

Tur2Spell

Turing Machine Implementation
for Spelling Turkish Words

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WHAT IS TURING MACHINE?

- A **Turing machine** is a mathematical model of computation that defines an abstract machine which manipulates symbols on a strip of tape according to a table of rules. [1]

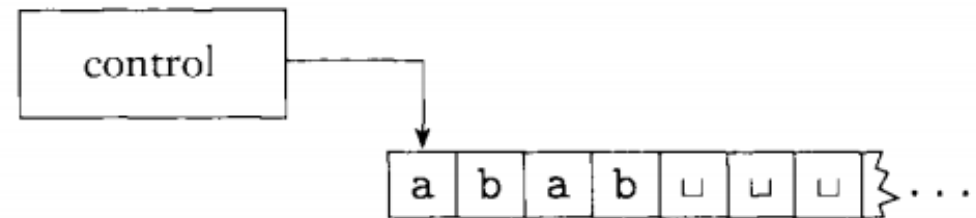


Figure 1.1 Schematic of a Turing machine [2]



FORMAL DEFINITION OF TURING MACHINE

A Turing Machine is a 7-tuple, $(Q, \Sigma, \Gamma, \delta, q_0, q_{accept}, q_{reject})$, where Q, Σ, Γ are all finite sets and

1. Q is the set of states,
2. Σ is the input alphabet not containing the blank symbol $\#$
3. Γ is the tape alphabet, where $\# \in \Gamma$
4. $\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$ is the transition function,
5. $q_0 \in Q$ is the start state,
6. $q_{accept} \in Q$ is the accept state and
7. $q_{reject} \in Q$ is the reject state, where $q_{accept} \neq q_{reject}$



HOW TO SPELL TURKISH WORDS?

There are 3 rules according to TDK[3] :

1. If there is consonant between two vowels in word, this consonant has a syllable with the next vowel.
For example: ar**a**ba → a-ra-ba
2. If there are two repeated consonant in word, the first one has a syllable with the previous vowel and the second one has a syllable with the next vowel.
For example: se**v**mek → sev-mek
3. If there are three repeated consonant in word, the last one has a syllable with the next vowel.
For example: ko**r**kmak → kor**k**-mak



WHAT ARE THE TUPLES OF TUR2SPELL

$Q : \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}\}$

$\Sigma : \{\text{'consonants': ['b', 'c', 'd', 'g', 'ğ', 'j', 'l', 'm', 'n', 'r', 'v', 'y', 'y', 'z', 'ç', 'f', 'h', 'k', 'p', 's', 'ş', 't'],$
 $\text{'vowels': ['a', 'ı', 'o', 'u', 'e', 'i', 'ö', 'ü']} \}$

$\Gamma : \{\text{'consonants': ['b', 'c', 'd', 'g', 'ğ', 'j', 'l', 'm', 'n', 'r', 'v', 'y', 'y', 'z', 'ç', 'f', 'h', 'k', 'p', 's', 'ş', 't'],$
 $\text{'vowels': ['a', 'ı', 'o', 'u', 'e', 'i', 'ö', 'ü']},$
 $\text{'other': ['-', '#']} \}$

