# Week 6

Artificial Intelligence

# ChatGPT

https://chatgpt.com/

# Did a Fourth Grader Write This? Or the New Chatbot?

## Essay 1

... I like to bring a yummy sandwich and a cold juice box for lunch, and sometimes I'll even pack a tasty piece of fruit or a bag of crunchy chips. As we eat, we chat and laugh and catch up on each other's day. ...

## Essay 2

... My mother packs me a sandwich, a drink, fruit, and a treat. When I get in the lunchroom I find an empty table and sit there, and eat my lunch. My friends come and sit down with me. ...

Source: *The New York Times*

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AI

## Essay 2

... My mother packs me a sandwich, a drink, fruit, and a treat. When I get in the lunchroom I find an empty table and sit there, and eat my lunch. My friends come and sit down with me. ...

Child

Source: *The New York Times*

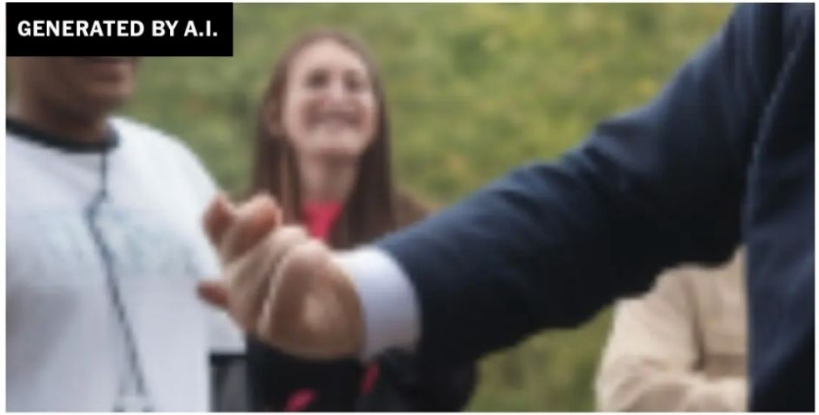
# DALL-E 2

https://labs.openai.com/

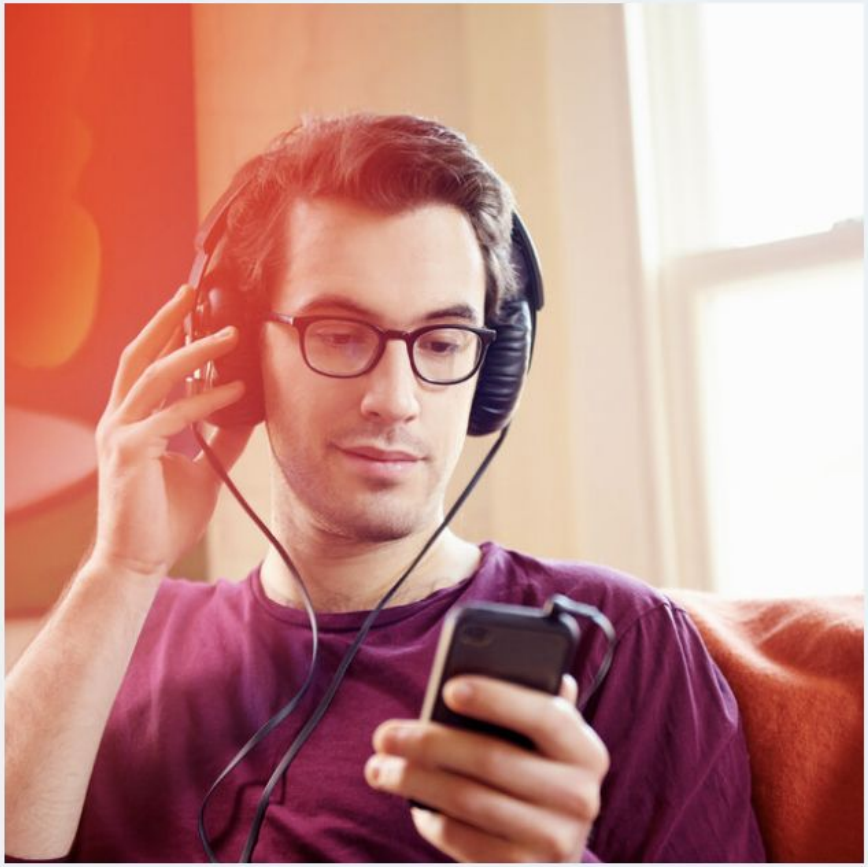
# Midjourney

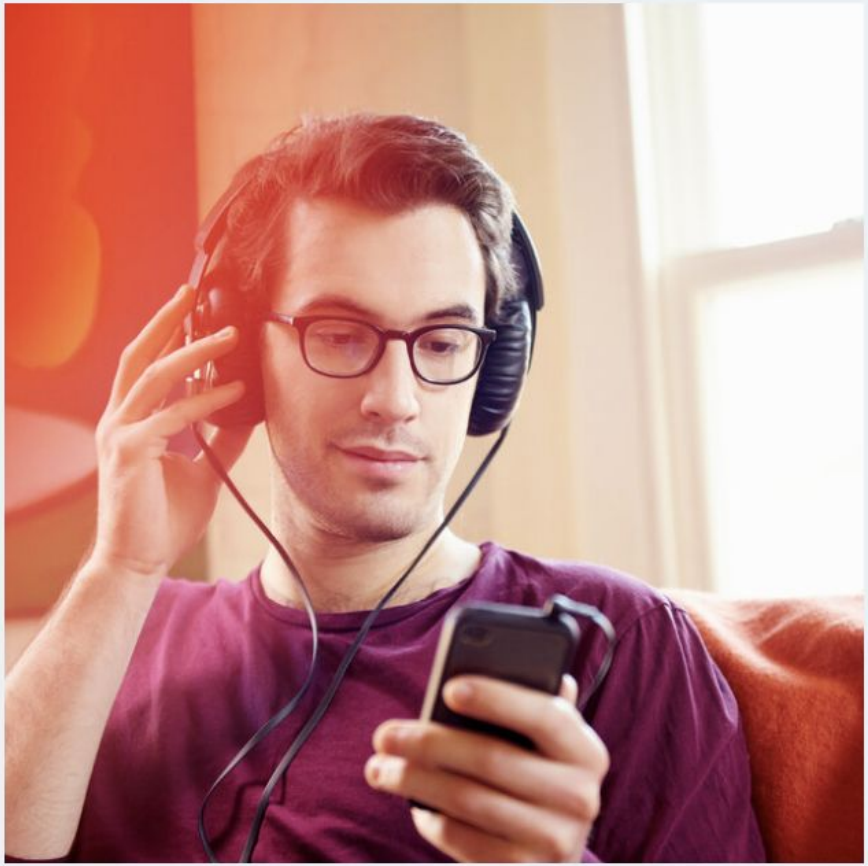
https://www.midjourney.com/

A photograph of the former British prime minister Boris Johnson dancing is not implausible. Eliot Higgins



Still, the distortions in his hands, and those of some of the onlookers, are a giveaway. A.I. tools have struggled to get hands and feet right. Eliot Higgins





