Exercise 9.1 (Action emulation, 2+2 points)
Consider the following action models (for the one-agent case):

\[ a_1 = e_1 : p \lor q, \quad a_2 = e_2 : p e_3 : q, \quad a_3 = e_4 : p e_5 : q e_6 : p \lor q \]

(a) Show that \( a_1 \) and \( a_3 \) are emulous.
(b) Show that \( a_2 \) and \( a_3 \) are emulous.

Exercise 9.2 (Bisimilarity and action properties, 2+2+2+1+1 points)
Consider the following epistemic state \( s_0 \), alongside the \textit{Mayset} actions from Exercise 8.2. The state represents the situation where no agent has pressed the switch yet, but both agents have had the opportunity to do so.

![Diagram of epistemic state](image)

We say that an action \( a \) is \textit{self-absorbing} if for all states \( s \) in which \( a \) is applicable, \( a \) is also applicable in \( s \otimes a \), and \( s \otimes a \otimes a \) is bisimilar to \( s \otimes a \). We say that two actions \( a_1 \) and \( a_2 \) \textit{commute} if for all states \( s \) where \( a_1 \) is applicable in \( s \) and \( a_2 \) is applicable in \( s \otimes a_1 \), also \( a_2 \) is applicable in \( s \otimes a_2 \), and \( s \otimes a_1 \otimes a_2 \) is bisimilar to \( s \otimes a_2 \otimes a_1 \).

(a) Show that \( s_0 \), and \( s_0 \otimes \text{Mayset}_1 \), and \( s_0 \otimes \text{Mayset}_2 \) are bisimilar.
(b) Show that \( \text{Mayset}_1 \) and \( \text{Mayset}_2 \) are self-absorbing actions.
(c) Show that \( \text{Mayset}_1 \) and \( \text{Mayset}_2 \) commute.
(d) Give an example for an action that is not self-absorbing.
(e) Give an example for actions that do not commute.