admissible heuristics

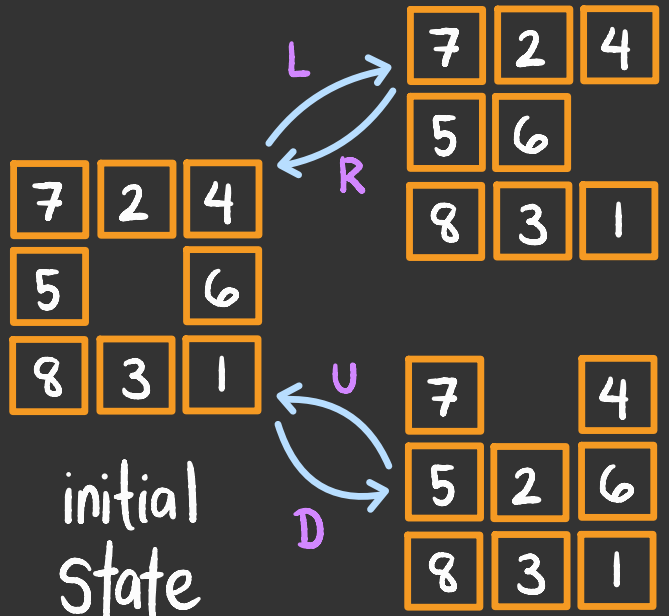
CSCI 373

if H is consistent, then A* is optimal

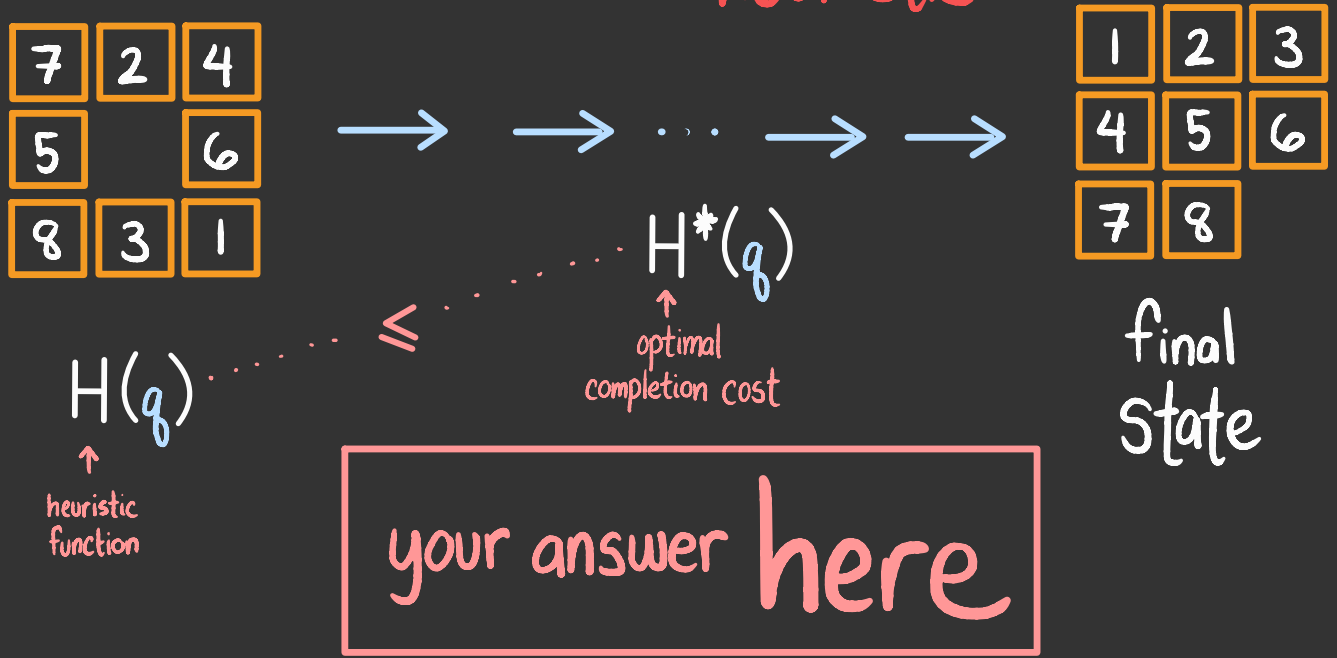
if H is admissible, then non-memoized A* is optimal

