Question 3 (10 points)
This question asks you to study reachability. Reachability is a liveness property. A global state $S'$ is reachable from another global state $S$, if there exists a valid computation (i.e. a sequence of states and state transitions) that leads the systems from $S$ to $S'$. We consider an example from Petri nets that represent asynchronous control structures.

In a Petri net, each circle is called a place and it denotes a condition. Each box represents a transition that represents an event. A token in a place implies that the condition holds. For a given transition, if every input place has a token, then the transition fires (i.e. the event takes place), all tokens disappear from the input places, and every output place of the transition acquires a token. The global state consists of the set of places that have a token.

![Petri net diagram]

Let $S = \{p_4, p_5, p_6, p_7\}$ and $S' = \{p_1, p_2, p_3, p_8\}$ Is $S'$ reachable from $S$? Justify your answer.

Question 4. (10 points)
In a computation running on a distributed system, let $S$ be the initial state, and $S'$ be a terminal state (a state in which the system does not have any eligible action, and all channels are empty). Also, assume that $S'$ is reachable from $S$. Will the distributed computation always terminate?

Explain your answer. If necessary, use examples.