

Changing TMs

The power of TM (as recognizer) is not altered by small changes.

e.g. having multiple tapes
replacing tapes by RAM
adding nondeterminism

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If adding feature,
show that standard TM can
emulate new feature.

If removing feature,
show that crippled TM can
emulate standard TM.

Example

Adding multiple tapes does not alter power.

Idea: Ordinary TM stores all tapes on its tape with some special character for head positions. For one step of multitape TM, ordinary TM scans tape to find chars under heads, and then scans again to update them.

Example

Adding RAM doesn't alter power.

Idea:

Use one tape as RAM and second tape as Address-register

Example

Adding nondeterminism doesn't change power

Idea:

Nondeterminism can be viewed as tree. Should accept $\Leftrightarrow$ some leaf is Accept. Standard TM can do breadth-first-search

Example

Forcing state change doesn't alter power.

Idea:

If want to stay in state x , introduce new state y and go $x \rightarrow y \rightarrow x$.