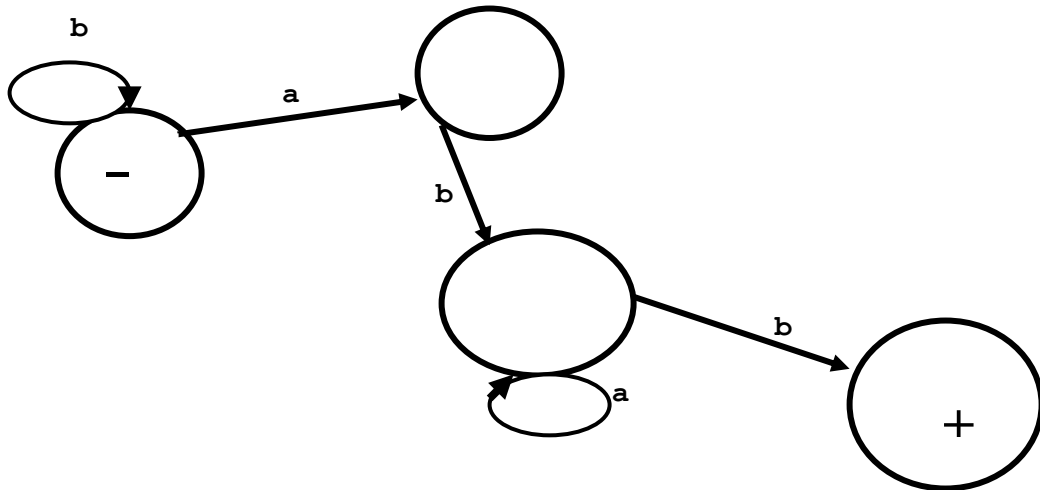


## REQUIRED PROJECT: PROBLEM Piccini

### PART 1

Build the most powerful computing machine that you can think of. Your machine should be able to process complex languages such as  $L_{16} = \{ d^n b j^n b o^n b : \text{where } n > 0 \}$ . Demonstrate that a string like **ddbjjboob** would be accepted by the machine. You need to build the machine by defining its elements mathematically. You are not required to deliver the machine with hardware components. If you do not use standard notations provided in the textbook or discussed in the class then you need to explain your notations.

It is known that Finite State Machines or Finite Automata can accept regular expressions. So, any string from the regular expression  **$b^*aba^*b$**  would be accepted by the following Non-deterministic Finite Automaton.



However, Non-deterministic Finite Automata cannot process a language like  $L_{16}$ , mentioned above, which requires a more powerful machine. You should be able to build such a machine. Explain how your machine will accept strings from  $L_{16}$ .

## PART\_2:

A Turing Machine has a finite set of states with one START state and some (may be none) HALT states. We always mark the START state with 1 and the HALT state with 2 (when there is only one HALT state).

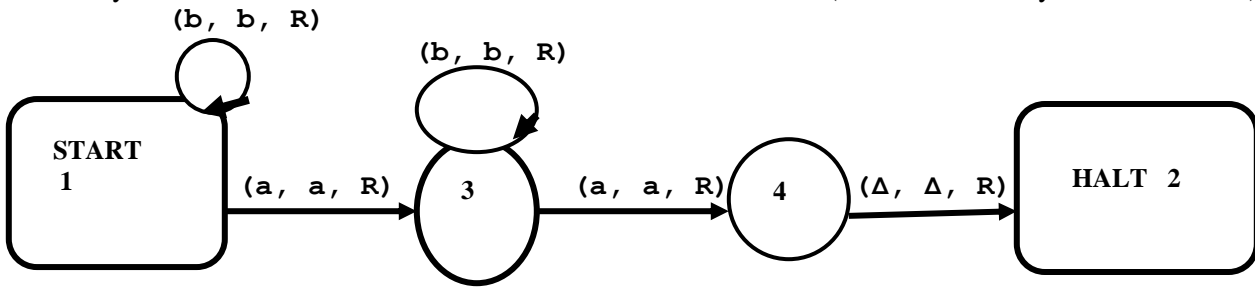


Figure 1. A Turing Machine for  $\{ b^*ab^*a \}$

The Turing Machine given above accepts the language:  $\{ b^*ab^*a \}$ . When an input is given it is processed by the transitions as the Turing Machine goes from state to state starting from the start state. The input is accepted by reaching the HALT state. If the HALT state and its incoming transition are destroyed then no input is accepted. The Turing Machine of Figure 1 would look like the machine given below after the destruction of the HALT state and its incoming transition.

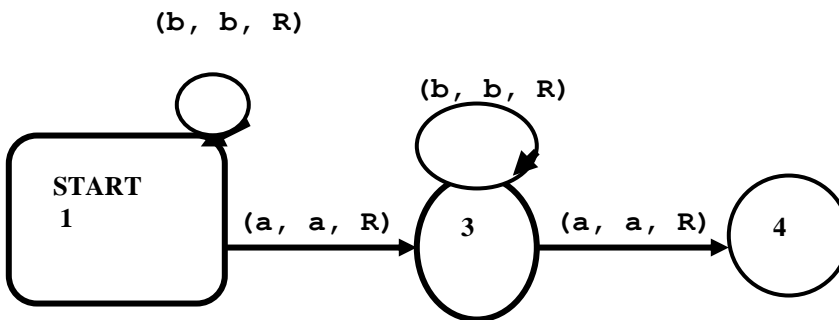


Figure 2. The Turing Machine of Figure 1 after the HALT state and its incoming transition are destroyed.

If the input is: **aba**, then the machine will start in the START state and reach state 4 after going through the loop of state 3. However, the input is not accepted.

You are asked to complete the following three tasks:

- 1) In the first step, destroy the HALT state(s) and their incoming transitions of your machine of the assigned problem (of PART\_1) and examine the consequences.
- 2) In the second step, destroy the START state and the associated transitions of your machine (in addition to the destructions mentioned in step 1) and examine the consequences.
- 3) In the third step, reconstruct the machine so that it is distinct from the original machine of PART\_1 (may have one or more additional states and/or transitions) and still process the same language.

**Due:**