

# CSC236 Worksheet 8 Solution

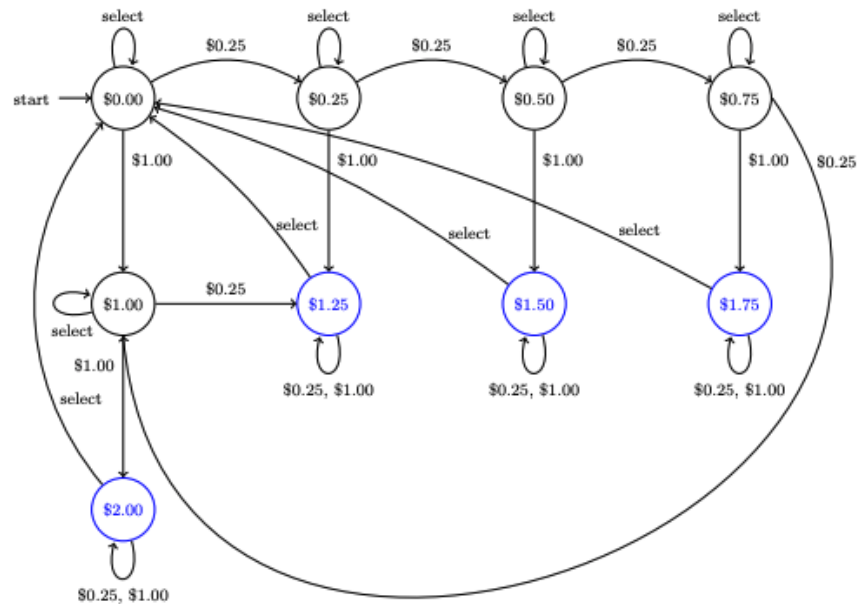
Hyungmo Gu

May 12, 2020

## Question 1

### Notes:

- **Deterministic Finite State Automaton (DFSA):** is a mathematical method of machine which, given any input string  $x$ , **accepts** or **rejects**  $x$ .
- Applications of DFSA
  1. Vending Machine



2. Protocol analysis
3. Text parsing
4. Video game character behavior

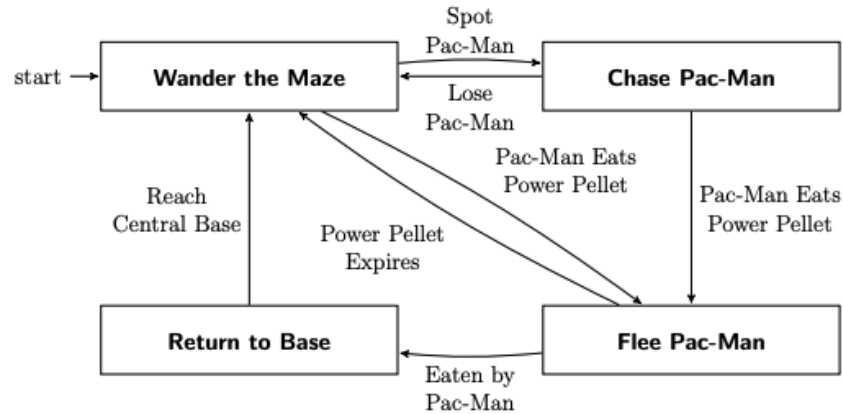
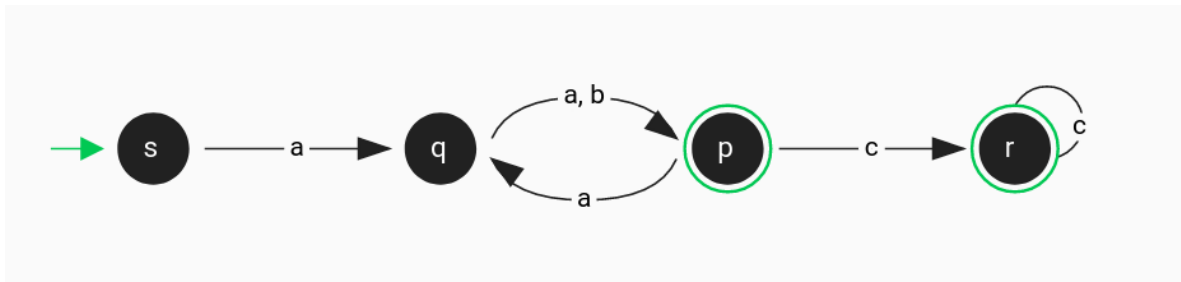