AI

Image 1

Image 2

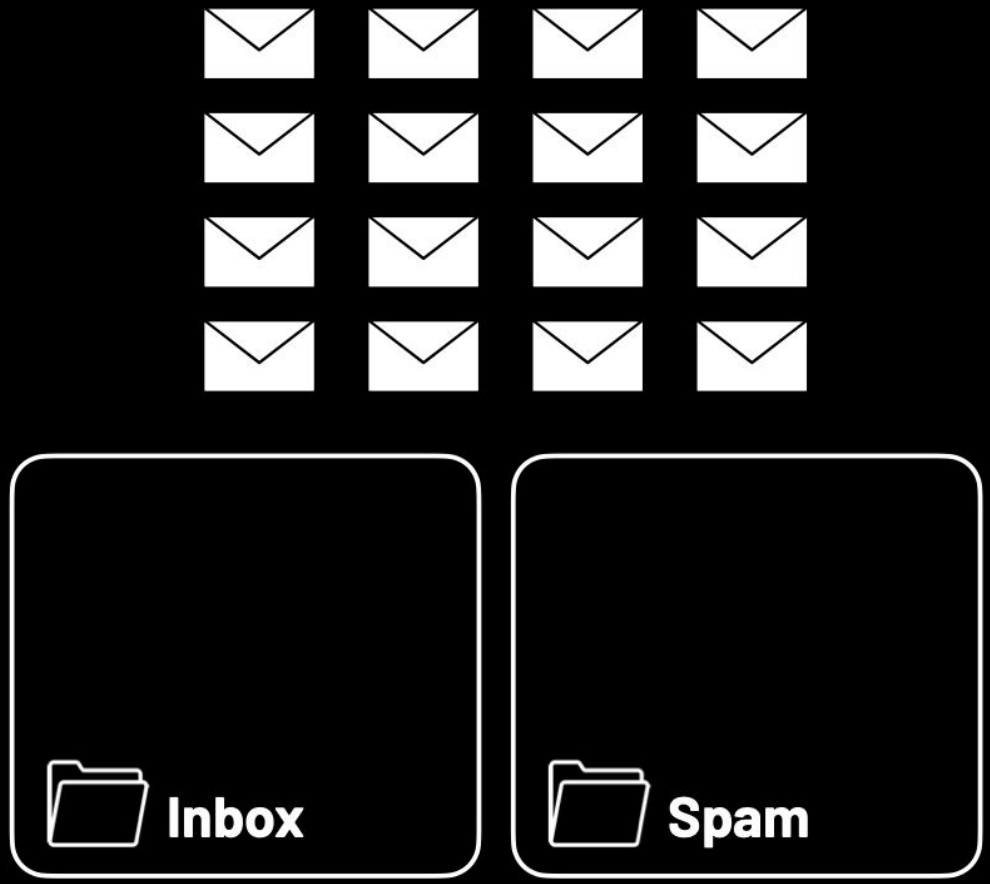
Image 1

AI

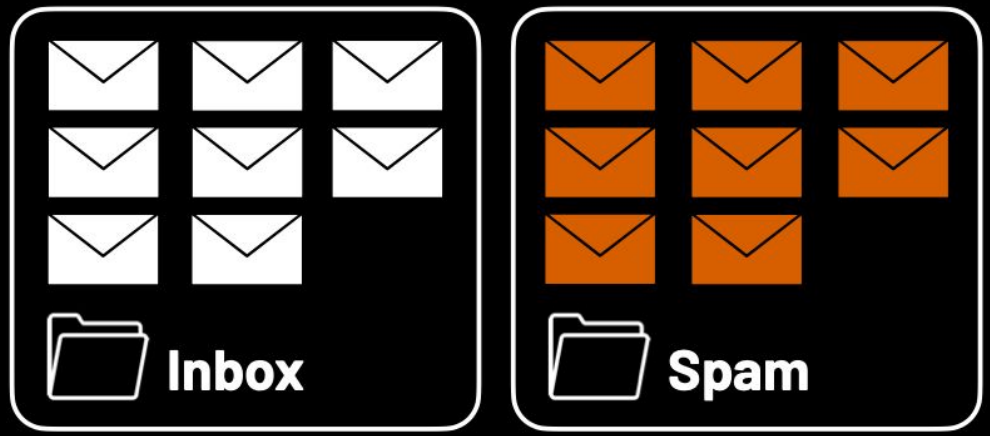
Image 2

AI

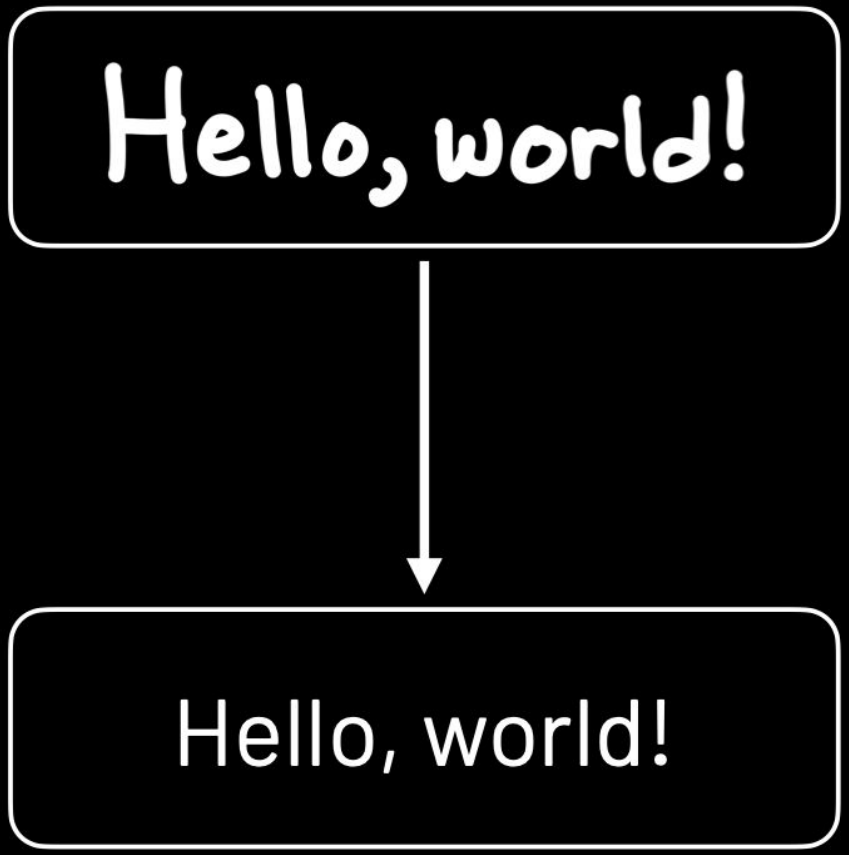
# current use cases for AI



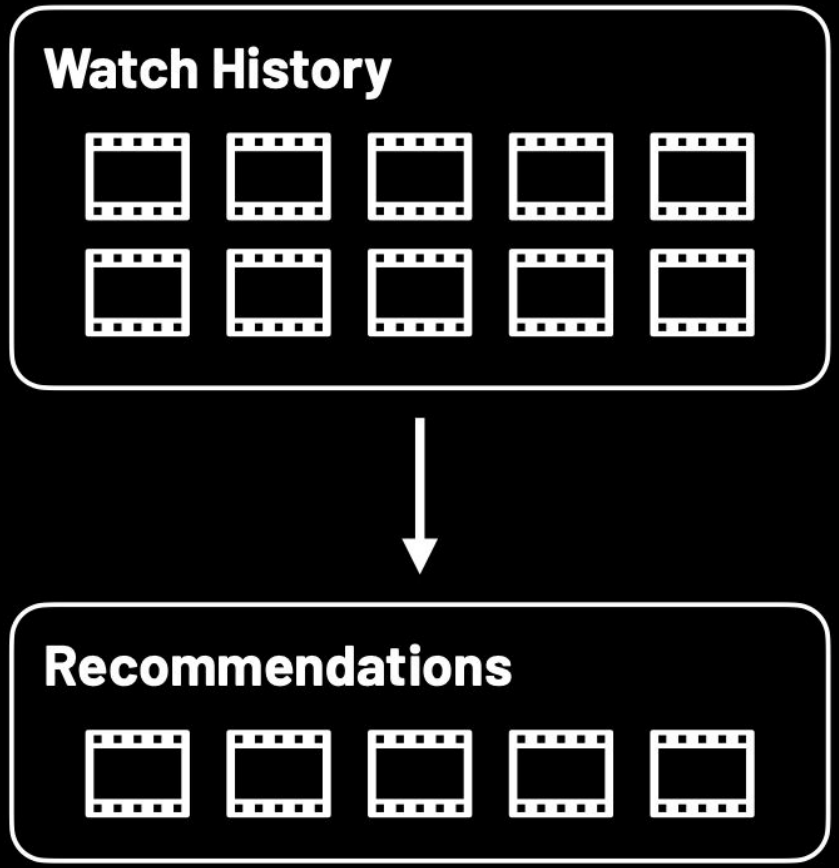

# Classification




# Classification




**Handwriting Recognition**



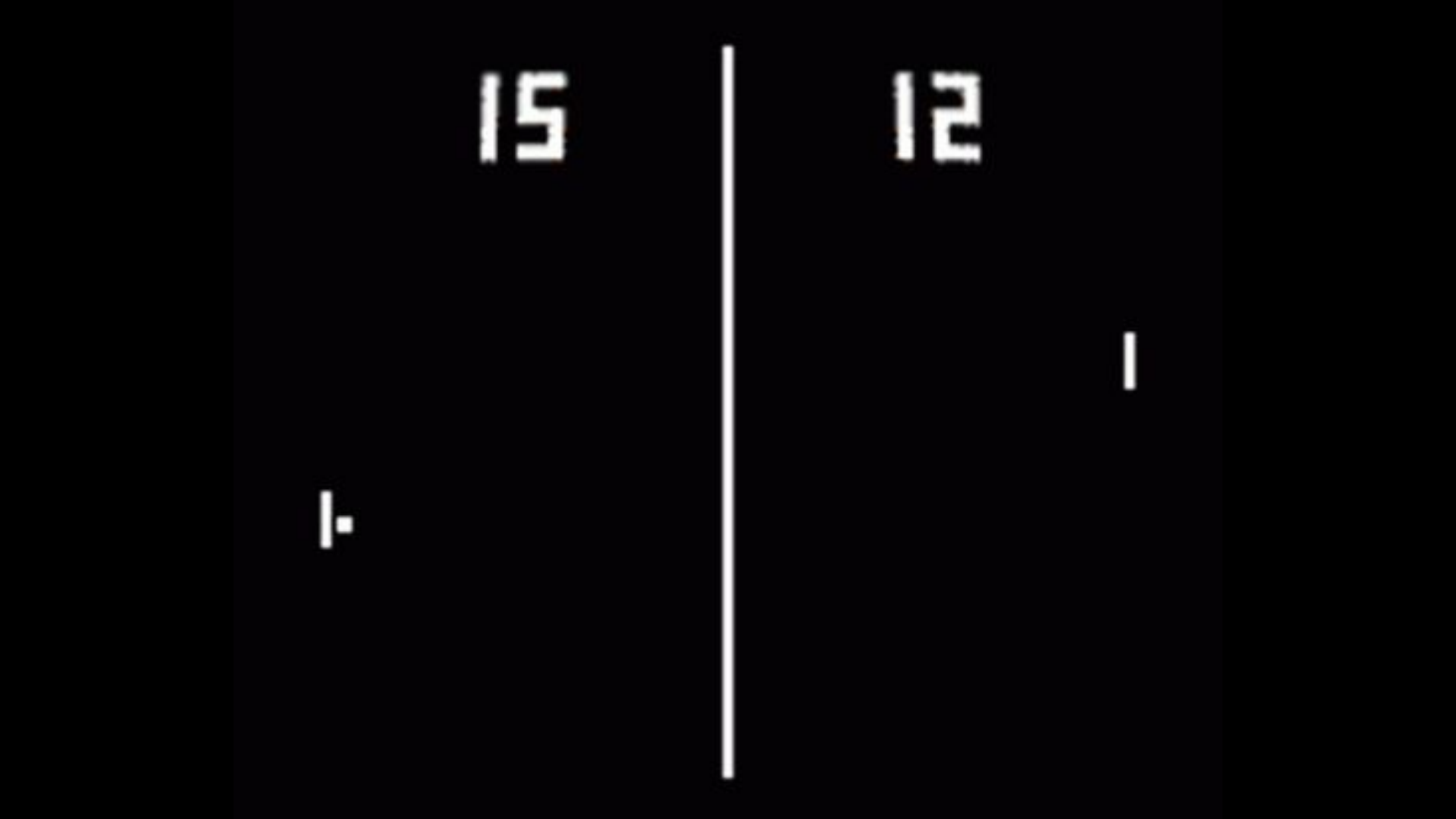

# Recommendation Systems

# Question Answering

Source: *The Verge*

h/t Brian Yu

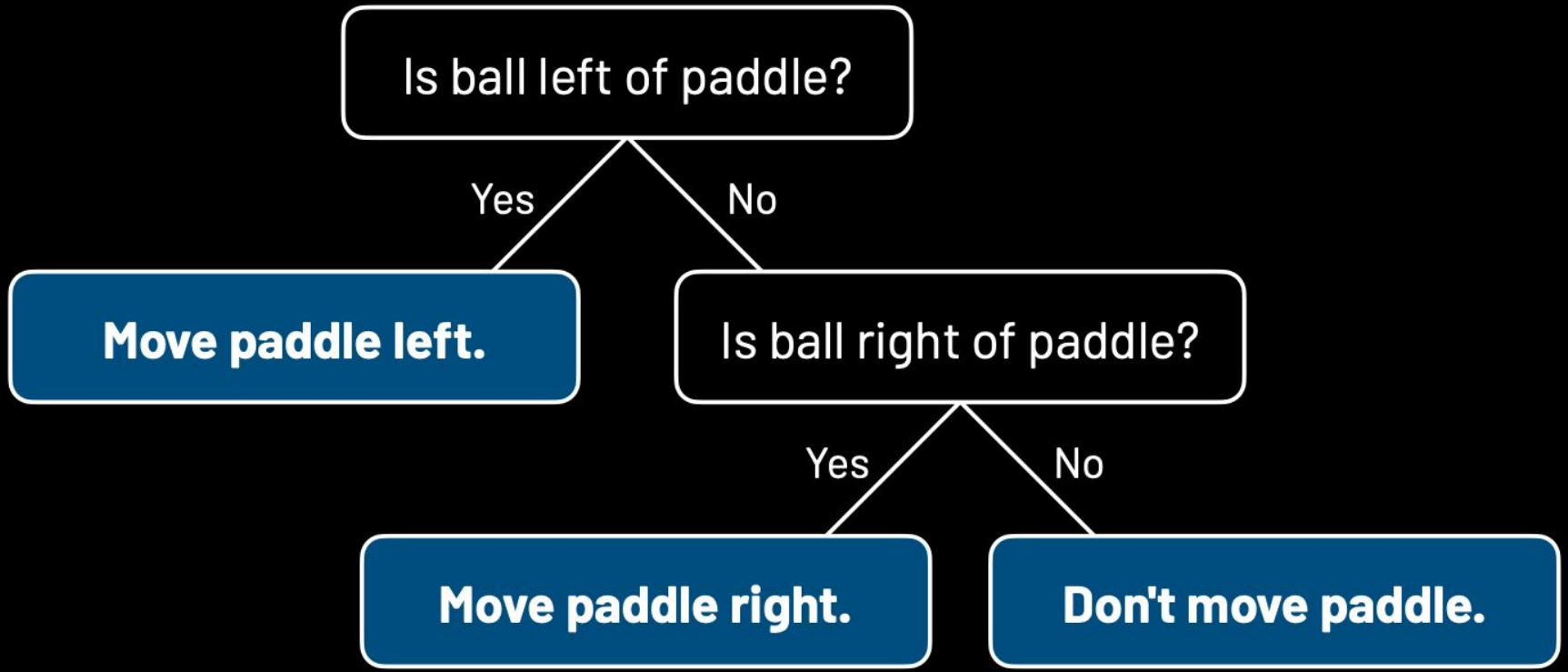
artificial intelligence

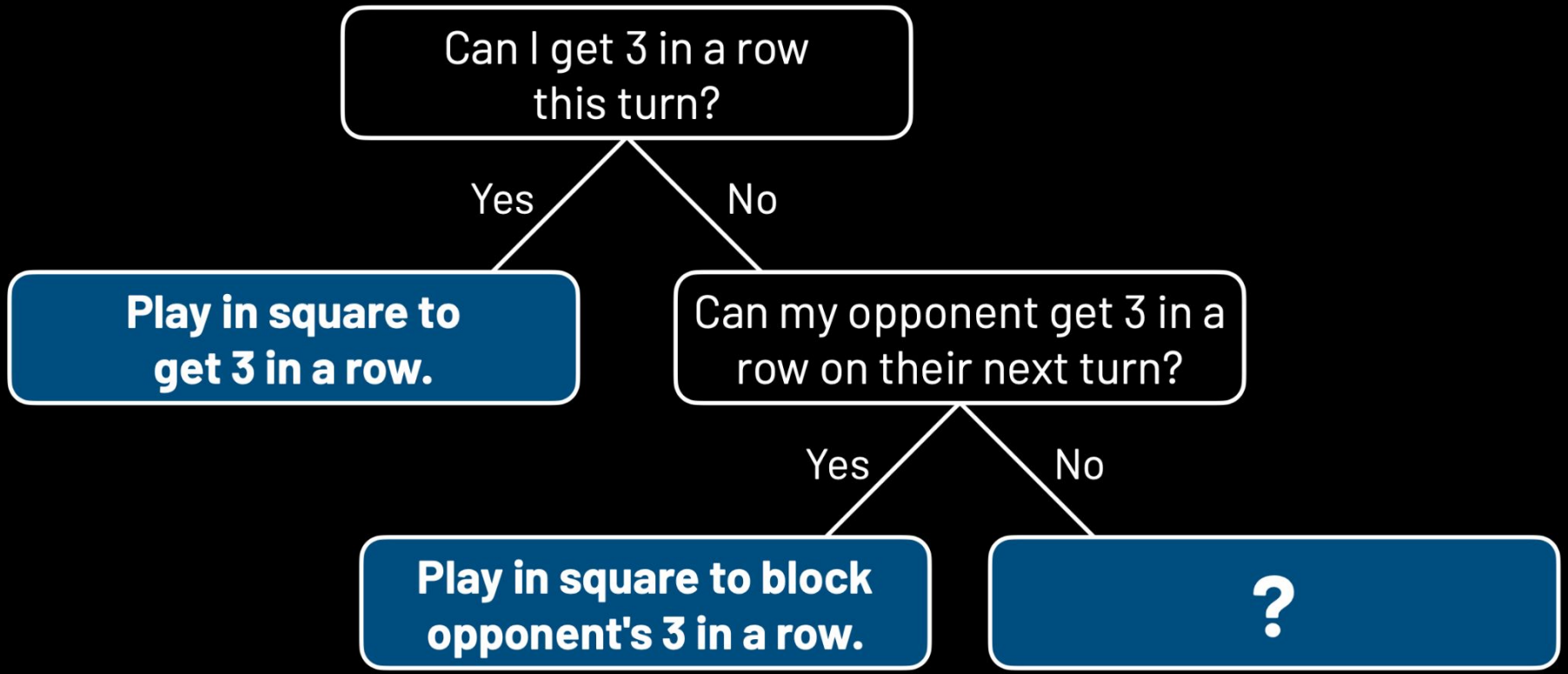

15
12

001 2 1

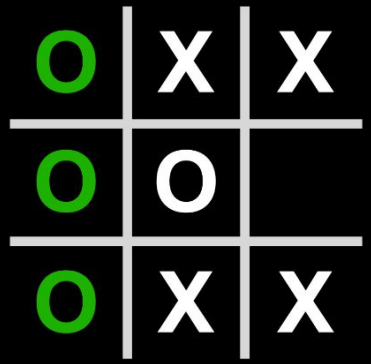
001 2 1

# decision trees

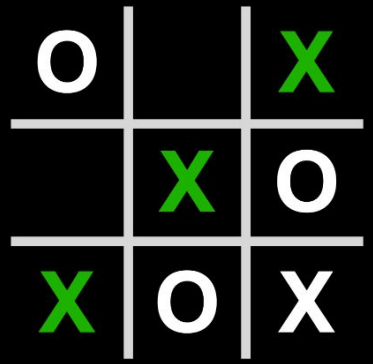

Is ball left of paddle?
Yes
No
Move paddle left.
Is ball right of paddle?
Yes
No
Move paddle right.
Don't move paddle.

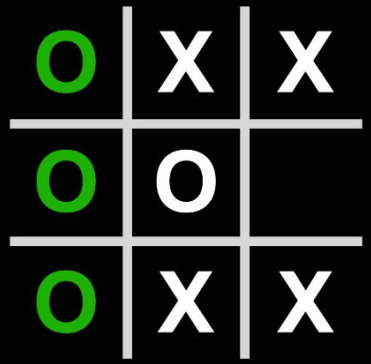

Can I get 3 in a row this turn?
Yes
No
Play in square to get 3 in a row.
Can my opponent get 3 in a row on their next turn?
Yes
No
Play in square to block opponent's 3 in a row.
?

# minimax


o x x
o o
o x x

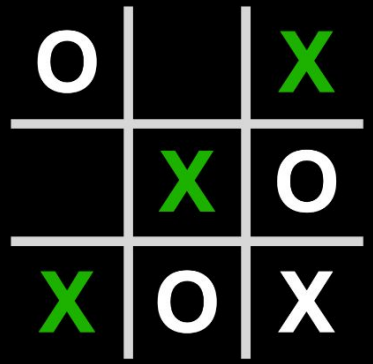
x o x
o o x
x x o


o x
x o
x o x




-1

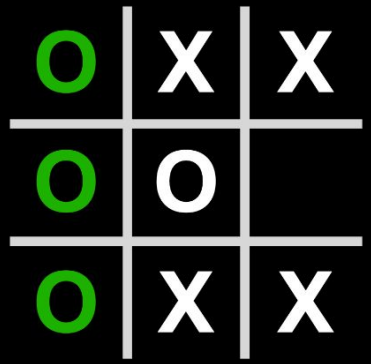
0




1

MAX (X) aims to maximize score.

MIN (O) aims to minimize score.

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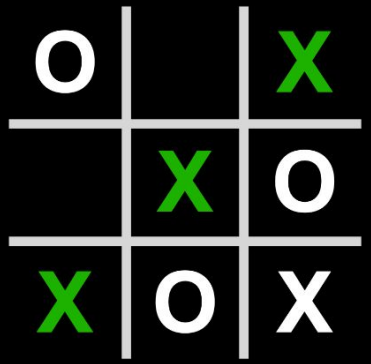


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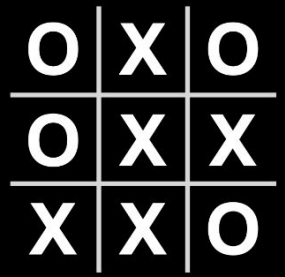
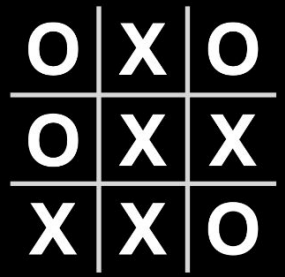
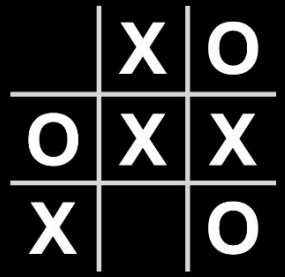
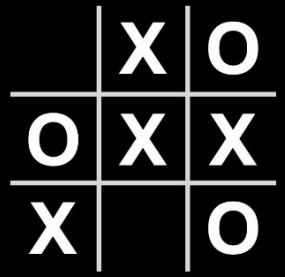

O X O
O X X
X X O




VALUE: 1


X O
O X X
X O

TURN = O



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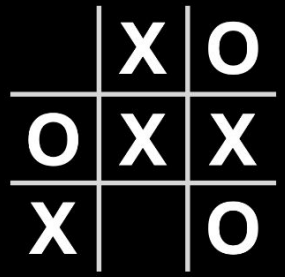
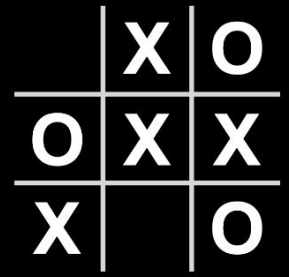
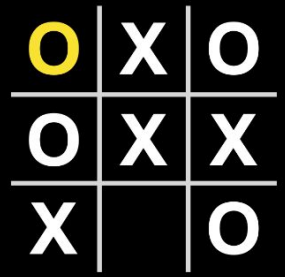



Turn = O

Turn = O

Value:

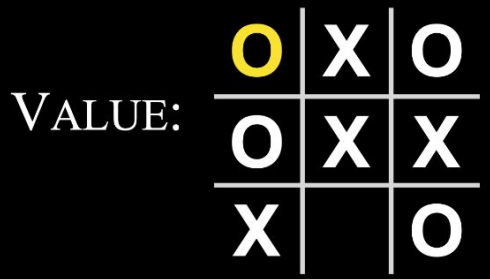


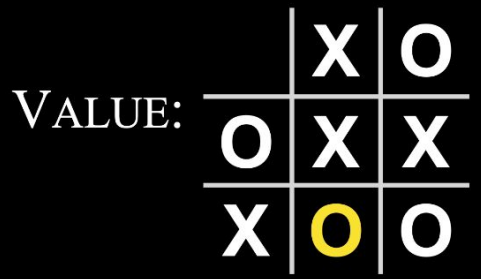



Turn = O

Value:

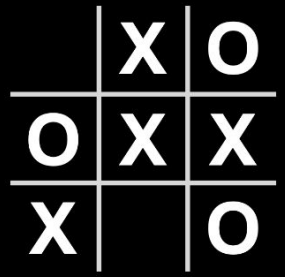
| | | |
|---|---|---|
| | X | O |
| O | X | X |
| X | | O |



Turn = O

Value:

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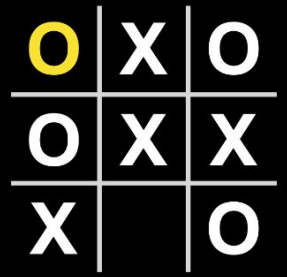
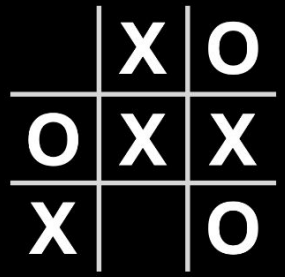


Value:

Turn = O

Value:

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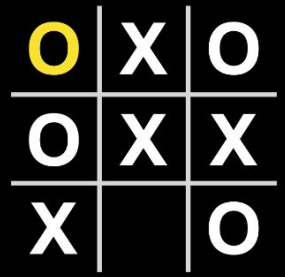
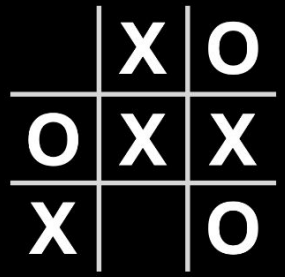



Value:

Value:

Turn = O

Value:

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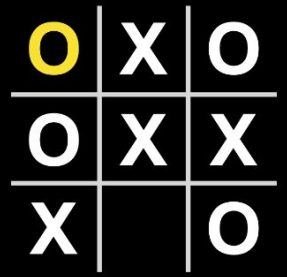



Value:

Value:
1

Turn = O

Value:

| | | |
|---|---|---|
| | X | O |
| O | X | X |
| X | | O |

Value:
1

| | | |
|---|---|---|
| O | X | O |
| O | X | X |
| X | | O |

Value:

| | | |
|---|---|---|
| | X | O |
| O | X | X |
| X | O | O |

Value:
1

| | | |
|---|---|---|
| O | X | O |
| O | X | X |
| X | X | O |

Turn = O

Value:

| | | |
|---|---|---|
| | X | O |
| O | X | X |
| X | | O |

Value:
1

| | | |
|---|---|---|
| O | X | O |
| O | X | X |
| X | | O |

Value:
1

| | | |
|---|---|---|
| O | X | O |
| O | X | X |
| X | X | O |

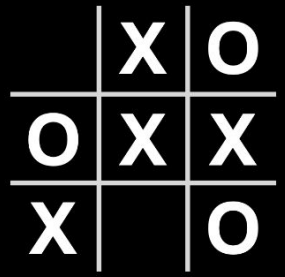
Value:

| | | |
|---|---|---|
| | X | O |
| O | X | X |
| X | O | O |

| | | |
|---|---|---|
| X | X | O |
| O | X | X |
| X | O | O |

Turn = O

Value:



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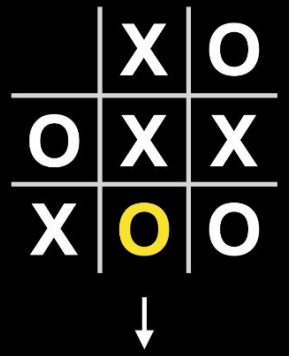


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Value:

Turn = O

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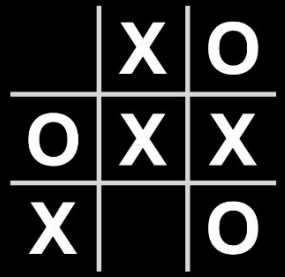

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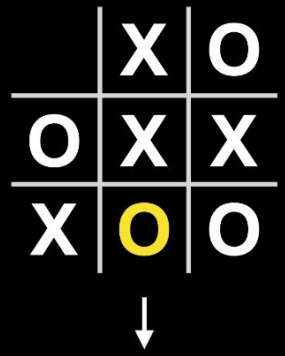
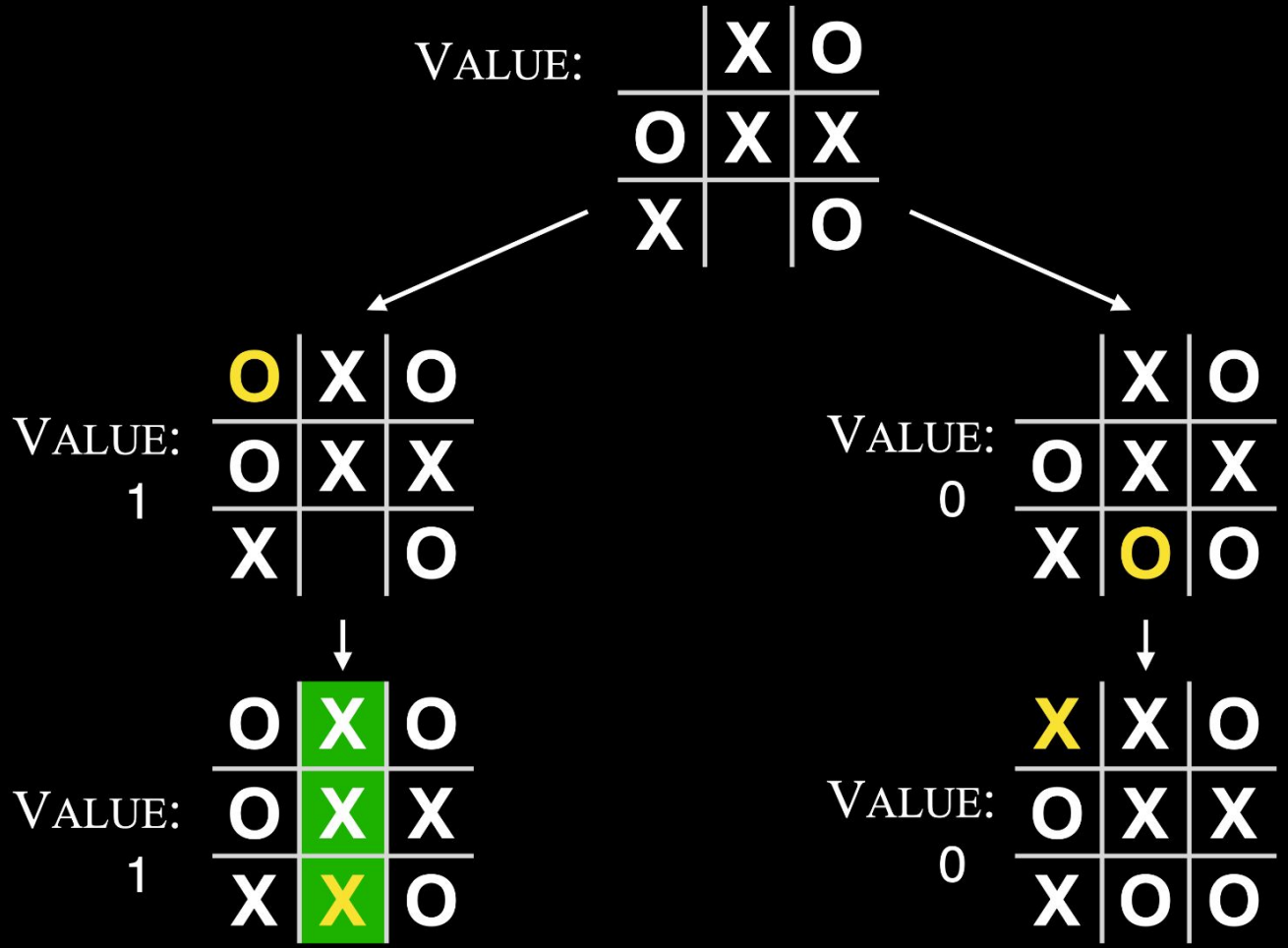
Value: 1



