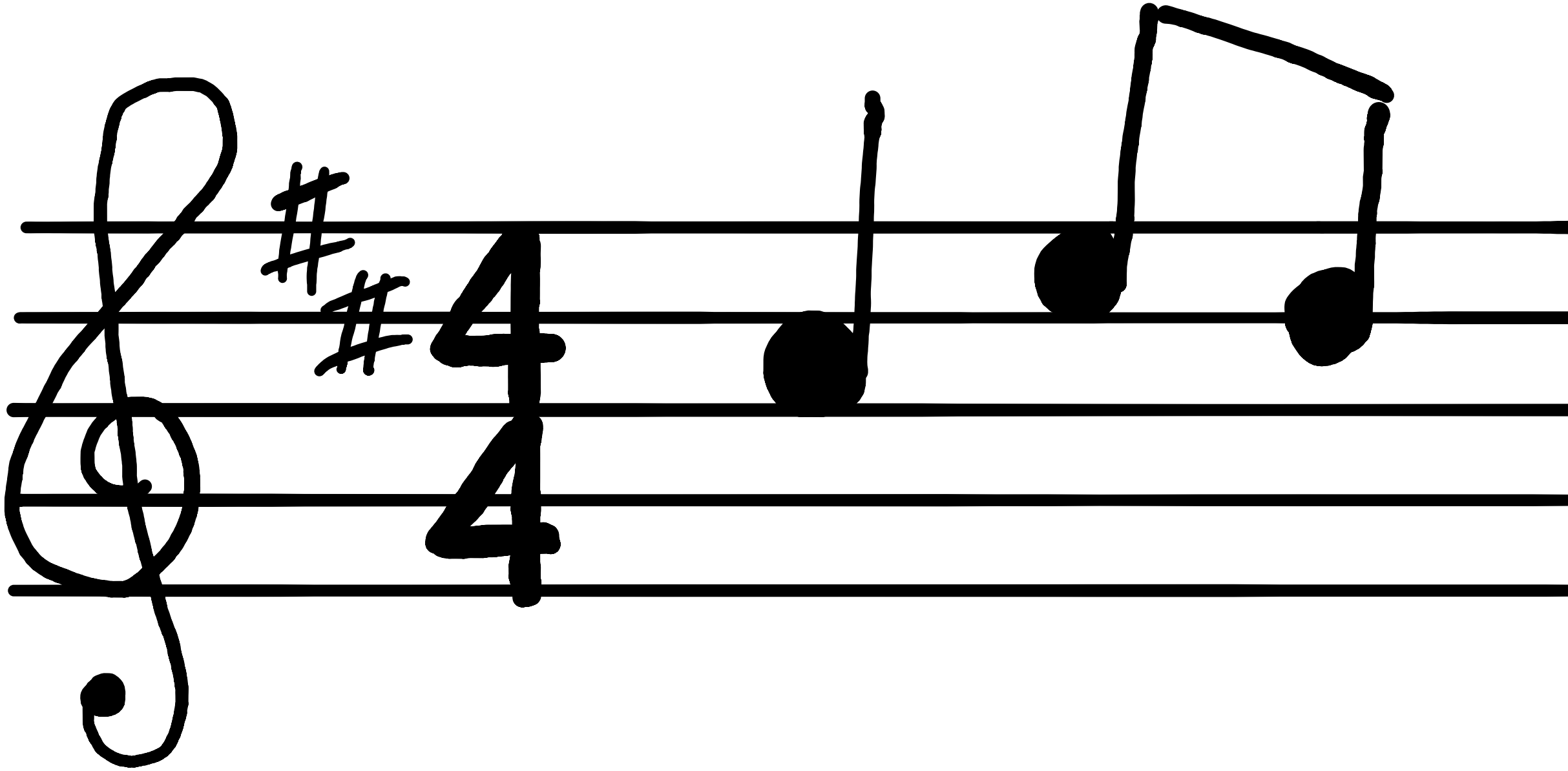
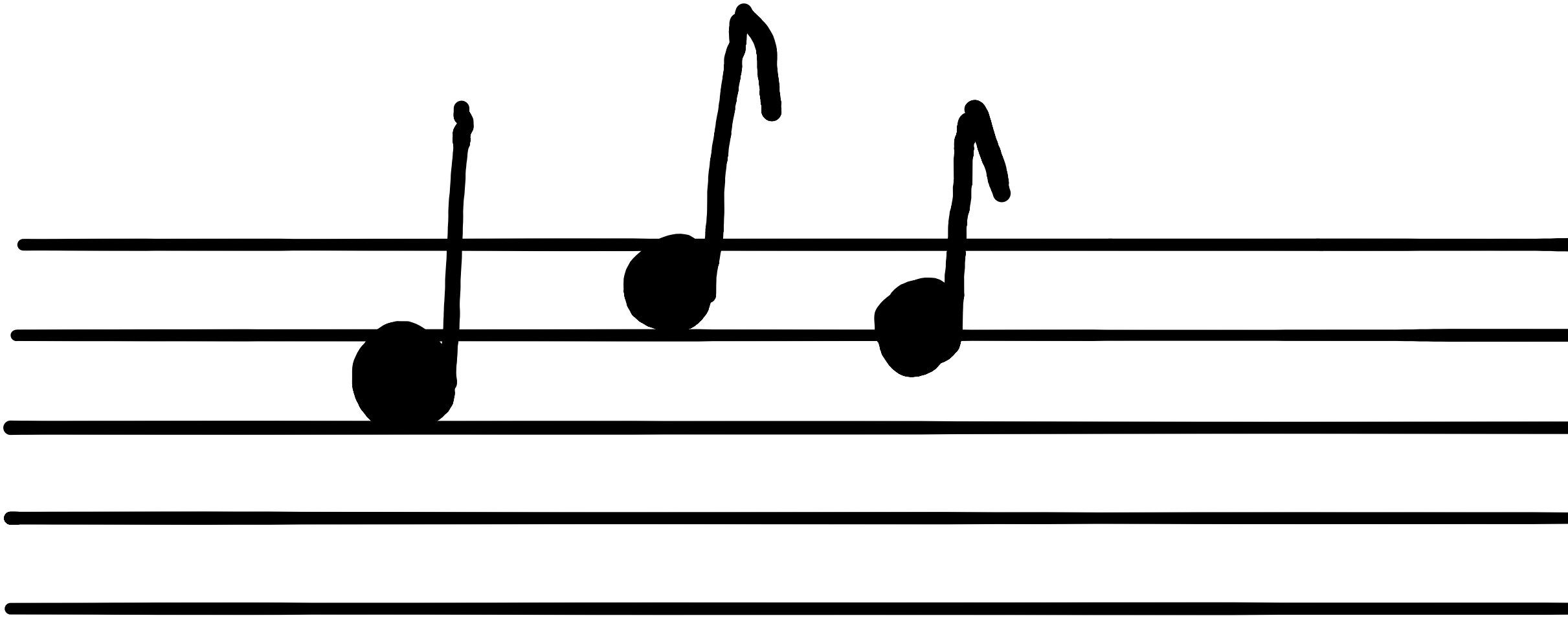
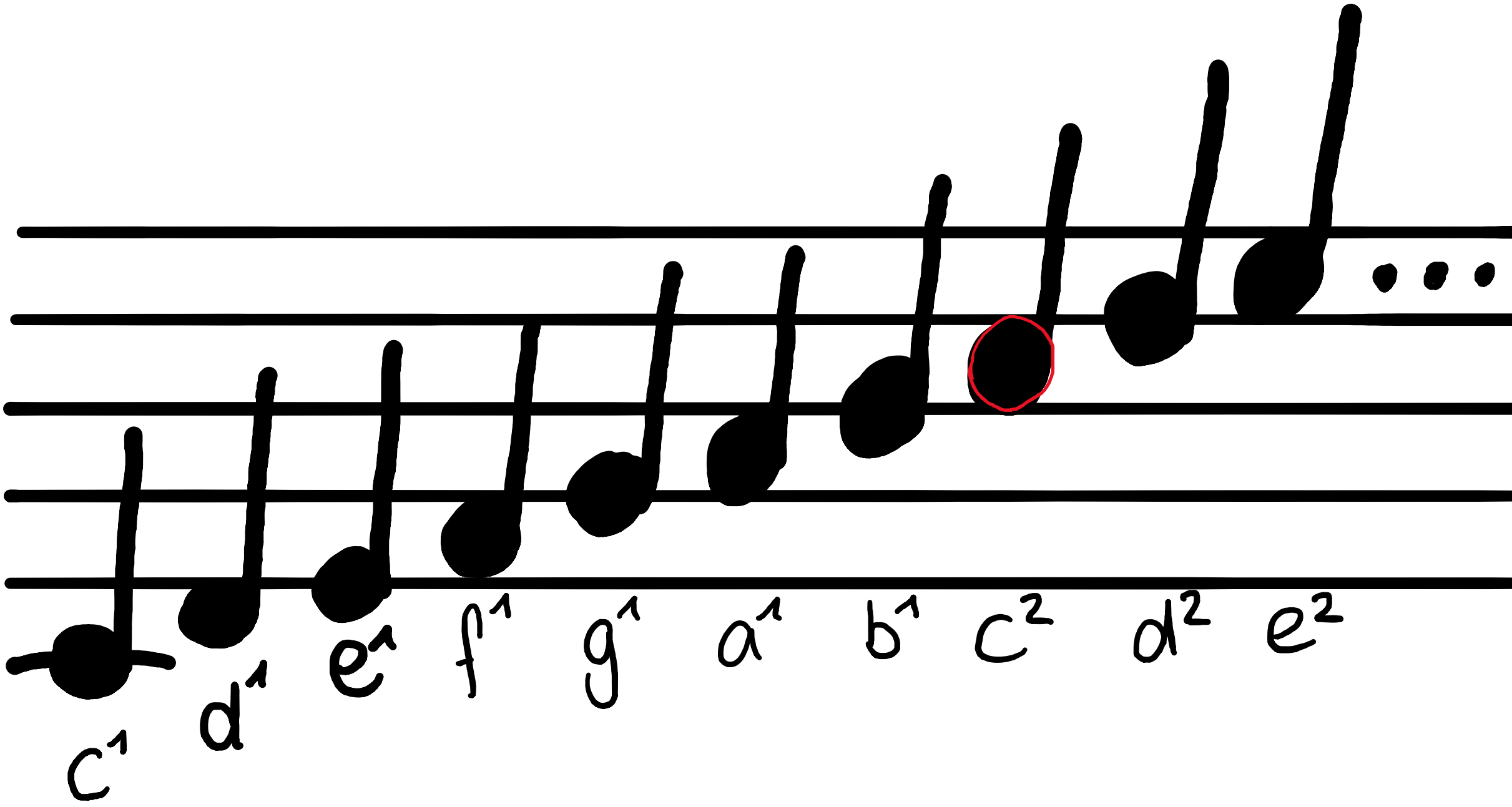
Musical Variation Automata

