Theorem: Multitrack TMs with one head are equivalent to one track, one head TMs.

$$\begin{array}{|c|c|c|c|c|c|}\hline 0 \\ \hline 1 \\ \hline 0 \\ \hline \end{array} \longrightarrow \begin{array}{|c|} \hline 0 \\ 1 \\ 0 \\ \hline \end{array}$$
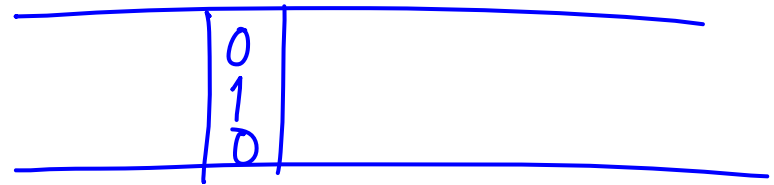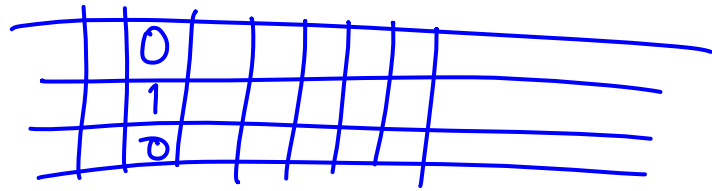
Theorem: One track, one head TMs are equivalent to one track, one head TMs with $\Sigma = \{0, 1\}$.

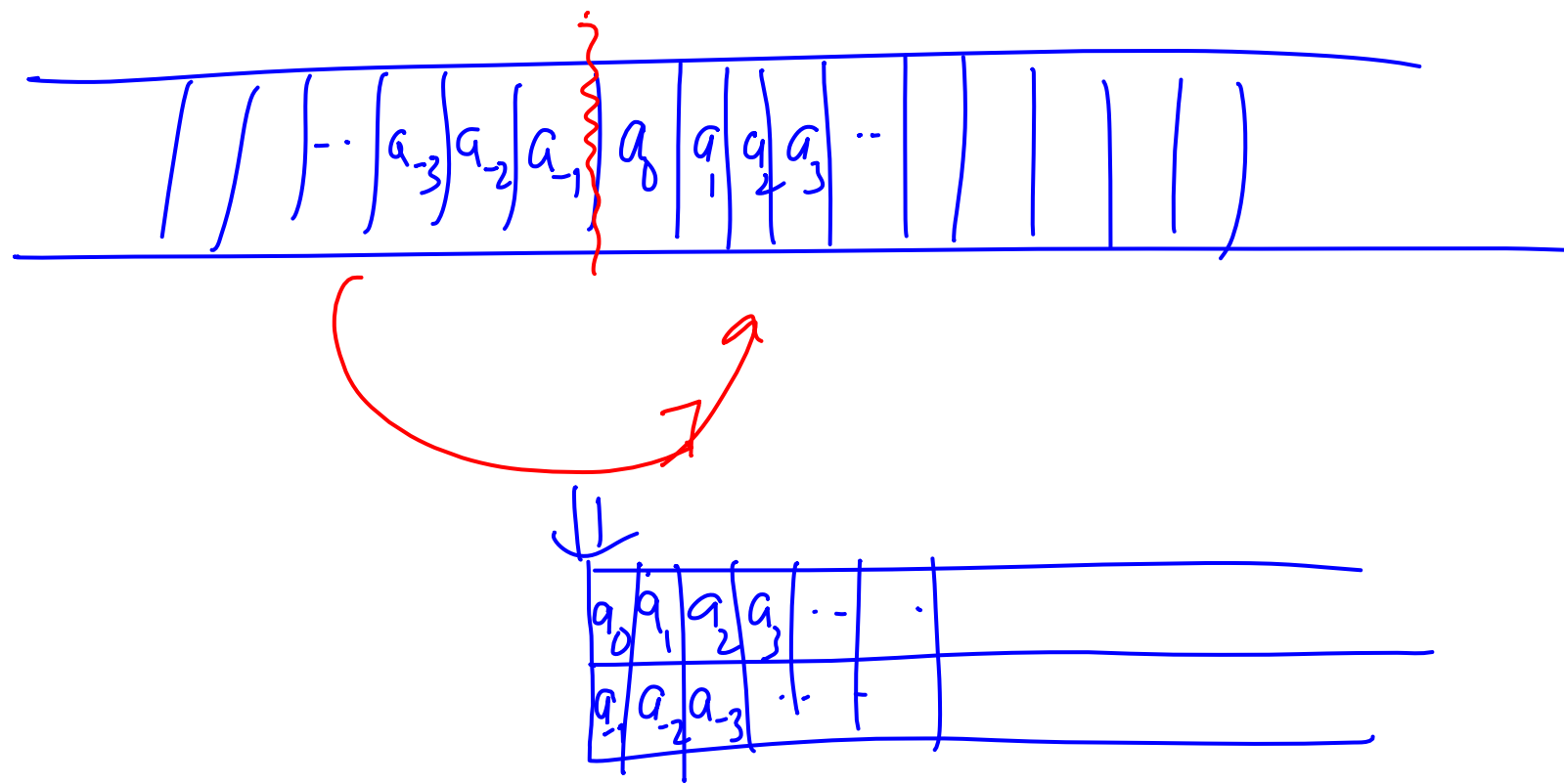**proof:** Suppose $|\Sigma| = k$.

Let $\ell = \lceil \log_2 k \rceil$

Code each symbol as ℓ-bit binary sequence.

Theorem: TMs with $\Sigma = \{0, 1\}$ are equivalent to TMs with $\Sigma = \{0\}$.

proof: Use B to view 0 as $0B$, 1 as $B0$, B as BB.

Theorem: 2-way infinite TMs are equivalent to 1-way infinite TMs.

proof:

Church – Turing Thesis

Computability is exactly captured by TMs.

Universal TMs

▷ Input is of the form (P, x)

▷ Simulates M on x and accepts iff M accepts x.

Q	Σ	q_{accept}	q_{reject}	q_0	δ

Γ^*		

$$\downarrow$$

x