2024-01-25
Winter Semester 2023/2024

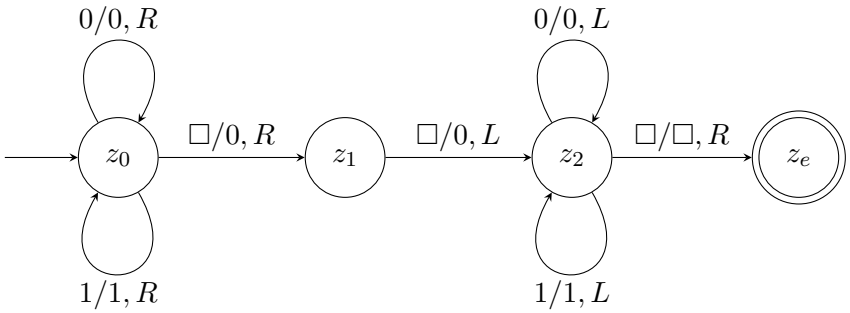
University of Konstanz
Faculty of Science
(Computer and Data Science)

Elias Gestrich

Turing Machines & Decidability

Exercise 1: Turing Machine II

a)



b) $z_0 10 \vdash 1 z_0 0 \vdash 10 z_0 \square \vdash 100 z_1 \square \vdash 10 z_2 00 \vdash 1 z_2 000 \vdash z_1 1000 \vdash z_1 \square 1000 \vdash z_e 1000$

c) $z_0 110 \vdash 1 z_0 10 \vdash 11 z_0 0 \vdash 110 z_0 \square \vdash 1100 z_1 \square \vdash 110 z_2 00 \vdash 11 z_2 000 \vdash 1 z_1 1000 \vdash z_1 11000 \vdash z_1 \square 11000 \vdash z_e 11000$

d) M_1 computes $4 \cdot \mathit{theinput}$ as it adds two zeros to the end of a binary number.

Exercise 2: Busy Beavers

z_1	□	z_2	1	R
z_1	1	z_3	1	L
z_2	□	z_1	1	L
z_2	1	z_2	1	R
z_3	□	z_1	1	L
z_3	1	z_e	1	N

Table 1: δ

Exercise 3: Decidability

a) `true`, since the definition of semi-decidability is that it stops if there is an answer but loops endlessly if there is no answer

b) `unkown`, because the turing machine is semi-decidable, but there might be a turing machine that can identify if words are B or not and is decidable.