Solution to Homework Problem 17

**Task.** Use the general algorithm to transform a finite automaton from Homework 1.1 – as simplified in Homework 3, into a Turing machine. Show step-by-step, on an example of a word Aaa, how this word will be processed by your Turing machine.

**Automaton from Homework 1.1 as simplified in Homework 2: reminder.** This automaton has three states: $s$, $n$, and $e$; $s$ is the starting state, $n$ is the only final state. The transitions are as follows:

- from $s$, $A$ leads to $n$, every other symbol leads to $e$;
- from $n$, $a$ leads back to $n$, every other symbol leads to $e$;
- from $e$, every symbol leads back to $e$.

**Solution.** Here are the rules for the Turing machine:

\[
\begin{align*}
\text{start, } - & \rightarrow \text{R, } s \\
\text{s, } A & \rightarrow \text{R, } n \\
\text{s, } a & \rightarrow \text{R, } e \\
\text{s, } 1 & \rightarrow \text{R, } e \\
\text{n, } A & \rightarrow \text{R, } e \\
\text{n, } a & \rightarrow \text{R, } n \\
\text{n, } 1 & \rightarrow \text{R, } e \\
\text{s, } - & \rightarrow \text{reject} \\
\text{n, } - & \rightarrow \text{accept} \\
\text{e, } - & \rightarrow \text{reject}
\end{align*}
\]

**Tracing.**

\[
\begin{array}{c|ccc|c}
\text{start} & A & a & a & \ldots & s \\
\text{s} & A & a & a & \ldots & n \\
\text{n} & A & a & a & \ldots & n \\
\text{n} & A & a & a & \ldots & n \\
\text{accept} & A & a & a & \ldots
\end{array}
\]