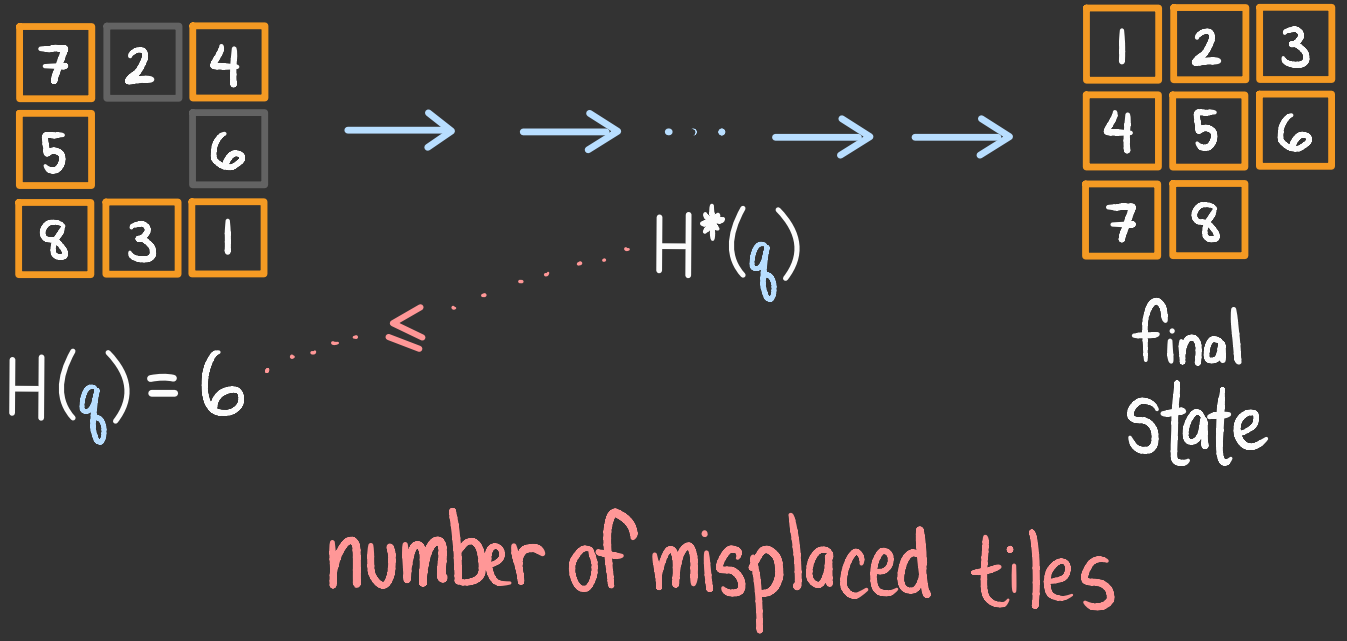
but how do we design such heuristics?