$\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$ (the next page),

q_0 is the start state,

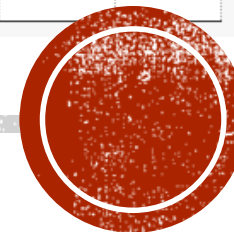
q_9 is accept state and

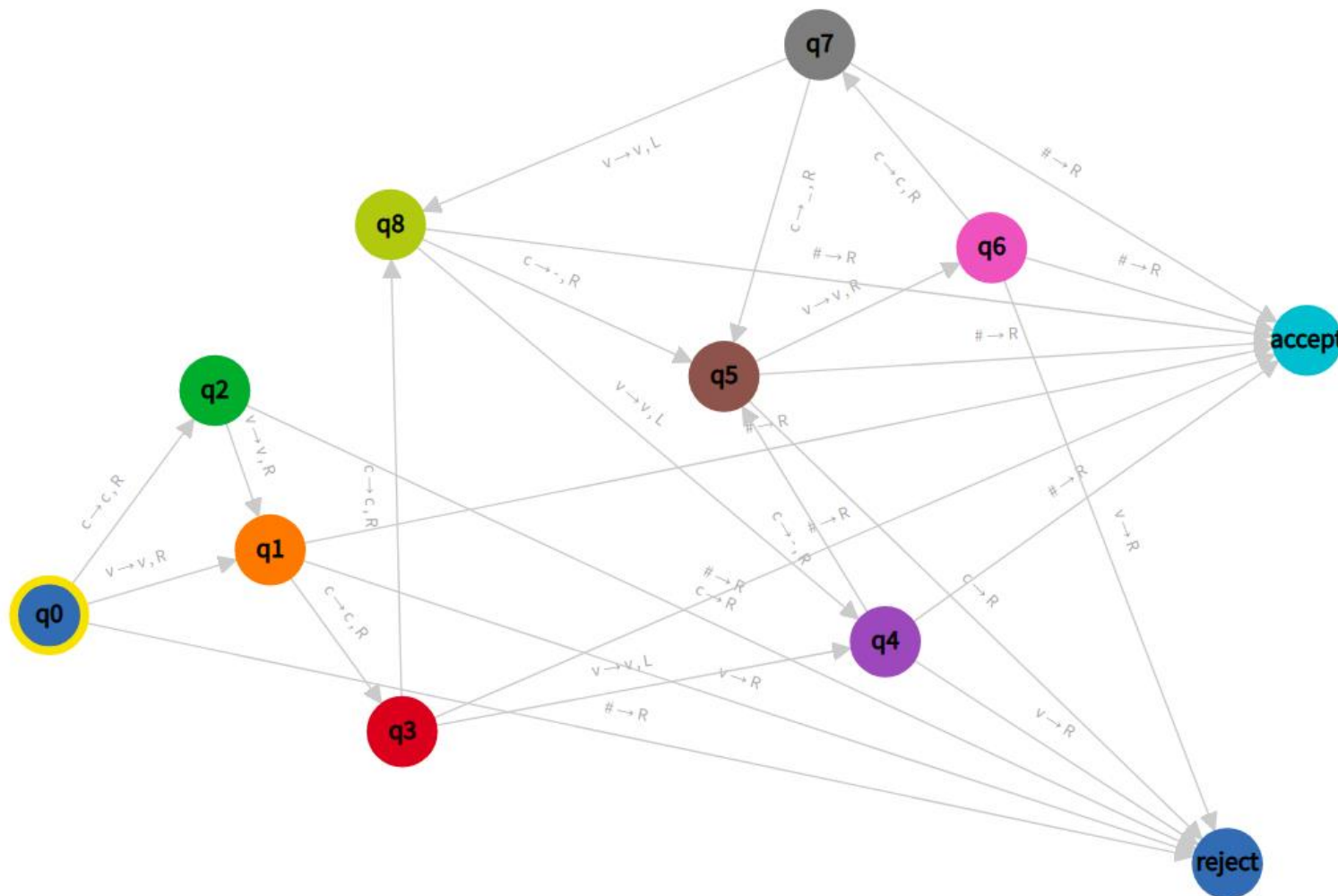
q_{10} is the reject state.