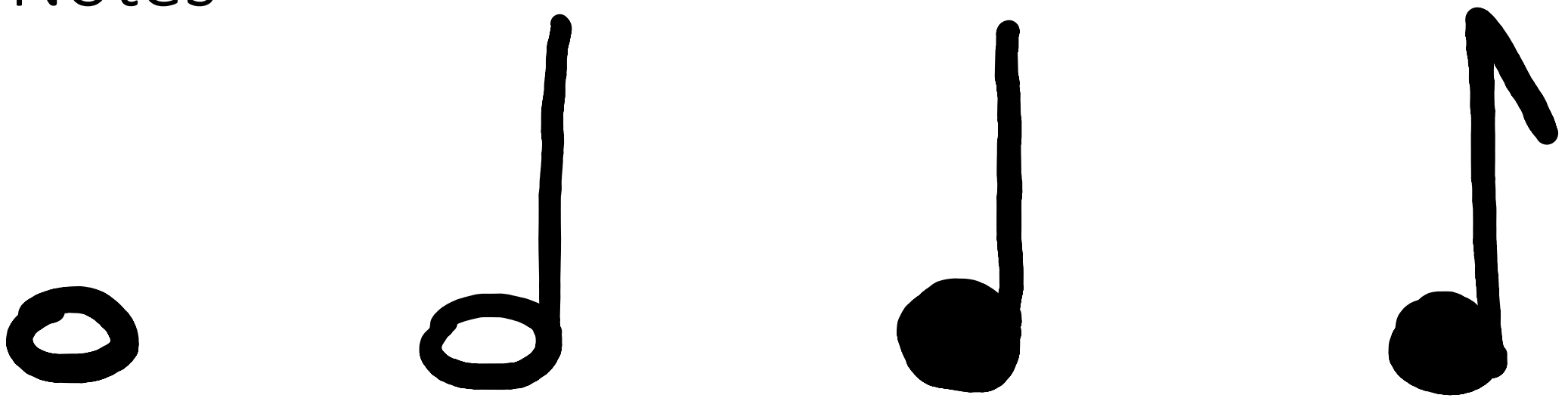
252-1424-00L Models of Computation






c¹
d¹
e¹
f¹
g¹
a¹
b¹
c²
d²
e²

Notes



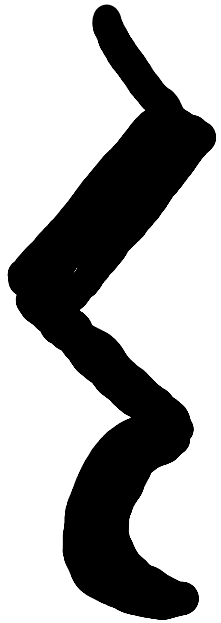
1

$\frac{1}{2}$

$\frac{1}{4}$

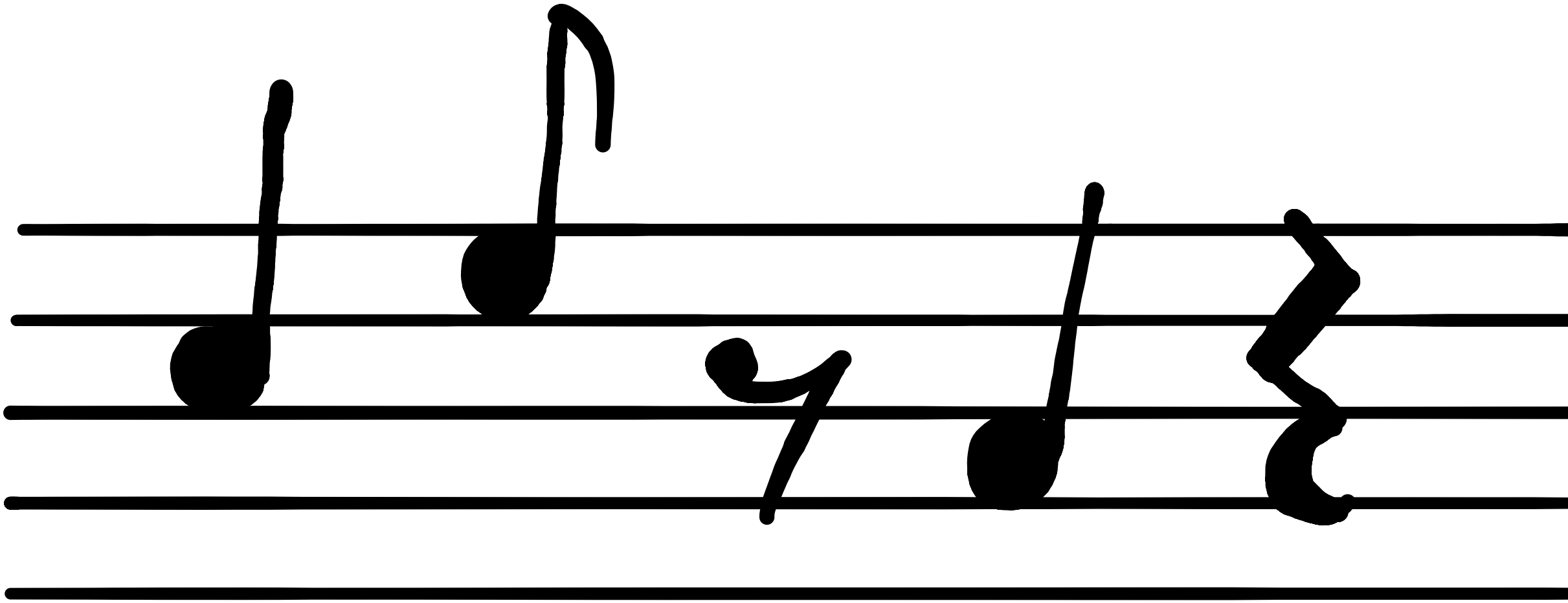
$\frac{1}{8}$

Pause

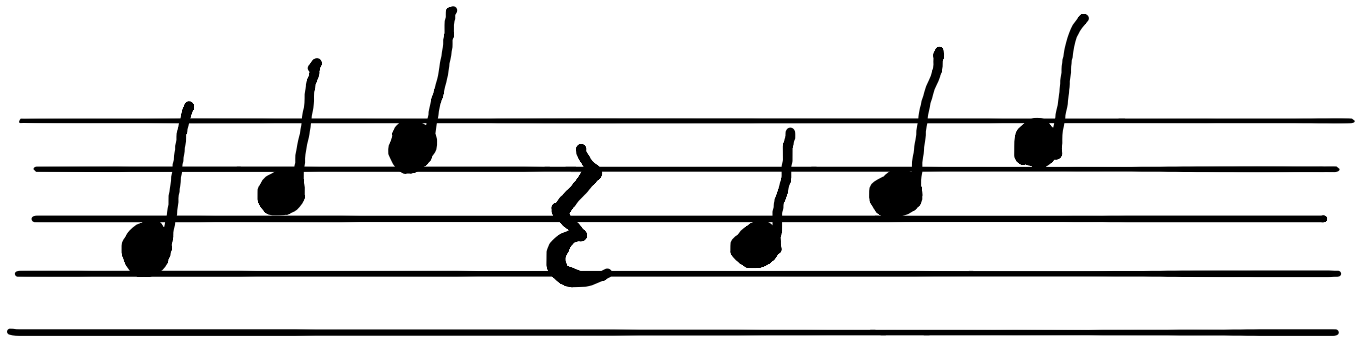


$\frac{1}{4}$

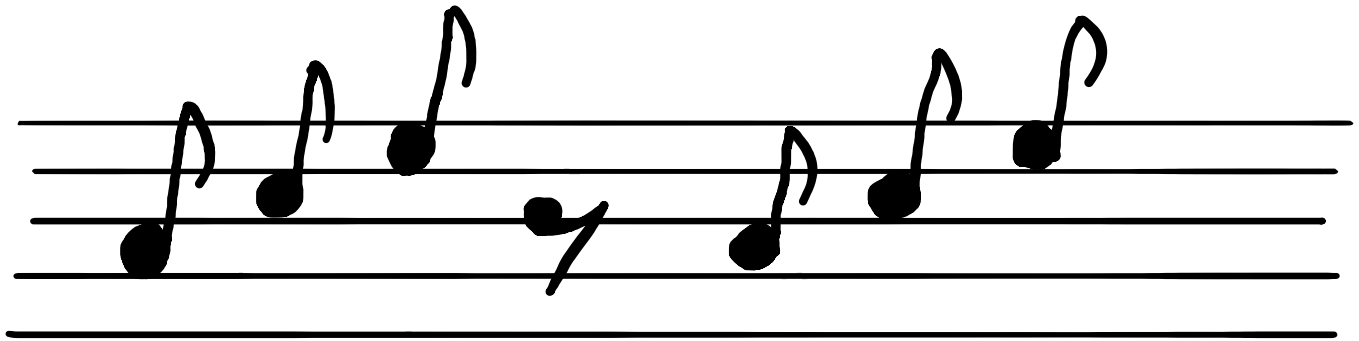
$\frac{1}{8}$



Theme and Variation