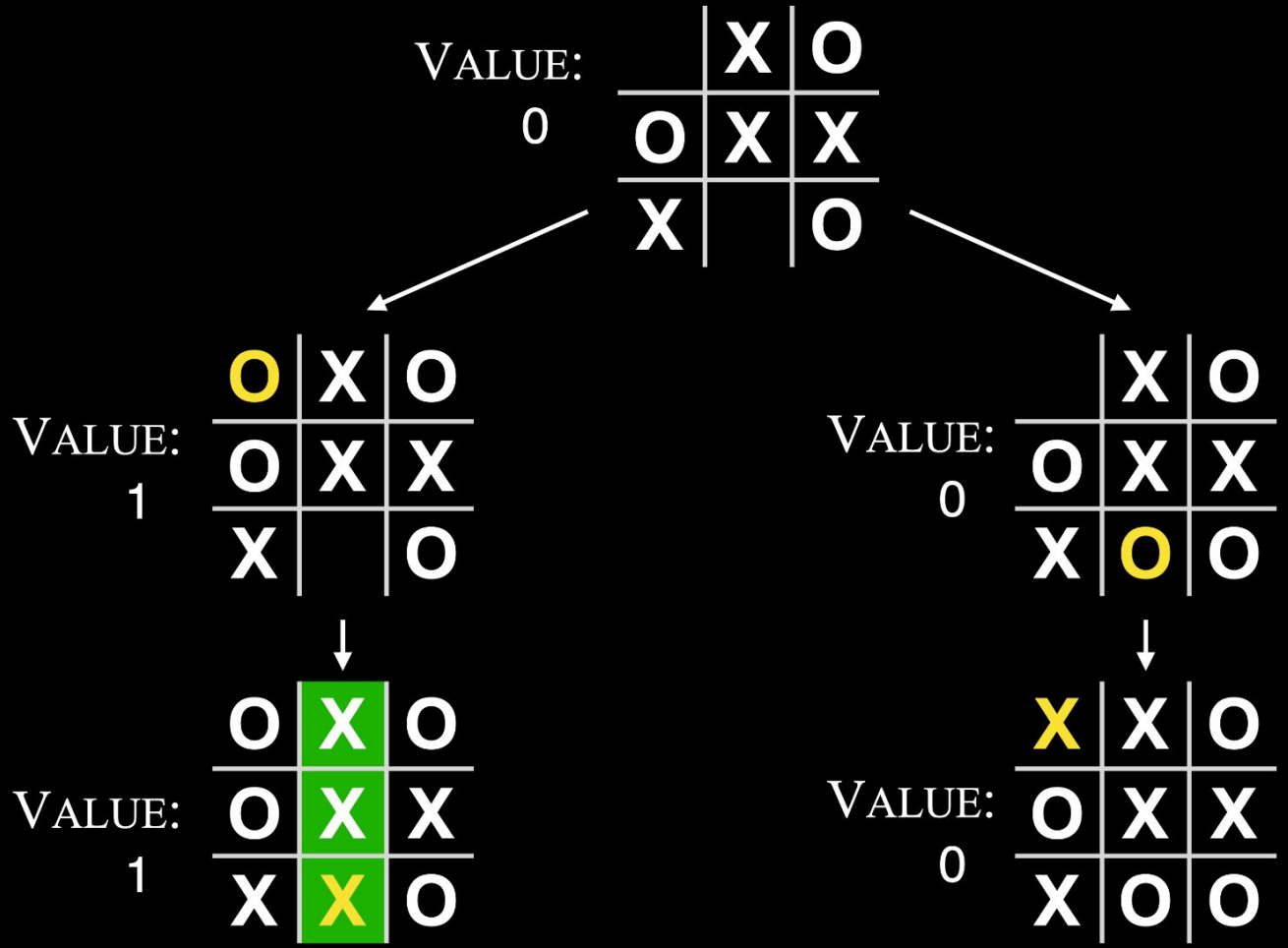

Value:

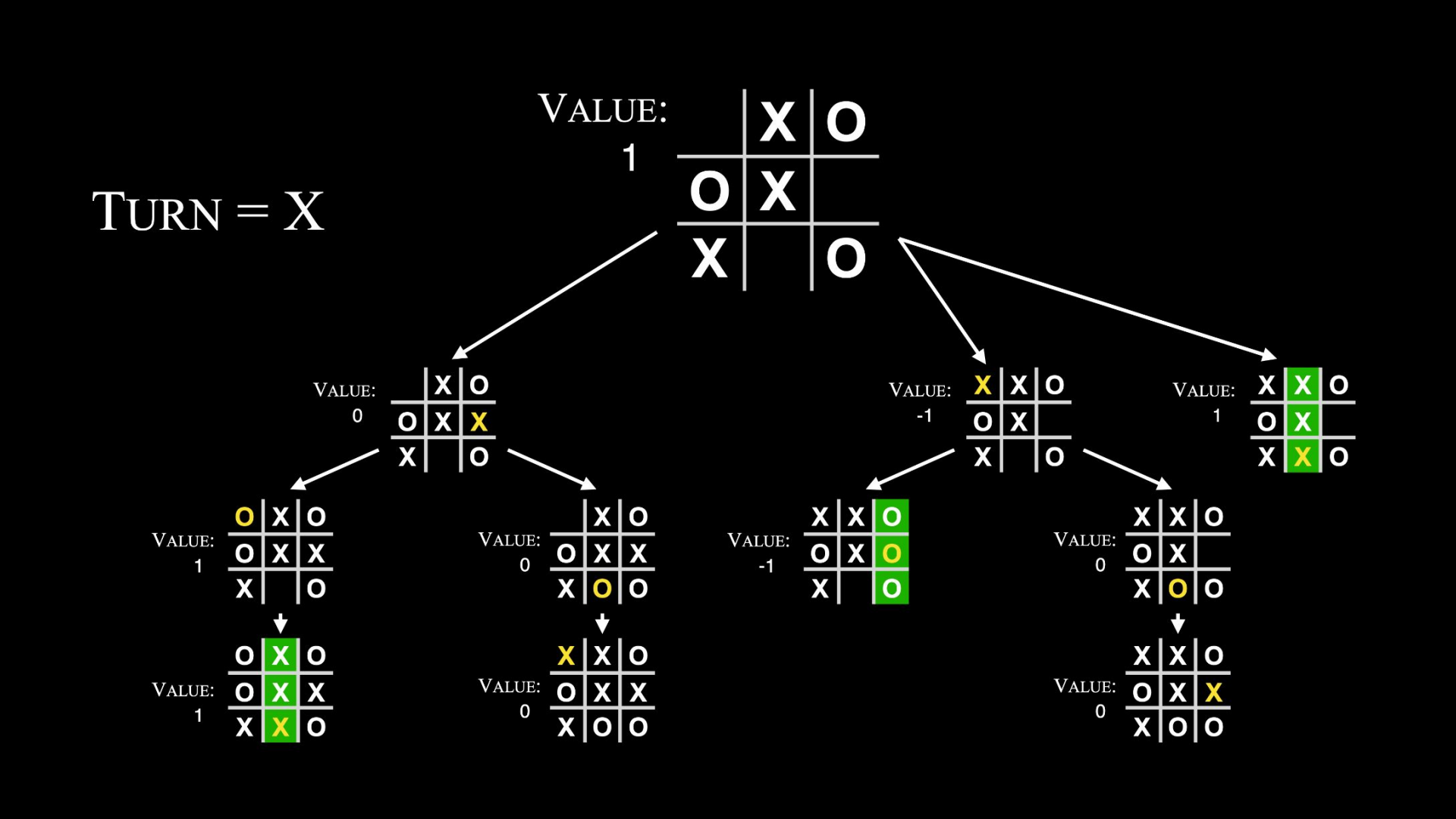
Value: 0

Turn = O



Turn = O




Turn = X
Value:
1
Value:
0
Value:
-1
Value:
1
Value:
1
Value:
0
Value:
-1
Value:
0
Value:
1
Value:
0
Value:
0

## Possibilities

### Tic-Tac-Toe

All possible games

| | Possibilities |
| --- | --- |
| **Tic-Tac-Toe**<br>All possible games | 255,168 |

| | Possibilities |
| --- | --- |
| **Tic-Tac-Toe**<br>All possible games | 255,168 |
| **Chess**<br>First 4 moves only | |

| | Possibilities |
| --- | --- |
| **Tic-Tac-Toe**<br>All possible games | 255,168 |
| **Chess**<br>First 4 moves only | 288 million |

| | Possibilities |
| --- | --- |
| **Tic-Tac-Toe**<br>All possible games | 255,168 |
| **Chess**<br>First 4 moves only | 288 million |
| **Go**<br>First 4 moves only | 266 quintillion |

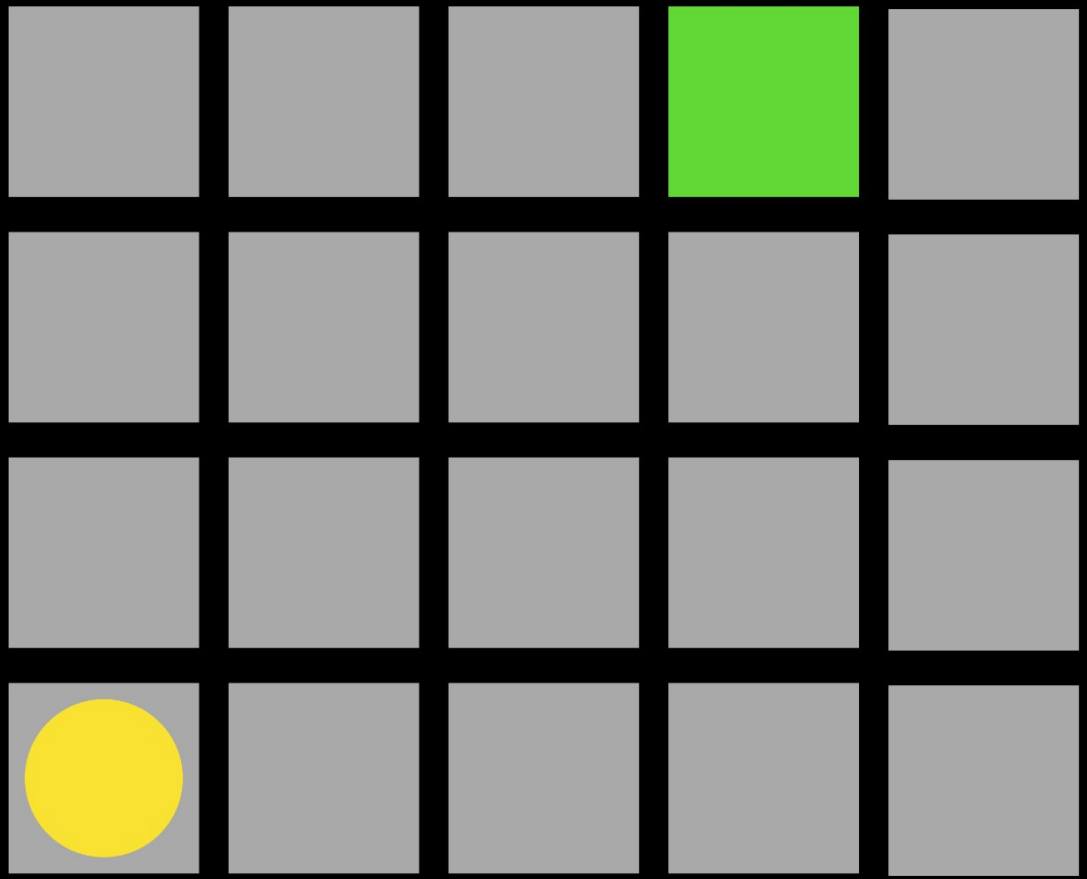
# Why AI is Good at Games

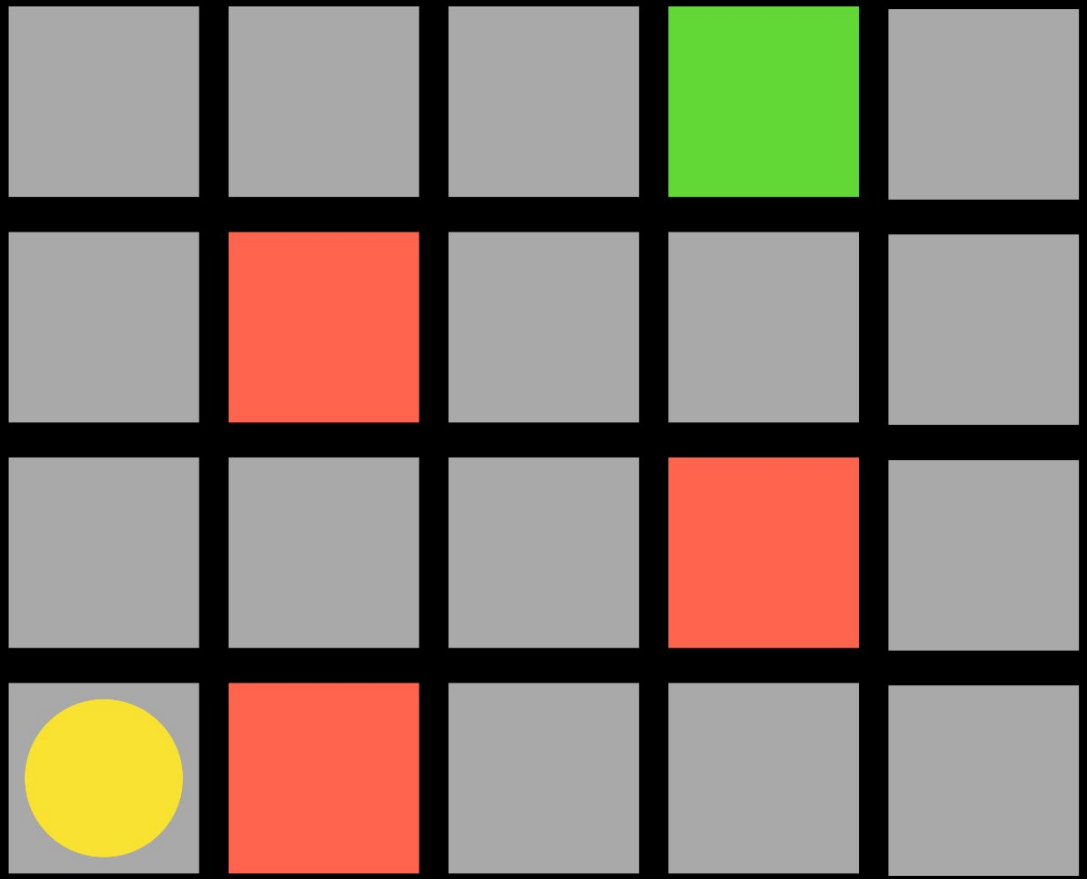
**Inputs and outputs** that can be **represented mathematically**.

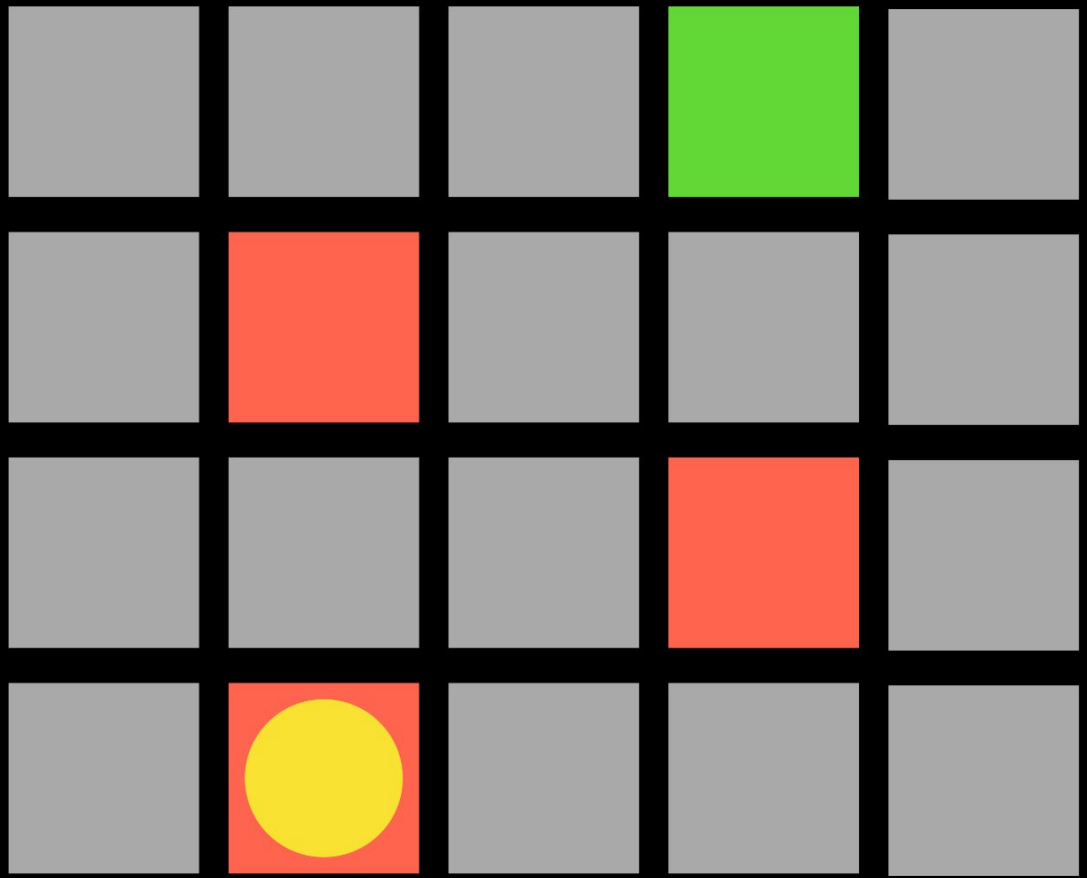
A **goal** in the form of a **function to maximize/minimize**.