THE TRANSITION FUNCTION

1		c	v	#
2	q0	(q2, c, R)	(q1, v, R)	(reject)
3	q1	(q3, c, R)	(reject)	(accept)
4	q2	(reject)	(q1, v, R)	(reject)
5	q3	(q8, c, R)	(q4, v, L)	(accept)
6	q4	(q5, c, R)	(reject)	(accept)
7	q5	(reject)	(q6, v, R)	(accept)
8	q6	(q7, c, R)	(reject)	(accept)
9	q7	(q5, c, R)	(q8, v, L)	(accept)
10	q8	(q3, -c, R)	(q4, v, L)	(accept)
11	accept			
12	reject			

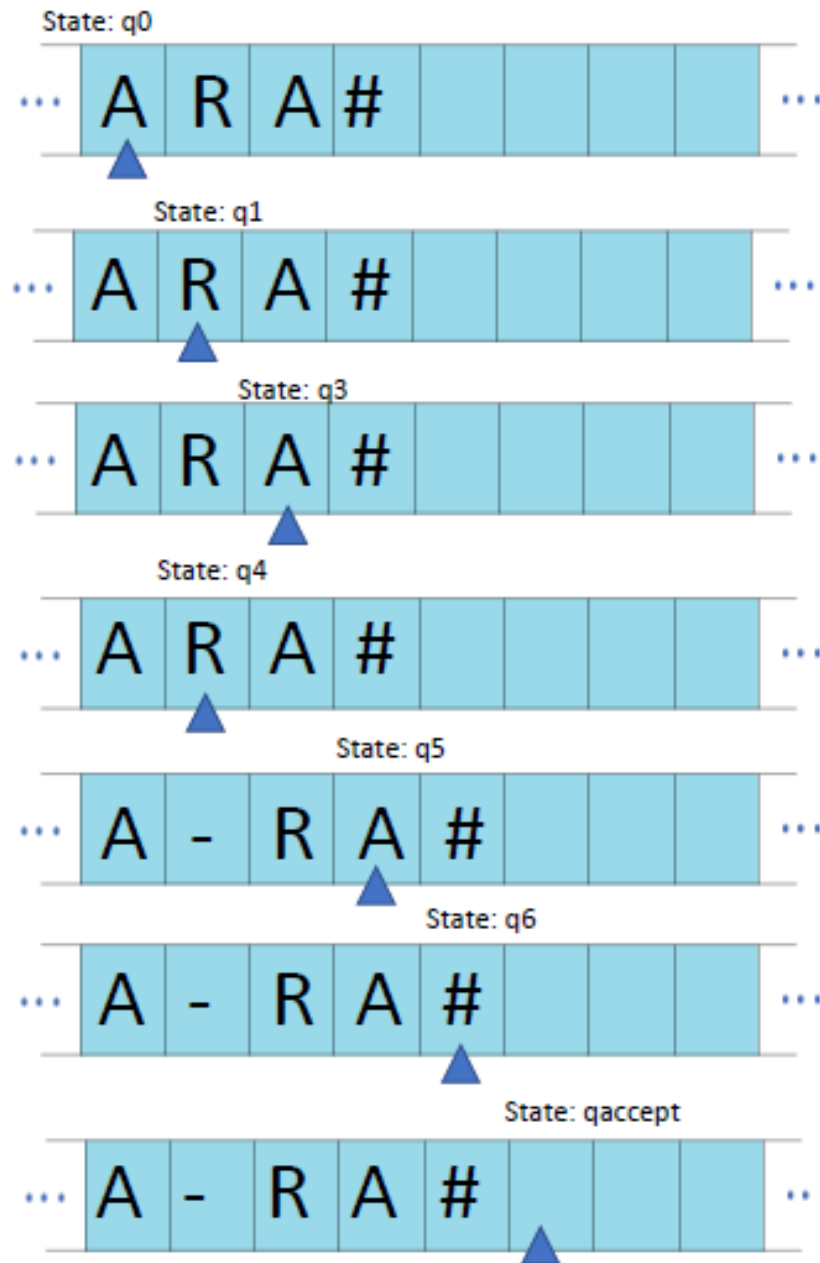




THE MACHINE



EXAMPLES



The current state: q0, the input symbol: a

The transition: ('q1', 'v', 'R')

The current state: q1, the input symbol: r

The transition: ('q3', 'c', 'R')

The current state: q3, the input symbol: a

The transition: ('q4', 'v', 'L')

The current state: q4, the input symbol: r

The transition: ('q5', '-c', 'R')

