Problem

Using the solution you gave to Exercise 1.25, give a formal description of the machines T_1 and T_2 depicted in Exercise 1.24

Step-by-step solution

Step 1 of 3

Here, the formal description of Turing machine T_1 and T_2 need to be defined. A finite state transducer (FST) is formally defined by the $(Q,\Sigma,\Gamma,\delta,q_0)$ tuple, where:

• The finite set of states is Q.

• The input alphabet is Σ.

• The output alphabet is Γ.

• The transition function δ takes a state and an input symbol and returns a state and an output symbol.

$\delta: Q\times\Sigma\to Q\times\Gamma$

• The start state q_0.

Comment

Step 2 of 3

The finite state transducer T_1 is formally defined by the $(\{q_1,q_2\},\{0,1,2\},\{0,1\},\delta_1,q_1)$, where the transition function δ_1 is as follows:

Input / *State*	0	1	2
q_1	$\{q_1,0\}$	$\{q_1,0\}$	$\{q_2,1\}$
q_2	$\{q_1,0\}$	$\{q_2,1\}$	$\{q_2,1\}$

Comment

Step 3 of 3

The second FST is defined as $T_2=(\{q_1,q_2,q_3\},\{a,b\},\{0,1\},\delta_2,q_1)$. The transition function δ_2 is given by:

Input / *State*	a	b
q_1	$\{q_2,1\}$	$\{q_3,1\}$
q_2	$\{q_3,1\}$	$\{q_1,0\}$
q_3	$\{q_1,0\}$	$\{q_2,1\}$

Comment