Student Information

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Answer 1

a.

$M = (K, \Sigma, \Delta, p, F)$, where
$K = \{p, q\}, F = q$,
$\Delta = \{((p, a, e), (p, a))$,
$((p, b, e), (p, b))$,
$((p, c, e), (p, c))$,
$((p, e, e), (p, X))$,
$((p, e, Xb), (p, X))$,
$((p, e, Xa), (p, X))$,
$((p, e, XaXSa), (p, S))$,
$((p, e, XbXSb), (p, S))$,
$((p, e, c), (p, S))$,
$((p, e, S), (q, e))\}$

b.

(p, abbcbabbaa, e) $\vdash_M$ (p, bbcbabbaa, a)
(p, bbcbabbaa, a) $\vdash_M$ (p, bcbabbaa, ba)
(p, bcbabbaa, ba) $\vdash_M$ (p, cbabbaa, bba)
(p, cbabbaa, bba) $\vdash_M$ (p, babbaa, cbba)
(p, babbaa, cbba) $\vdash_M$ (p, babbaa, Sbba)
(p, babbaa, Sbba) $\vdash_M$ (p, babbaa, XSbba)
(p, babbaa, XSbba) $\vdash_M$ (p, abbaa, bXSbba)
(p, abbaa, bXSbba) $\vdash_M$ (p, bbaa, abXSbba)
(p, bbaa, abXSbba) $\vdash_M$ (p, bbaa, XabXSbba)
(p, bbaa, XabXSbba) $\vdash_M$ (p, bbaa, XbXSbba)
(p, bbaa, XbXSbba) $\vdash_M$ (p, bbaa, Sba)
(p, bbaa, Sba) $\vdash_M$ (p, bbaa, XSba)
(p, bbaa, XSba) $\vdash_M$ (p,baa, bXSba)
(p, baa, bXSba) $\vdash_M$ (p,aa, bbXSba)
(p, aa, bbXSba) $\vdash_M$ (p,aa, XbbXSba)
(p, aa, XbbXSba) $\vdash_M$ (p,aa, XbXSba)
(p, aa, XbXSba) $\vdash_M$ (p,aa, Sa)
(p, aa, Sa) $\vdash_M$ (p,aa, XSa)

(p, aa, XSa) $\vdash_M$ (p,a, aXSa)
(p, a, aXSa) $\vdash_M$ (p,e, aaXSa)
(p, e, aaXSa) $\vdash_M$ (p,e, XaaXSa)
(p, e, XaaXSa) $\vdash_M$ (p,e, XaXSa)
(p, e, XaaXSa) $\vdash_M$ (p,e, S)
(p, e S) $\vdash_M$ (q,e)

Answer 2

a.

We can define the Turing Machine which computes f(x) as $M_1 = (K, \Sigma, \delta, s, H)$, where
$K = \{s, q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, h\}$,
$\Sigma = \{\sqcup, 1, \triangleright\}$,
$H = \{h\}$ and the transition function is defined as follows;
$\delta(s, \sqcup)) = (q_0, \rightarrow)$
$\delta(q_0, 1)) = (q_1, \rightarrow)$
$\delta(q_1, 1)) = (q_0, \rightarrow)$
$\delta(q_1, \sqcup)) = (q_2, 1)$
$\delta(q_2, 1)) = (h, \rightarrow)$
$\delta(q_0, \sqcup)) = (q_3, \leftarrow)$
$\delta(q_3, 1)) = (q_3, \leftarrow)$
$\delta(q_3, \sqcup)) = (q_4, \rightarrow)$
$\delta(q_4, 1)) = (q_5, m)$
$\delta(q_5, m)) = (q_5, \rightarrow)$
$\delta(q_5, 1)) = (q_5, \rightarrow)$
$\delta(q_5, \sqcup)) = (q_5, \leftarrow)$
$\delta(q_6, 1)) = (q_0, \sqcup)$
$\delta(q_3, m)) = (q_7, 1)$
$\delta(q_7, 1)) = (q_4, \rightarrow)$
$\delta(q_4, \sqcup)) = (h, \sqcup)$

Answer 3

It will be the regular languages accpeted by some finite automata.

Since Turing machines do not have any memory (like pushdown automata's stack), move-restricted Turing Machine's computes only the current input symbol, and once it read and passed (i.e. moved right), it won't have any idea what's back. Since it cannot turn back to any symbol, writing will not change anything. Consequently, it will act like finite automata.

Answer 4

a.

Let $M = (K, \Sigma, \delta, s, H)$, where
K is a finite set of states such that :
$K = \{s, f, r, e, d, h\}$,
Σ is an alphabet,
$s \in K$ is the initial state,
$H \subset K$ is the set of halting states.
δ the transition function:
$(K - H)x(\Sigma x \Sigma)$ to $Kx((\Sigma)x(\Sigma))$

b.

Configuration for TM is a member of $Kx \triangleright \Sigma^* x(\Sigma\ {}^*(\Sigma - \{\sqcup\})U\{e\})$.

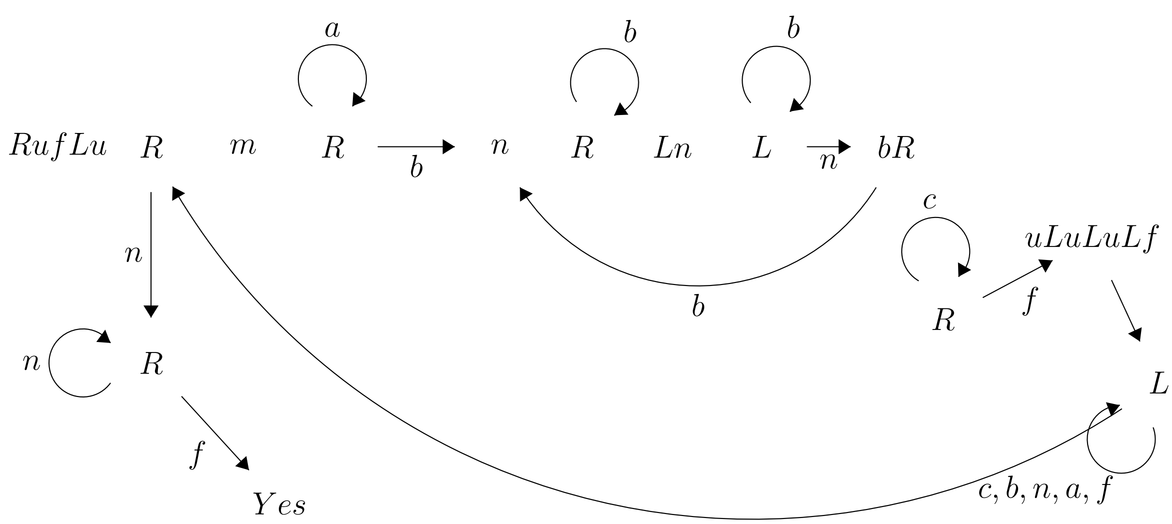
c.

d.

e.

Answer 5

a



b.

G = (V, Σ, R, S), where
$V = \{S, a, b, c, A, B, C, R, K, L\}$,
$\Sigma = \{a, b, c\}$, and
$R = \{S \to RB$,
$R \to e$,
$RB \to KABBCCC$,
$K \to KK$,
$K \to e$,
$KA \to AK$,
$KB \to ABBL$,
$LB \to ABL$,
$LC \to CCCC$,
$A \to a$,
$B \to b$,
$C \to c\}$.

Answer 6

a.

b.

c.

d.