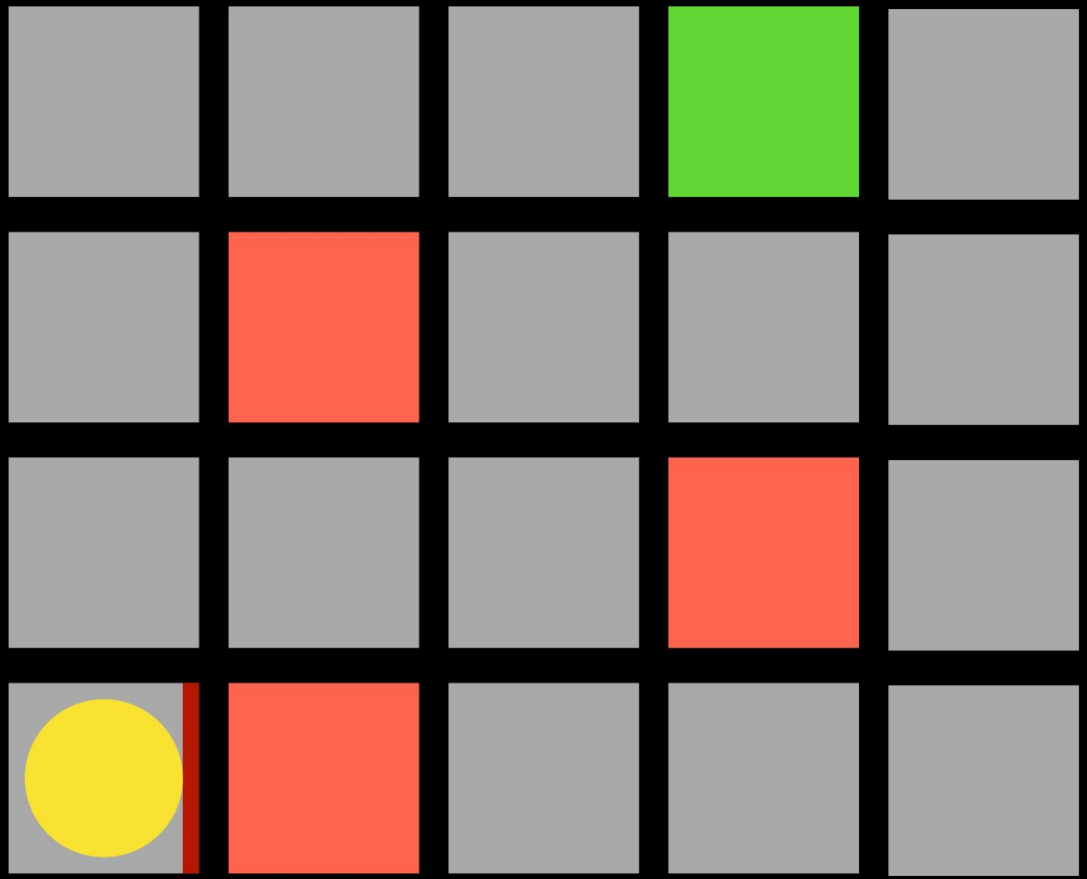
machine learning

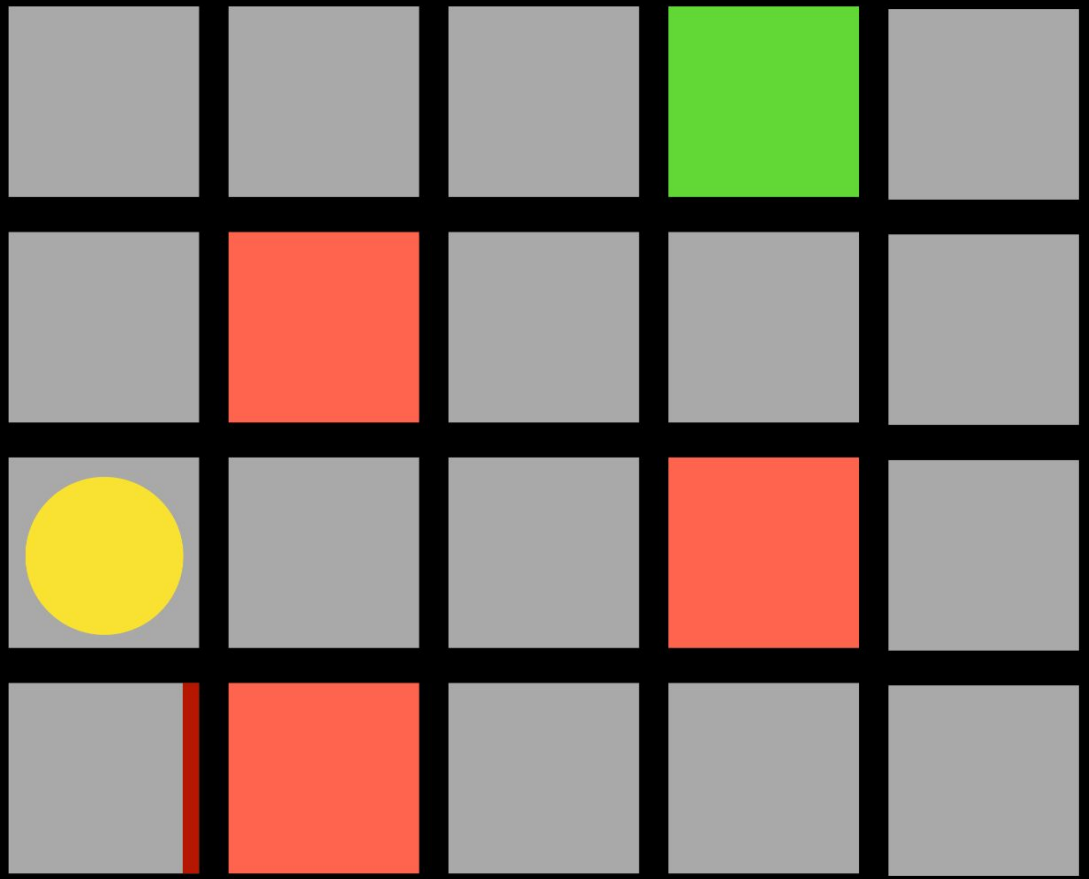
reinforcement learning

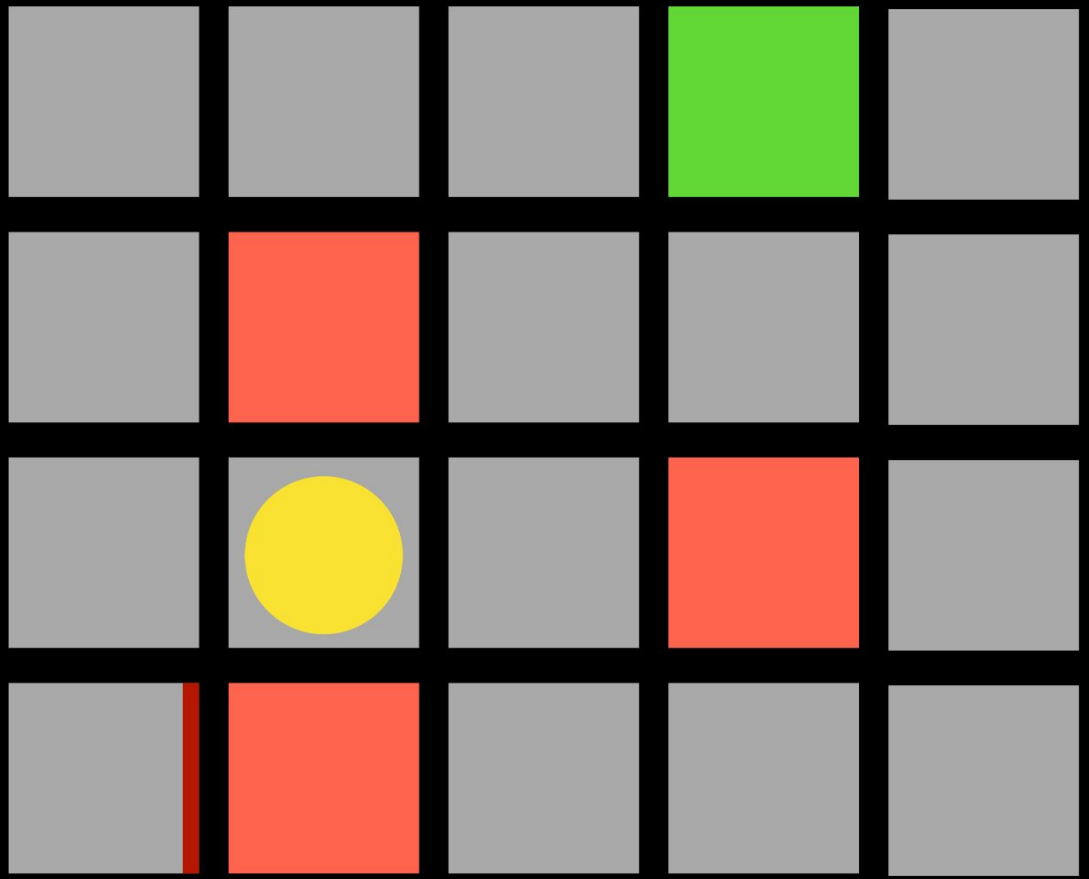


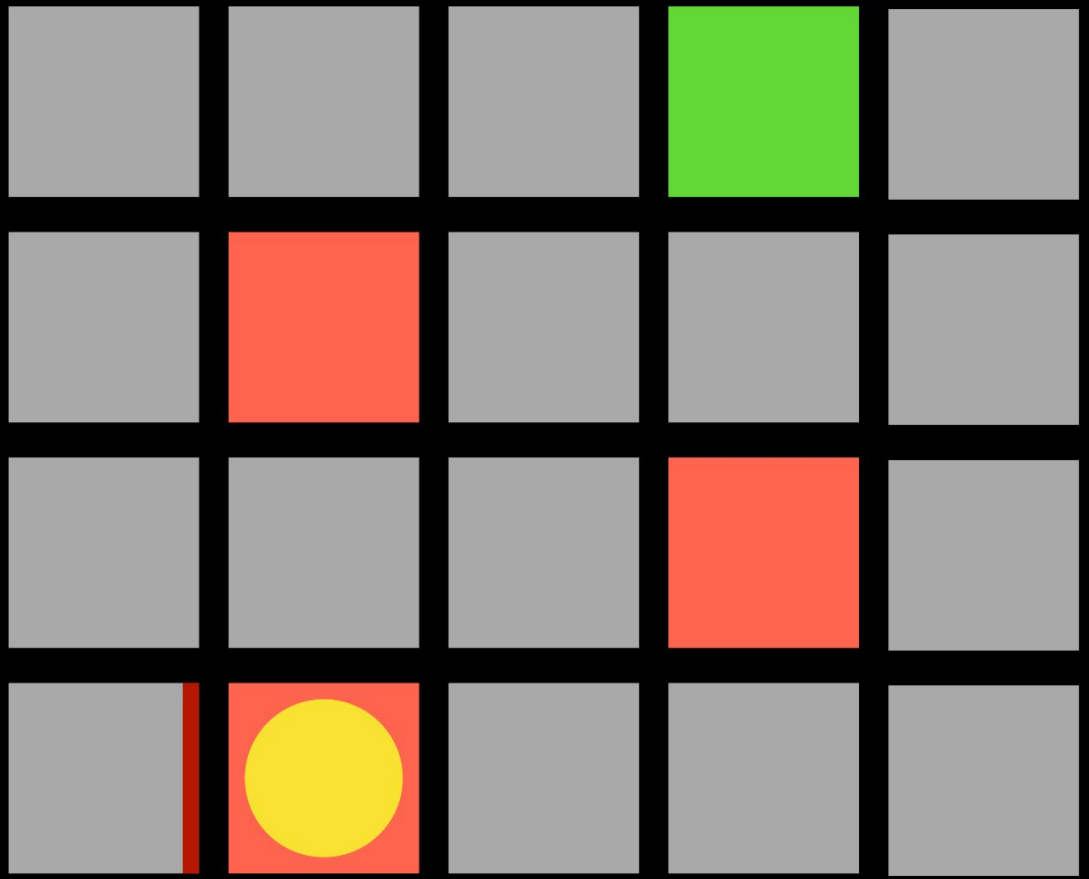


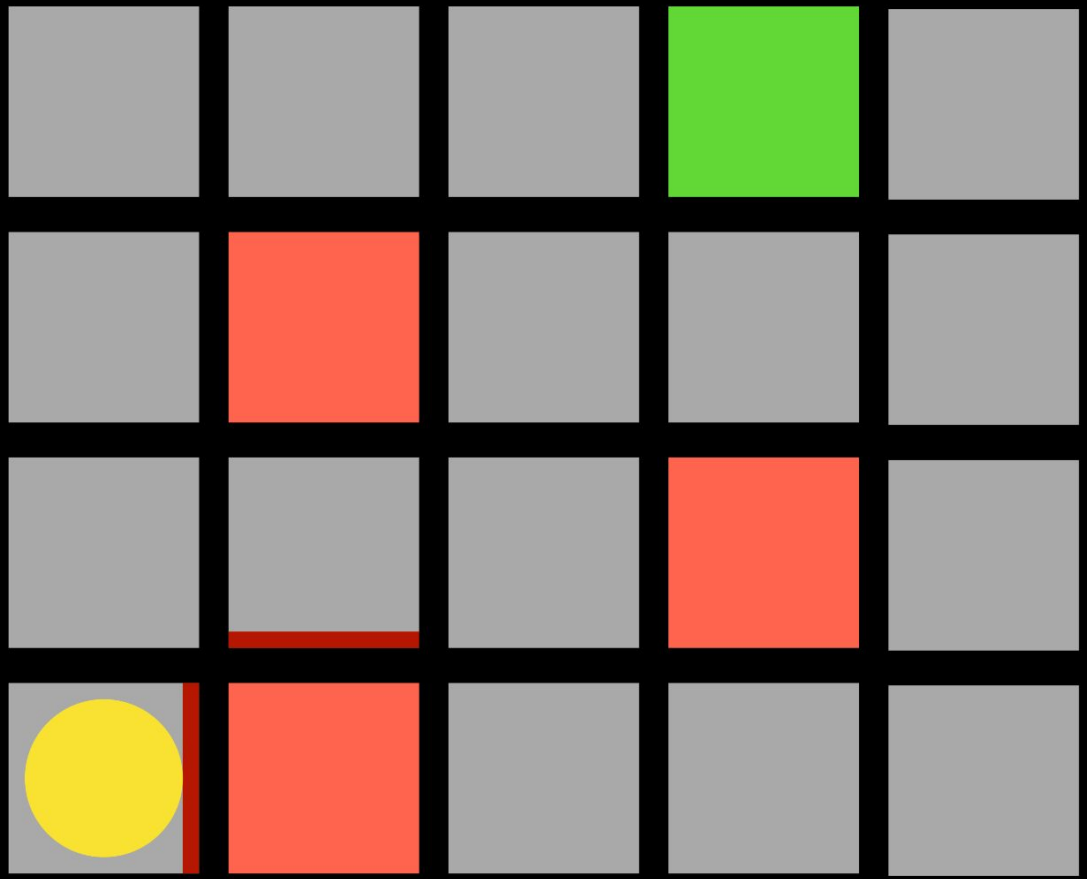


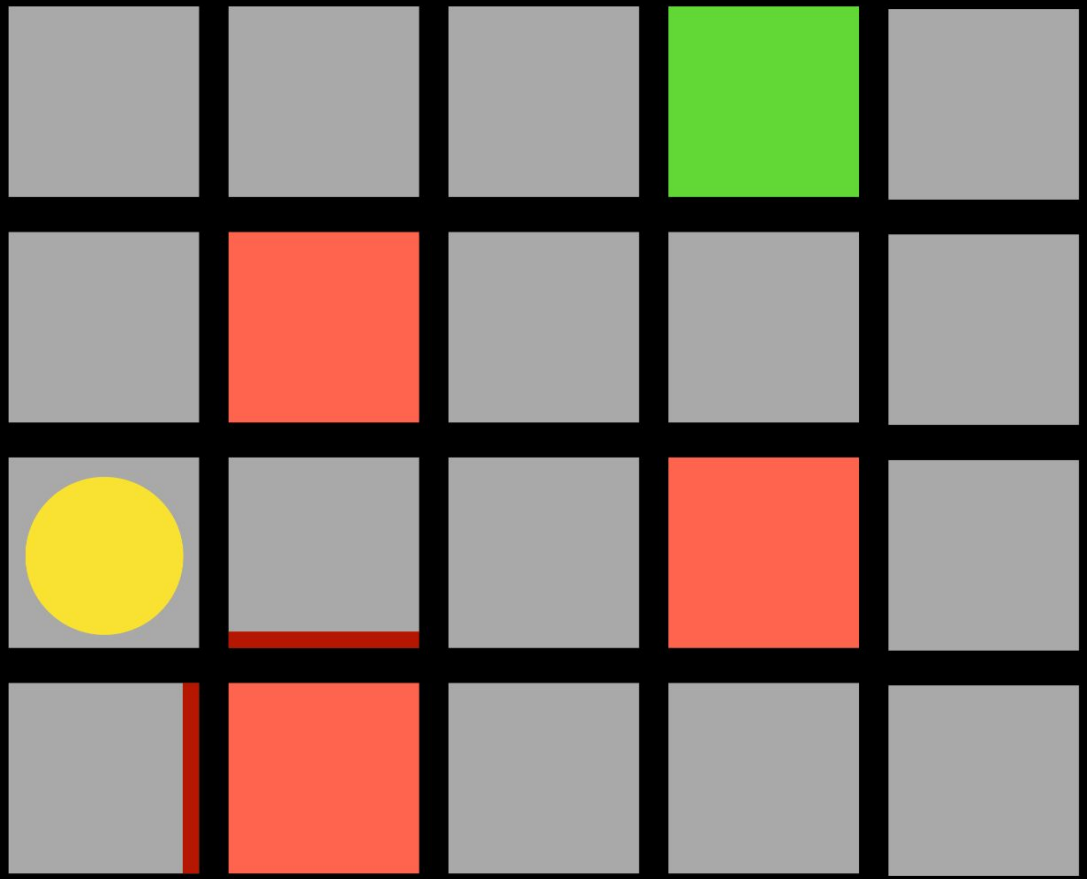


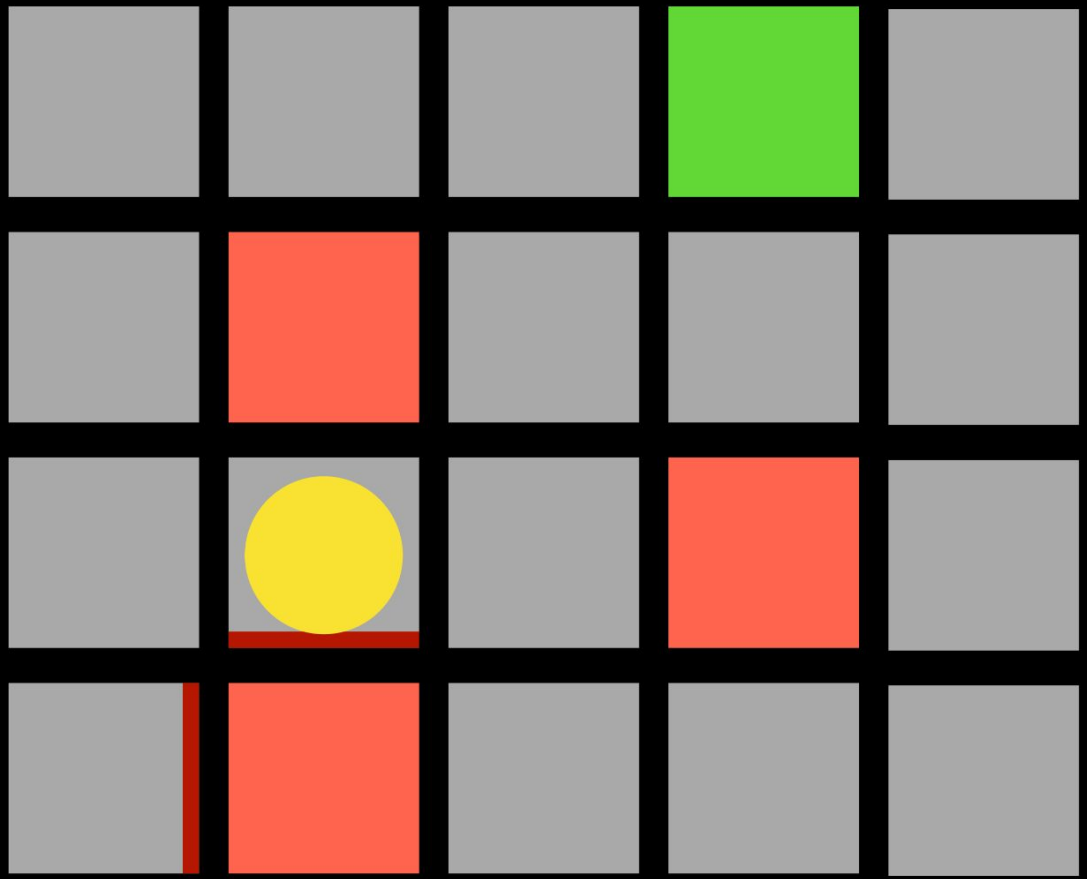


