Time Versus Space

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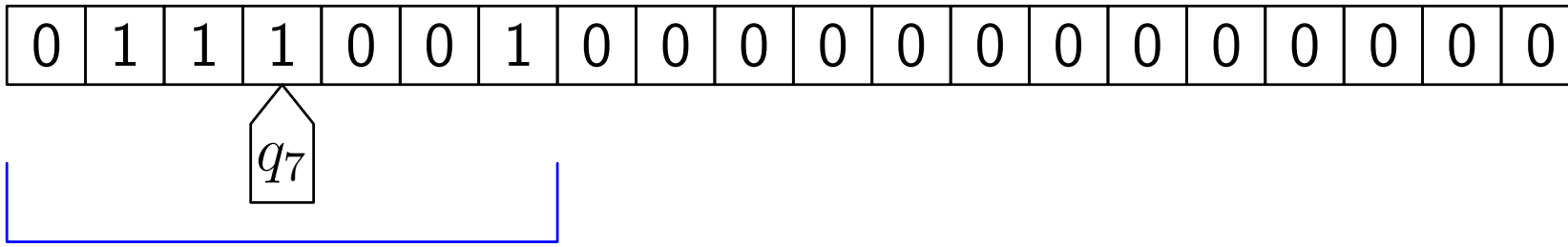
Computation Models

- Turing machine



SPACE (used memory size)

TIME (number of steps)

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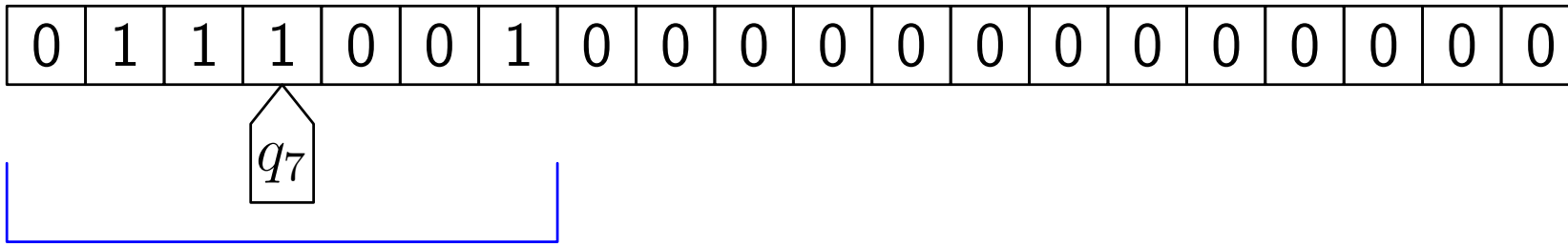

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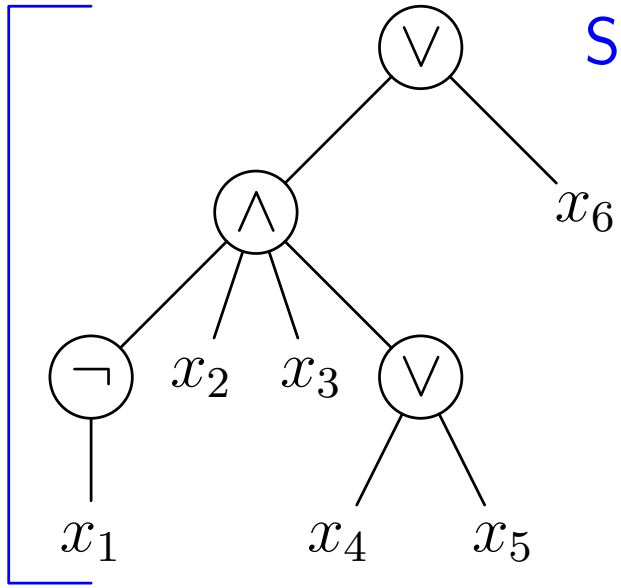
TIME (number of steps)

- Circuit



DEPTH
(number of levels)

SIZE (number of gates)

Locality & Space-Time Compression

”Computation is data manipulation” where only a small amount of data is relevant at any moment of computation.

