

Machines & Berkenbaarheid

A Universal Turing Machine

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Overzicht

- Doelstelling
- Uitleg TM
- Principe UTM
- Demo

Doelstelling

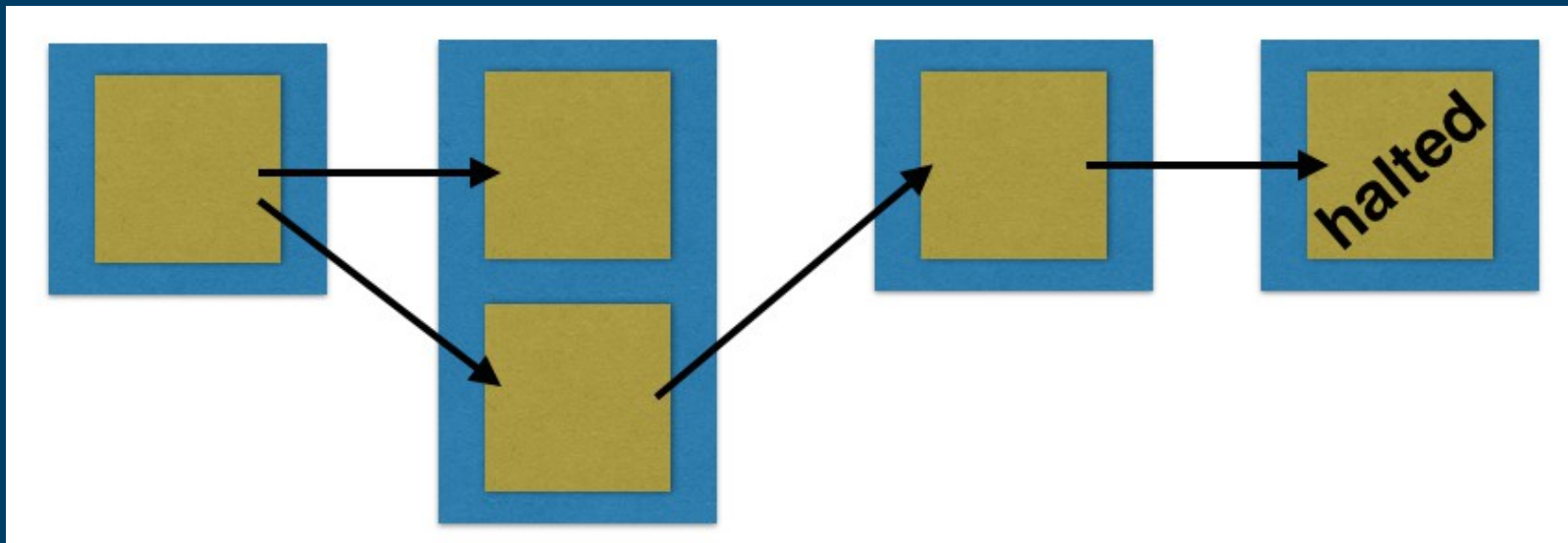
“Teaching tool voor het vergemakkelijken van het uitleggen/demonstreren van onderdelen binnen de cursus Machines & Berekenbaarheid”

Rode draad

- XML → CFGs/PDAs → CNFs → CYK tests
- Elementaire & Universele turing machine

Implementatie TM

Implementatie TM



Turing Machine \approx Algoritme

**Universele TM \approx Algoritme dat Algoritmen
uitvoert**

Definitie

$$M = (Q, \Sigma, \Gamma, \delta, q_0, B, F)$$

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Verschillen: 4 tapes
Transities