The current state: q5, the input symbol: a

The transition: ('q6', 'v', 'R')

The current state: q6, the input symbol: #

The transition: ('q9', '', 'R')

The word ara is accepted, the final tape: a-ra#



EXAMPLES

Your input: sevmek

The current state: q0, the input symbol: s

The transition: ('q2', 'c', 'R')

The current state: q2, the input symbol: e

The transition: ('q1', 'v', 'R')

The current state: q1, the input symbol: v

The transition: ('q3', 'c', 'R')

The current state: q3, the input symbol: m

The transition: ('q8', 'c', 'R')

The current state: q8, the input symbol: e

The transition: ('q4', 'v', 'L')

The current state: q4, the input symbol: m

The transition: ('q5', '-c', 'R')

The current state: q5, the input symbol: e

The transition: ('q6', 'v', 'R')

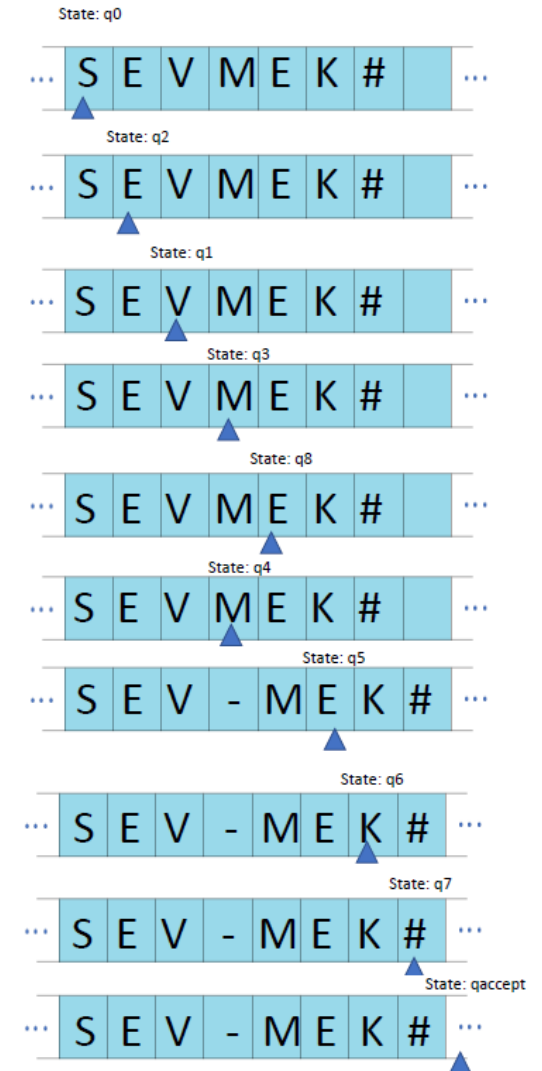
The current state: q6, the input symbol: k

The transition: ('q7', 'c', 'R')

