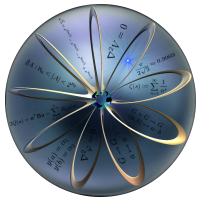

planetmath.org

Math for the people, by the people.

non-deterministic Turing machine

Canonical name	NondeterministicTuringMachine
Date of creation	2013-03-22 13:01:25
Last modified on	2013-03-22 13:01:25
Owner	Henry (455)
Last modified by	Henry (455)
Numerical id	6
Author	Henry (455)
Entry type	Definition
Classification	msc 68Q05
Related topic	TuringMachine2
Defines	certificate

The definition of a non-deterministic Turing machine is the same as the definition of a deterministic Turing machine except that δ is a relation, not a function. Hence, for any particular state and symbol, there may be multiple possible legal moves.

If $S \in \Gamma^+$ we say T accepts S if, when S is the input, there is some finite sequence of legal moves such that δ is undefined on the state and symbol pair which results from the last move in the sequence and such that the final state is an element of F. If T does not accept S then it rejects S.

An alternative definition of a non-deterministic Turing machine is as a deterministic Turing machine with an extra one-way, read-only tape, the guess tape. Then we say T accepts S if there is any string $c(S)$ such that, when $c(S)$ is placed on the guess tape, T accepts S. We call $c(S)$ a *certificate* for S, and otherwise that it rejects S. In some cases the guess tape is allowed to be two-way; this generates different time and space complexity classes than the one-way case (the one-way case is equivalent to the original definition).