

P01. TM Languages

Convert the following TMs first into summary tables and then into their code words in CWL. What are the two languages accepted by these TMs? Run each of the two encoded words on their respective machines to see which are in the language ALAN.

i

From	To	Read	Write	Move	Code
1	1	Λ	Λ	R	a b a b ba ba b
1	1	b	b	R	a b a b ab ab b
1	2	a	b	L	a b aa b aa ab a

For reference

a	aa
b	ab
Λ	ba
#	bb
Left	a
Right	b

a b a b ba ba b + a b a b ab ab b + a b aa b aa ab a = a b a b ba ba b a b a b ab ab b a b aa b aa ab a

This machine accepts any number of **bs** (including no **bs**) then an **a**, or in other words, any word containing at least a single **a** in it.

Running: a b a b ba ba b a b a b ab ab b a b aa b aa ab a

Reads **a** so it moves from state 1 to state 2, writes **b** moves tape head left. Is at state 2 so halt. Accepted.

ii

1	3	a	Λ	R	a b aaa b aa ba b
3	1	b	#	L	aaa b a b ab bb a
3	2	Λ	a	R	aaa b aa b ba aa b

a b aaa b aa ba b + aaa b a b ab bb a + aaa b aa b ba aa b = a b aaa b aa ba b aaa b a b ab bb a aaa b aa b ba aa b

This machine accepts **a**

- If it reads a **b** first it crashes.

- If it reads **b** after an **a** it writes a **#** and moves left.

Like this:

ab => Λb => Λ# => no state to go to if it reads Λ so crash

so **ab** is not accepted

If it reads **aa** it crashes after it moves to state 3, it has nothing to read the 2nd **a**.

only a is accepted

Running: a b aaa b aa ba b aaa b a b ab bb a aaa b aa b ba aa b

Same as what was written before if it reads **ab** as this starts with **ab**. Crash. In ALAN.

P02. TM Languages

Decode the following words from CWL into their corresponding TMs and run them on their corresponding TMs to see which are in ALAN and which are not:

- abaabbbbab
- abaabaabbb

a b aa b bb ba b
1 2 # \wedge R

Reads #, writes \wedge , moves right, halts. Accepts all strings that start with #
This string starts with **a** and would make my TM crash, so this is in ALAN.

a b aa b aa bb b
1 2 a # R

Reads **a**, writes #, moves right, halts. Accepts all strings that start with **a**.
This string starts with **a** and would be accepted, so this is not in ALAN.

From	To	Read	Write	Move
1	2	#	\wedge	R
From	To	Read	Write	Move
1	2	a	#	R