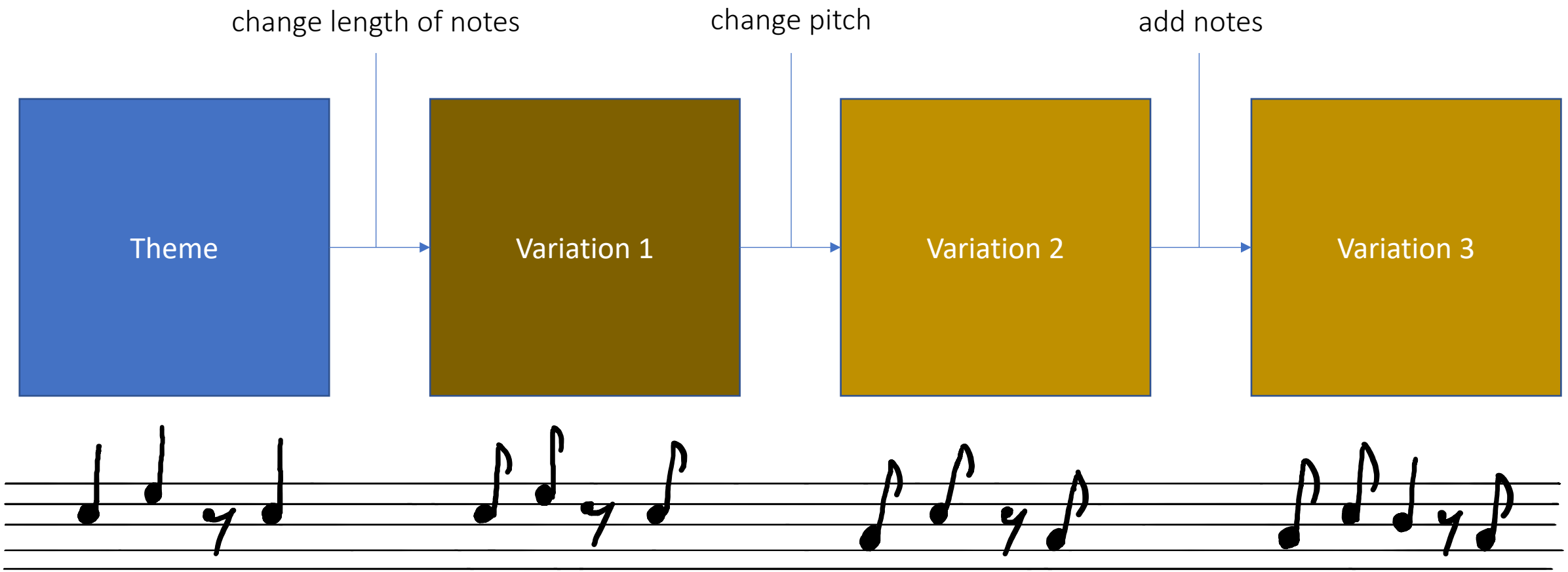


Theme

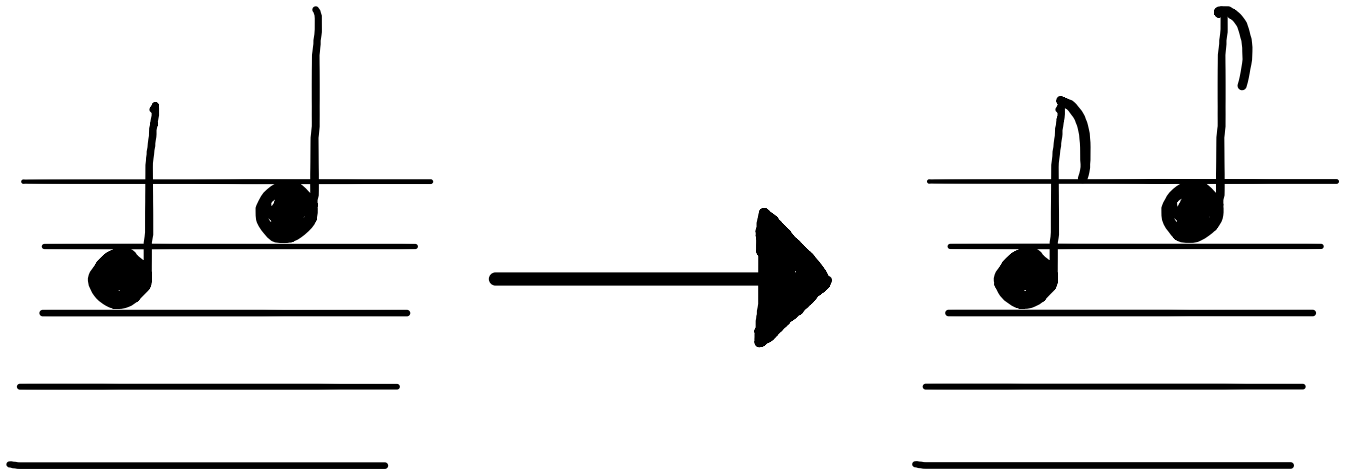


Variation

Theme and Variation



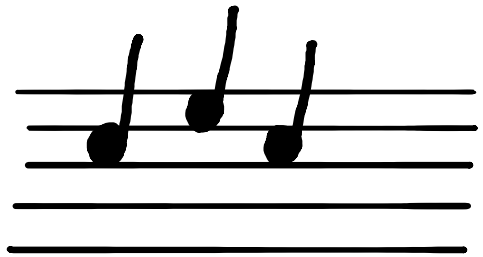
VARIATION FUNCTION



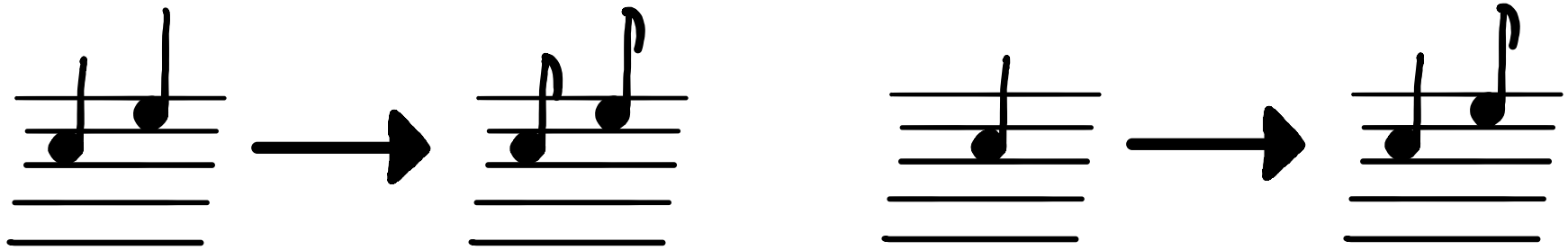
theme **variation**

Musical Variation Automata

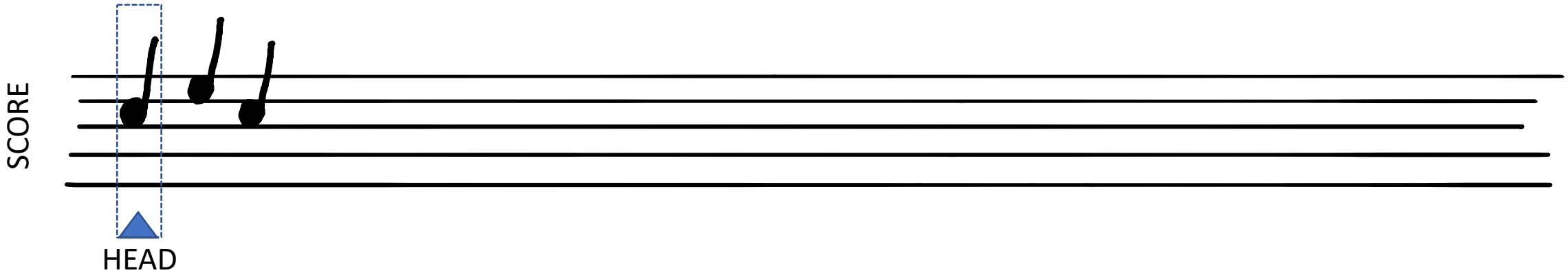
Given an initial theme:

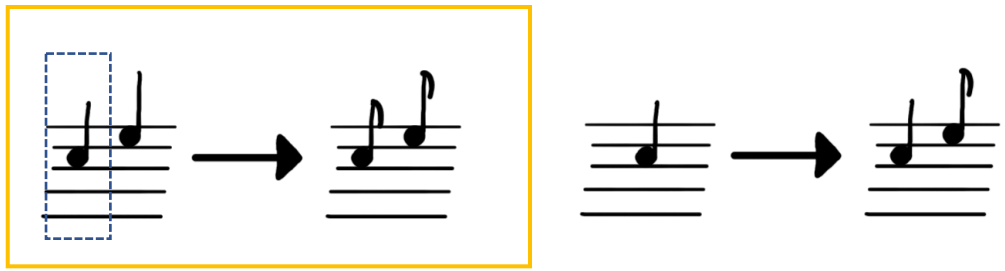


And a set of ordered Variation Functions:

