Practical Issues in Model Checking

Major difficulty: *state [space] explosion problem*: model size exponential in system description.

Scenarios:

- Sequential system with $n$ boolean variables has $2^n$ states.
- Concurrent system with $n$ components, $l$ local states each, has $l^n$ global states.

State explosion due to data domains and concurrency.
Algorithms so far use *explicit state representation*: model with 10 states = list of 10 pieces of data.

**Symbolic representation:**

- Kripke structure as boolean formula (BF):
  \[
  \text{if } x = 0 \text{ then } x := 1 \text{ represented as } \\
  (x \neq 0 \land x' = x) \lor (x = 0 \land x' = 1)
  \]

- Efficiently processable representations for BFs exist: BDD, CNF

⇒ “Symbolic Model Checking”