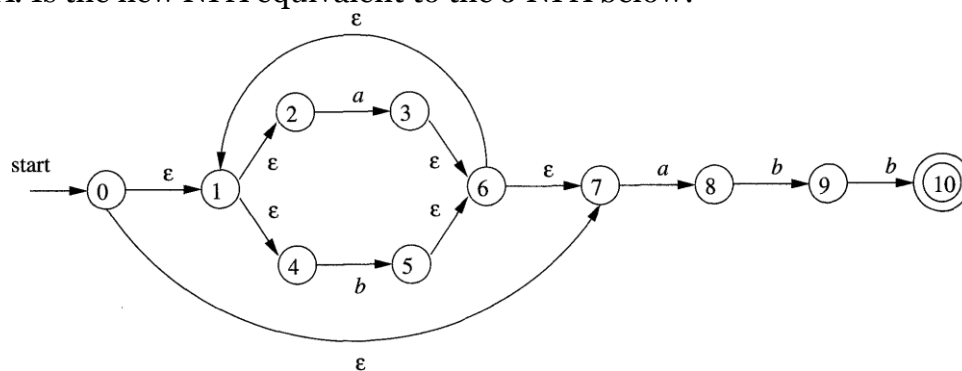


## Challenge Activity 4 – $\epsilon$ -NFAs

In order to diminish the size and to speedup the processing of  $\epsilon$ -NFAs, Calvin had an idea to remove the  $\epsilon$  transitions of the  $\epsilon$ -NFAs and thus to translate them to NFAs. His idea groups states based on their  $\epsilon$ -closure as follows:

- All states belonging to the  $\epsilon$ -closure of a state are transformed into a new state (grouping them) and are removed from the resultant FA;
  - Transitions to a state that now belongs to a group state are now transitions to that group state;
  - Transitions from a state that now belongs to a group state are now transitions from that group state;
  - Group states including one or more final states in the  $\epsilon$ -NFAs are now final states.
1. Apply the approach of Calvin<sup>1</sup> to the following  $\epsilon$ -NFA and draw the resultant NFA. Is the new NFA equivalent to the  $\epsilon$ -NFA below?



2. Do you think that the Calvin's approach works? Justify your answer and if you think it does not work give an example of an  $\epsilon$ -NFA that using the Calvin's approach results in a non-equivalent NFA.

<sup>1</sup> In case of possible doubts about the Calvin's approach try to make assumptions based on what you think could work.