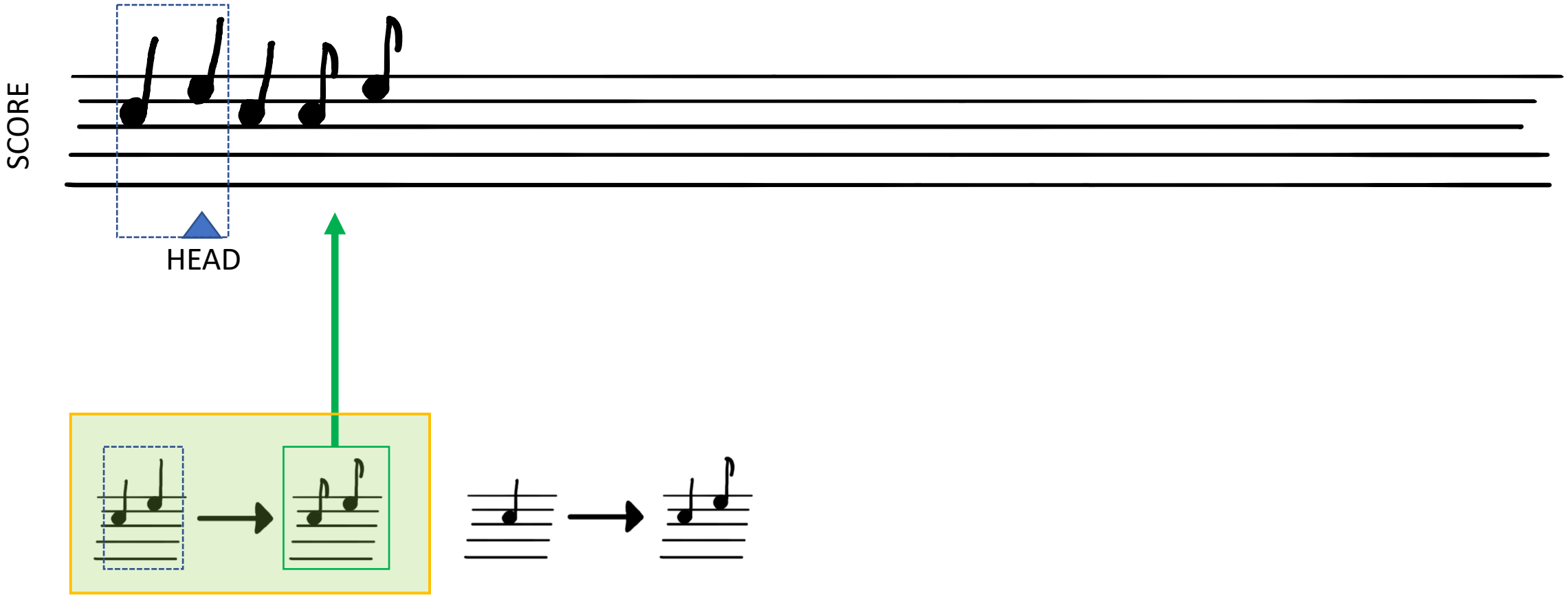


Musical Variation Automata

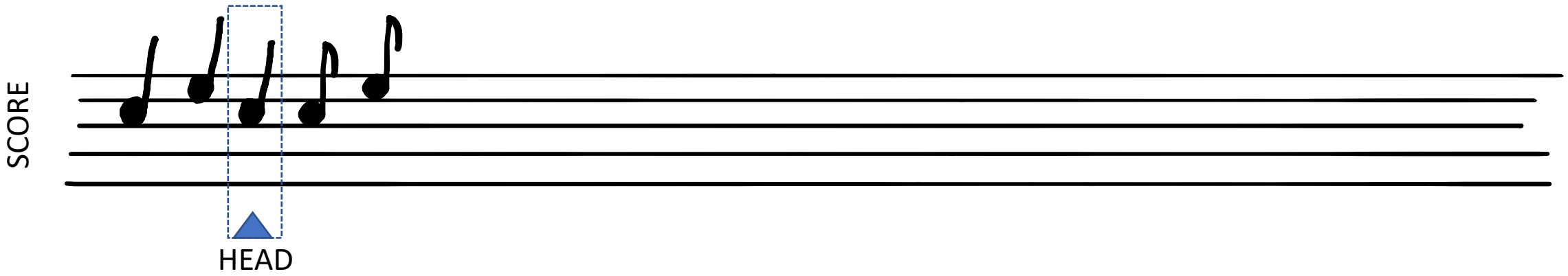


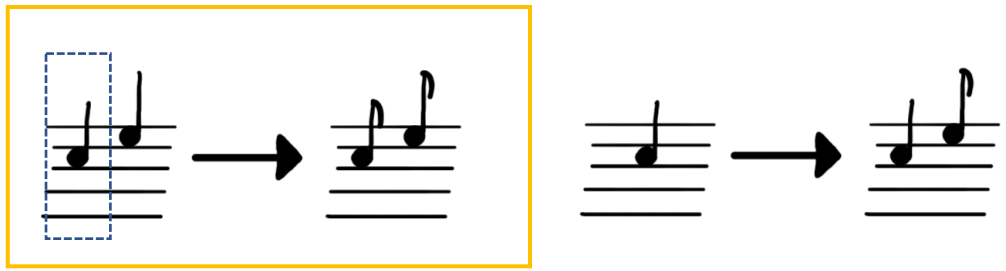


Musical Variation Automata

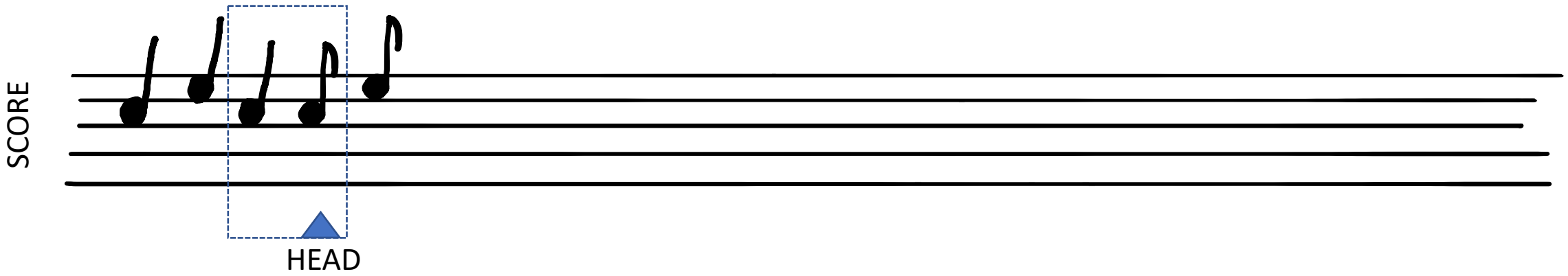


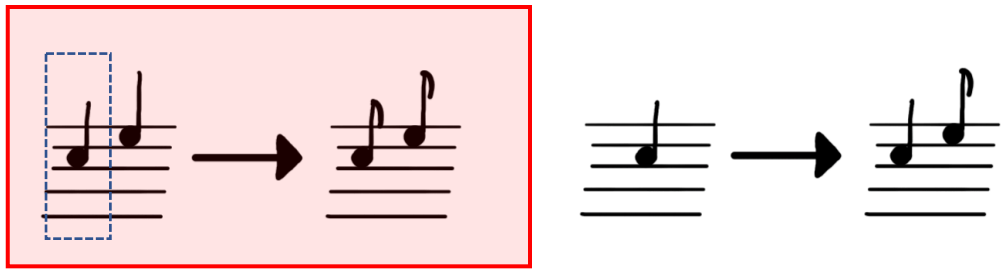
Musical Variation Automata



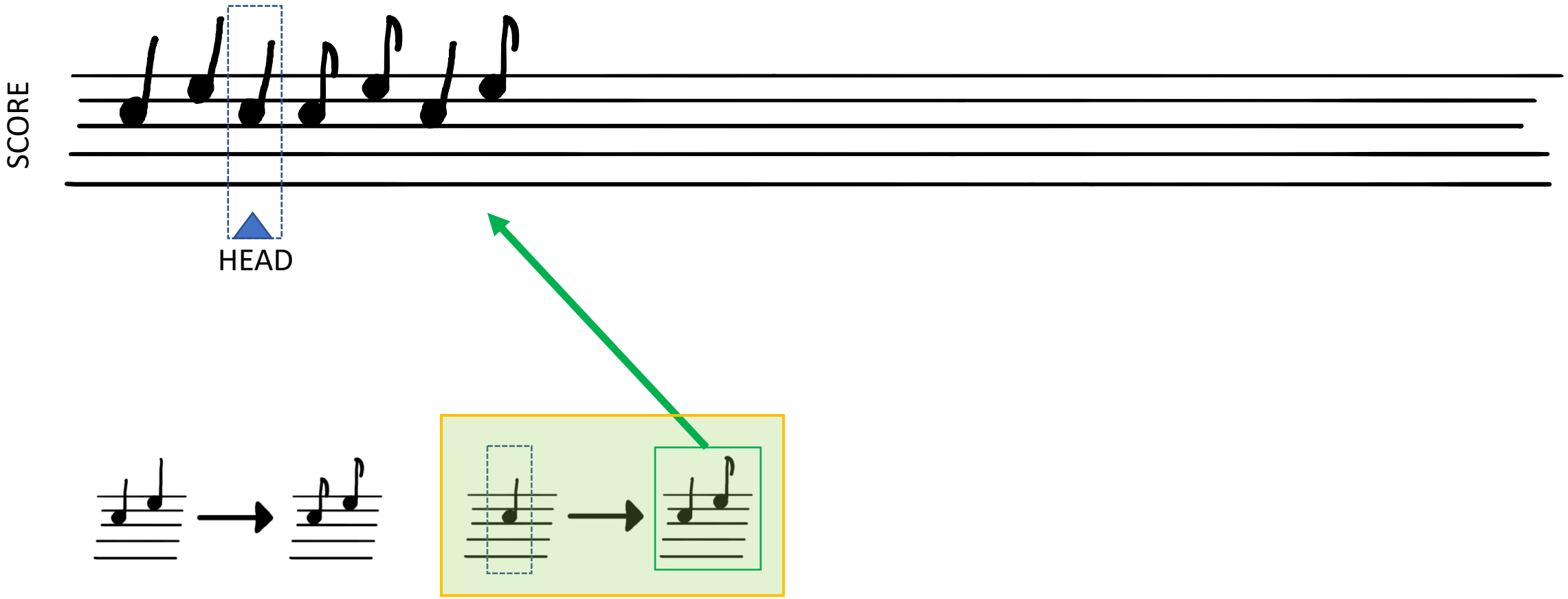


Musical Variation Automata





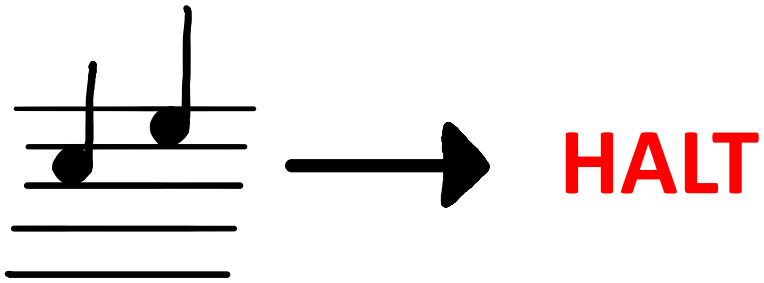
Musical Variation Automata



Halting conditions

- **Implicit**:
  The Automata halts if there's no matching variation function found.

- **Explicit**:

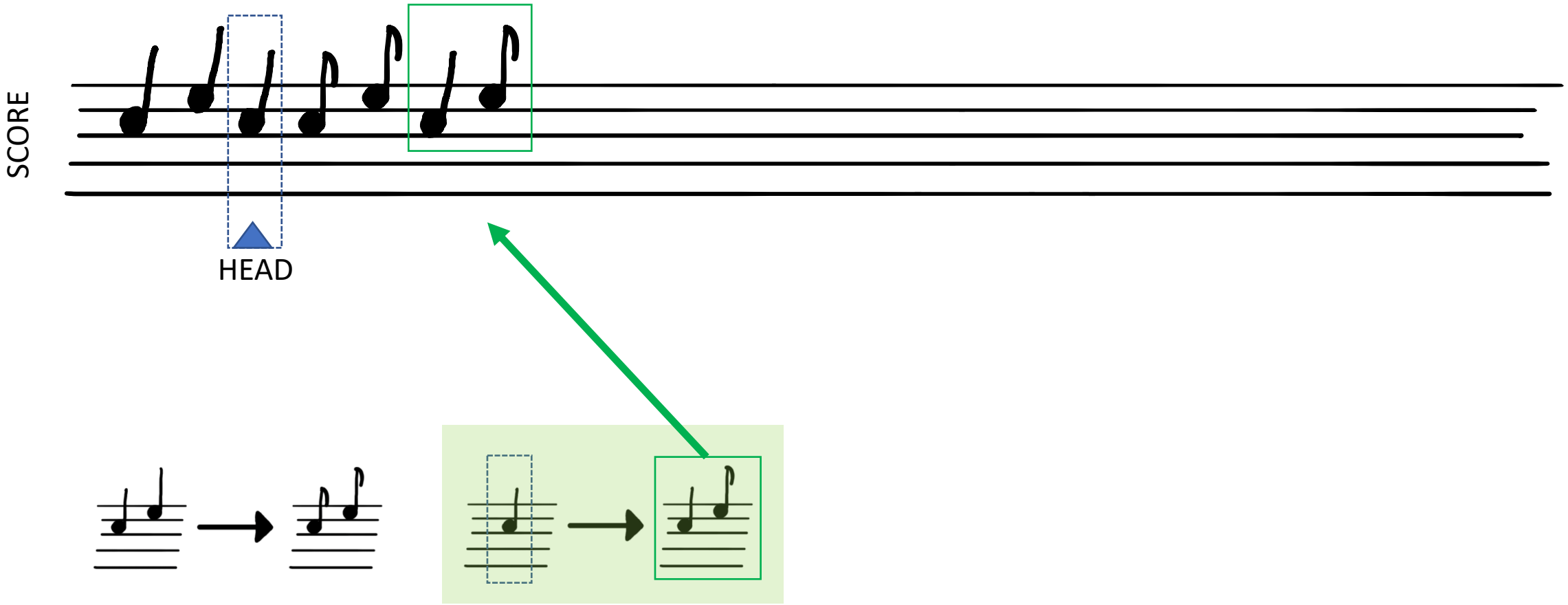


Output definition

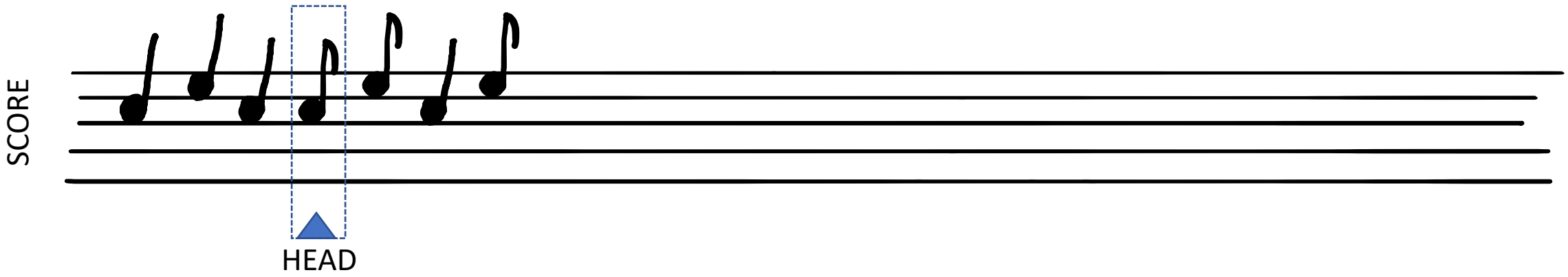
Upon halting (implicit or explicit) **the automata head is advanced one more time.**