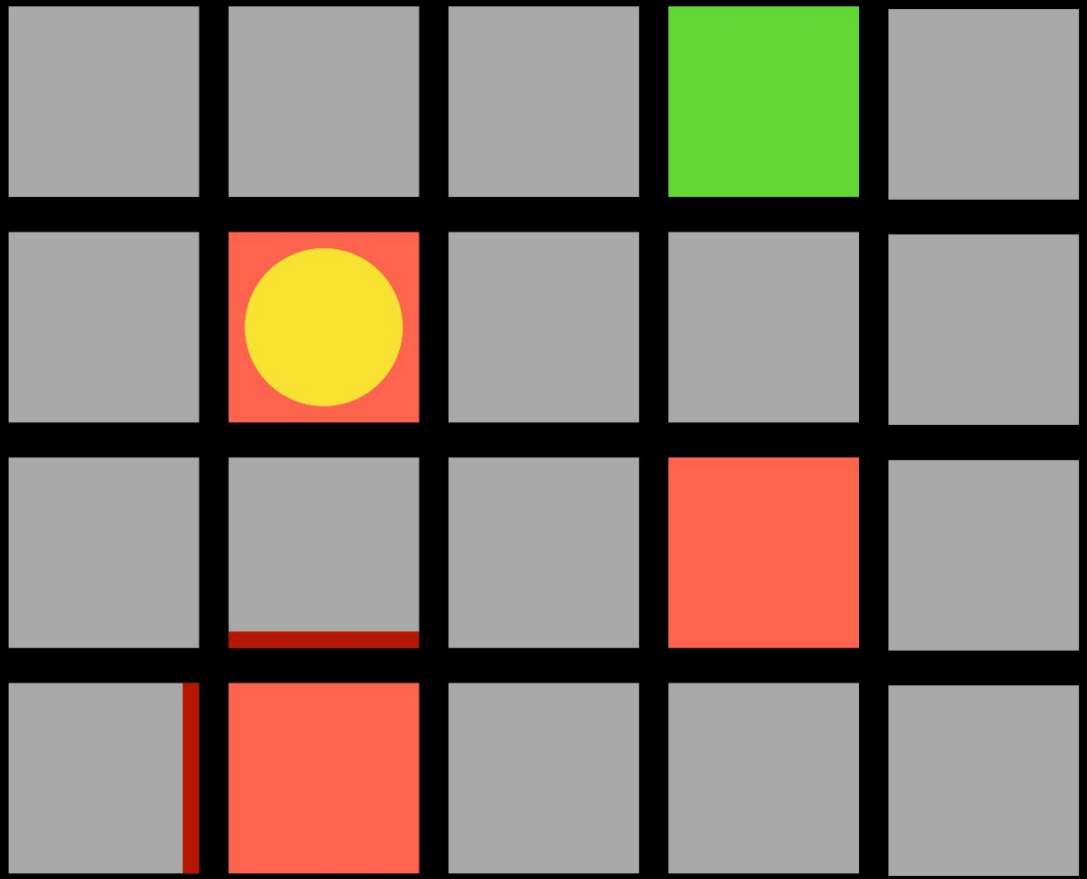


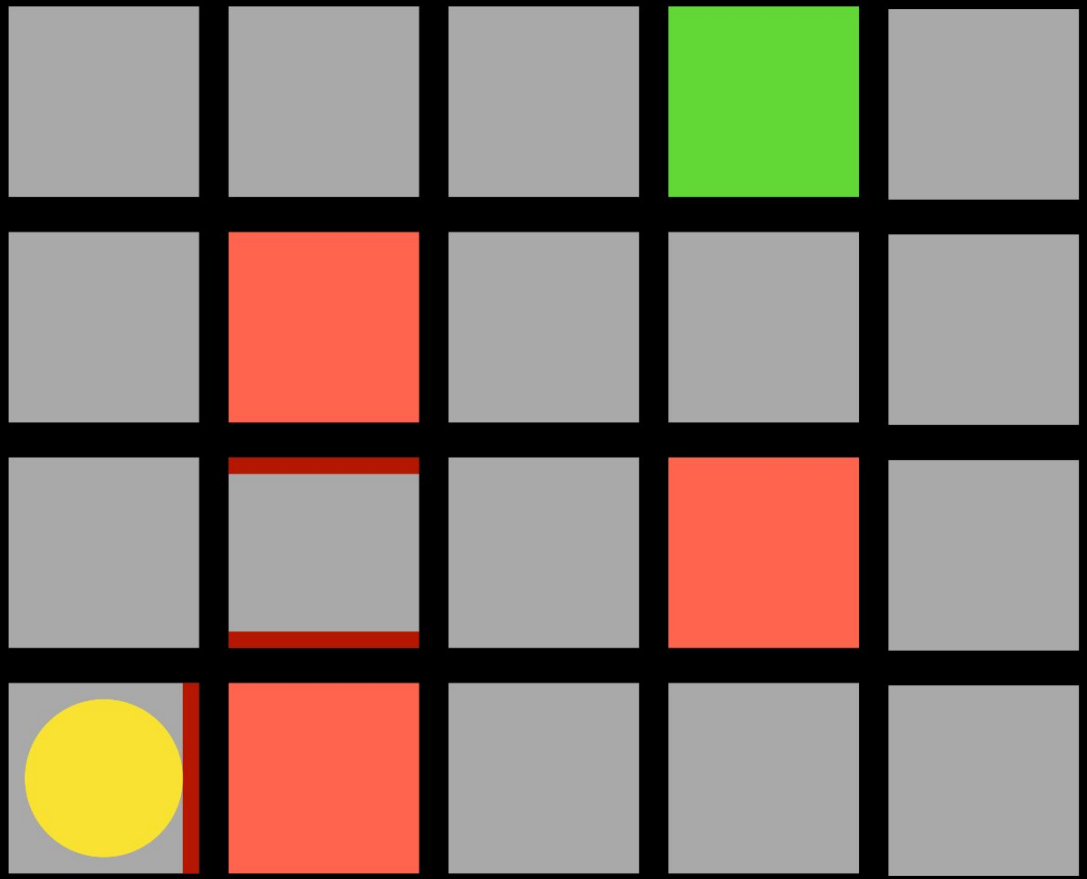


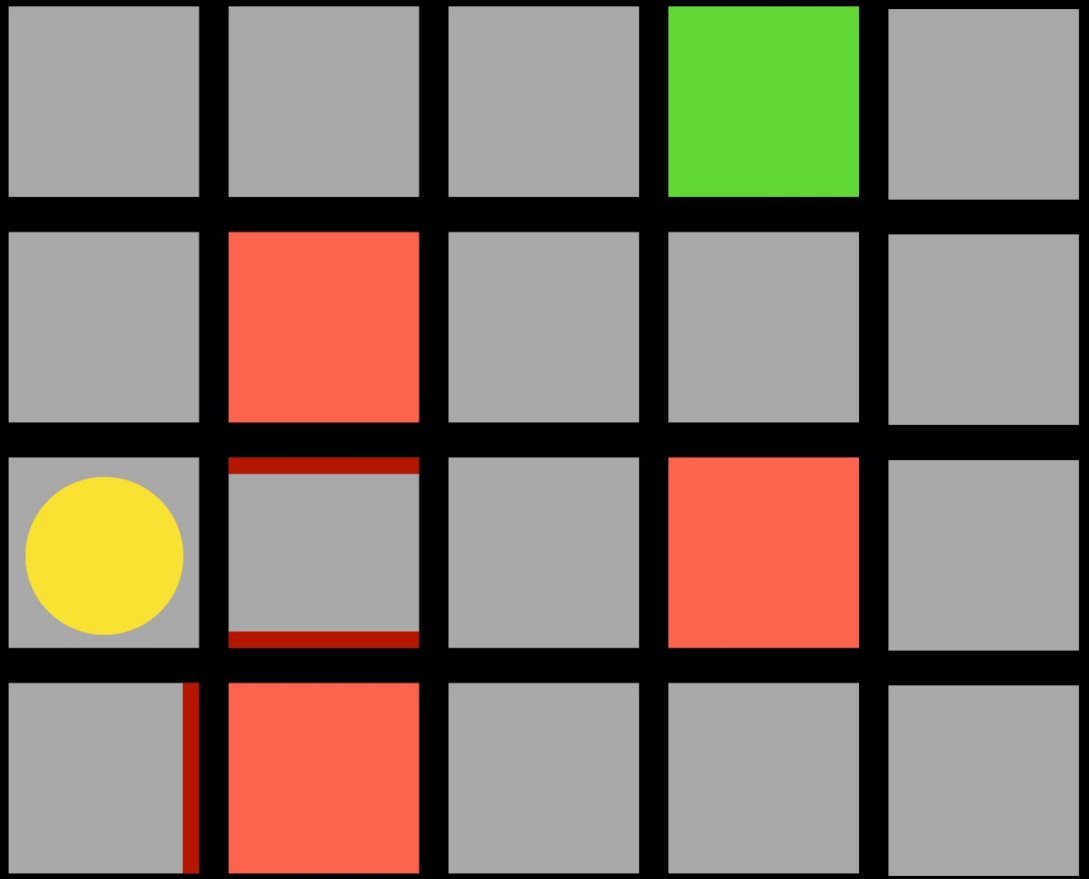


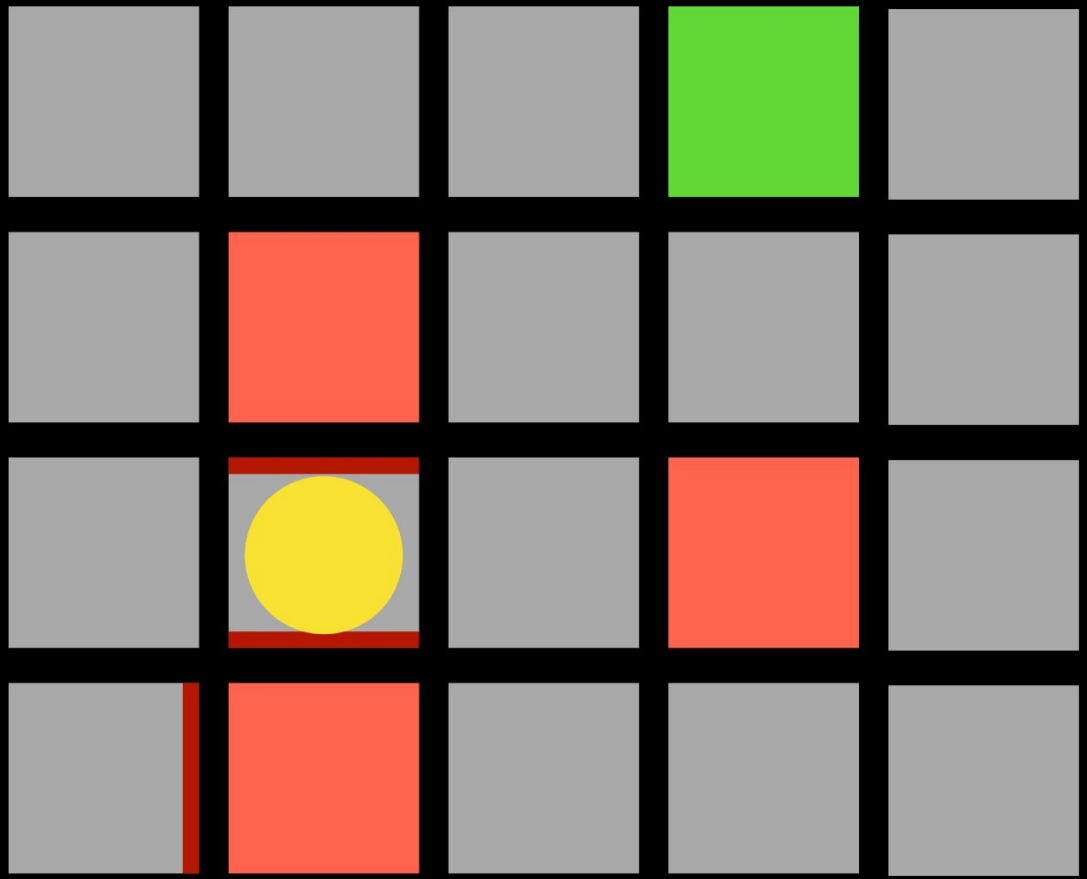


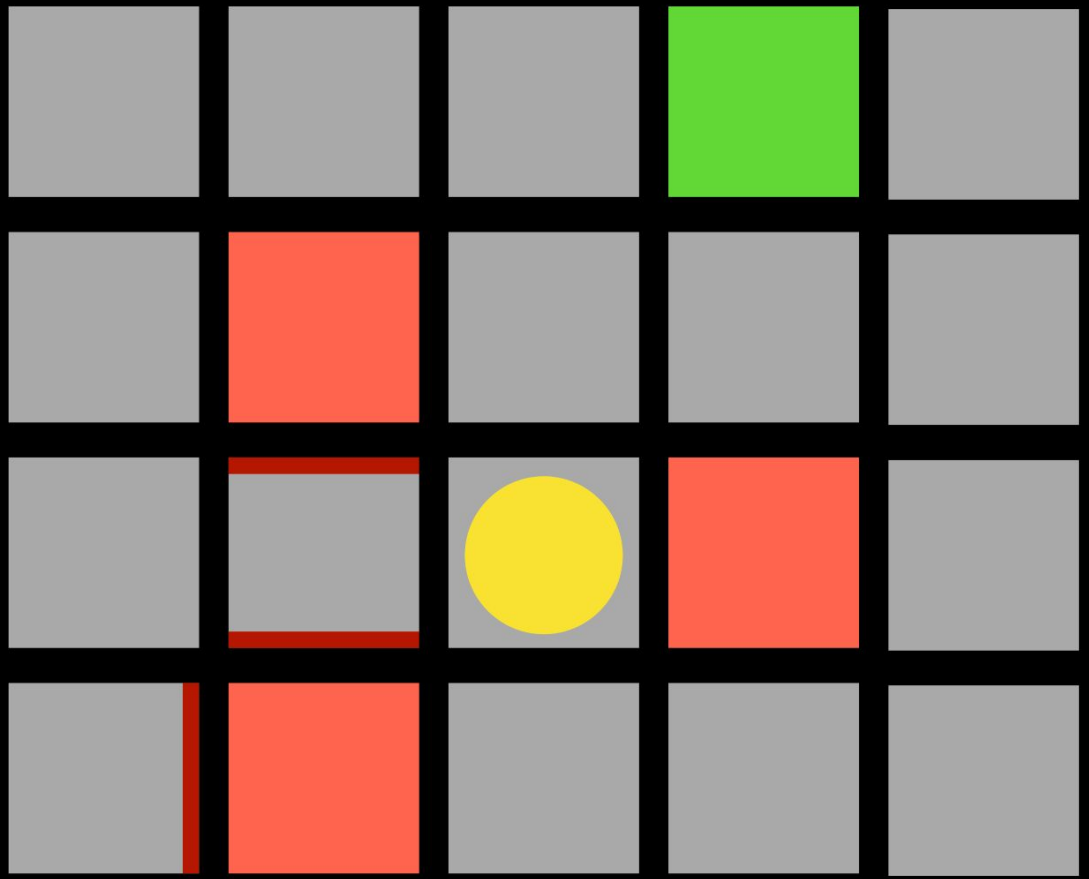


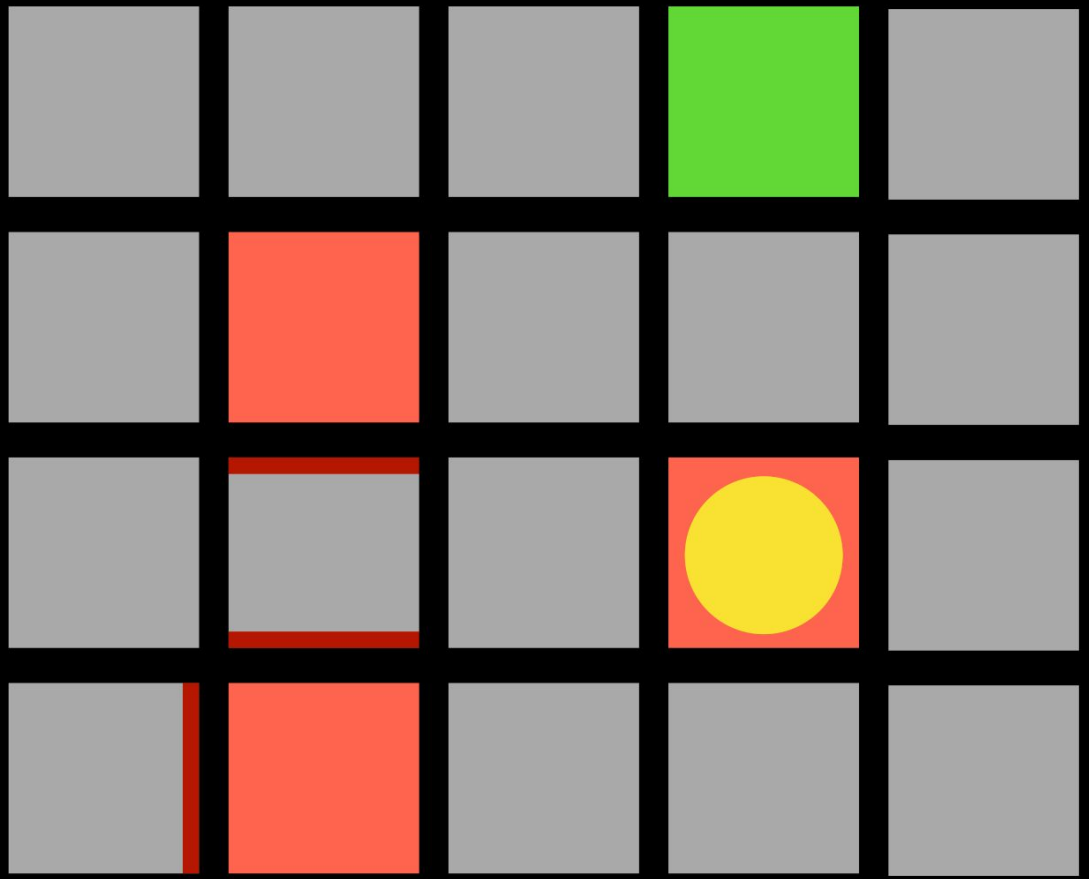


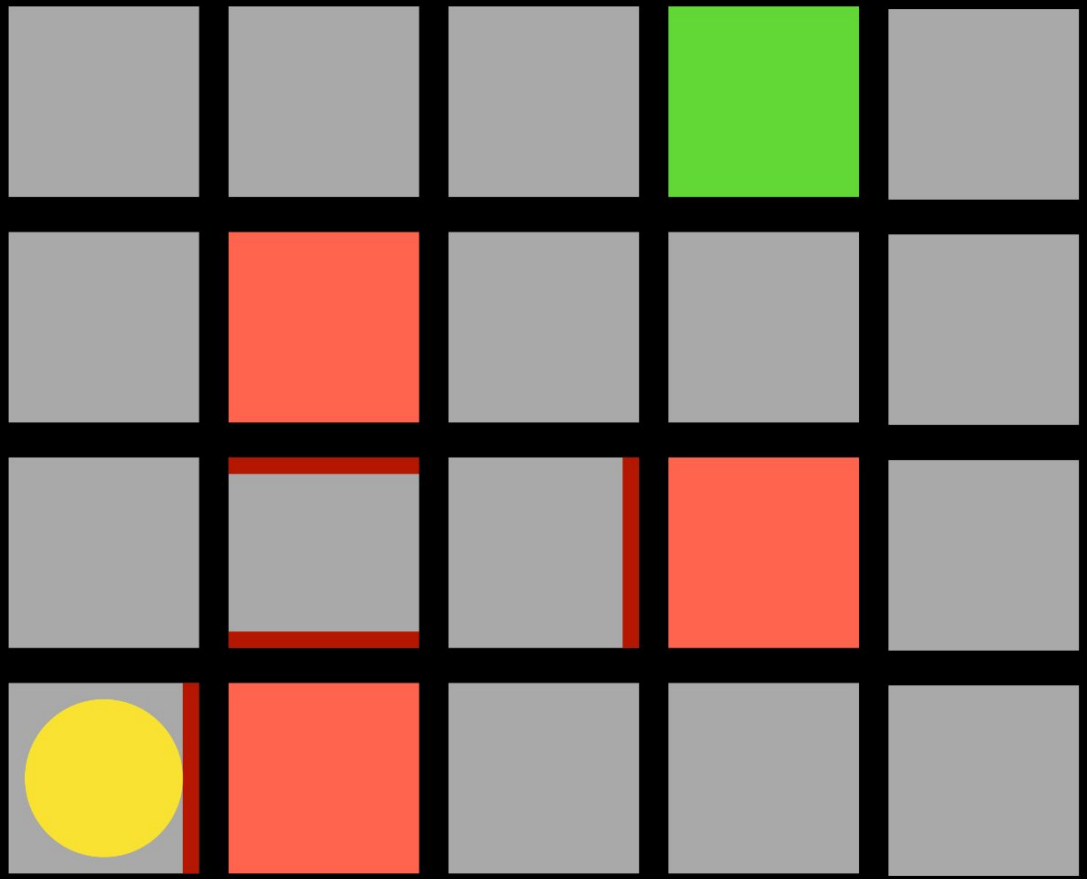


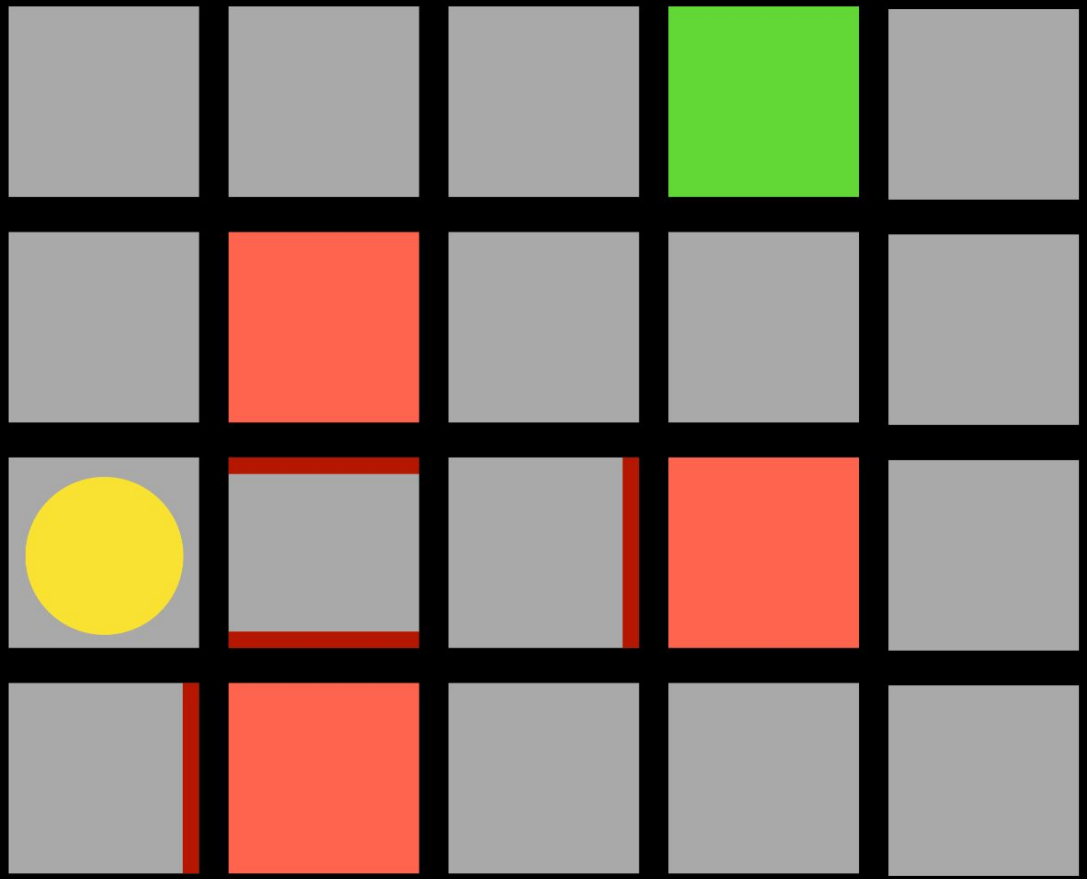


