Challenge 5 –Equivalences

In a project dealing with large DFAs (Deterministic Finite Automata) there is the need to partitioning the DFAs in regions, possibly partially overlapping, and to identify which are the set of regions, named by Φ, that form the same set of substrings which represent paths in the DFAs starting in the states that define the beginning of each region and finishing in the states that define the end of each region (see below examples of DFA regions and examples of Φ regions).

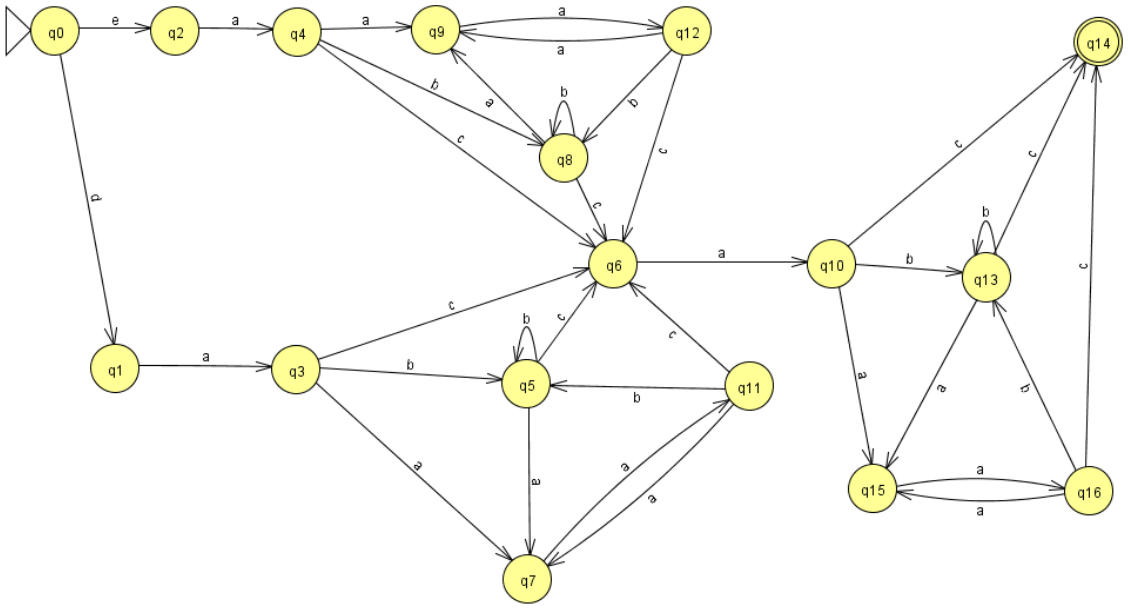
(a) Describe a method to identify the Φ regions considering that the input to the method is a set of regions, each one defined by a tuple (S_{region}, R_{begin}, $\sum_{region}$, δ_{region}, R_{end}), where:

- S_{region}: the set of states belonging to the region;
- R_{begin}, : the set of states that are the initial states of the region (i.e., the states with input transitions from states belonging to different regions of the DFA, with the possibility to also include the initial state);
- $\sum_{region}$: the set of symbols used in the transitions between the states of the region;
- δ_{region}, : the transition function for the states and transitions in the region;
- R_{end}: the set of states that define the end boundary of the region (i.e., the states in the region with at least one transition to states of other region in the DFA, with the possibility to include final and dead states);

(b) Apply your method to the two regions, whose S_{region} sets are {q2, q4, q9, q12, q8, q1, q3, q5, q11, q7} and {q6, q10, q13, q15, q16}, of the DFA illustrated below and indicate if they form a Φ set;

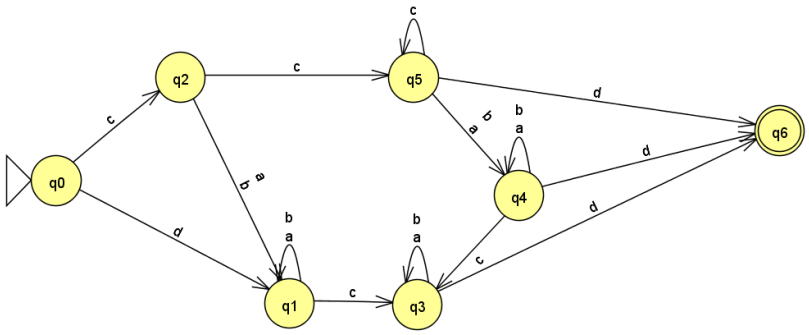
Suggestion: use the JFLAP tool[1] for the conversions you may need to apply your method.

[1] www.jflap.org/

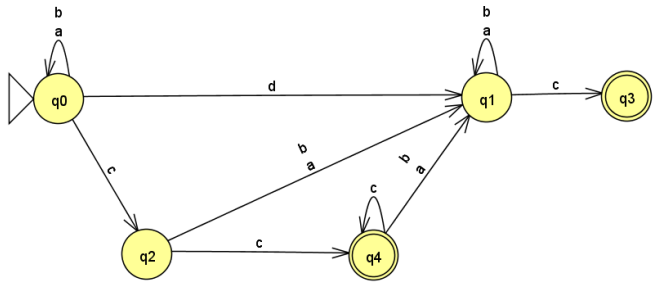


Examples

DFA1:



DFA2:



Consider the two DFAs below and the following examples of Φ regions:

- in DFA1: {q4, q6} and {q3, q6}
- in DFA2: {q0, q2} and {q1, q3}
- in both DFAs: all the four regions {q4, q6} and {q3, q6} in DFA1, and {q0, q2} and {q1, q3} in DFA2, are Φ regions