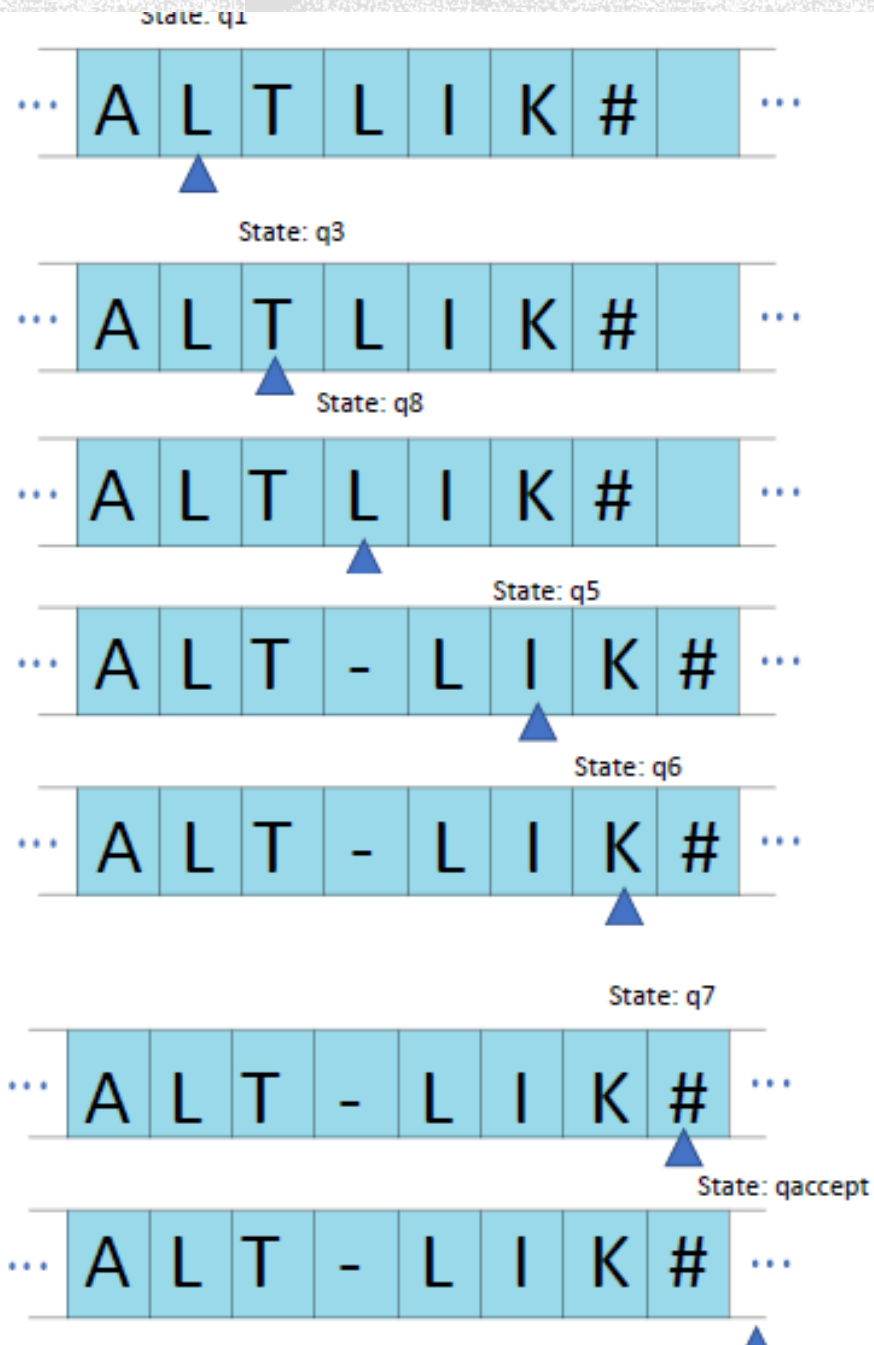
The current state: q7, the input symbol: #

The transition: ('q9', '', 'R')

The word sevmek is accepted, the final tape: sev-mek#



EXAMPLES



The current state: q0, the input symbol: a

The transition: ('q1', 'v', 'R')

The current state: q1, the input symbol: l

The transition: ('q3', 'c', 'R')

The current state: q3, the input symbol: t

The transition: ('q8', 'c', 'R')

The current state: q8, the input symbol: l

The transition: ('q5', '-c', 'R')

The current state: q5, the input symbol: i

The transition: ('q6', 'v', 'R')

The current state: q6, the input symbol: k

The transition: ('q7', 'c', 'R')

The current state: q7, the input symbol: #

The transition: ('q9', '', 'R')

The word altlik is accepted, the final tape: altlik#



REFERENCES

- [1] https://en.wikipedia.org/wiki/Turing_machine
- [2] **Introduction to the Theory of Computation**, Second Edition. by Michael Sipser.
- [3] http://www.tdk.gov.tr/index.php?id=208:Hece..&option=com_content