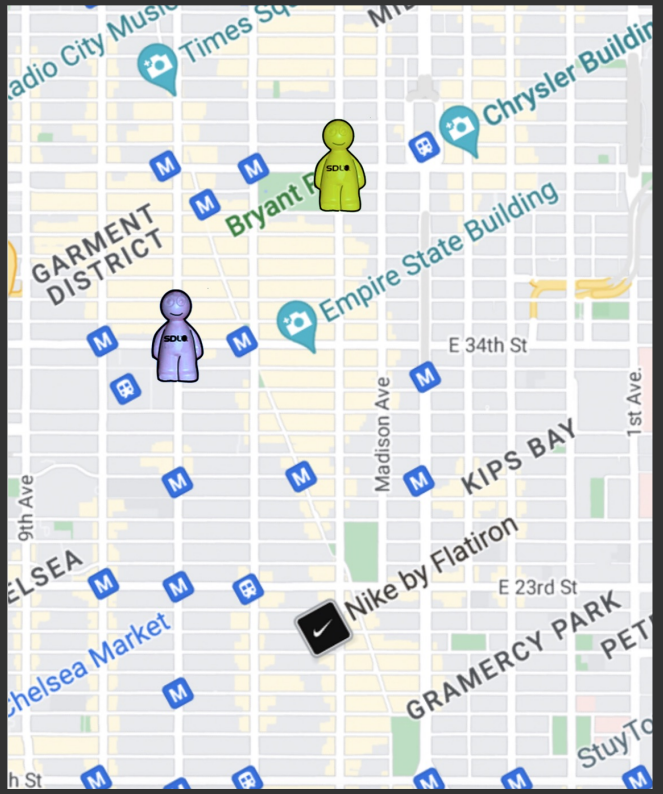
back to sliding tiles



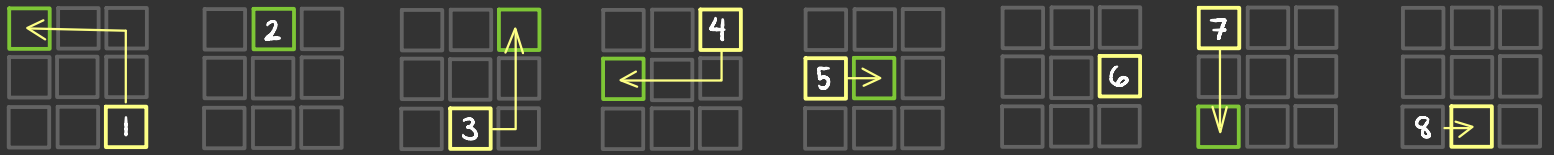
what might be an admissible heuristic?




7 2 4
5 6
8 3 1
1 2 3
4 5 6
7 8
H*(q)
H(q) = 6
≤
final state
number of misplaced tiles



manhattan distance



4 + 0 + 3 + 3 + 1 + 0 + 2 + 1

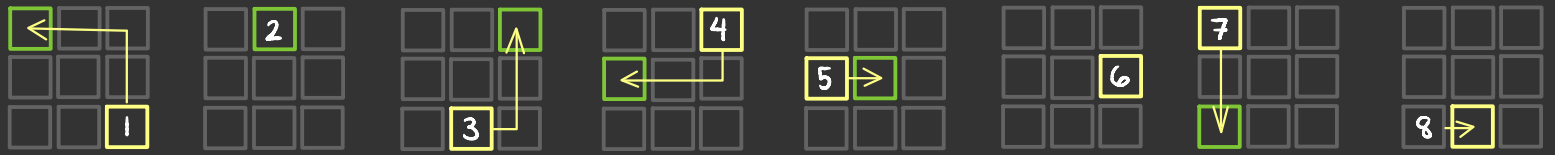
$H^*(q)$

final state

$H(q) = 14$

$\leq$

cumulative manhattan distance between current locations and target locations



4 + 0 + 3 + 3 + 1 + 0 + 2 + 1

$H^*(q)$

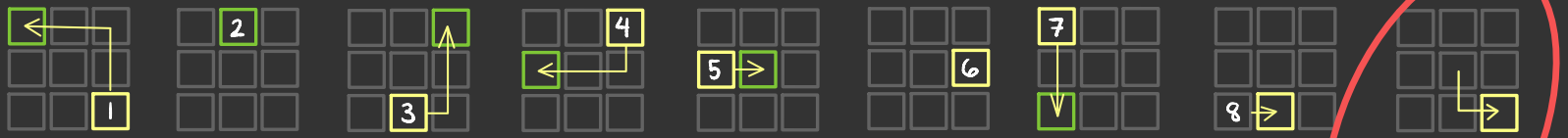
final state

$H(q) = 14$

$\leq$

cumulative manhattan distance between current locations and target locations

why is this admissible?