Figure 3: Behavior of a Pac-Man Ghost

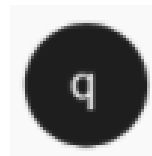
5. Security Analysis
6. CPU control units (\*\*)
7. Natural Language Processing (\*\*)
8. Speech Recognition (\*\*)

• Definitions and Syntax



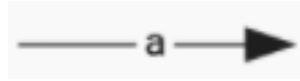
– *DFSA*  $M$  is a quintuple  $M = (Q, \Sigma, q_0, F, \delta)$ , where

- \*  $Q$  : a finite set of **states**.
  - Represents status of system
  - Is represented by a black circle, i.e. s,q

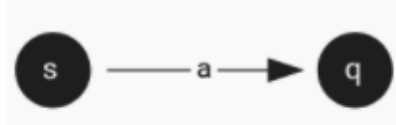


- i.e. automatic sliding door at walmart has two states: either close or open
- i.e. traffic light has three states: red, yellow, green

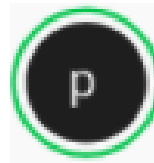
- \*  $\Sigma$  : a finite non-empty alphabet
  - is set of symbols in each transition, i.e. a, b, c



- \*  $q_0 \in Q$  : the start or initial state
- \*  $\delta : Q \times \sigma \rightarrow Q$  : a transition function
  - is a connection between two states.
  - is represented by an arrow



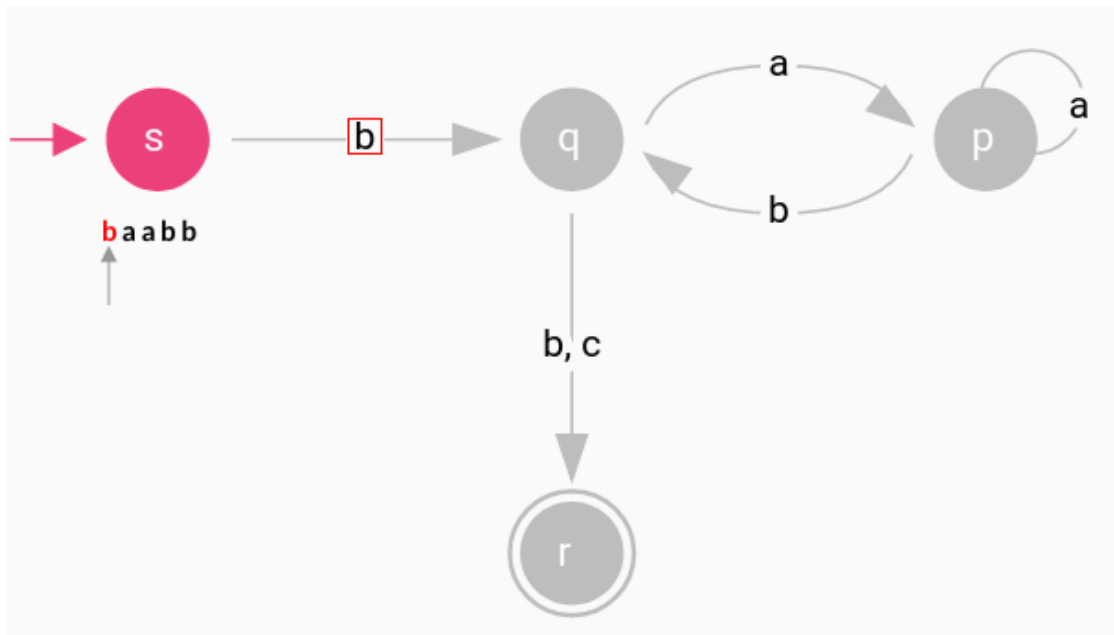
- \*  $F \subseteq Q$  : the set of accepting or final states
  - Is represented by a double circle



- Multiple accepting states may exist
- Purpose: When processing ends, the output is either *accept* or *reject*