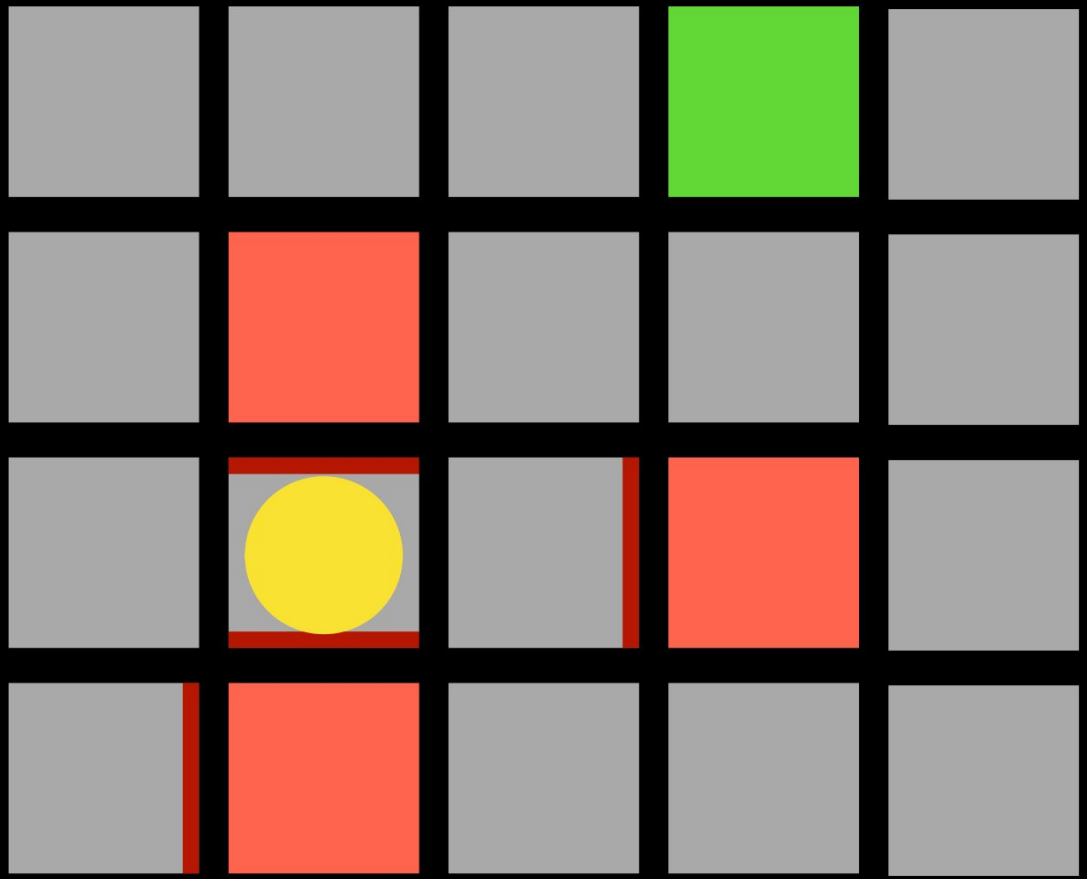


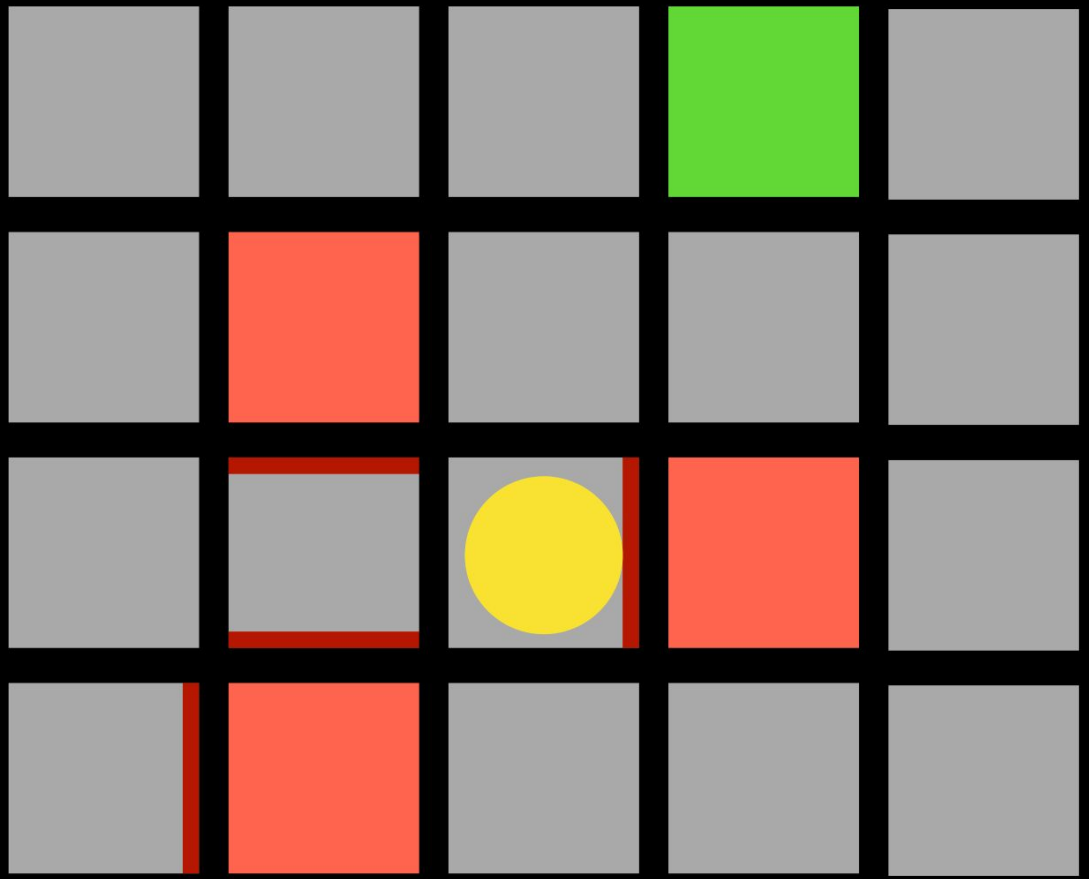


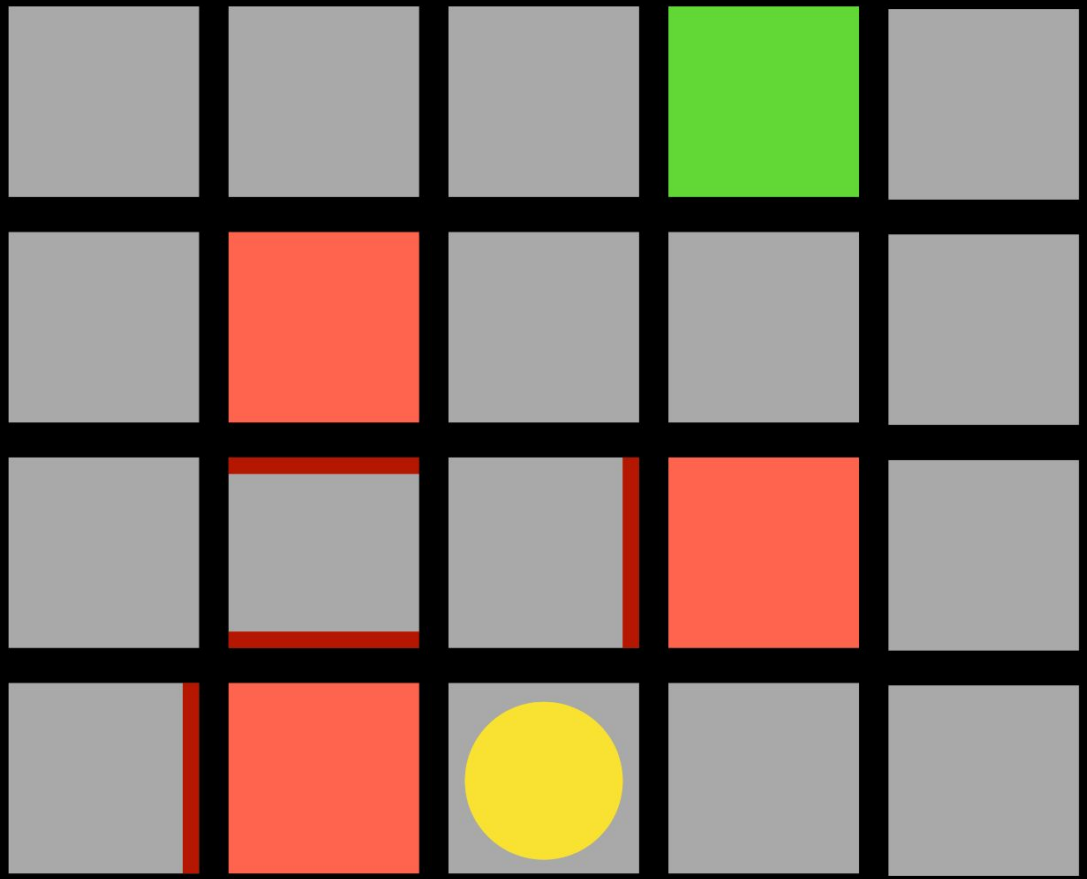


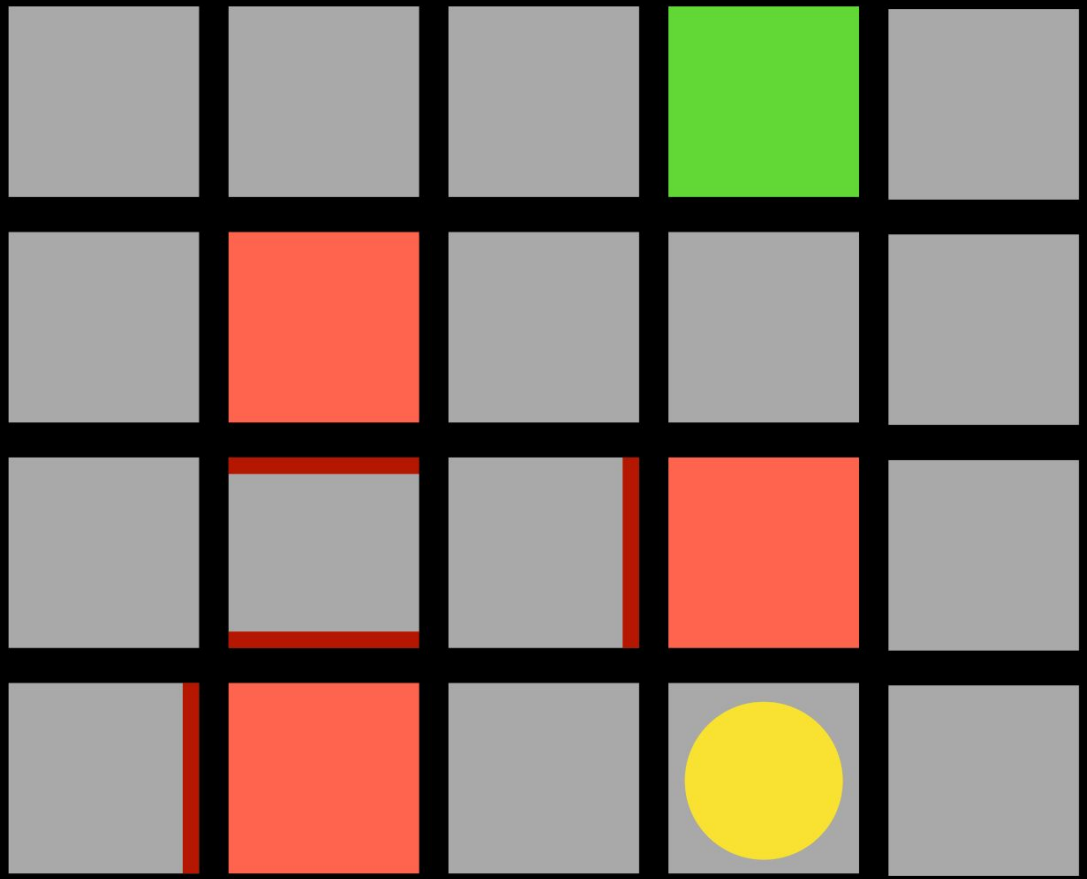


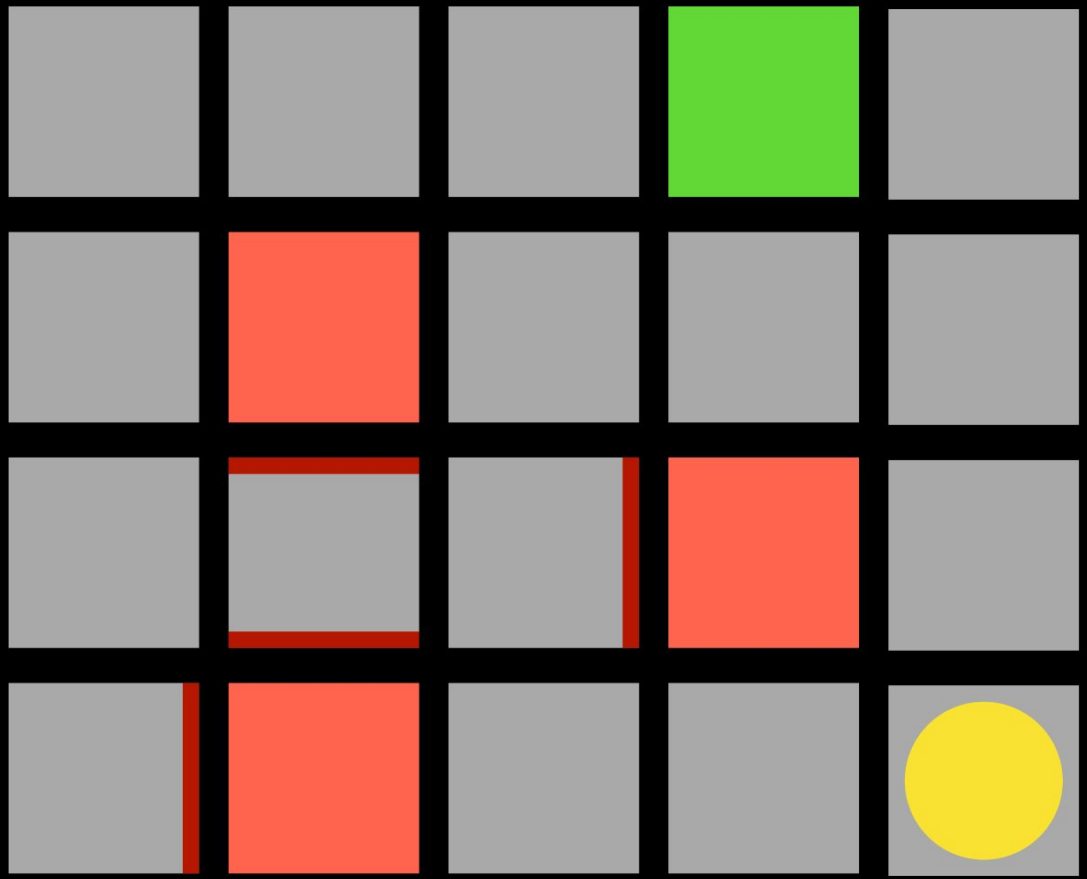


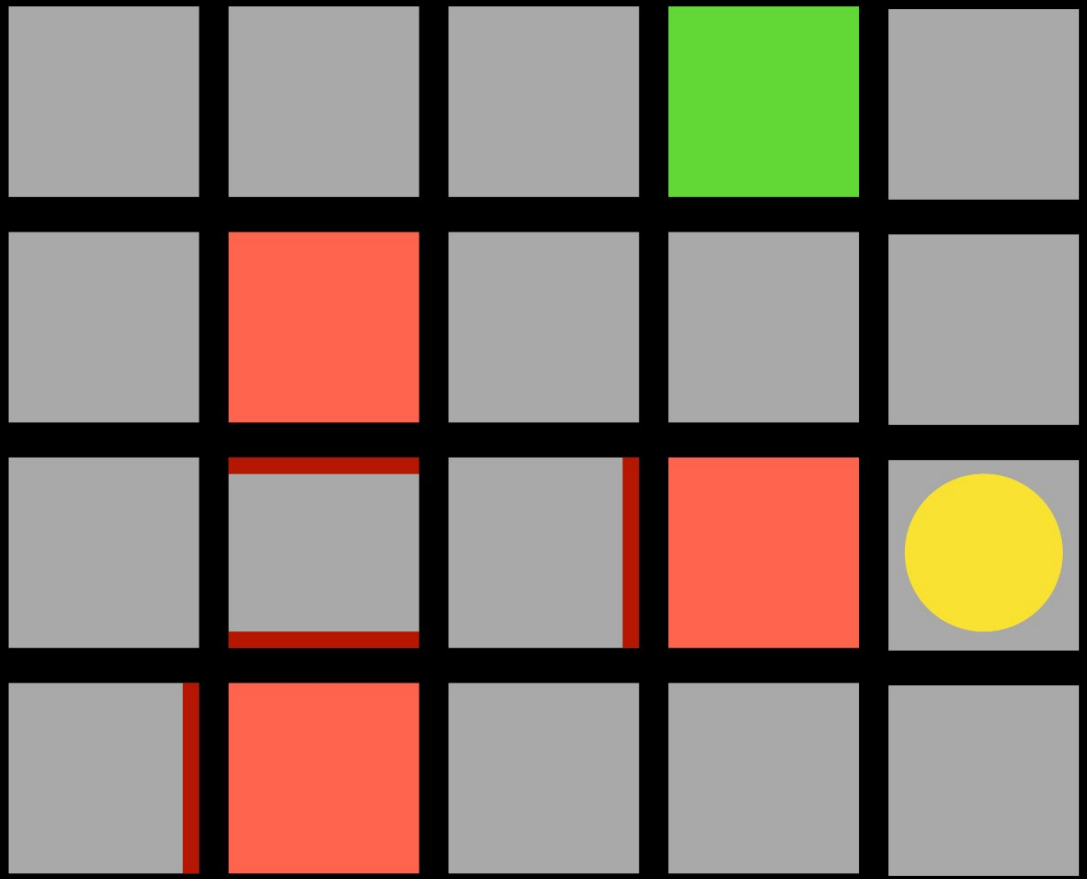


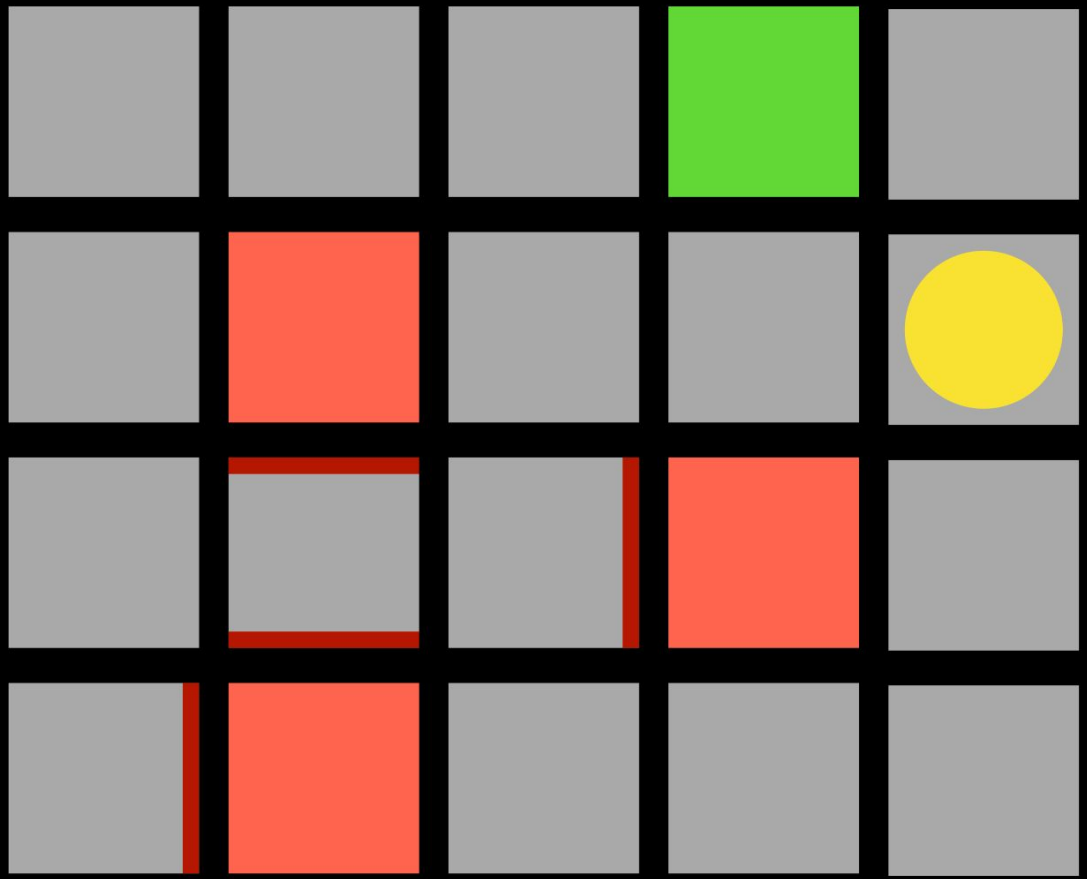


