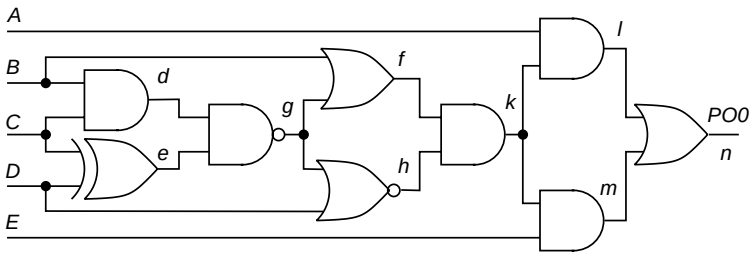

Figure 7.30: Example of dominators.

The main contribution of FAN is to introduce the immediate implications of signal assignments, unique sensitization, headlines, and multiple backtrace.

7.5.4 Advanced Algorithms

We briefly summarize additional ATPG algorithms that have been developed.

Dominator ATPG Programs. Kirkland and Mercer [360] developed TOPS, which found even more immediate signal assignments than FAN using *dominators*. A *dominator* is a circuit signal through which the fault effect *has* to pass in order to be detected at a particular PO. An *absolute dominator* is a dominator through which the fault effect *has* to pass to be detected at any PO. In Figure 7.30, l and n are absolute dominators of A, k and n are absolute dominators of B, and g, k, and n are absolute dominators of C. k and n are absolute dominators of D and m and n are absolute dominators of E. For absolute dominators of a fault, we must set the inputs to those absolute dominators that are not in the fault effect cone to non-controlling values to propagate the fault effect through the absolute dominator. These are *mandatory assignments*, meaning that they can be determined by topological circuit analysis rather than by search. This would sometimes cause faults to be proved redundant without any search. During search, whenever any dominators of a fault become the constant values 0 or 1, fault propagation has been cut off, and the algorithm can back-up immediately.

Learning ATPG Programs.

SOCRATES (Schulz et al.) Schulz *et al.* introduced SOCRATES [574, 576, 577], an ATPG program that does *static* and *dynamic learning*. The *learning procedure* systematically sets all circuit signals to 0 and 1, and discovers what other signal values are implied. These implications are saved in the circuit netlist, in the form of *implication* arcs, and are used during search when they cause additional signals to be assigned. SOCRATES also uses *dynamic learning*, which invokes the learning procedure between search steps. This is costly but effective, because additional signal relationships can be learned when signals are already partially set in the circuit. Not all implications are worth learning. Consider Figure 7.31. The implication