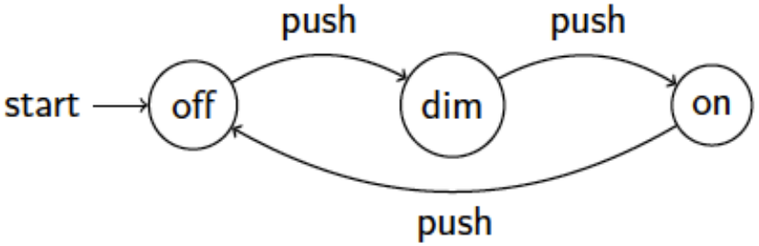
Alphabets, Strings and Languages



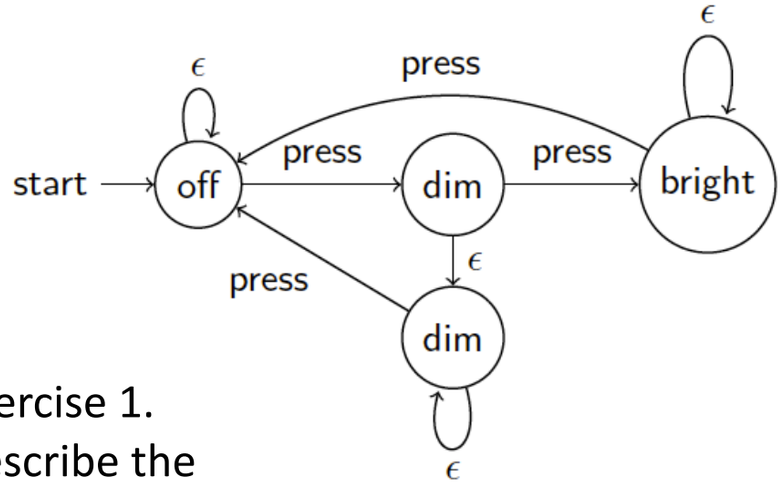
- An *alphabet* Σ is a set of symbols (or letters)

Σ={push}

- A *string* $w=a_1, a_2,\ldots,a_k$ is a sequence of symbols from Σ

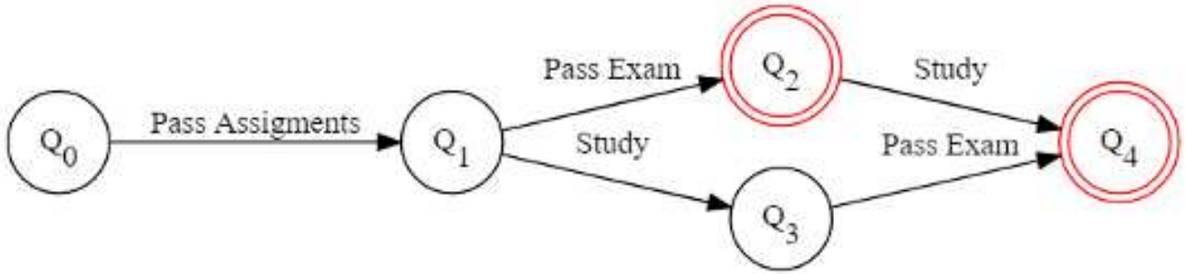
w_1= push,push;
w_2= push,push,push;
w_3=
push,push,pushpush,push,push;
…

- The empty string is written ε
- A language *L* is a set of strings over Σ, that is, a subset of Σ*
  - It includes the empty language: Ø
  - It includes the language of the empty string: {ε}



Exercise 1.
Describe the language of this automaton

How does a DFA define a language?

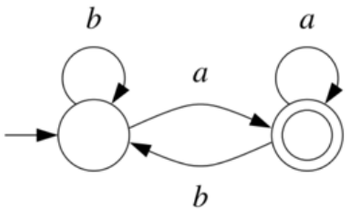


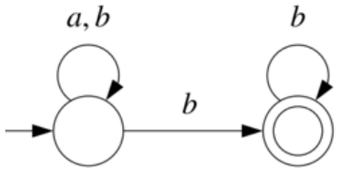
- Consider a string *w*
- Start in the initial state Q_0
- Read the first symbol, say *Pass Assignments*, of w
- Determine the new state $Q_1 = \delta(Q_0, \textit{Pass Assignments})$
- Read the second symbol, say *Pass Exam*, of w
- Determine the new state $Q_2 = \delta(Q_1, \textit{Pass Exam})$
- ...
- Let Q_k be the state obtained after having read the last symbol of *w*
- If Q_k is in F then accept w; otherwise reject w

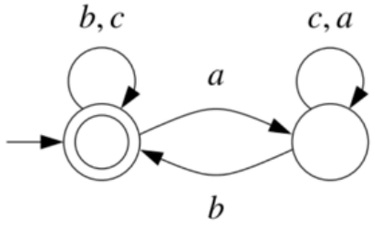
Exercise 2:
How many words exist in the language above?