4 + 0 + 3 + 3 + 1 + 0 + 2 + 1 + 2

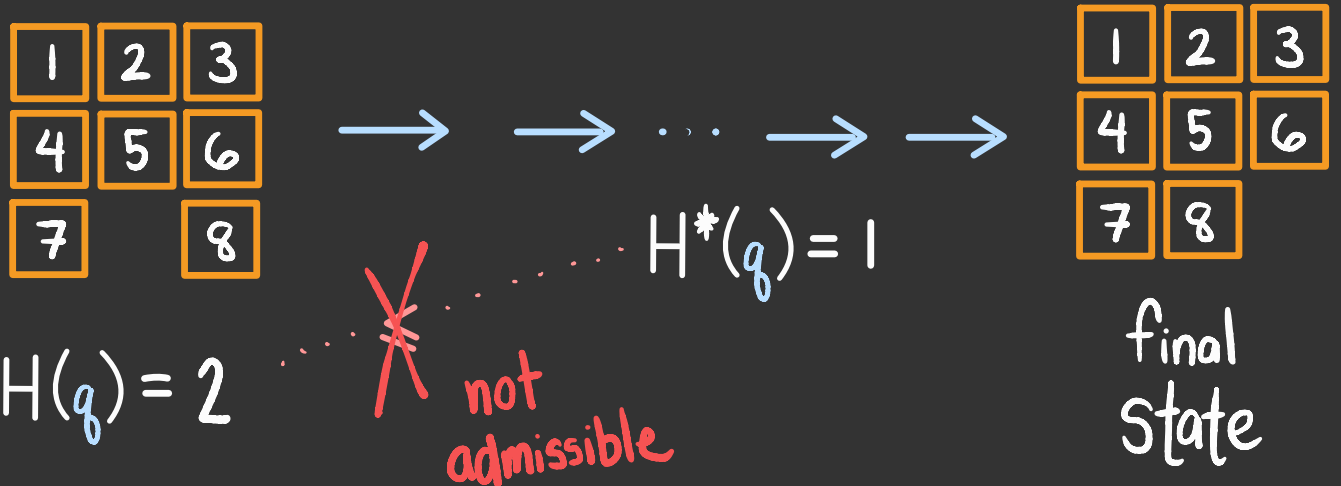
$H^*(q)$

final state

$H(q) = 14$

$\leq$

what if we include the empty space?



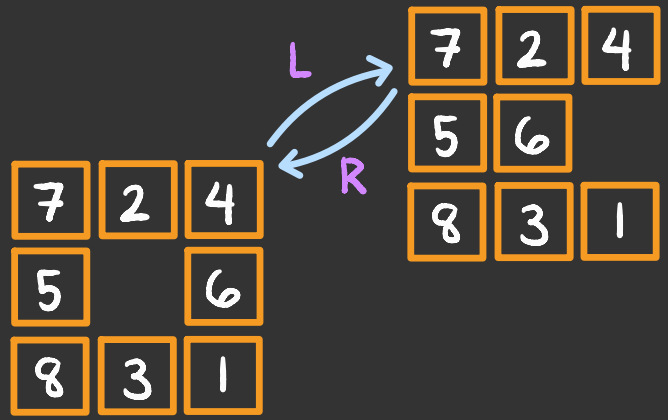
what if we include the empty space?

is there a less ethereal way to derive

relax

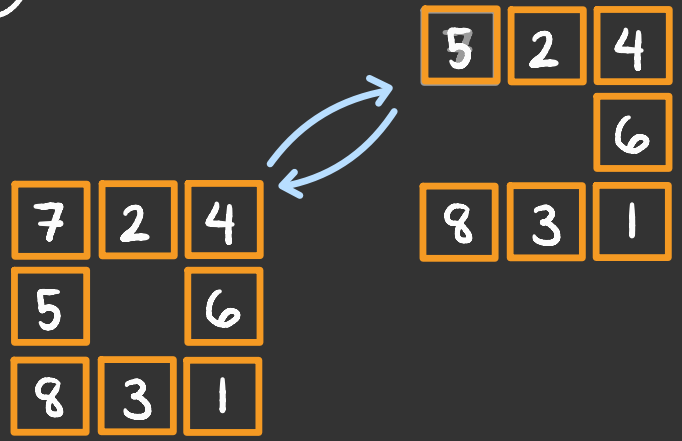
a tile can move from square A to square B if:

- A is adjacent to B
- B is empty



a tile can move from square A to square B if:

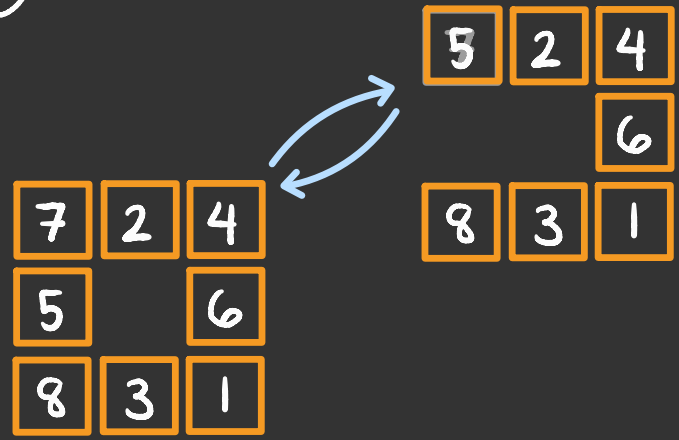
- A is adjacent to B
- ~~B is empty~~



a tile can move from square A to square B if:

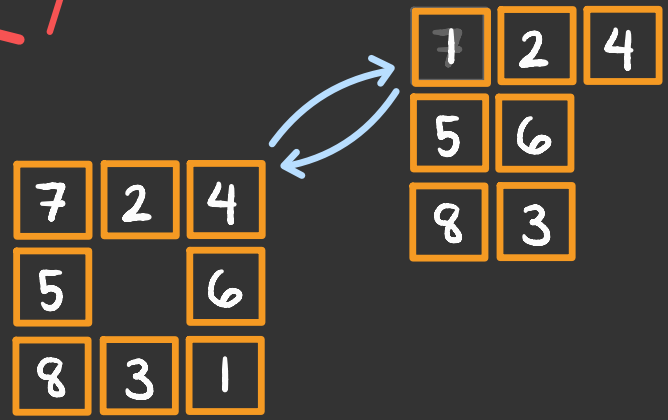
- A is adjacent to B
- ~~B is empty~~

the optimal solution to this "relaxed" puzzle is cumulative manhattan distance



a tile can move from square A to square B iff:

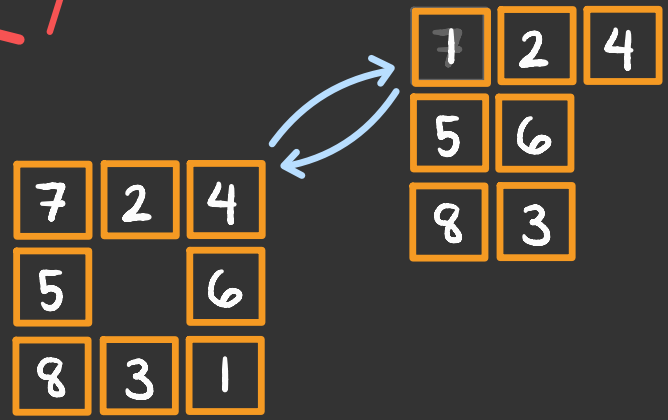
- ~~A is adjacent to B~~
- ~~B is empty~~



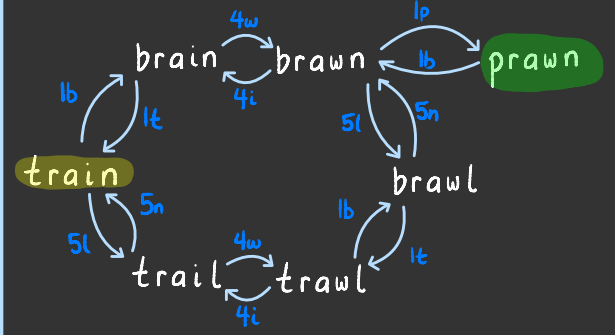
a tile can move from square A to square B if:

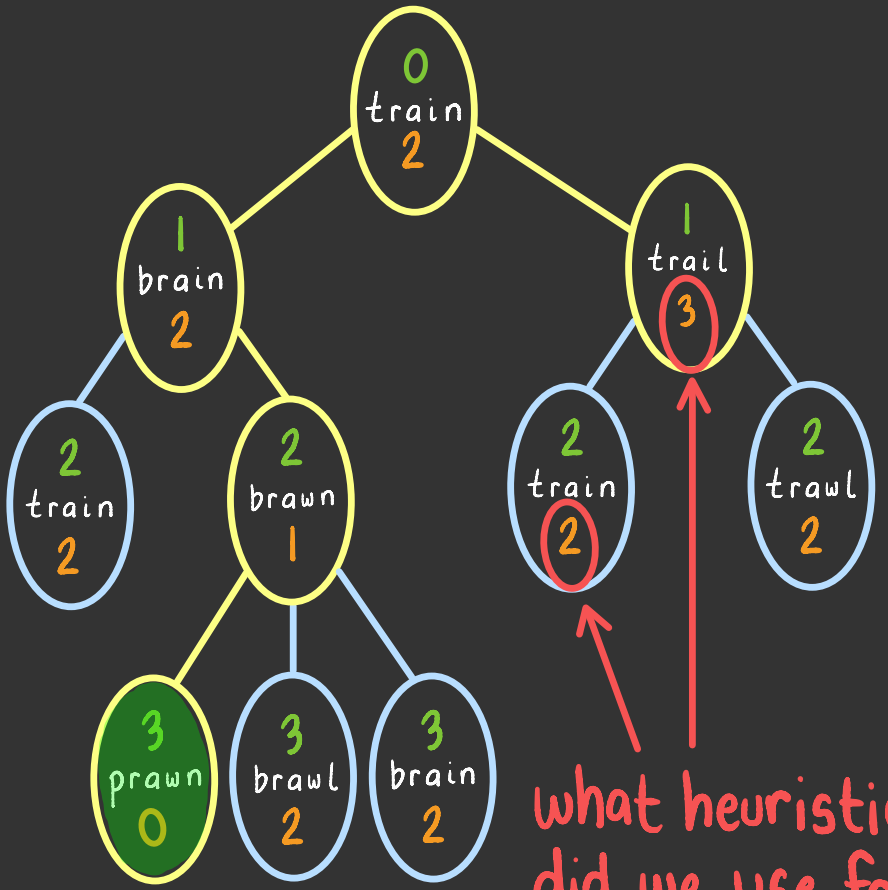
- ~~A is adjacent to B~~
- ~~B is empty~~

