Middle East Technical University | Department of Computer Engineering

CENG 280

Formal Languages and Abstract Machines

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Homework 6

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Answer for Q1

(i) 1954
(ii) Enigma
(iii) Turing Test
(iv) The Chemical Basis of Morphogenesis
(v) The Imitation Game

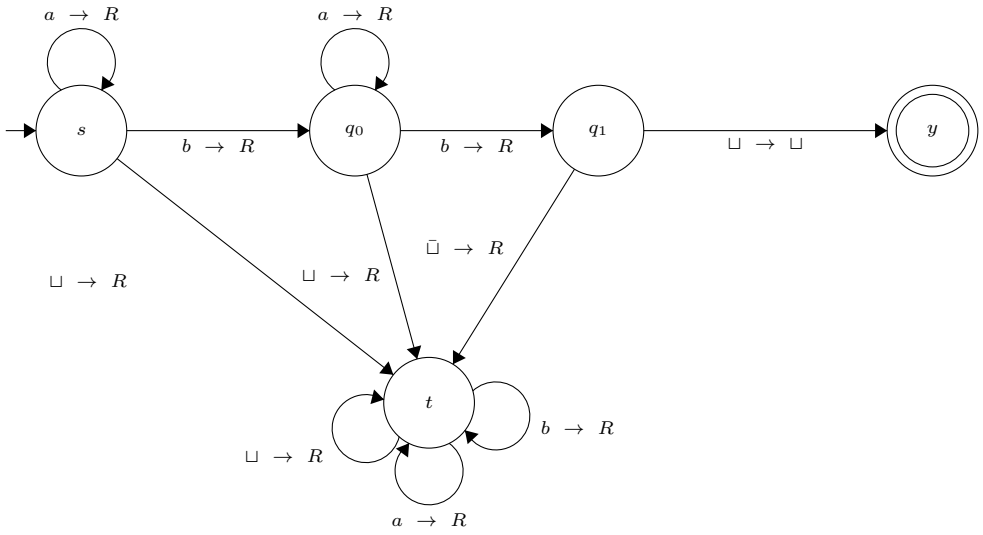
Answer for Q2

a.

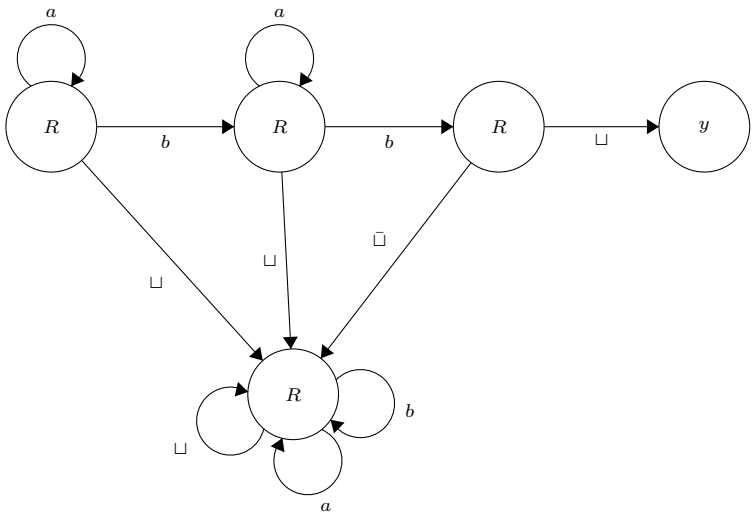
$$M = (K, \Sigma, \delta, s, H)$$

$K = \{s, q_0, q_1, y, t\}$
$\Sigma = \{a, b, \sqcup, \triangleright\}$
$H = y$
δ :

q	σ	$\delta(q, \sigma)$
s	a	(s,$\rightarrow$)
s	b	(q_0, $\rightarrow$)
s	$\sqcup$	(t, $\rightarrow$)
s	$\triangleright$	(s, $\rightarrow$)
q_0	a	(q_0, $\rightarrow$)
q_0	b	(q_1, $\rightarrow$)
q_0	$\sqcup$	(t, $\rightarrow$)
q_0	$\triangleright$	(q_0, $\rightarrow$)
q_1	a	(t, $\rightarrow$)
q_1	b	(t, $\rightarrow$)
q_1	$\sqcup$	(y, $\sqcup$)
q_1	$\triangleright$	(q_1, $\rightarrow$)
t	$\sqcup$	(t, $\rightarrow$)
t	a	(t, $\rightarrow$)
t	b	(t, $\rightarrow$)
t	$\triangleright$	(t, $\rightarrow$)



b.



Answer for Q3

1) The first tape is never changed; it always contains the original input w, so that each simulated computation of M we can use the input a.

2) We have to copy the input 'b' (which starts with after the comma, and ends with before the first empty string of the tape 1) to the tape 2, and we should insert 1 to the third tape so that we can multiply and store the data.

3) If the data from tape 2 is 0, then halt. If the data from second tape is greater than 0, we have to send input 'a' (we can reach it by looking the content of left side of the comma in the tape 1), and tape 3 content to M_X. Then, the machine M_X should write the output to the tape 3 to store data. After that operation, we call to the M_- with input 1, content of the tape 2 in order to subtract 1 from the content of tape 2.

4) Finally, we have to do step 3 until the machine halts. Content of the tape 3 our result after the halt.