Storage in States

- Each state could store a finite amount of information

- For example, a state may record the tape symbol just read.
  - the state is \([q, s]\) q from Q and s from \(\Gamma\).

- This does not change the definition of TM

- Example: TM that accepts the strings in \(\{0, 1\}\)* whose first symbol will never appear again.
Stay-Option TM

- It allows the tape head stay in the same cell after a move.
- This can be implemented using left and right moves.
- This makes a TM simpler in some applications, which involves searching for a given symbol.
K-Track TM

- A k-track TM has k tapes and one head.
- The head reads and writes corresponding cells on all tapes simultaneously.
- The symbols on the k tapes can be viewed as a k-tuple.
- Initially, the input string is stored in the first tapes, the symbols on other tapes are all blanks.
- If it halts on an input string, the string is accepted.
- The symbols on all tapes are the output.
- K-track TM is equivalent to TM.
Read-Only TM

- A read-only TM can only read the symbols on the tape, but cannot change the content of the tape.

- Read only TM is equivalent to FA and accepts exclusively regular languages.
K(multi)-tape TM

- A k-tape TM has k tapes and k heads. Each tape has its only head. The machine can
  - change state;
  - print a new symbol on each of the cells scanned by its tape heads
  - move each of its tape heads, independently, one cell to the left or right, or keep it stationary.
- Initially, the input appears on the first tape and the other tapes are blank.
- K-tape TM is equivalent to TM.
Nondeterministic TM

- A nondeterministic TM is a TM that allows a finite number of choices for the next move.
- Each choice consists of a new state, a tape symbol to print, and a direction of head move.
- The NTM accepts its input if any sequence of choices of moves leads to a halt state.
- Output of a NTM is not meaningful, because if there exist more than one sequences of moves lead to some halt state, there would be more than one output.
- NTM is equivalent to TM.