the optimal solution to this "relaxed" puzzle is number of misplaced tiles

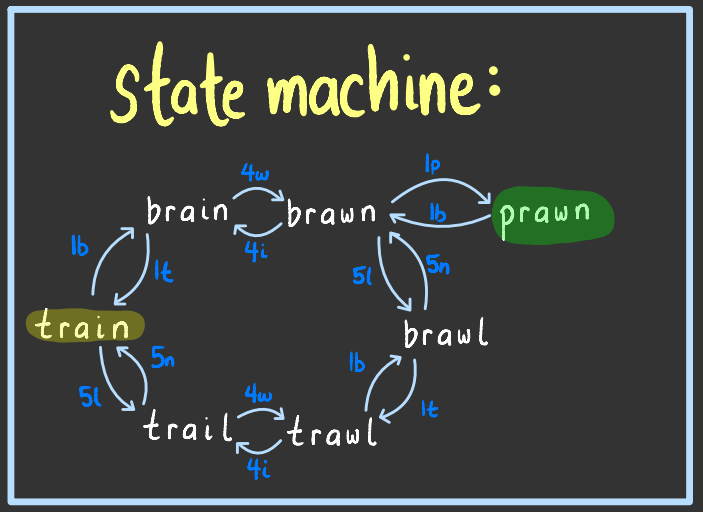


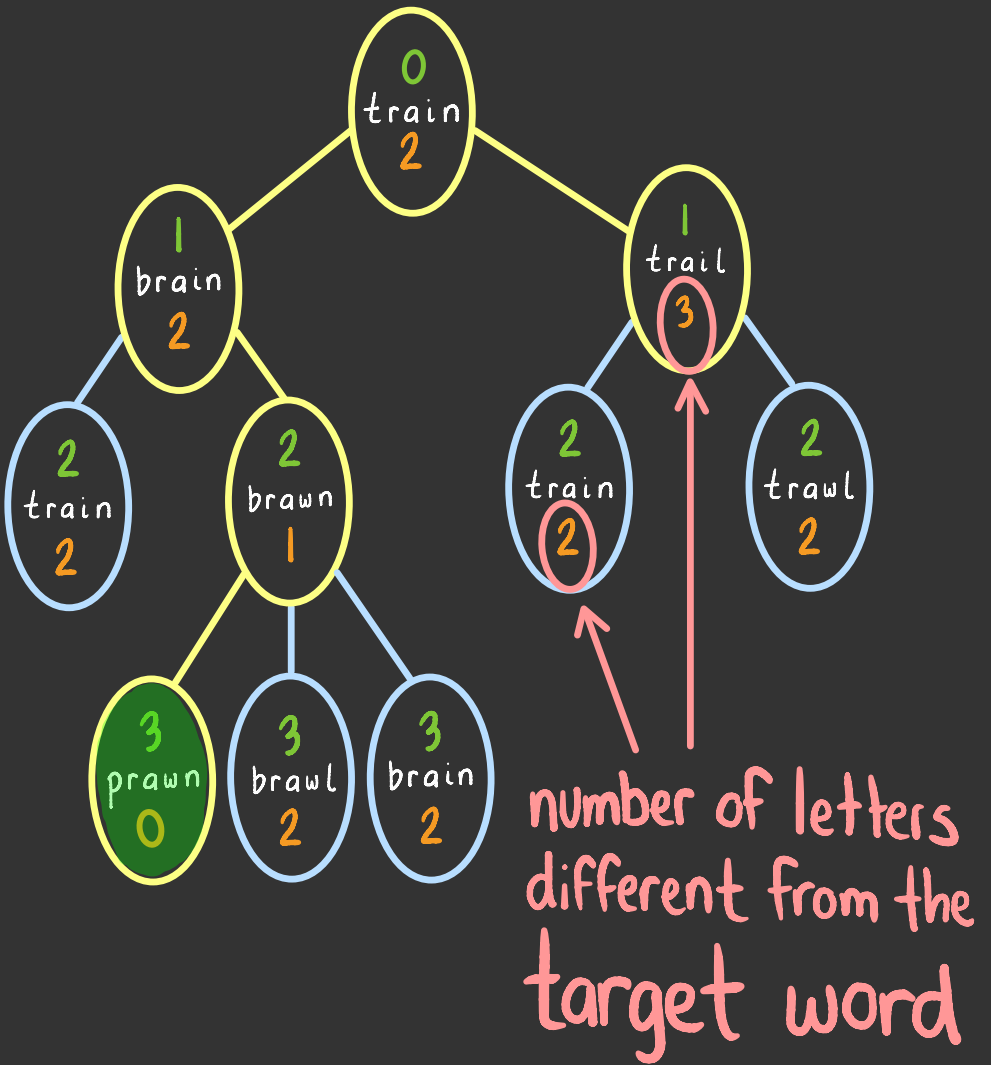
State machine:

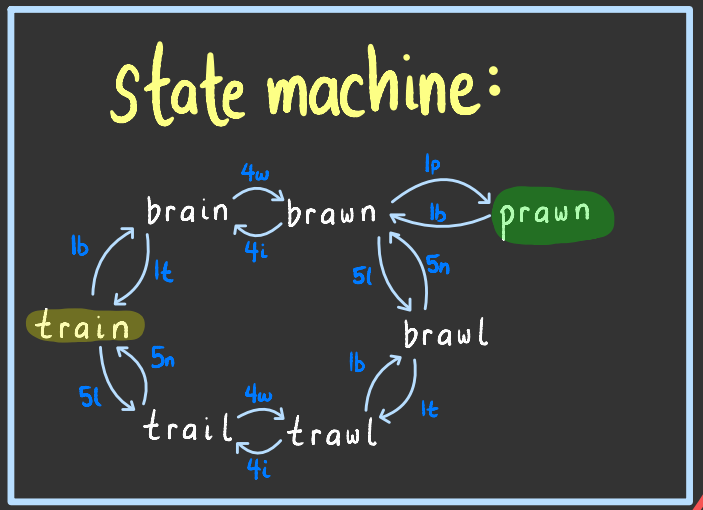




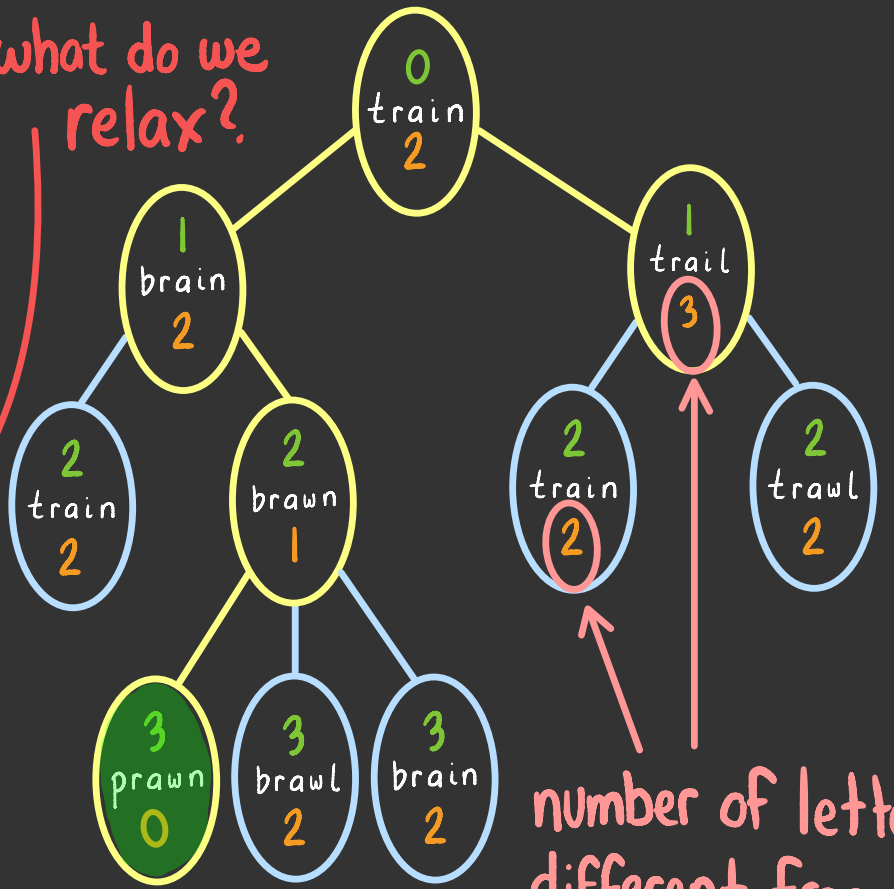
what heuristic did we use for word ladder?


