Assignment 10

Exercise 2a

i)

Z_0, a, # --> Z_0, b, A --> Z_1, a, #

--> Z_1, b, A --> Z_0, b, A --> Z_1, b, #

--> Z_0, a, # --> Z_0, b, A --> Z_1, b, #

--> Z_0, $\in$, # --> Z_e

ii)

This automaton recognises a context free language made up of [a]s and [b]s of certain quantities and orders. There can be no more than two [B]s in the stack without the TM crashing except for the final stages. There can be an arbitrary number of [a]s in the word as long as it is eventually followed by double the amount of [b]s. A word cannot begin with more than one [b] and the number of [b]s must never go more than three above the amount of preceding [a]s.

iii)

There is only one possible transition for each unique combination of state and input which makes this automaton a deterministic one.

Exercise 2b

iv)

$\vdash Z_0\ 1\ 0\ 1\ 0\ 0\ 1\ 0$ $\vdash 0\ Z_0\ 0\ 1\ 0\ 0\ 1\ 0$

$\vdash 0\ 1\ Z_0\ 1\ 0\ 0\ 1\ 0$ $\vdash 0\ 1\ 0\ Z_0\ 0\ 0\ 1\ 0$

$\vdash 0\ 1\ 0\ 1\ Z_0\ 0\ 1\ 0$ $\vdash 0\ 1\ 0\ 1\ 1\ Z_0\ 1\ 0$

$\vdash 0\ 1\ 0\ 1\ 1\ 0\ Z_0\ 0$ $\vdash 0\ 1\ 0\ 1\ 1\ 0\ 1\ Z_0\ \square$

$\vdash 0\ 1\ 0\ 1\ 1\ 0\ Z_1\ 1\ \square$ $\vdash 0\ 1\ 0\ 1\ 1\ Z_1\ 0\ 0\ \square$

$\vdash 0\ 1\ 0\ 1\ Z_2\ 1\ 1\ 0\ \square$ $\vdash 0\ 1\ 0\ Z_2\ 1\ 1\ 1\ 0\ \square$

$\vdash 0\ 1\ Z_2\ 0\ 1\ 1\ 1\ 0\ \square$ $\vdash 0\ Z_2\ 1\ 0\ 1\ 1\ 1\ 0\ \square$

$\vdash Z_2\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ \square$ $\vdash Z_2\ \square\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ \square$

$\vdash Z_3\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ \square$ $\vdash 1\ Z_3\ 1\ 0\ 1\ 1\ 1\ 0\ \square$

$\vdash 1\ 0\ Z_3\ 0\ 1\ 1\ 1\ 0\ \square$ $\vdash 1\ 0\ 1\ Z_3\ 1\ 1\ 1\ 0\ \square$

$\vdash 1\ 0\ 1\ 0\ Z_3\ 1\ 1\ 0\ \square$ $\vdash 1\ 0\ 1\ 0\ 0\ Z_3\ 1\ 0\ \square$

$\vdash 1\ 0\ 1\ 0\ 0\ 0\ Z_3\ 0\ \square$ $\vdash 1\ 0\ 1\ 0\ 0\ 0\ 1\ Z_3\ \square$

$\vdash 1\ 0\ 1\ 0\ 0\ 0\ Z_4\ 1\ \square$ $\vdash 1\ 0\ 1\ 0\ 0\ Z_4\ 0\ 1\ \square$

$\vdash 1\ 0\ 1\ 0\ Z_4\ 0\ 0\ 1\ \square$ $\vdash 1\ 0\ 1\ Z_4\ 0\ 0\ 0\ 1\ \square$

$\vdash 1\ 0\ Z_4\ 1\ 0\ 0\ 0\ 1\ \square$ $\vdash 1\ 0\ Z_4\ 1\ 0\ 0\ 0\ 1\ \square$

$\vdash 1\ Z_4\ 0\ 1\ 0\ 0\ 0\ 1\ \square$ $\vdash Z_4\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ \square$

$\vdash Z_4\ \square\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ \square$ $\vdash Z_e\ \square\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ \square$

v)

This TM reduces a binary coded number (82) by one (81)

vi)

The TM we saw in the lecture increased a binary coded number (5) by one (6). So, this TM does the exact opposite and it does so by inverting the entire binary number either side of an addition. The addition takes a similar form to that of the lecture TM.