## The Holmes scenario

Mr. Holmes lives in a high crime area and therefore has installed a burglar alarm. He relies on his neighbors to phone him when they hear the alarm sound. Mr. Holmes has two neighbors, Dr. Watson and Mrs. Gibbon.

Unfortunately, his neighbors are not entirely reliable. Dr. Watson is known to be a tasteless practical joker and Mrs. Gibbon, while more reliable in general, has occasional drinking problems.

Mr. Holmes also knows from reading the instruction manual of his alarm system that the device is sensitive to earthquakes and can be triggered by one accidentally. He realizes that if an earthquake has occurred, it would surely be on the radio news.

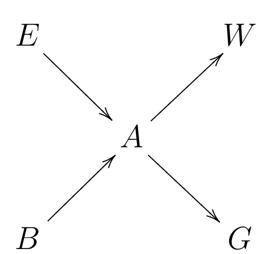
Construct a correct Bayesian network using the following ordering. (Let's drop Radio.)

$$B, E, A, W, G$$

Add each node to the Bayes network.

1. If E has no parent, we are claiming that B and E are independent, which is true.
2. If A has no parent, then we are claiming that A is independent of both E and B, which is false (A is directly affected by both B and E). If A has E has its only parent, then we are claiming that given E, A and B are independent, which is false (Given E, A is still directly affected by B). By the same reasoning, A cannot have B as its only parent. Thus, A must have both B and E as its parents.
3. Whether Watson calls directly depends on Alarm, and does not directly depend on Earthquake or Burglary. In other words, we are assuming that Watson does not directly observe Earthquake nor Burglary.

   No parent for W does not work because W is directly affected by A. If W has E, B, or both E and B as parents, then we are claiming that W is independent of A given E and B, which is false. If W has A has its only parents, then we are claiming that W is independent of B and E given A, which is true.
4. Using similar reasoning as W, G is independent of B and E given A. Thus, we can choose A as the only parent of G.




Some observations:

- A separates B and E from W and G. Given A, the two sides of the network are independent.
- A casual model: links are from causes to effects/consequences.
- This requires 10 probabilities in total. $1 + 1 + 4 + 2 + 2 = 10$.