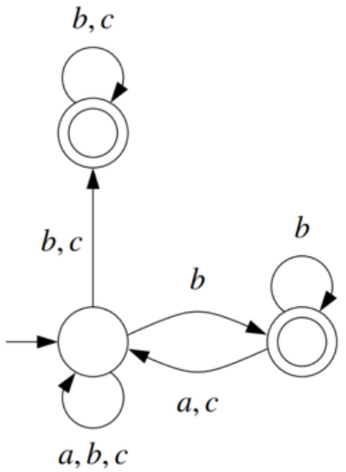
Exercise 3

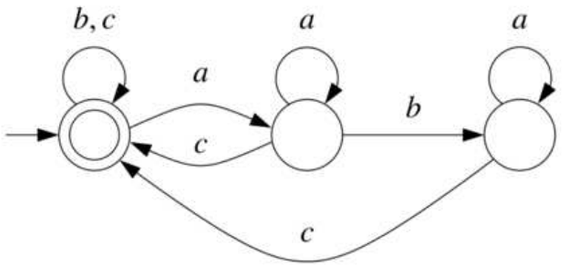
- Describe in natural language the following automata





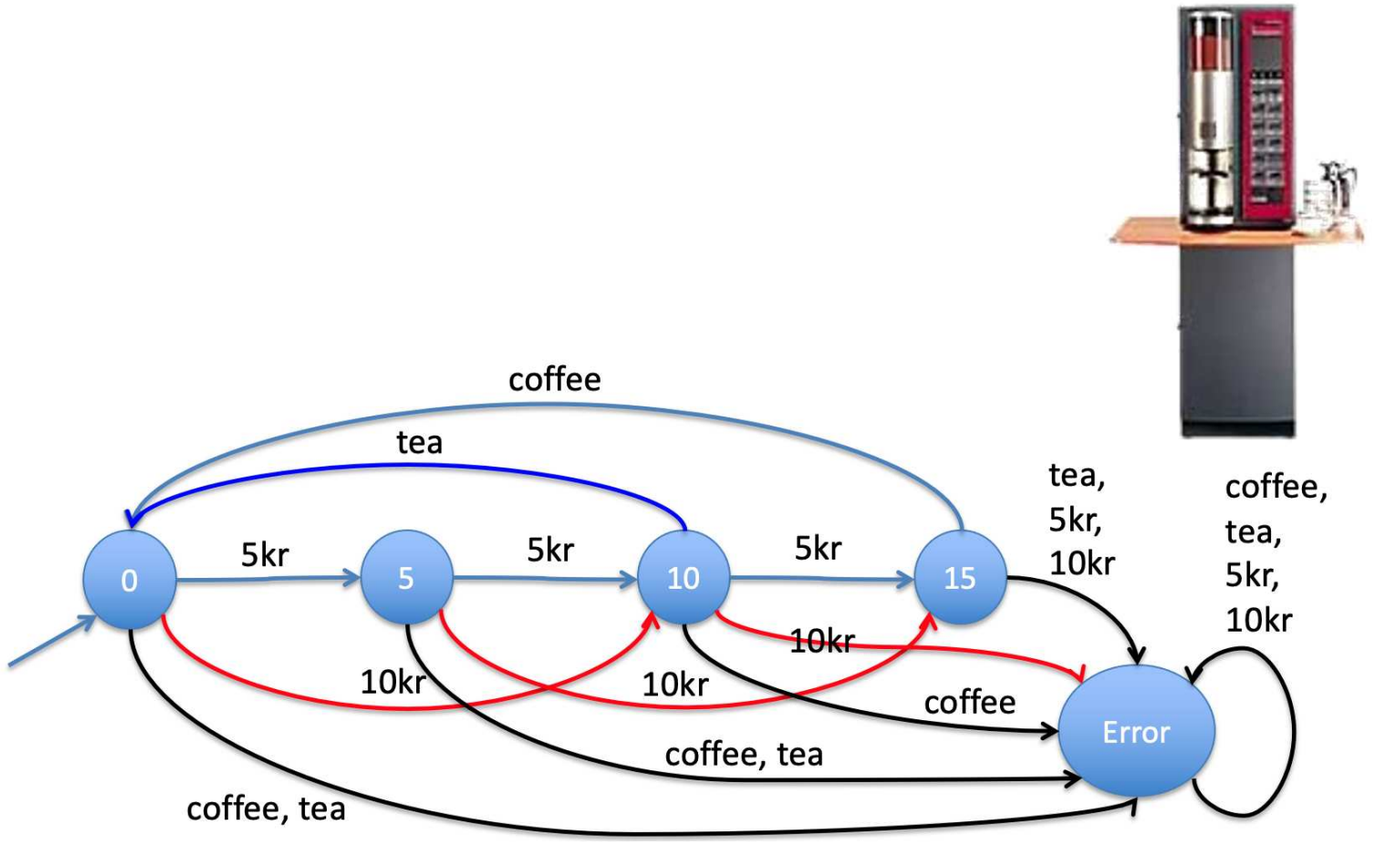






Exercise 4

- In the programming language of your choice, implement the following vending machine



Exercise 5

- Extend the vending machine:
  - To offer chocolate for 20kr.
  - To accept coins of 20kr.

Exercise 6 2x2 puzzle

- Model the 2 × 2 puzzle, the simplest form of the N × N puzzle (https://en.wikipedia.org/wiki/15_puzzle) with a DFA. Which sequences of transitions help you solve the puzzle?