State machine:
brain
brawn
prawn
train
brawl
trail
trawl
4w
4i
1p
1b
1b
1t
5l
5n
5n
5l
1b
1t
4w
4i


0
train
2
1
brain
2
1
trail
3
2
train
2
2
brawn
1
2
train
2
2
trawl
2
3
prawn
0
3
brawl
2
3
brain
2
number of letters different from the target word

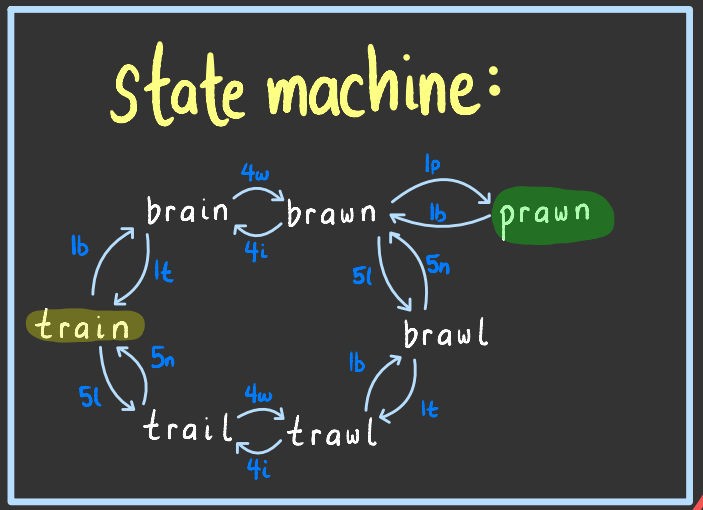


what do we relax?

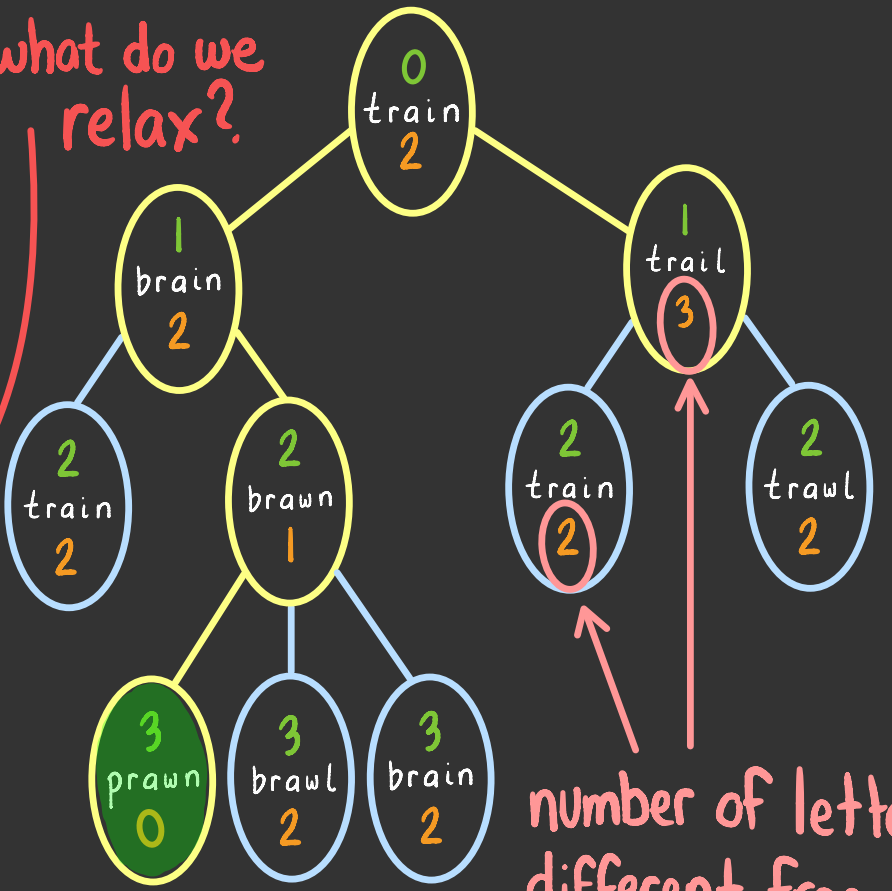


we can move from one word to any other english word that is one letter different

number of letters different from the target word



what do we relax?



we can move from one word to any ~~other~~ string ~~english word~~ that is one letter different

number of letters different from the target word