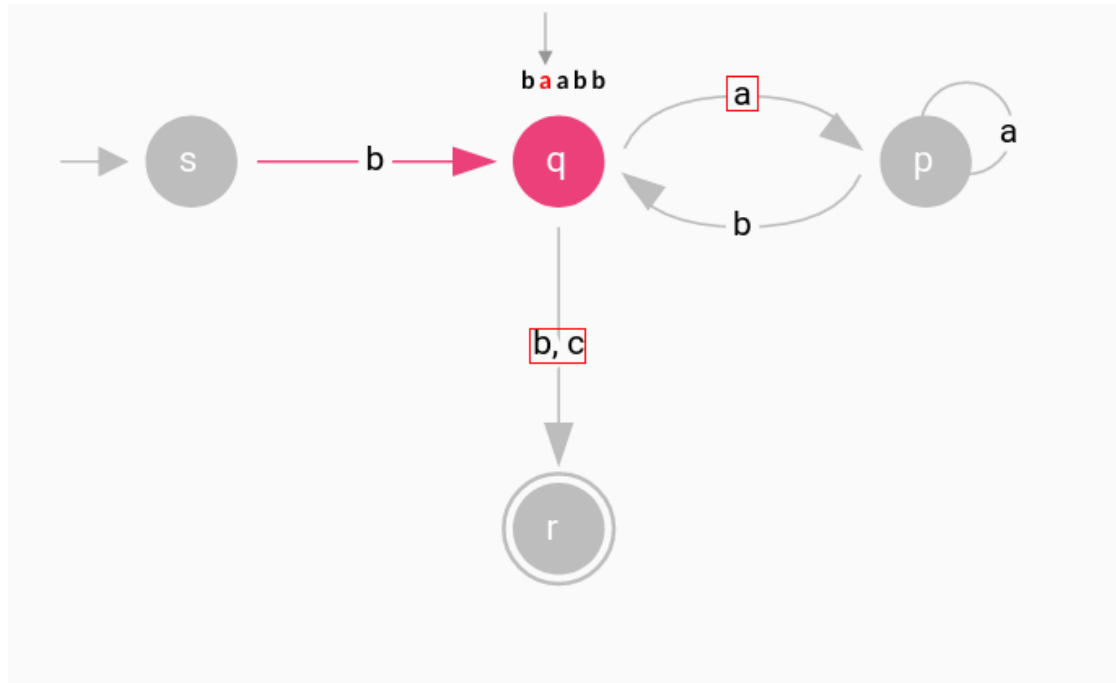
- Simple Example

– Step 1



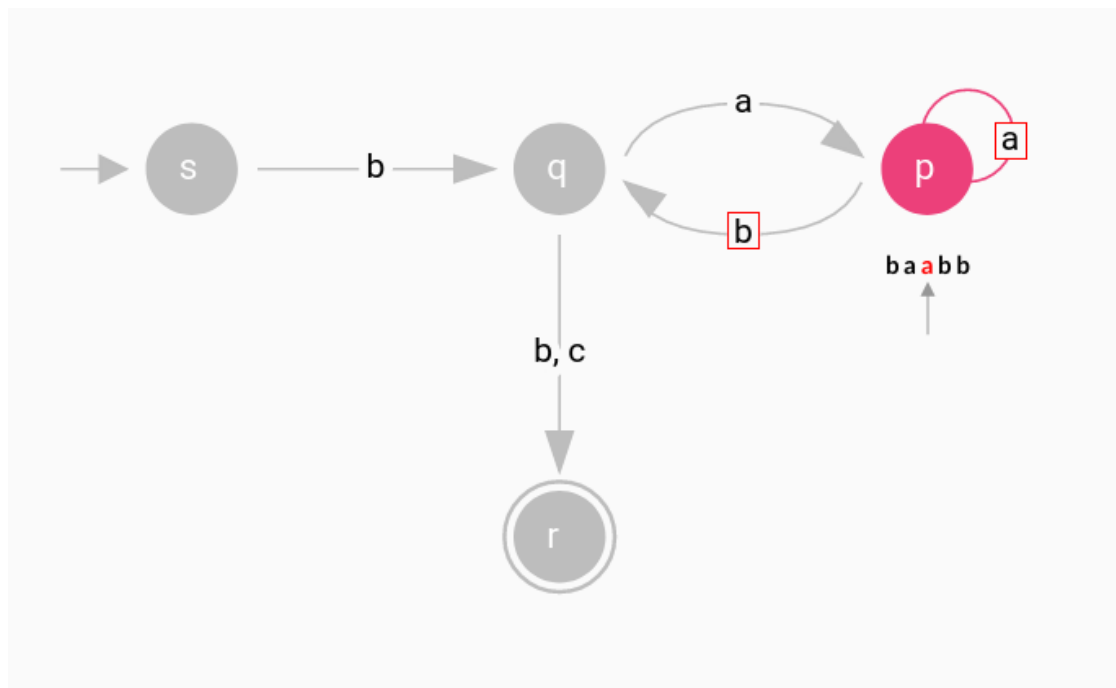
1. First symbol of the input **baabb** is **b** and the current state is *s*.
2. Ask, is there any exiting transition from *s* that contains the symbol **b**?
3. The answer is yes, so move to *q*

