Problem 7:

A configuration of the LBA M consists of
- the current state of M
- contents of all tape cells
- position of the tape head

Idea: An LBA has finitely many configurations, so if we check for repetition of any configuration, we can stop it from running forever and reject the input.

For input w

let $|w| = n$

Q be the finite states of M

Γ be the tape alphabet of M

Total number of possible configurations is atmost $|Q| \times n \times |\Gamma|^n$

By pigeonhole principle, if M runs for more than these many steps, then some configuration must repeat, causing it to loop forever.

Construct at decider D, which on input $\langle M, w \rangle$
- Compute $MAX = |Q| \times n \times |\Gamma|^n$
- simulate M on input w for at most MAX steps
- If M accepts w within MAX steps, accept
- Reject in all other cases.