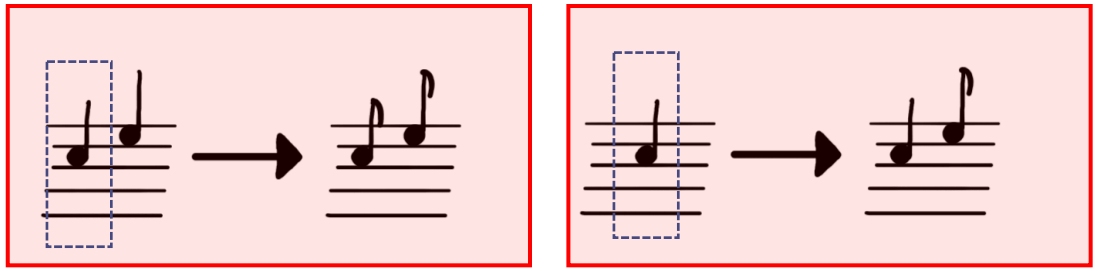
The output / final variation is given by the remaining content the head could read after halting.

Halting example



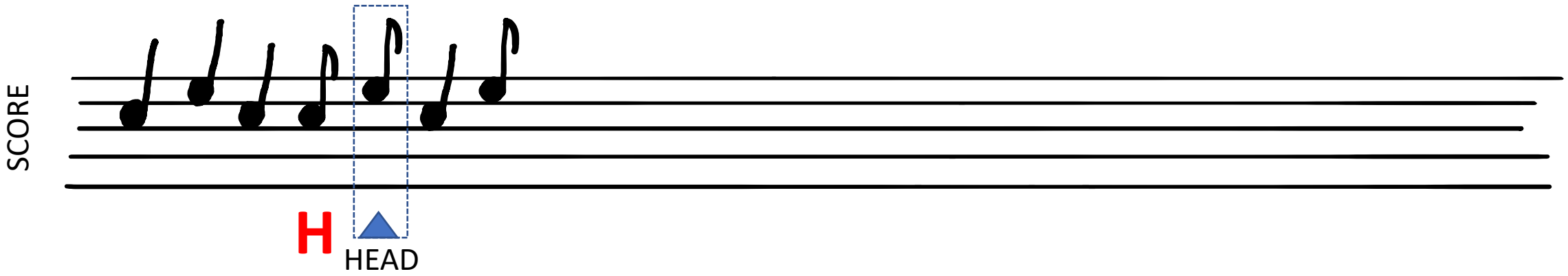
Halting example

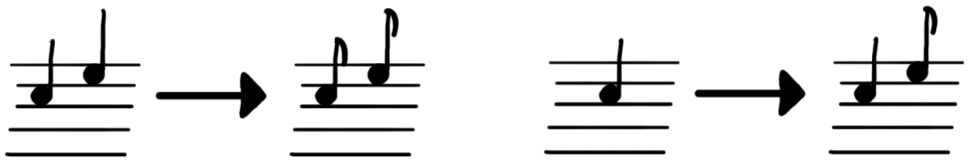




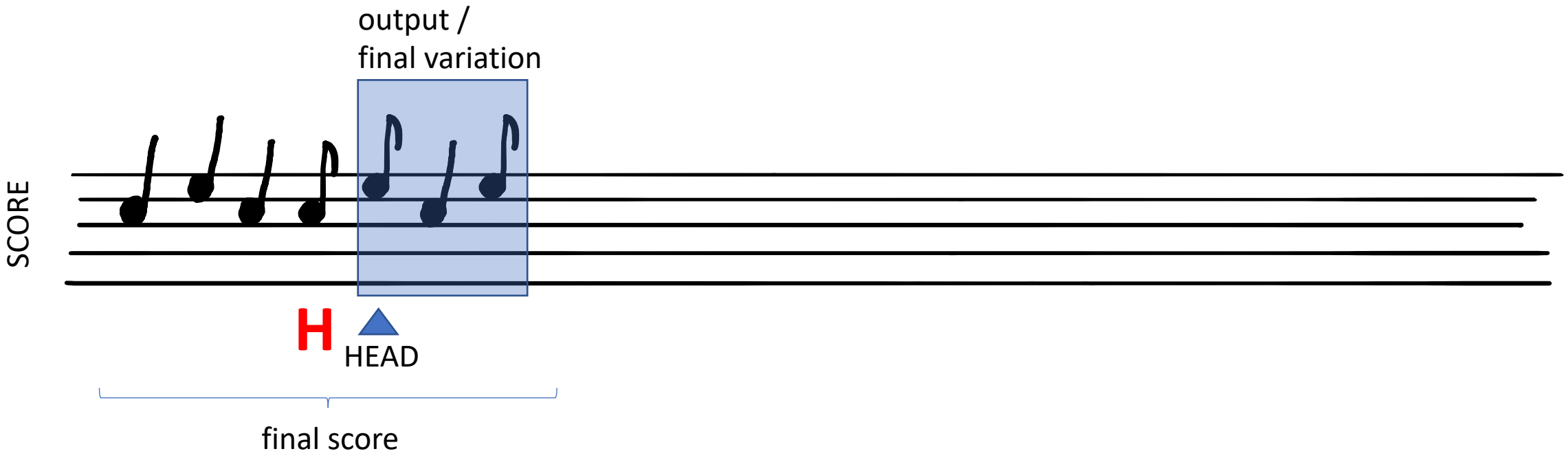
IMPLICIT HALT

Halting example





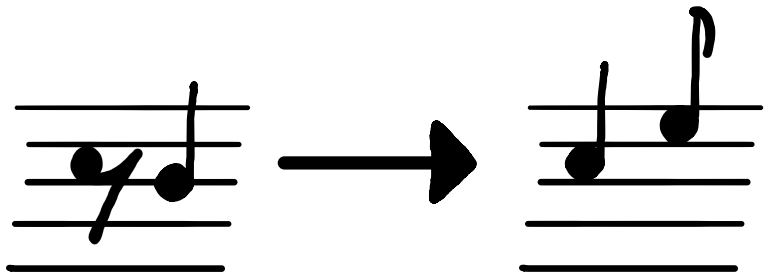
Halting example



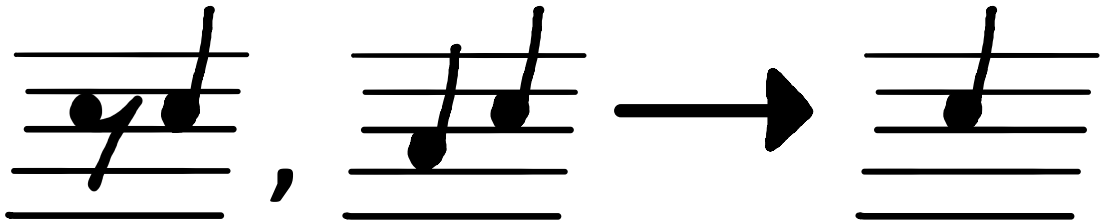
What can we do with this?

Additional information

- **Pauses have no pitch!**
- But can still be used to encode progress
- Are treated the same as notes

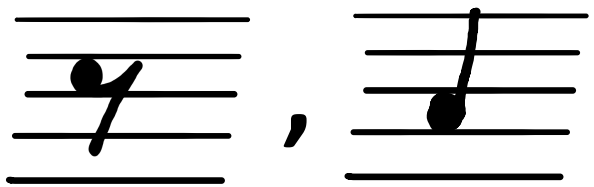


Simplified function writing

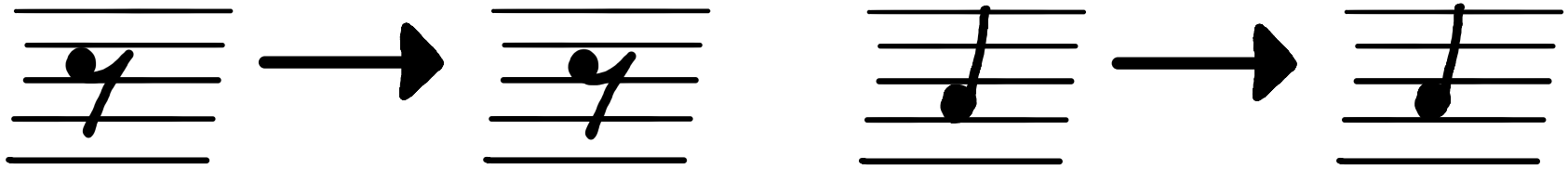


is short for:

Simplified function writing

Self-reproducing: {  **}**

is short for:



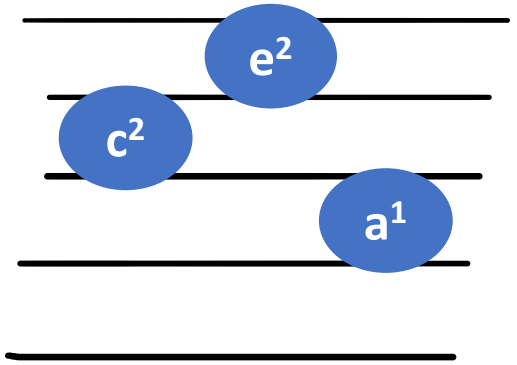
AND

Musical Boolean: TRUE =  FALSE = 

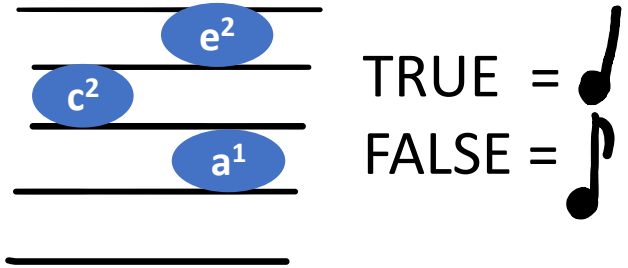
Task:

Compute an AND of a musical boolean in c^2 followed by a musical boolean in e^2

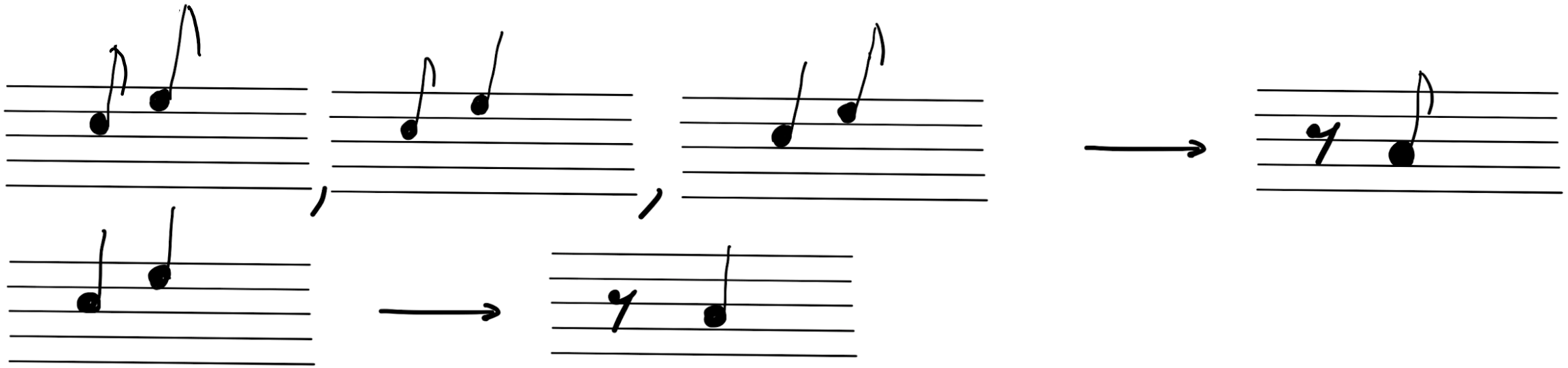
The output should be in a^1.