– Step 2



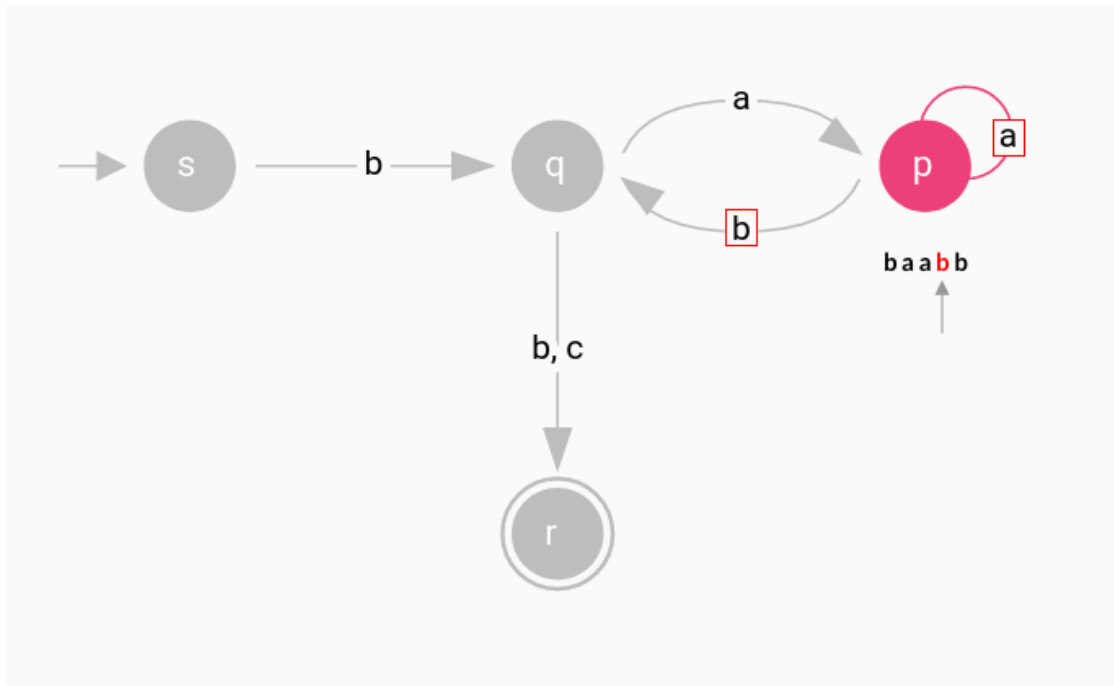
1. Next symbol of the input **baabb** is **a** and the current state is  $q$ .
2. Ask, is there any exiting transition from  $q$  that contains the symbol **a** or **b,c**?
3. The answer is yes, and it's **a**. So move to  $p$