37	TRANSITIONS		a = any/ignore	r = rewrite/dont write				UTM IS LIKE A WHILE LOOP
38	Current State	Input	Next State	Tape Head 1	Tape Head 2	Tape Head 3	Tape Head 4	
39	Copy3TO4	a, a, 1, a	Copy3TO4	r, S	r, S	1, R	1, R	← SETUP FOR WHILE LOOP
40	Copy3TO4	a, a, ".", a	Copy3TO4	r, S	r, S	(".", R	(".", R	
41	Copy3TO4	a, a, B, a	ReturnHead3.a	r, S	r, S	B,L	(".", R	
42								
43	ReturnHead3.a	a, a, 1, a	ReturnHead3.a	r, S	r, S	1, L	r, S	
44	ReturnHead3.a	a, a, ".", a	ReturnHead3.a	r, S	r, S	., L	r, S	
45	ReturnHead3.a	a, a, B, a	Copy1TO4.a	r, S	r, S	B, R	r, S	
46								
47	Copy1TO4.a	1,a,a,a	Copy1TO4.a	1, R	r, S	r, S	1, R	
48	Copy1TO4.a	(".",a,a,a	Copy1TO4.a	(".", R	r, S	r, S	(".", R	
49	Copy1TO4.a	0,a,a,a	ReturnHead1.a	0, L	r, S	r, S	B, L	

...

188	WriteBlankRight	B, 1,a,a	WriteBlankRight	1, R	1, R	r, S	r, S	
189	WriteBlankRight	B, ".",a,a	WriteBlankRight	(".", R	(".", R	r, S	r, S	
190	WriteBlankRight	B,B,a,a	ReturnHead1.c	B, L	B, R	r, S	r, S	
191								
192	ReturnHead1.c	1,a,a,a	ReturnHead1.c	1, L	r, S	r, S	r, S	
193	ReturnHead1.c	(".",a,a,a	ReturnHead1.c	(".", L	r, S	r, S	r, S	
194	ReturnHead1.c	0,a,a,a	Copy1TO4.b	0, R	r, S	r, S	r, S	
195								
196	NoTransFound							← END

Simulation Tape
Description of TM
Current State of TM
Work Tape

Met gecodeerde TM's werken

Simulation Tape

11..011..011..011..01...01...011..011..011..011..011..

Description of TM:

<current state>;<current symbol>;<next symbol>;<next state>;<dir>

1.....;1...;1.....;1...;101.....;11..;11.....;111.;1011.....;11..;11.....;11..;1011.....;1...;111.....;1...;10111.....;1...;111.....;1...;10111 etc.

Current State of TM

1.....

Work Tape: <current state>;<current symbol>

1.....;11..

Algoritme UTM

While (Encoded TM tape has not reached end):

 Compare Encoded TM tape to work tape

 If (work tape matches current transition in Encoded TM tape):

 Copy <new state> over in Current State tape

 Copy <new state> over in work tape

 Copy <next symbol> over in Simulated State tape

 Move the tape head in Simulated State tape in the direction of <dir>

 Copy <next symbol> over in work tape

 Else (not a match):

 Move tape head on Encoded TM tape to next transition

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<current state>;<current symbol>;<next symbol>;<next state>;<dir>

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Current State of TM

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→ **While (Encoded TM tape has not reached end):**

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41	Copy3TO4	a, a, B, a	ReturnHead3.a	r, S	r, S	B,L	(".", R	
42								
43	ReturnHead3.a	a, a, 1, a	ReturnHead3.a	r, S	r, S	1, L	r, S	
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45	ReturnHead3.a	a, a, B, a	Copy1TO4.a	r, S	r, S	B, R	r, S	
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47	Copy1TO4.a	1,a,a,a	Copy1TO4.a	1, R	r, S	r, S	1, R	
48	Copy1TO4.a	(".",a,a,a	Copy1TO4.a	(".", R	r, S	r, S	(".", R	
49	Copy1TO4.a	0,a,a,a	ReturnHead1.a	0, L	r, S	r, S	B, L	

123 Transities

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189	WriteBlankRight	B, ".",a,a	WriteBlankRight	(".", R	(".", R	r, S	r, S	
190	WriteBlankRight	B,B,a,a	ReturnHead1.c	B, L	B, R	r, S	r, S	
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192	ReturnHead1.c	1,a,a,a	ReturnHead1.c	1, L	r, S	r, S	r, S	
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194	ReturnHead1.c	0,a,a,a	Copy1TO4.b	0, R	r, S	r, S	r, S	
195								
196	NoTransFound							← END

Vragen?

Demo

Bedankt voor jullie aandacht!