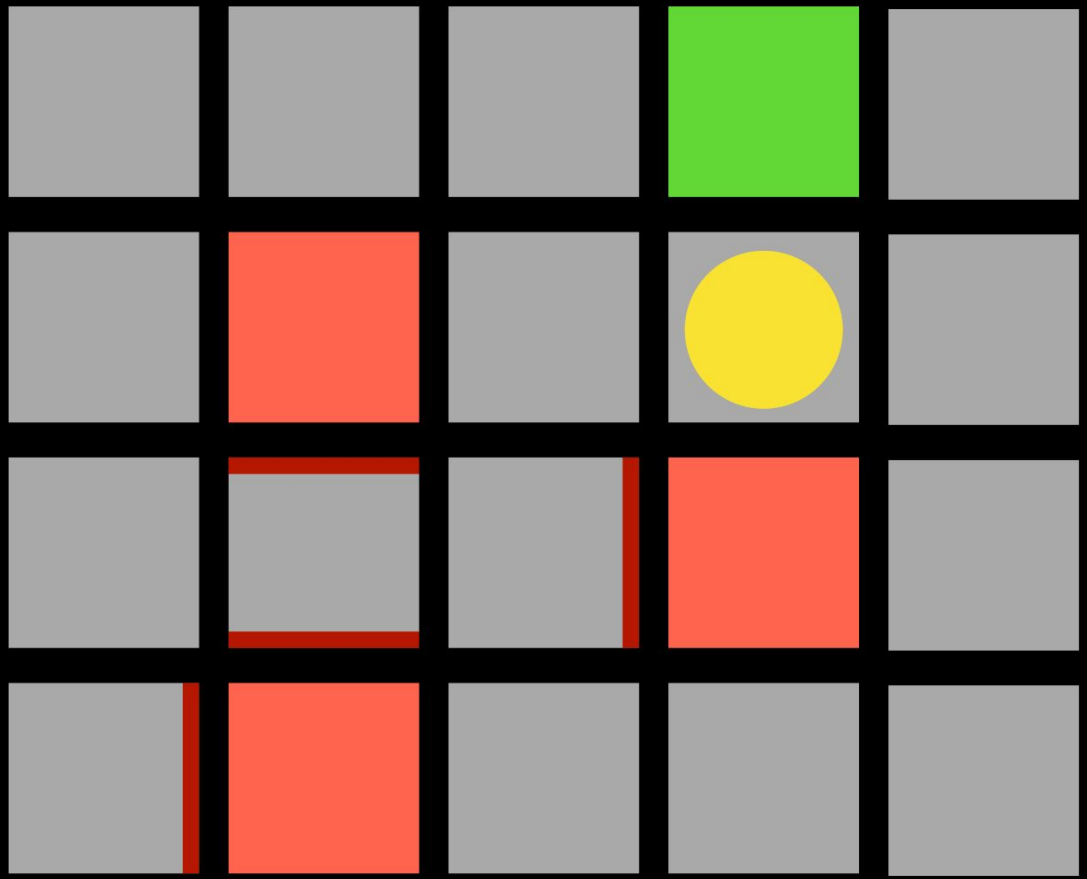


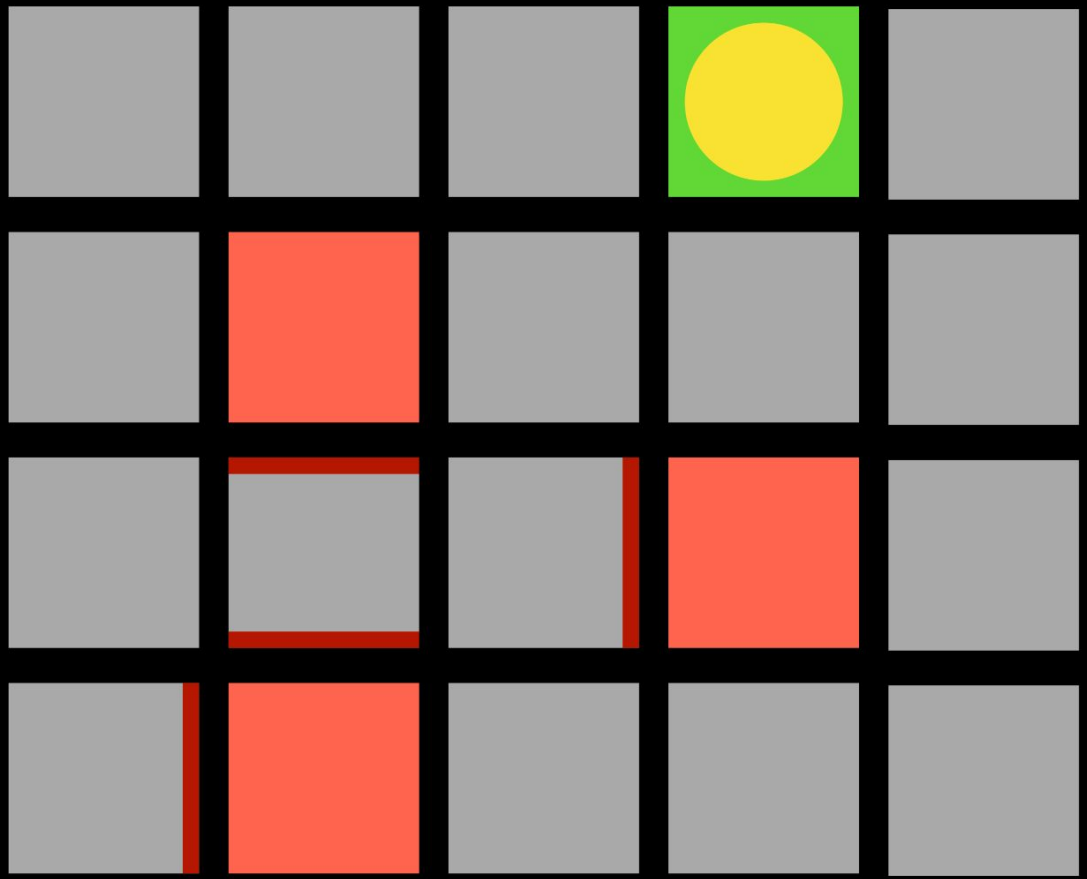


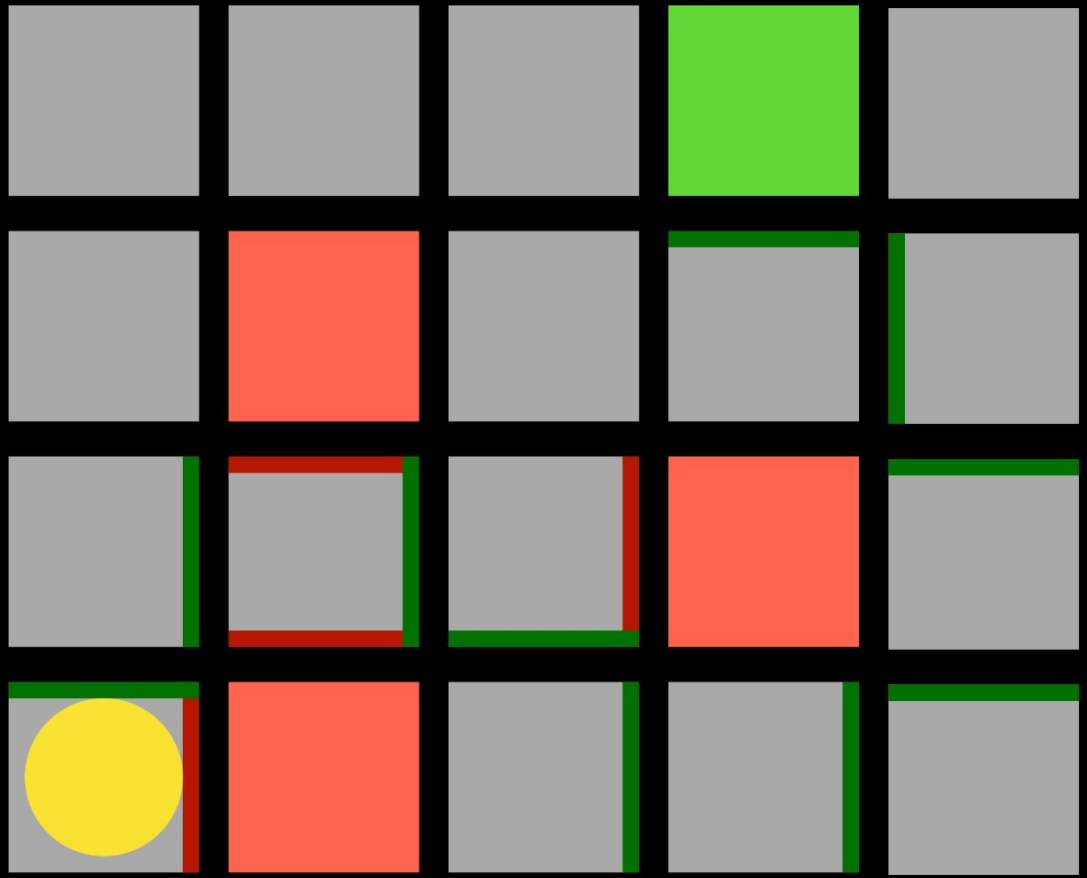


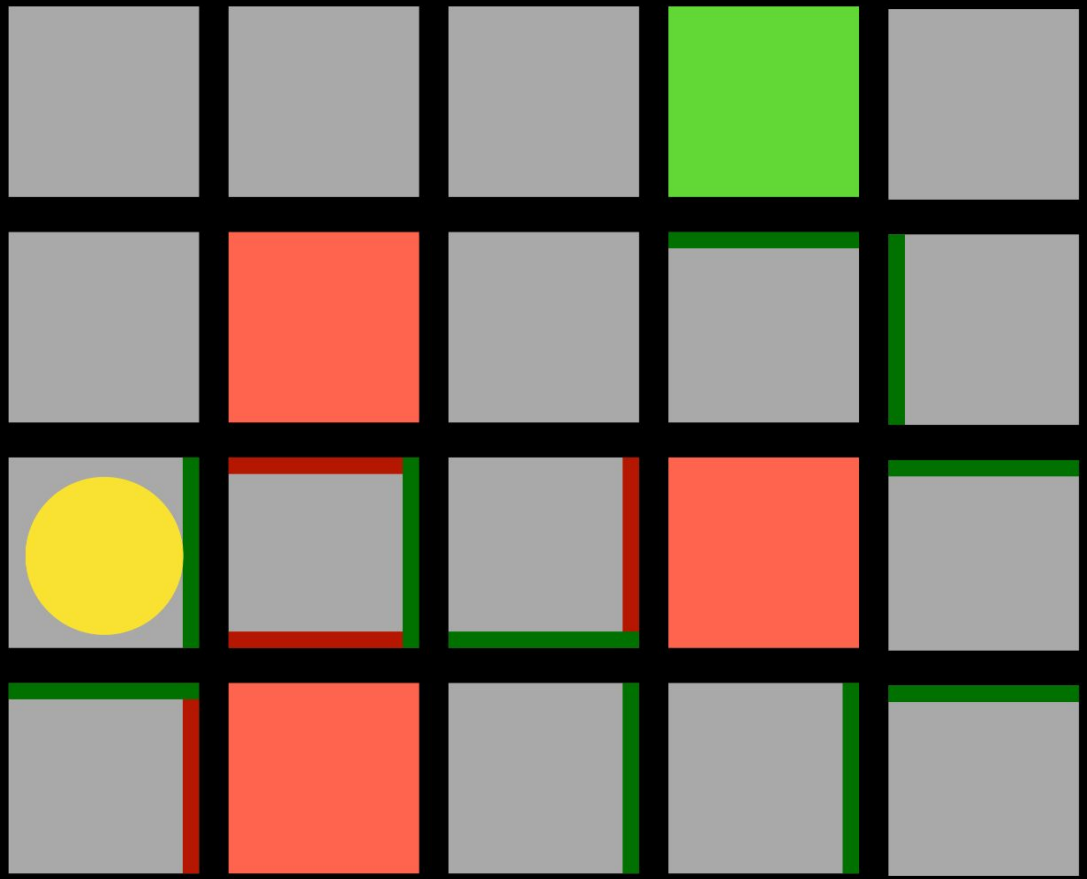


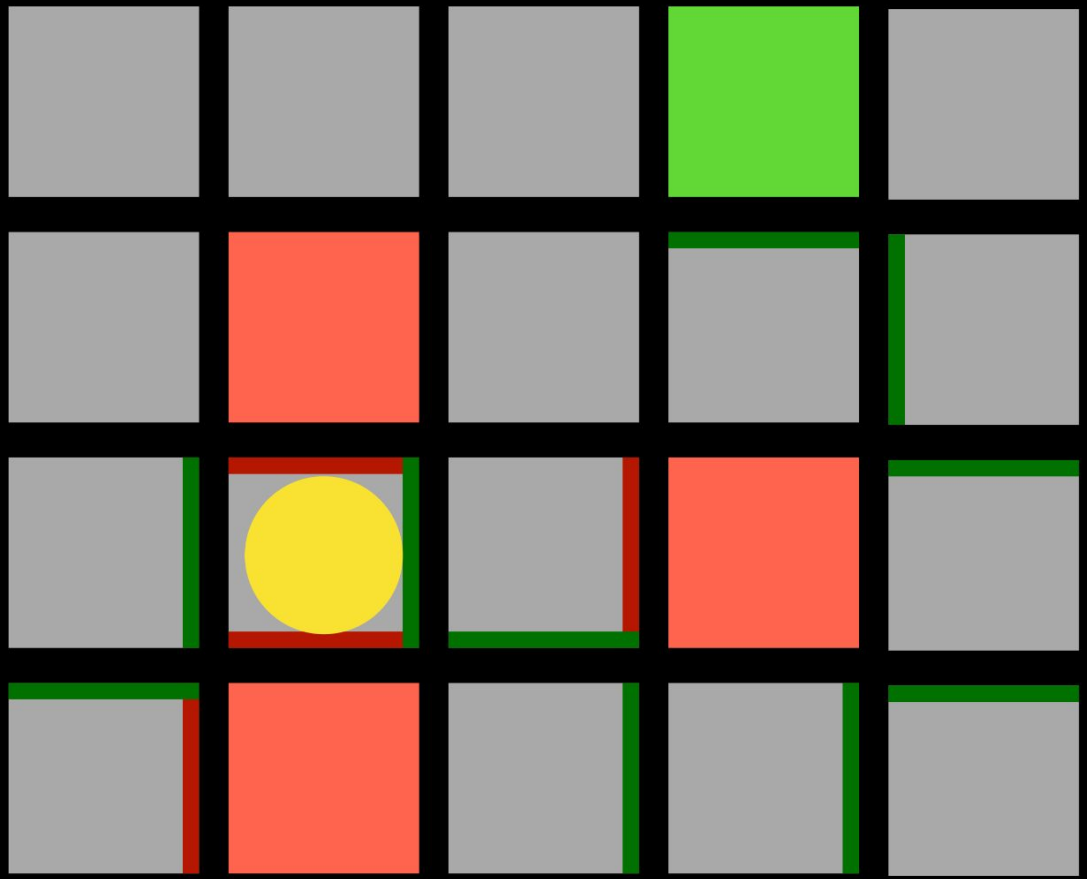


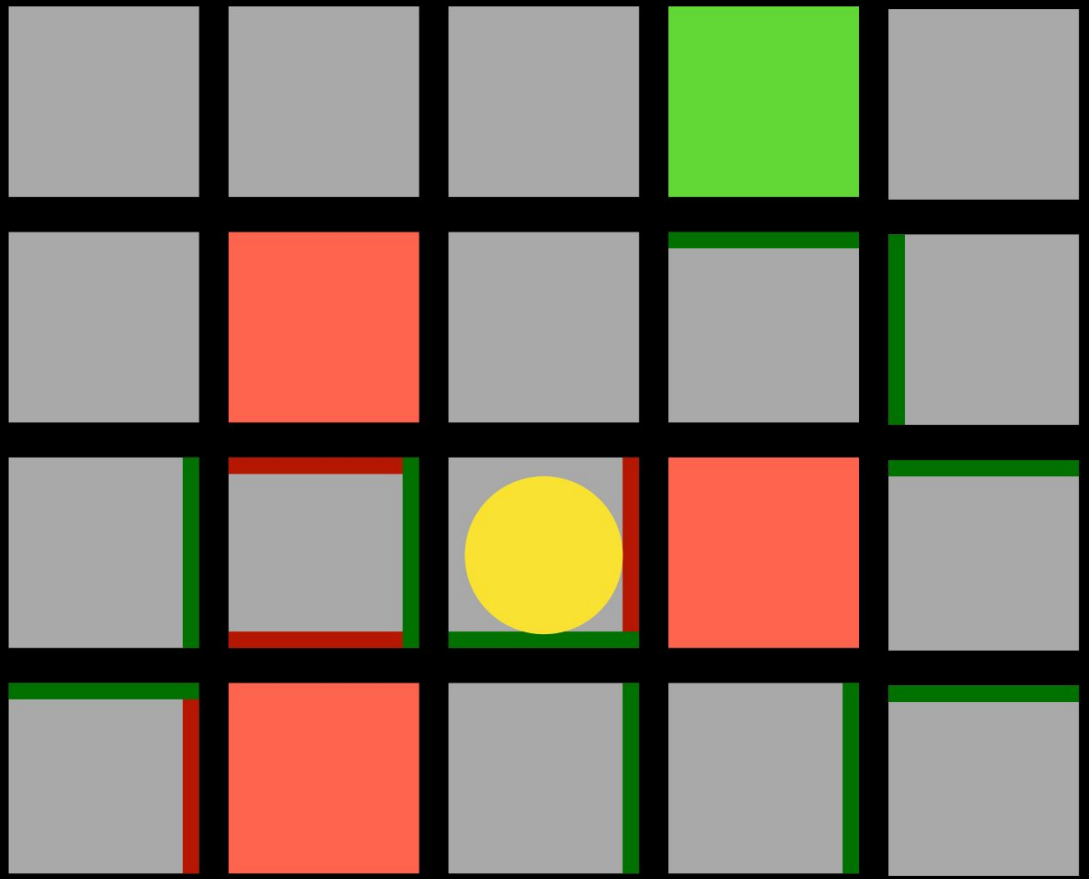


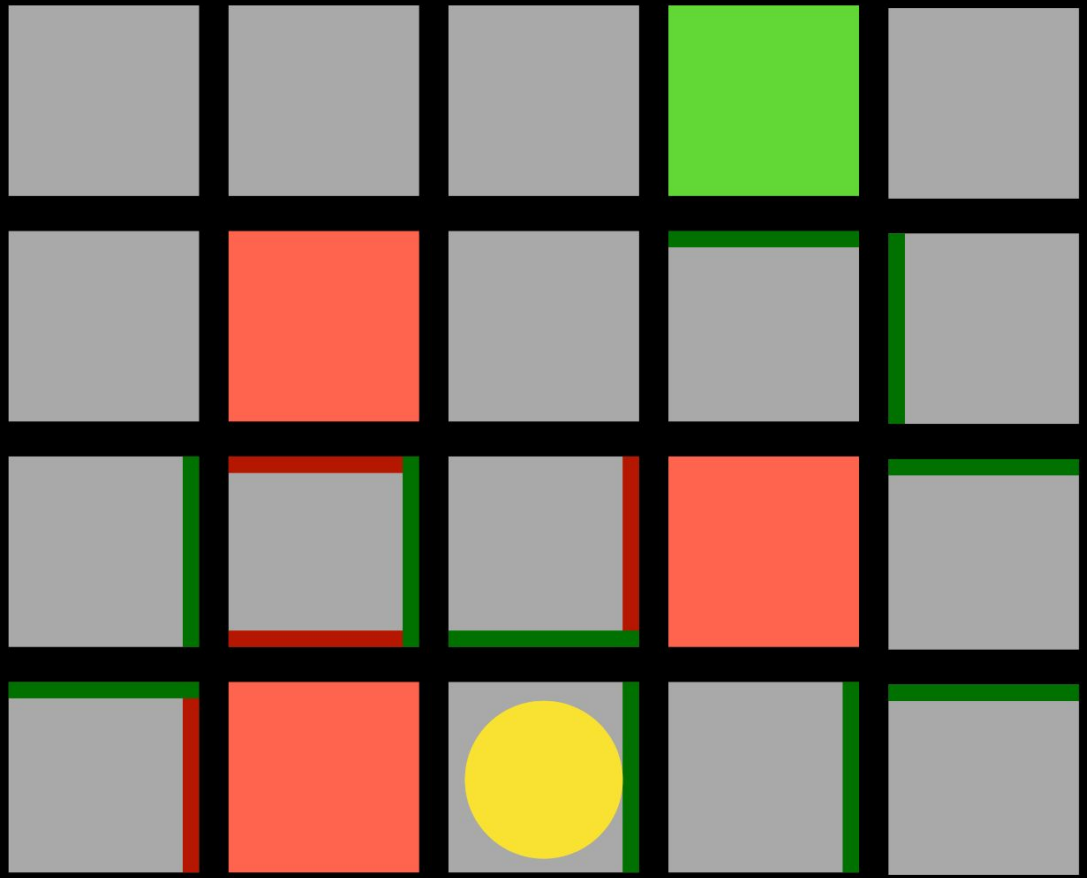


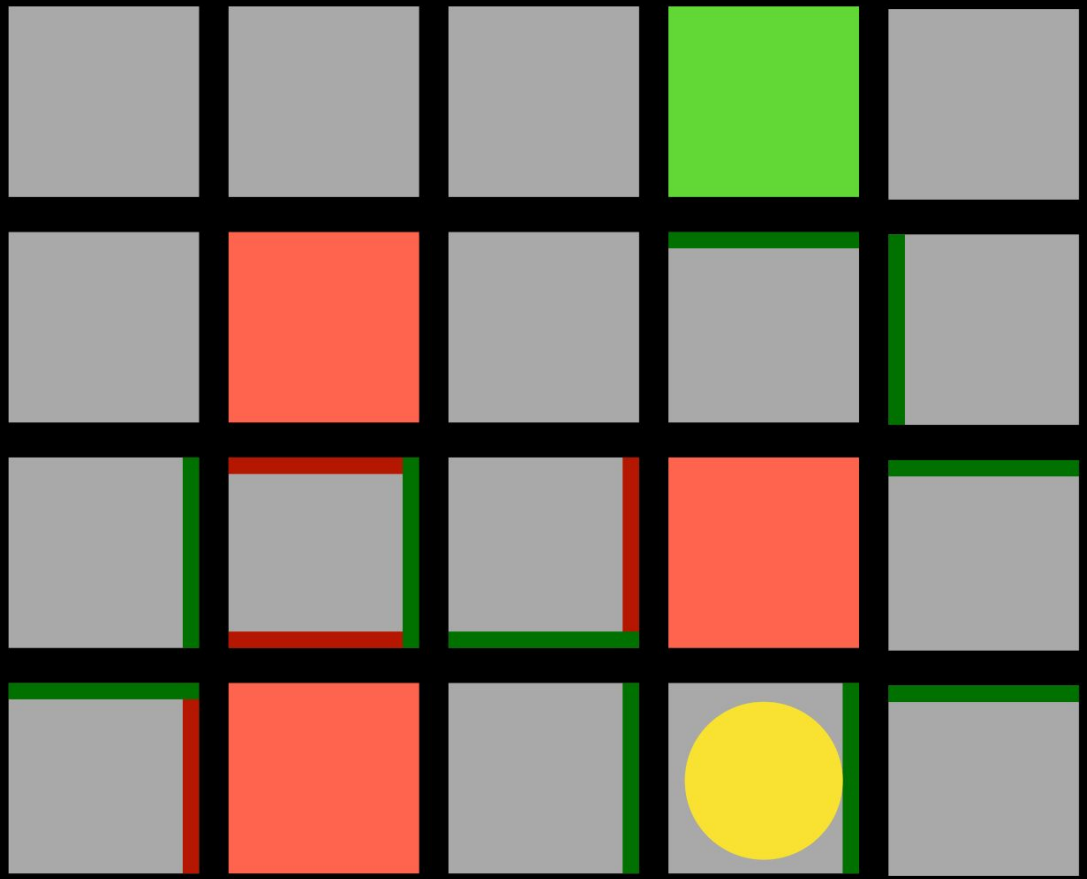


