2. Bayes Net

May 2, 2017

1 a) Write down the factorization of the joint distribution that is implied by the graph.

$$p(x,d,e,t,l,b,a,s) = p(a)p(t|a)p(s)p(l|s)p(b|s)p(e|t,l,a,s)p(d|e,b,t,l,a,s)p(x|e,t,l,a,s)$$

2 b) Are s and a independent?

Yes. They are only connected through their children, in fact neither node has any parents at all. This makes their relationship a "head-to-head" connection, which information cannot flow through. They have no influence on each other.

3 c) Are s and a conditionally indpendent given x?

No. x is descended from both s and a. The relationship between s and a is a head-to-head connection, so information about their mutual descendent opens up the flow of information between them. Knowing the state of x implies that at least one of s or a must have caused it. If then information surfaces indicating that a is the culprit, that influences the probability of s by explaining it away, back to its original probability before the state of x had been discovered.