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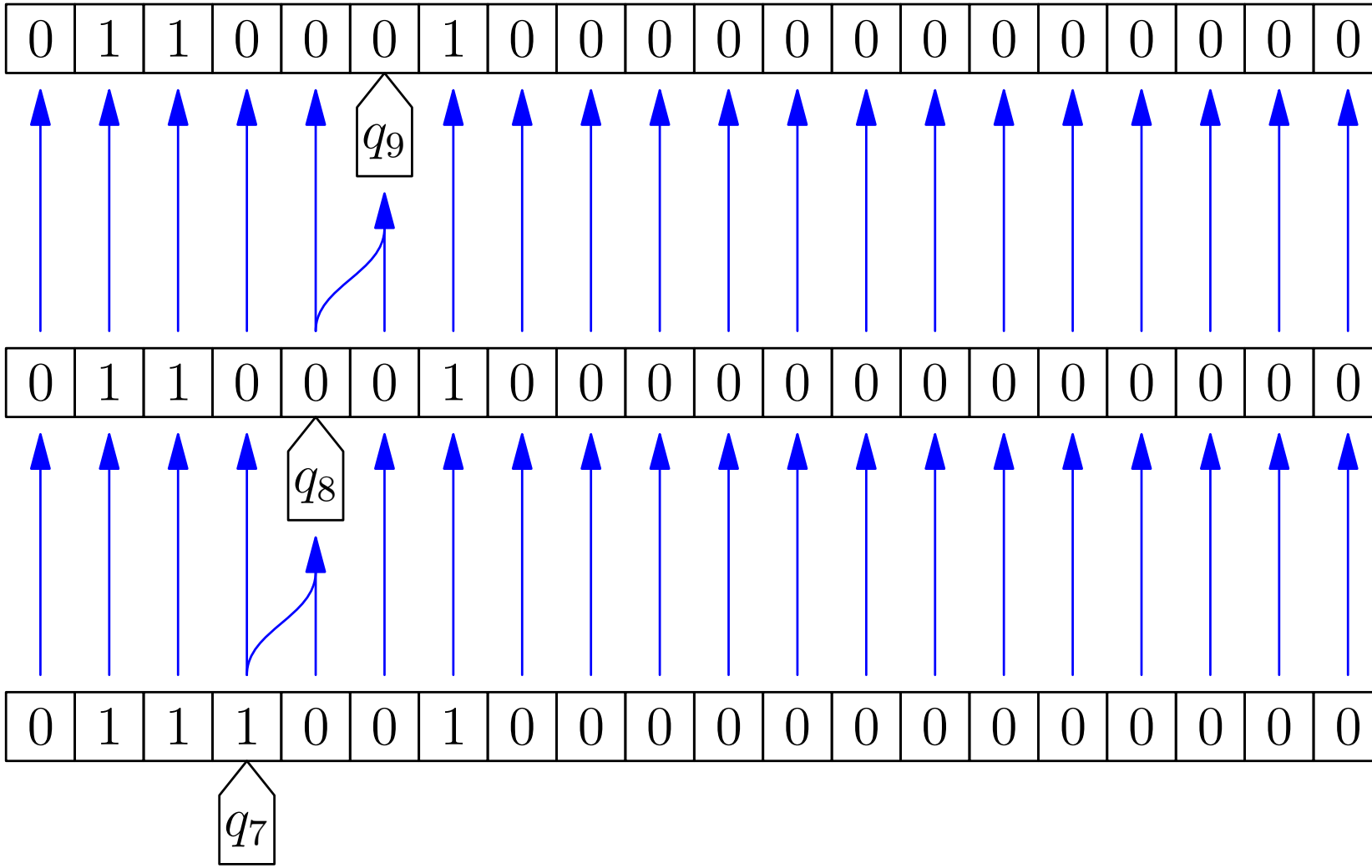
Fact: ($\sim$ 1980)