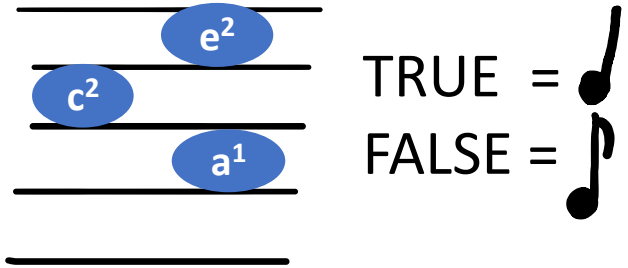
AND

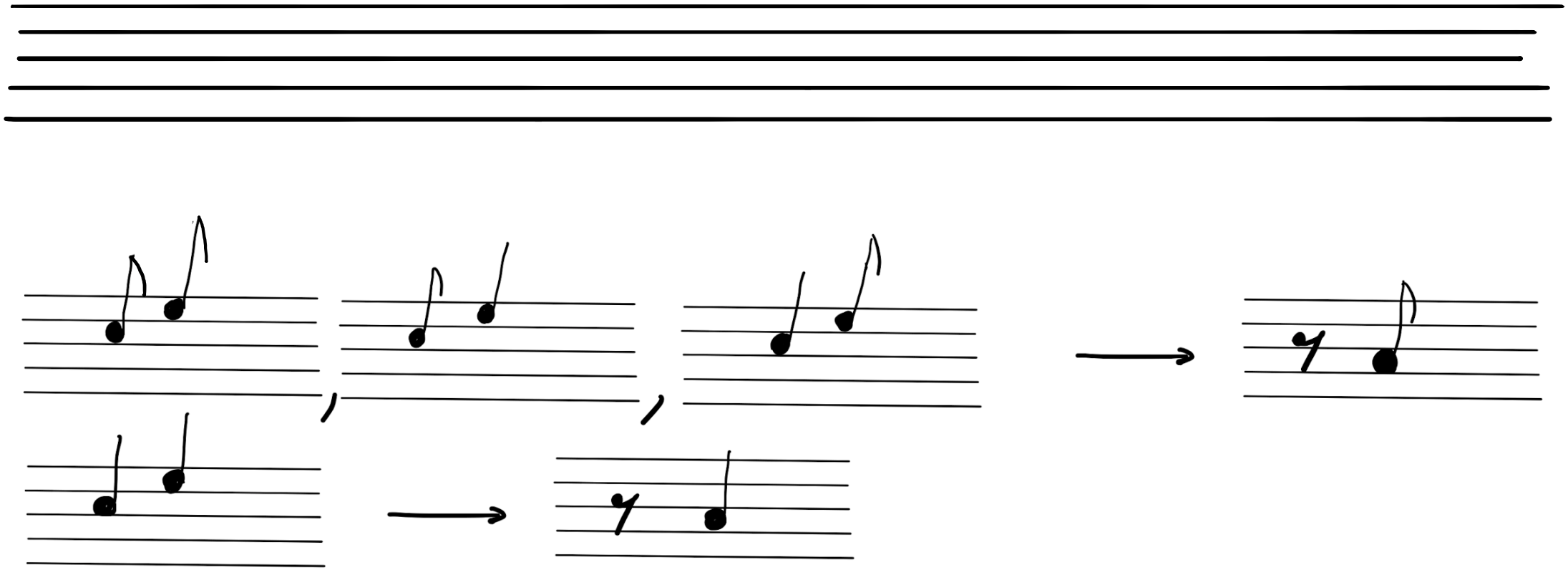


Variation d Functions:

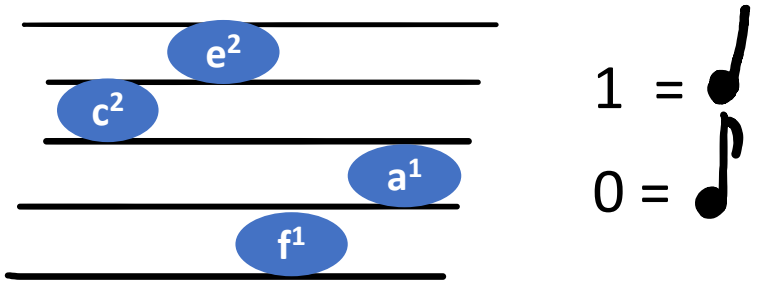


AND





BINARY ADDITION

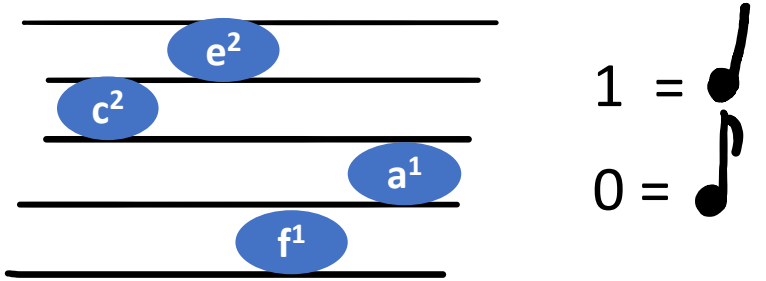


Task:

Add two binary values of equal length, where the first one is on c^2 and the second one is reversed on $e^{2.}$

The output should be in a^1.

BINARY ADDITION

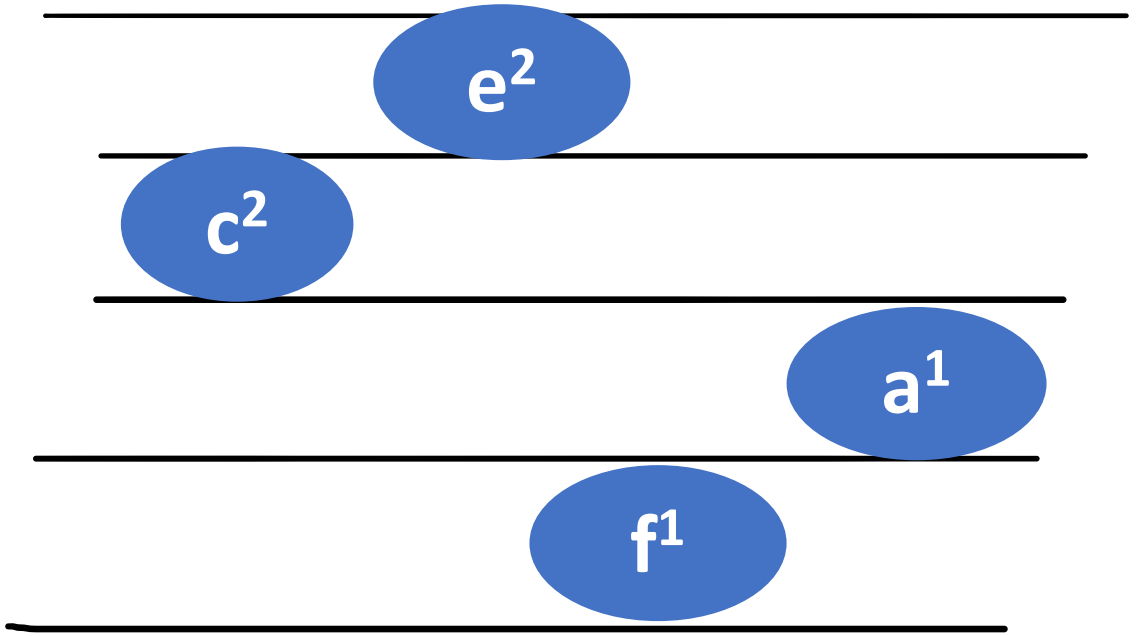


Idea:

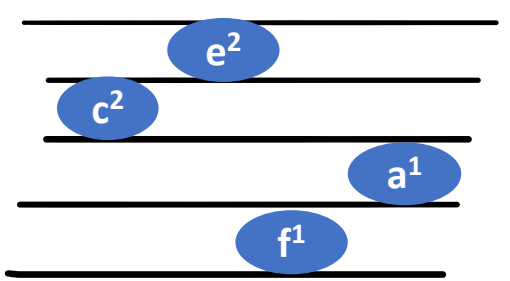
BINARY ADDITION

1 =

0 =

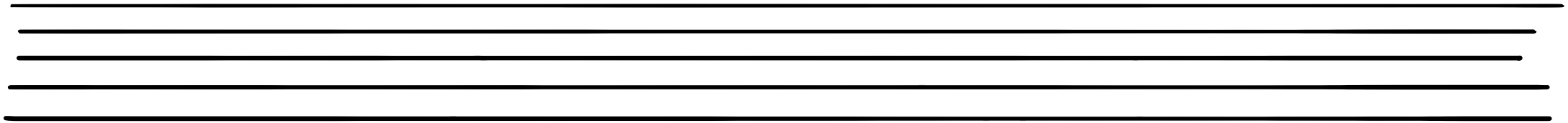


BINARY ADDITION

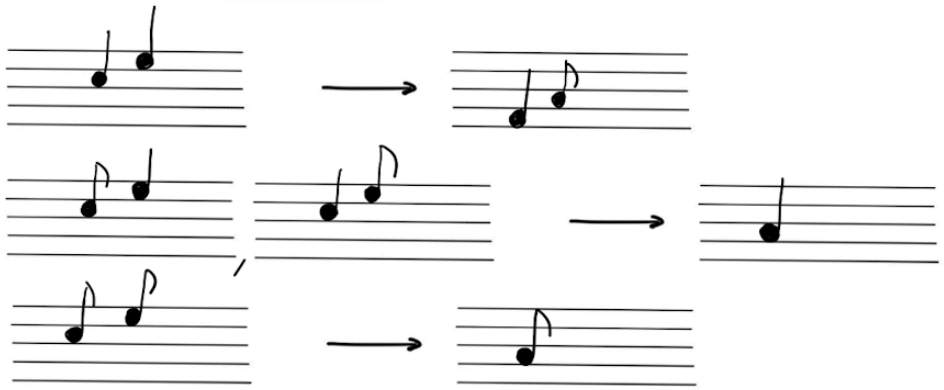


1 =

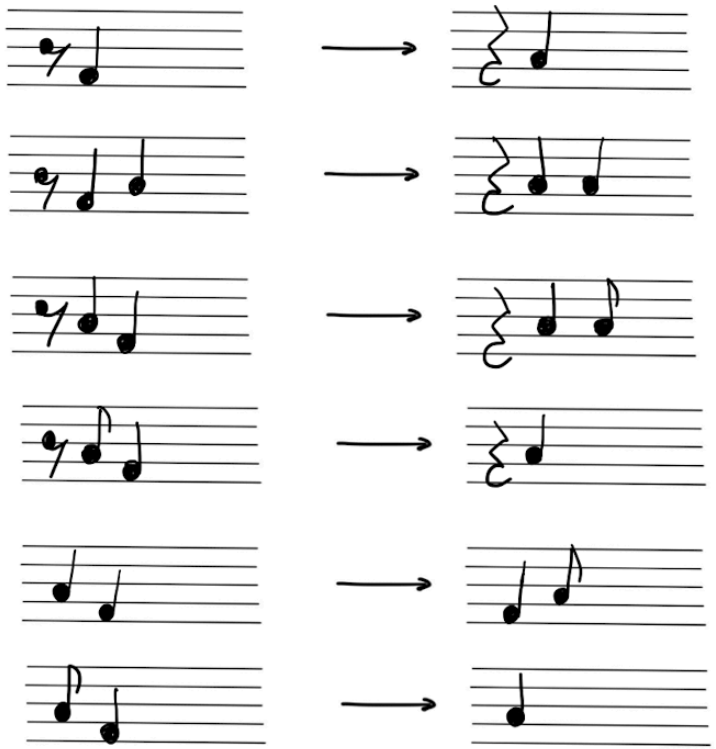
0 =



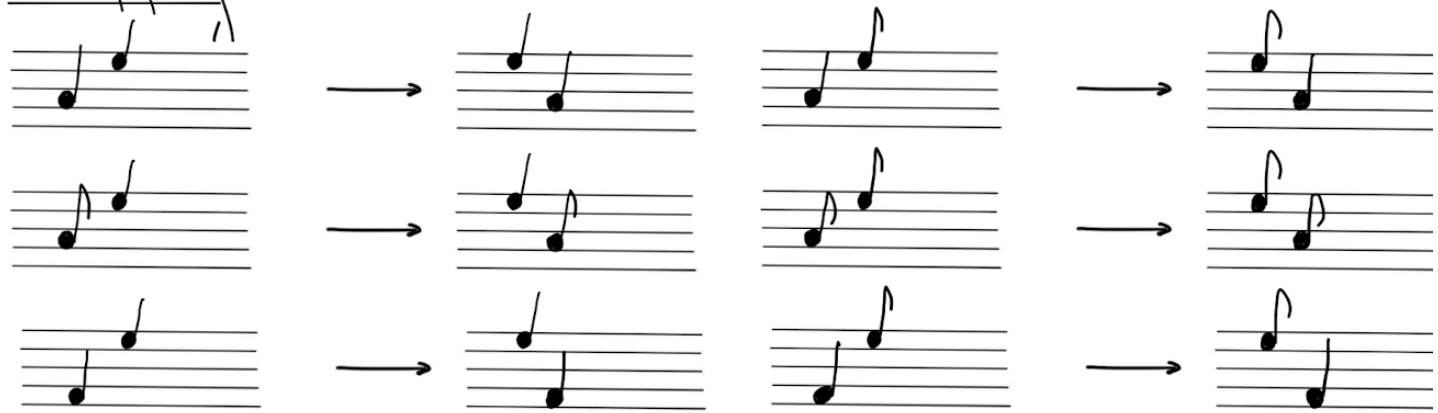
1. 1-bit addition



2. Concat carries



3. Swapping



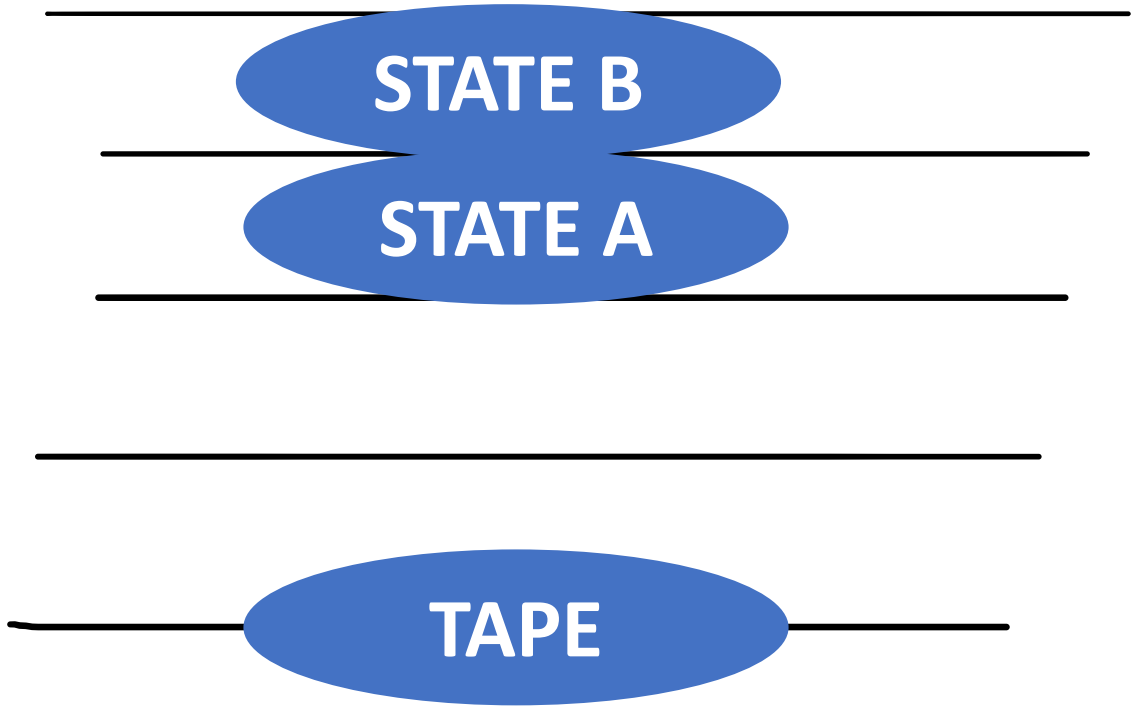
4. Self-reproducing: {, , , , , , }

Can we do a Turing Machine?

