Applications of Finite Automata

Applications of finite automata include string matching algorithms, network protocols and lexical analyzers

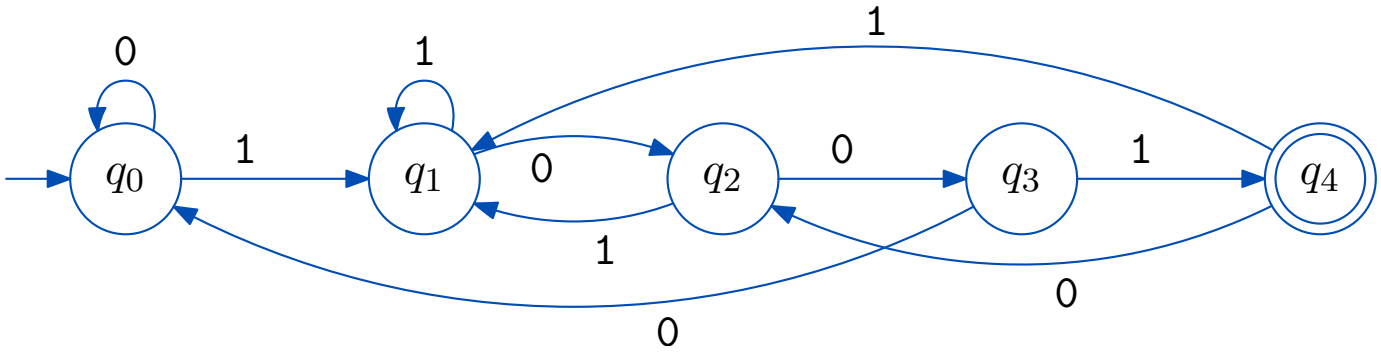
String Processing

Consider finding all occurrences of a short string (***pattern string***) within a long string (***text string***).

This can be done by processing the text through a DFA: the DFA for all strings that ***end*** with the pattern string. Each time the accept state is reached, the current position in the text is output.

Example: Finding 1001

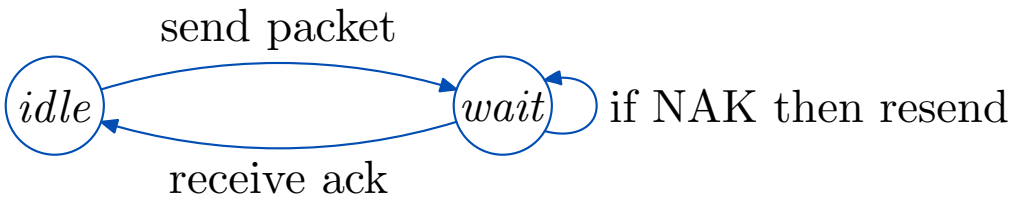
To find all occurrences of pattern 1001, construct the DFA for all strings ending in 1001.



Finite-State Machines

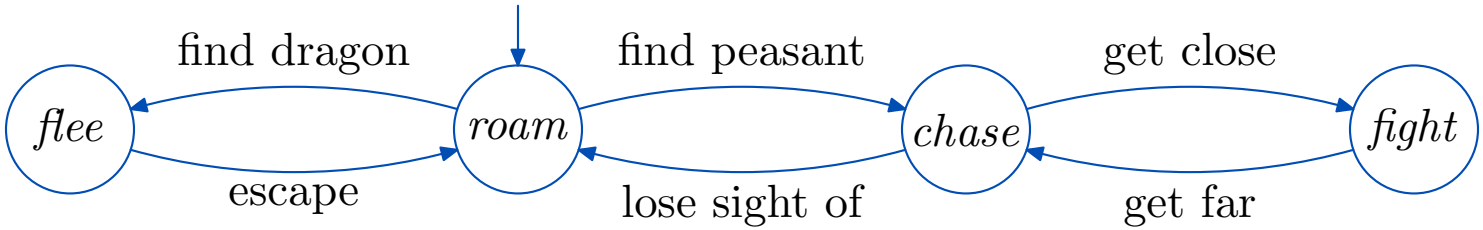
A ***finite-state machine*** is an FA together with actions on the arcs.

A trivial example for a communication link:



Example FSM: Bot Behavior

A ***bot*** is a computer-generated character in a video game.

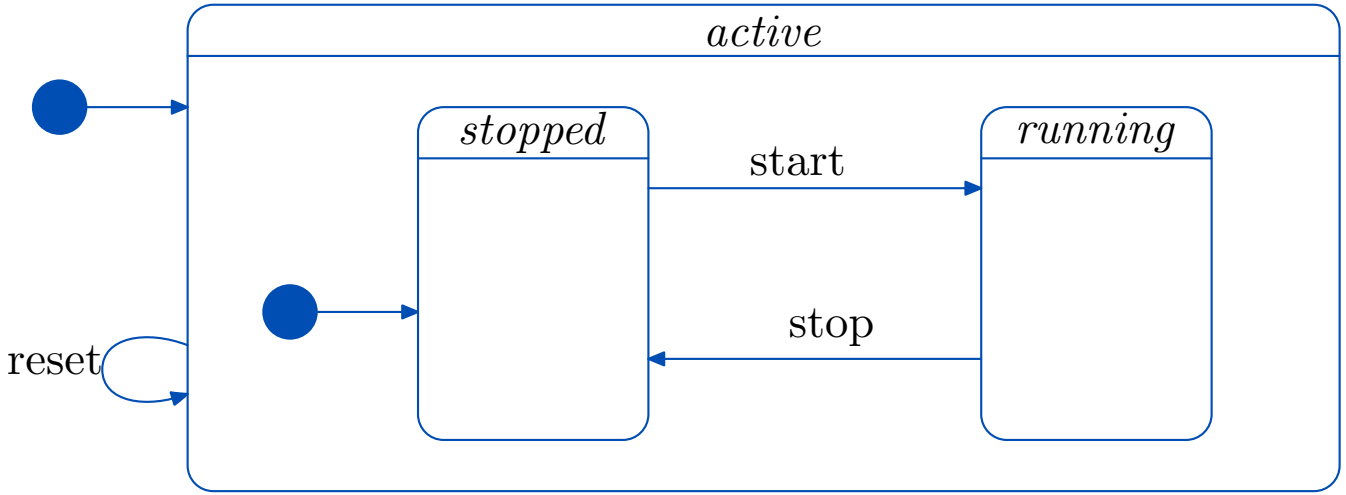


Note that using finite-state machine allows automation.

Statecharts

Statecharts model tasks as a set of states and actions. They extend FA diagrams.

Here is a simplified statechart for a stopwatch.



Lexical Analysis

In compiling a program, the first step is ***lexical analysis***. This isolates keywords, identifiers etc., while eliminating irrelevant symbols.

A ***token*** is a category, for example "identifier", "relation operator" or specific keyword.

For example,

token	*RE*
keyword then	`then`
variable name	`[a-zA-Z][a-zA-Z0-9]*`

where latter RE says it is any string of alphanumeric characters starting with a letter.

Lexical Analyzer

A lexical analyzer takes source code as a string, and outputs sequence of ***tokens***.

For example,

```
for i = 1 to max do
    x[i] = 0;
```

might have token sequence

for | id | = | num | to | id | do | id | [| id |] | = | num | sep

As a token is identified, there may be an action. For example, when a number is identified, its value is calculated,