hasn't seen anything like it before, but it seems to him that there is a 0.6 probability that this weapon is a neural disruptor, which would disable him permanently if he is shot. If the weapon is *not* a disruptor after all, then there is only a 0.1 probability that he will be disabled if he is shot. Data also estimates that he has a 0.5 probability of over-powering any alien he meets. If the alien is armed, but Data over-powers it, then the alien cannot fire the weapon. If he over-powers the next alien he meets, he will escape the planet.

- a. Draw a Bayes Net for this problem, assuming that Data will meet an alien. Include all conditional probability tables at each variable node.
- b. What is the probability that Data is disabled, given no other information?
- c. What is the probability that Data is disabled, if the alien actually has a weapon?
- d. Suppose that your friend has already watched this episode, and tells you that Data escapes unharmed. What is the probability that the alien was not carrying a weapon? What is the probability that the alien was carrying a neural disruptor?