

Example Turing Machine

We will give a Turing machine for the language

$$\mathcal{L}_3 = \{ a^i b^i c^i \mid i \geq 0 \}.$$

Before giving the Turing machine, try to answer the question: Is it context-free?

Design of the Turing Machine

The TM is deterministic. It uses a special tape symbol x that does not occur in \mathcal{L}_3 .

In state q_1 , if the first letter is an a , the TM replaces this a by a space \sqcup . After that it moves forward, and replaces one b by an x , and one c by an x . In state q_4 it rewinds, and goes back to state q_1 .

If the remaining words consists only of x -s, the TM moves to the accepting state q_5 .