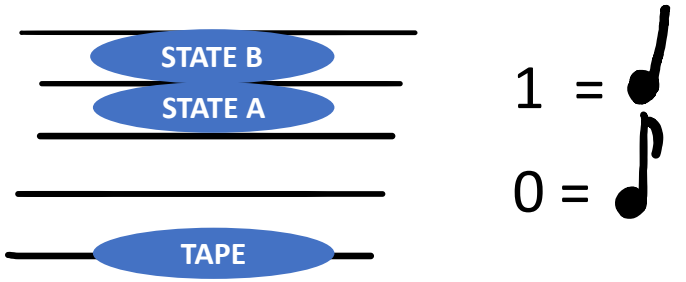
SIMULATE TURING MACHINE

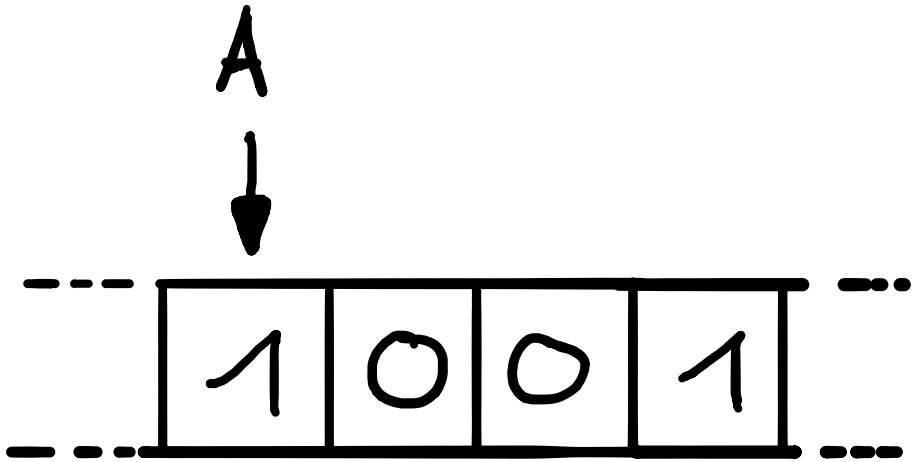
1 = 

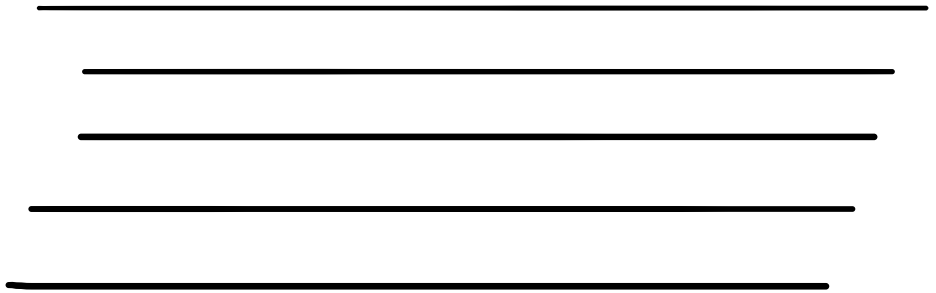
0 = 



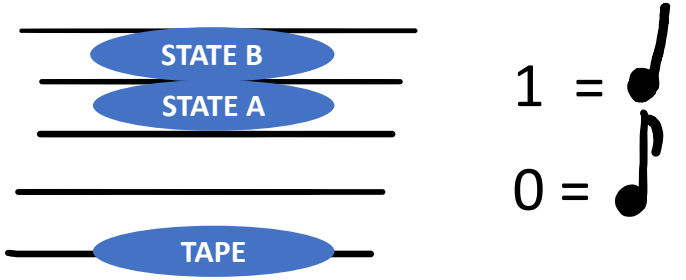
SIMULATE TURING MACHINE

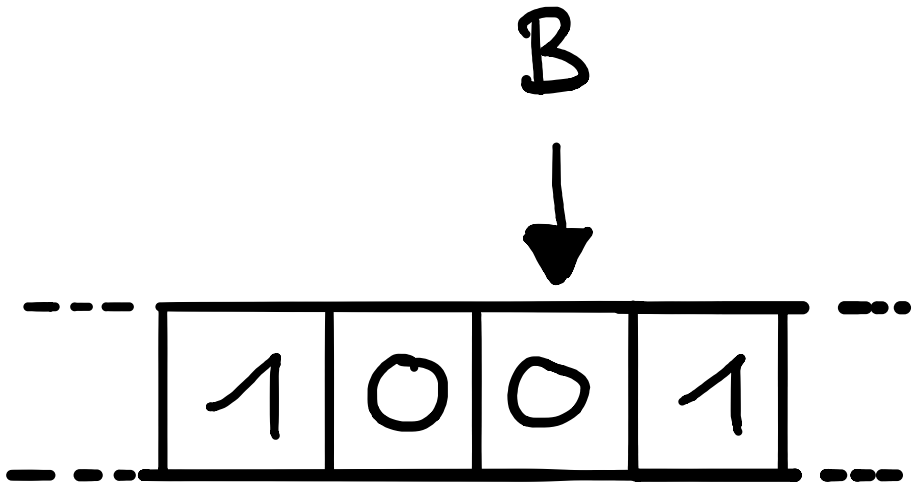


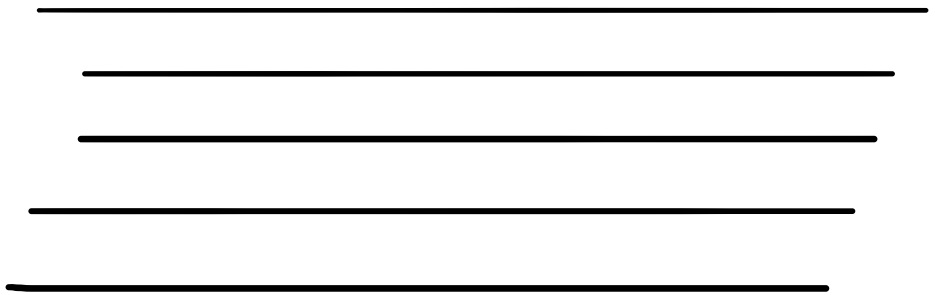




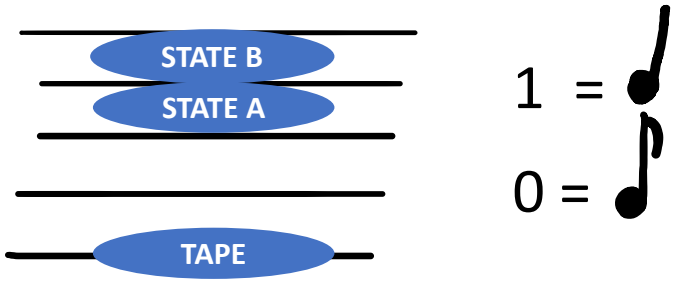
SIMULATE TURING MACHINE



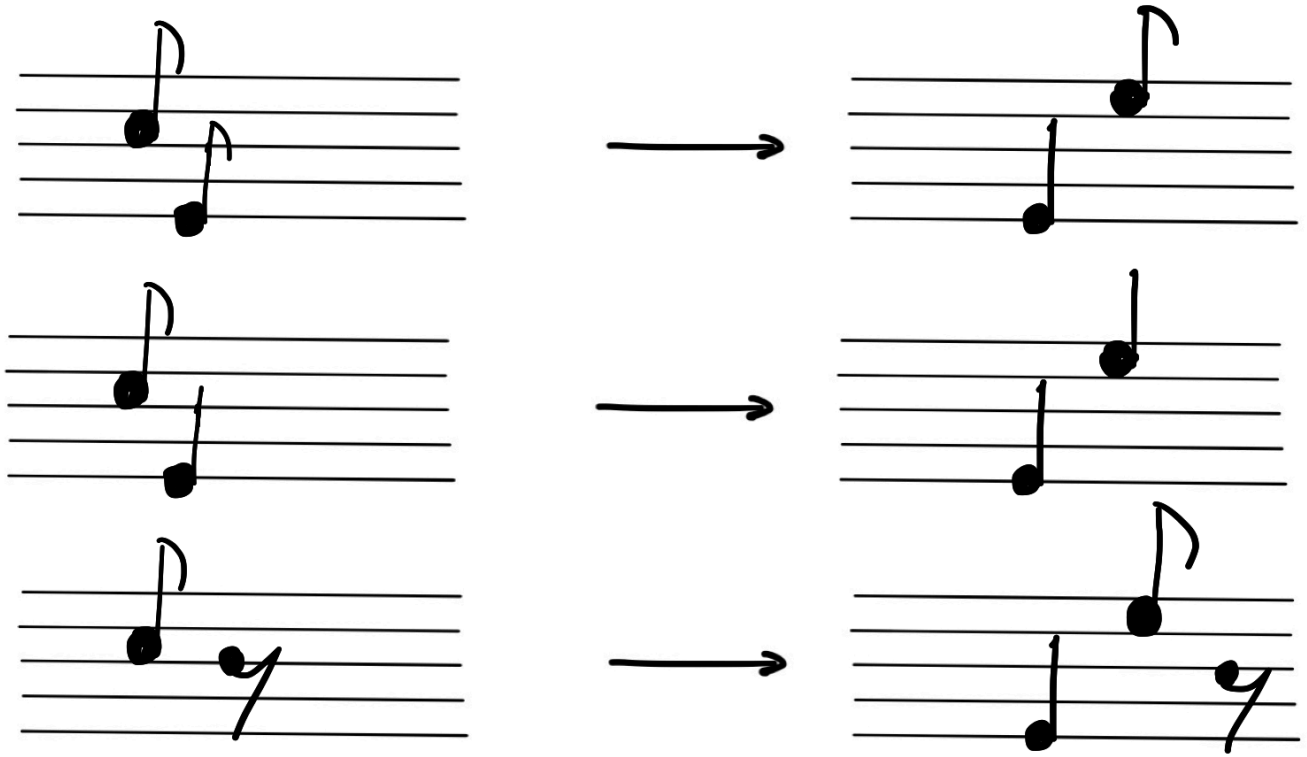




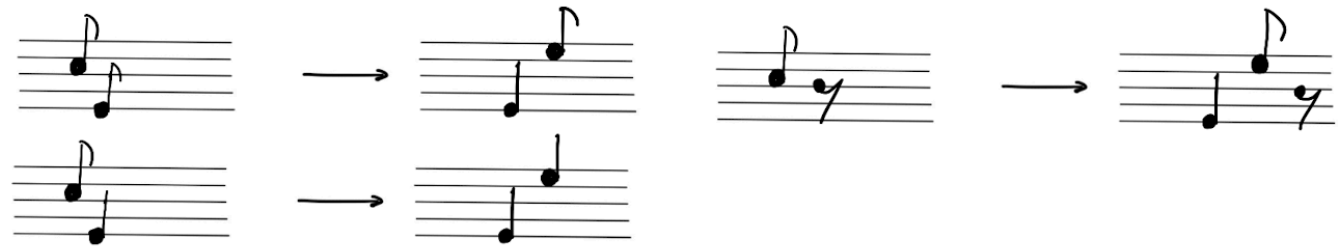
SIMULATE TURING MACHINE



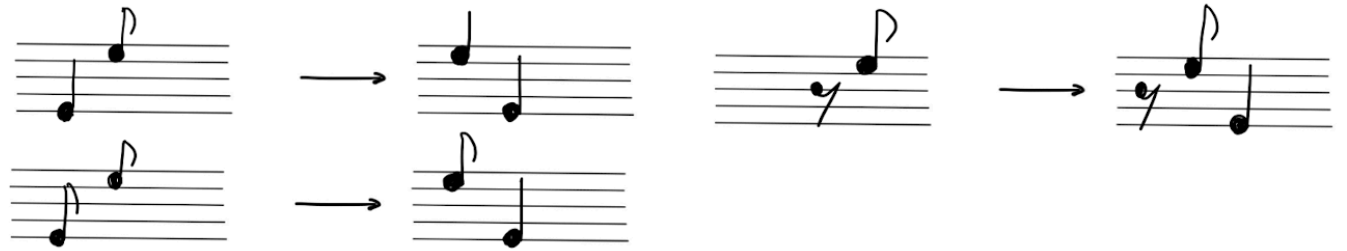
$(A, 0) : (1, \rightarrow, B)$



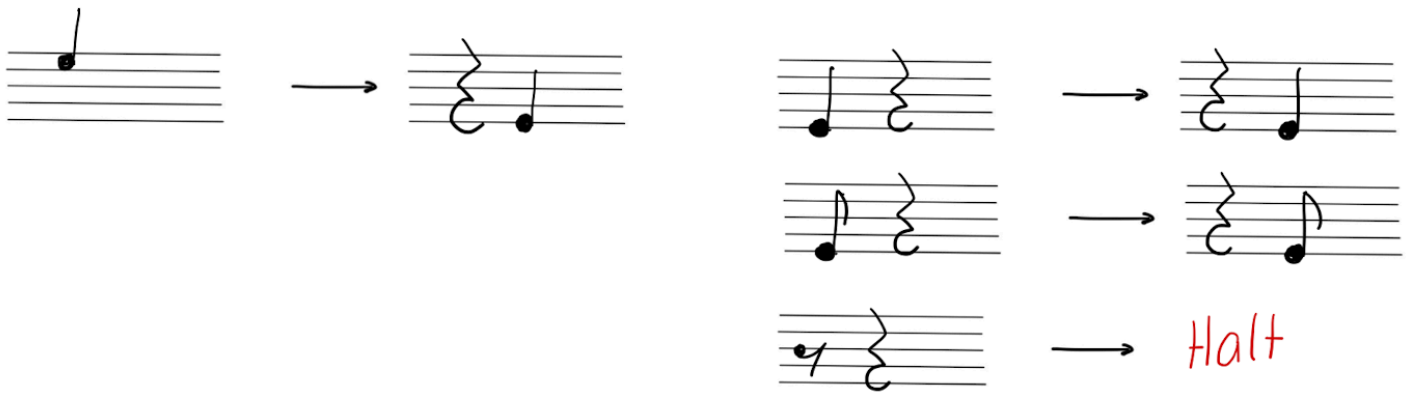
A, 0 : (1, →, B) :

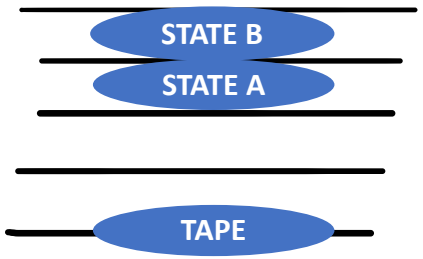


B, 0 : (1, ←, B) :



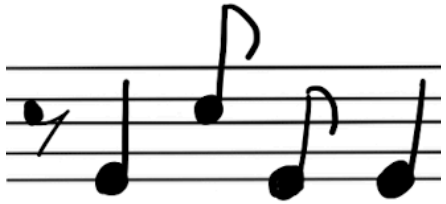
B, 1 : halt



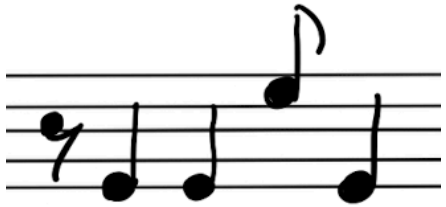


+ self replicating { all notes on (c^2, e^2, e^1), 𝄽 }

t = 0



t = 1



t = 2

t = 3
(halting)