– Step 3

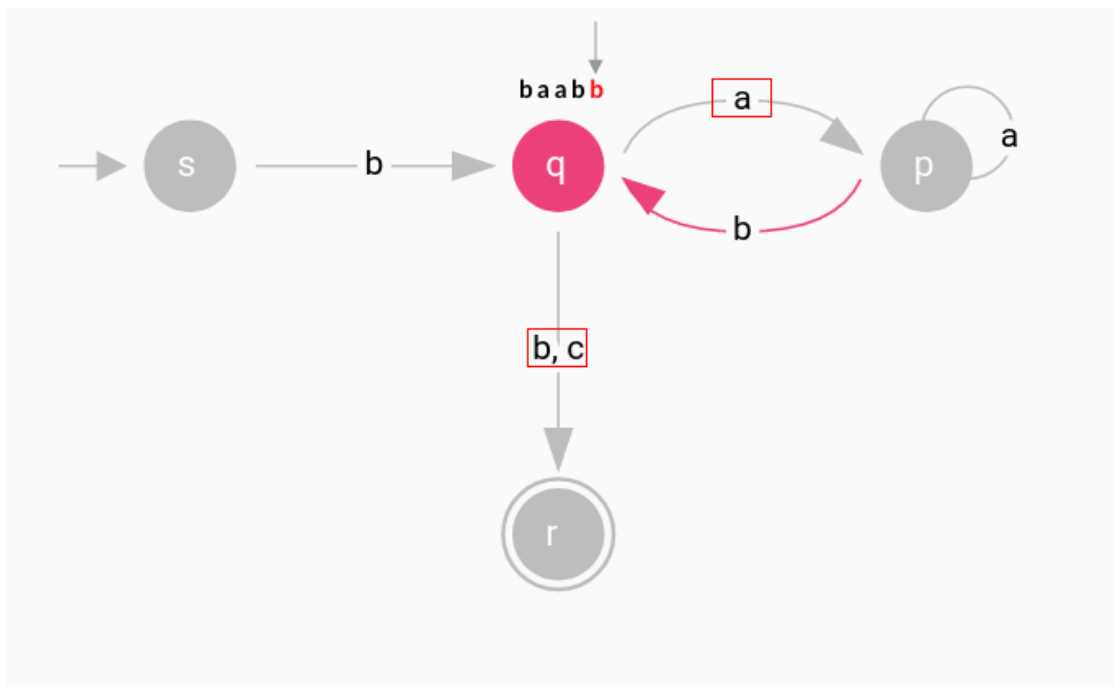


1. Next symbol of the input **baabb** is **a** and the current state is  $p$ .

2. Ask, is there any exiting transition from  $p$  that contains the symbol **a** or **b**?
  3. The answer is yes, and it's **a**. So move to  $p$
- Step 4

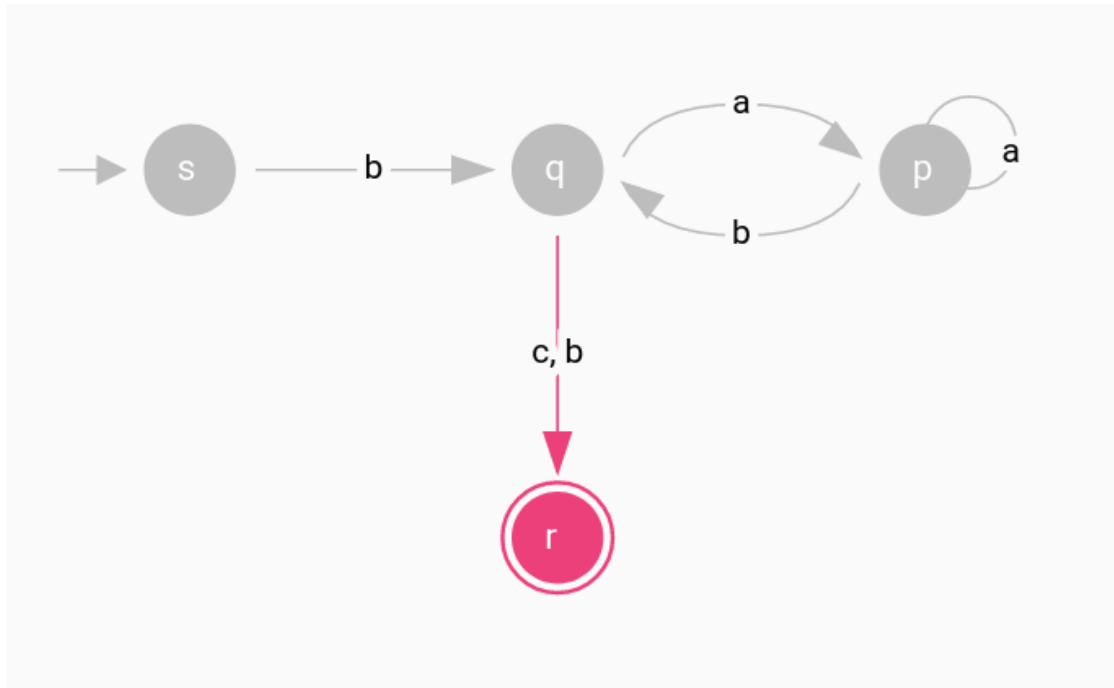


1. Next symbol of the input **baabb** is **b** and the current state is  $p$ .
  2. Ask, is there any exiting transition from  $p$  that contains the symbol **a** or **b**?
  3. The answer is yes, and it's **b**. So move to  $q$
- Step 5



1. Next symbol of the input **baabb** is **b** and the current state is  $q$ .
2. Ask, is there any exiting transition from  $q$  that contains the symbol **a** or **b,c**?
3. The answer is yes, and it's **b**. So move to  $r$

– Step 6



1. Next symbol of the input **baabb** is **b** and the current state is  $r$ .
2. Ask, if it satisfies the accepting or final state (i.e, has the end of string been reached?). If so, the output is accept. Otherwise, it's reject.

- Formal Languages

– is a subset of all possible words  $\Sigma^*$  formed by symbols of alphabet  $\Sigma$ .

- \*  $\Sigma^*$  is set of all possible strings over the alphabet  $\Sigma$ .
- \* i.e.  $\Sigma = \{a, b\}$ ,  $\Sigma^* = \{a, b, aa, ab, ba, bb, aaa, aab, \dots\}$