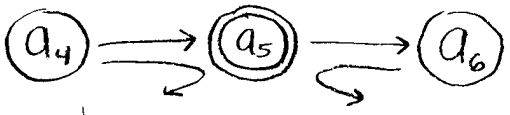
Problem 3

(a) We have observed $\{a_5, b_4, b_5, b_6, c_3 c_4 c_5 c_6 c_7, d_3 d_4 d_5 d_6 d_7, e_4 e_5 e_6 f_5\}$ and know they are not contaminated.

Without this observation, all nodes were dependent on a_1. a_1 directly affected a_2, b_1, and b_2, but through the graph connection affected every other node.

With the observed nodes, however, some of the nodes in the graph will no longer be affected by a_1.

- First off, the observed nodes are already determined and therefore not affected by a_1.
- Using Bayes Ball Algorithm, we can determine if a node is independent of a_1 given the observed. For example:



bounce back

$\Rightarrow a_4 \perp a_6 \mid a_5$

is a section of the Bayes Net, and a_5 is now observed.

From this we see that $a_6, a_7, a_8, b_7, b_8, c_8, d_8, e_8, e_7, f_6, f_7, f_8$ will be independent of a_1.

If you follow the bounce back rule and check these nodes (see attached graph) these nodes will not be influenced by a_1 since they are cut off with the observed nodes in between.

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Nodes that depend on a_1: $a_2 a_3 a_4, b_1 b_2 b_3, c_1 c_2, d_1 d_2, e_1 e_2 e_3, f_1, f_2, f_3, f_4$, all g nodes, all h nodes.