3. The notion of reachability has a nice symmetry. Instead of describing all states that are reachable from some initial state, it is just as easy to describe all states from which some state can be reached. Given a finite-state system M, the **backward reachable states** of a set F of states is the set B of all states from which some state in F can be reached. The following algorithm computes the set of backward reachable states for a given set of states F:

Input : A set F of states and transition relation δ for closed finite-state system M
Output: Set B of backward reachable states from F in M

1 **Initialize:** $B := F$
2 $B_{\text{new}} := B$
3 **while** $B_{\text{new}} \neq \emptyset$ **do**
4 $\quad B_{\text{new}} := \{s \mid \exists s' \in B \text{ s.t. } s' \in \delta(s) \wedge s \notin B\}$
5 $\quad B := B \cup B_{\text{new}}$
6 **end**

Explain how this algorithm can check the property $\mathbf{G}p$ on M, where p is some property that is easily checked for each state s in M. You may assume that M has exactly one initial state s_0.

Solution: Let the input F to the algorithm be the set of all states where p does not hold. Then $\mathbf{G}p$ is true if and only if the output B of the algorithm does not contain the initial state s_0.