$$TIME(T) \subseteq SPACE\left(\frac{T}{\log T}\right)$$

Cook Construction àla Tiling



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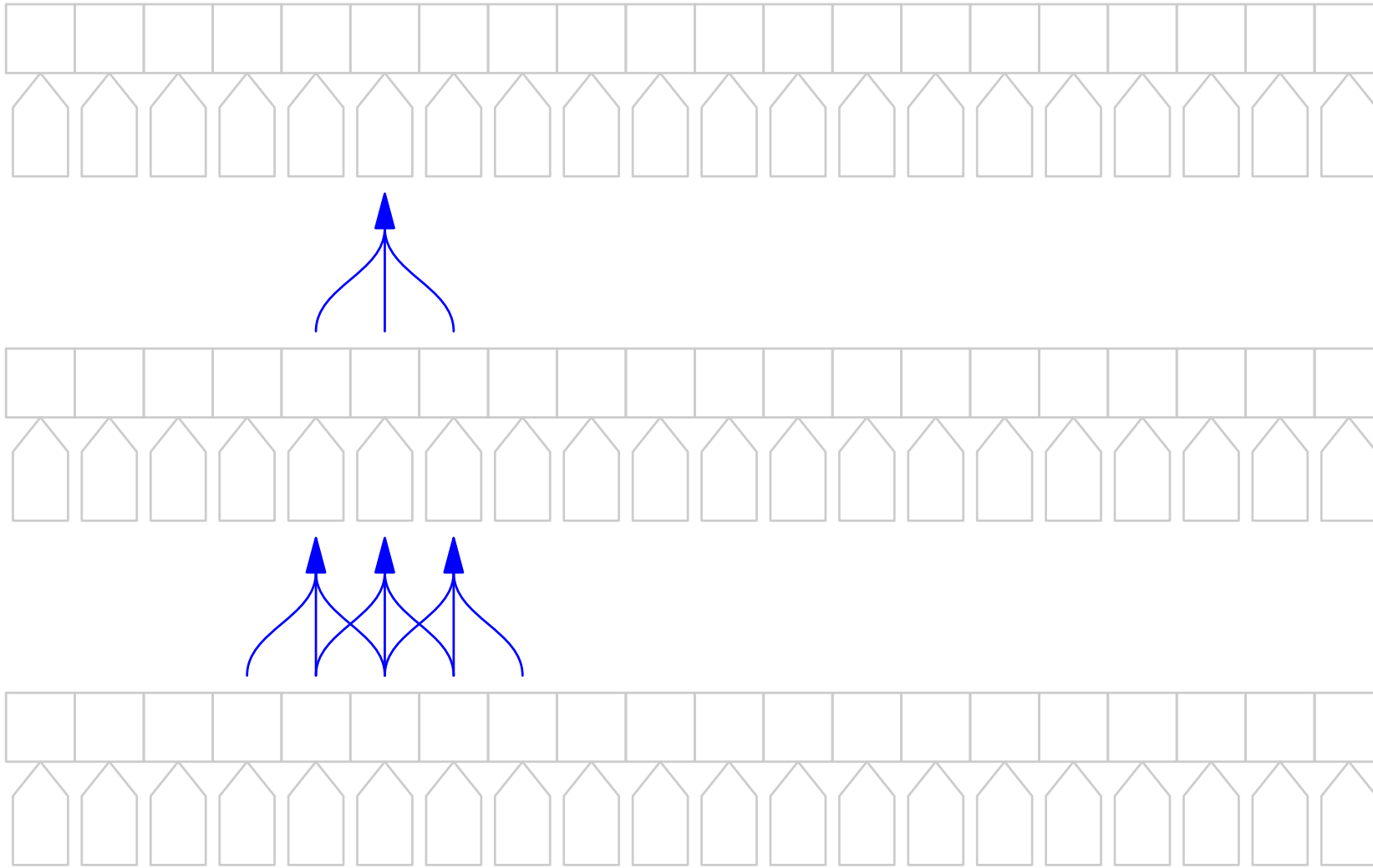

Depth-Size Compression

Fact:

Small deep circuits can be transformed into big shallow circuits.

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Degeneracies in previous construction may allow ”Turing-circuit” to be even more depth-compressed.

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Or are they? ¯_(ツ)_/¯