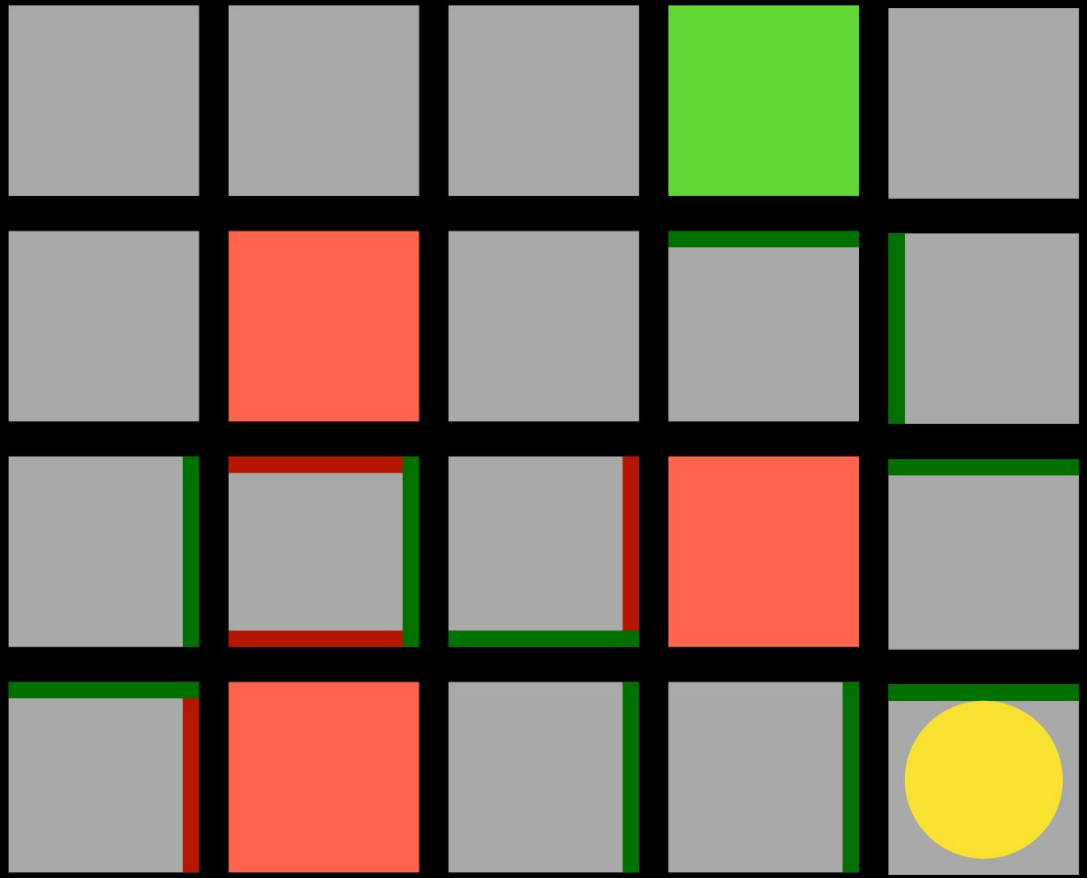


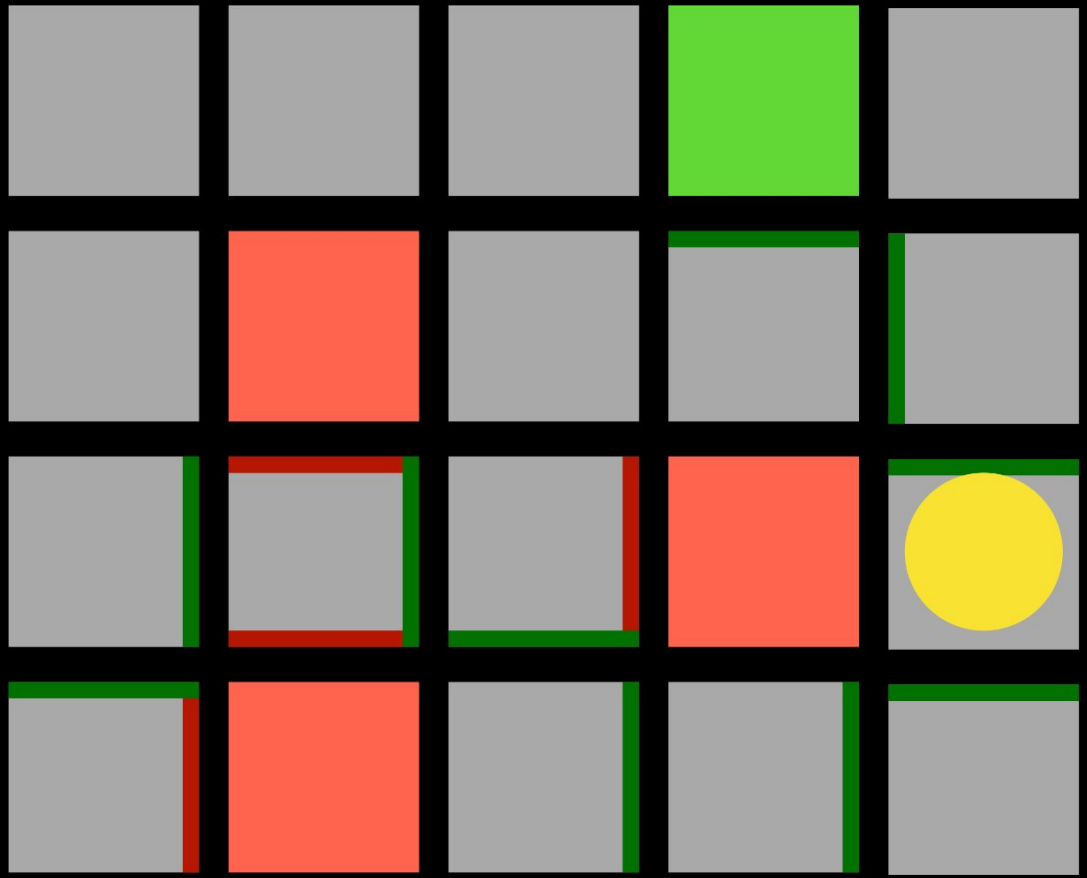


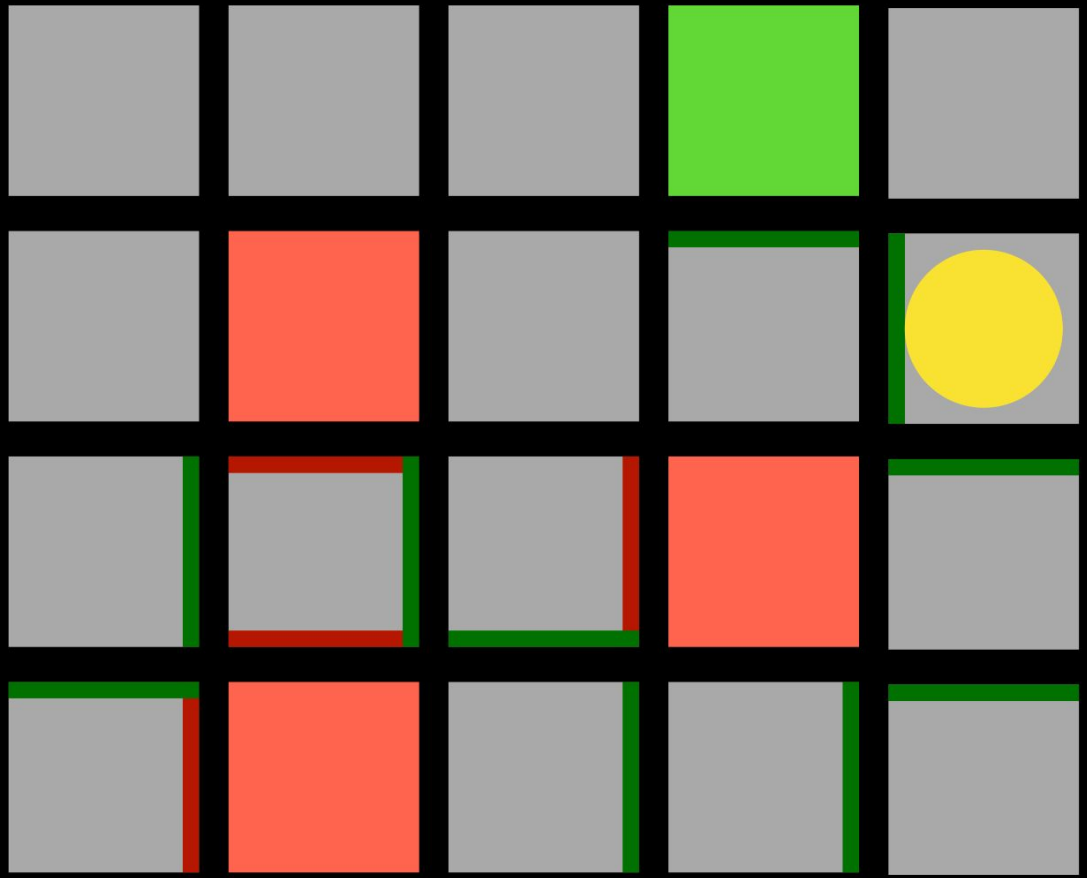


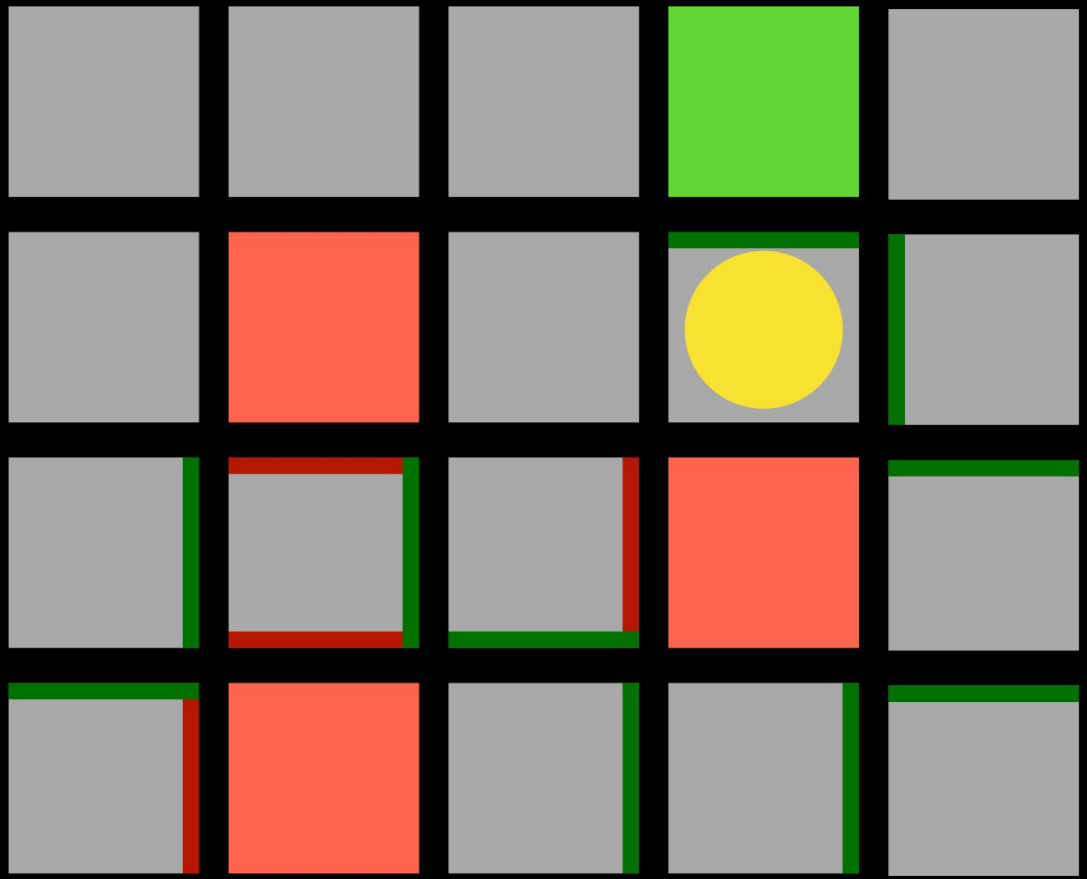


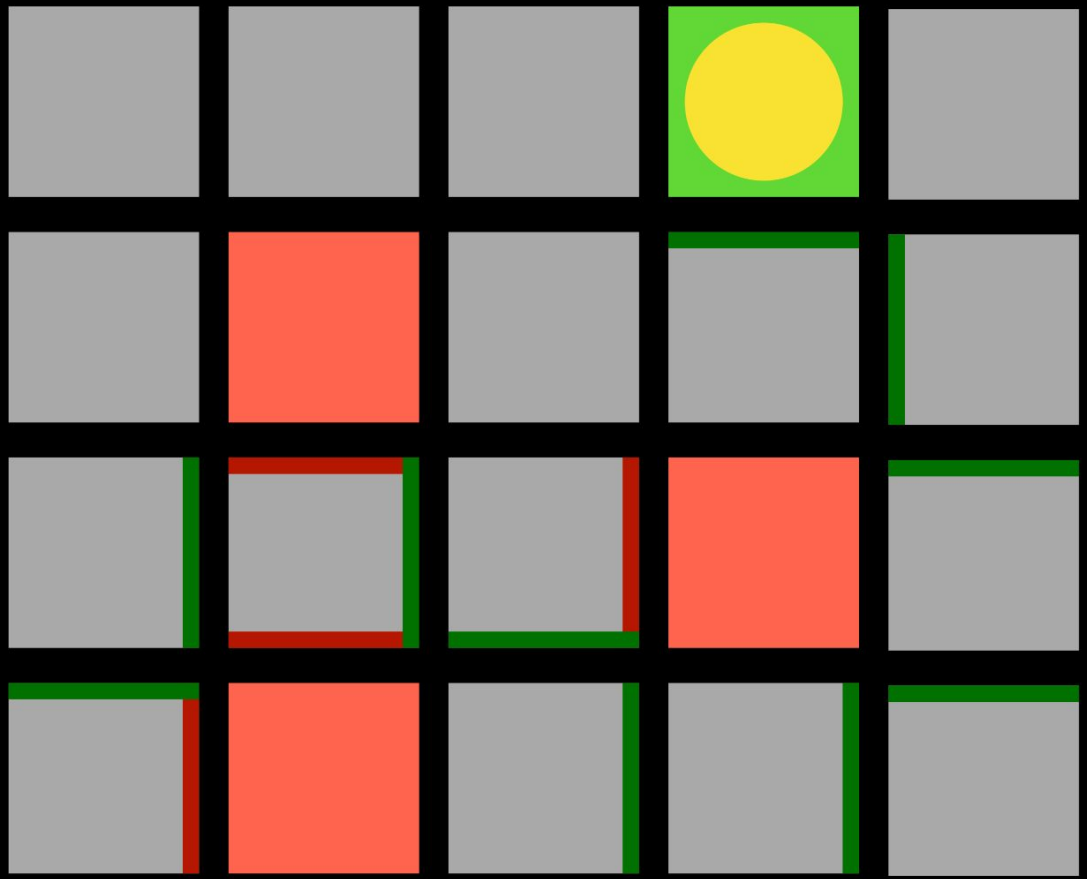










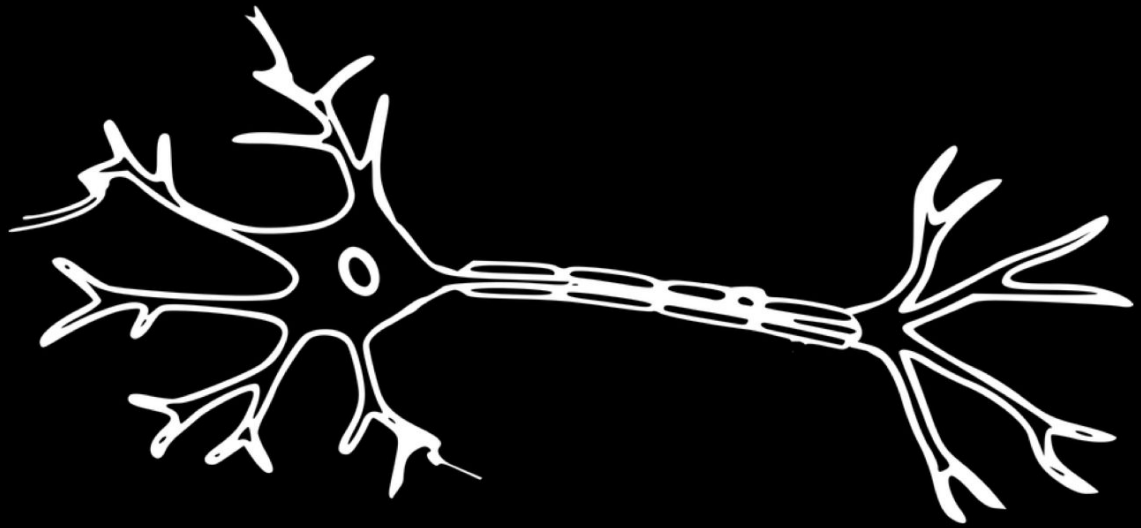


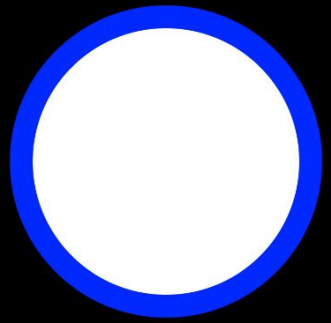
# explore vs. exploit

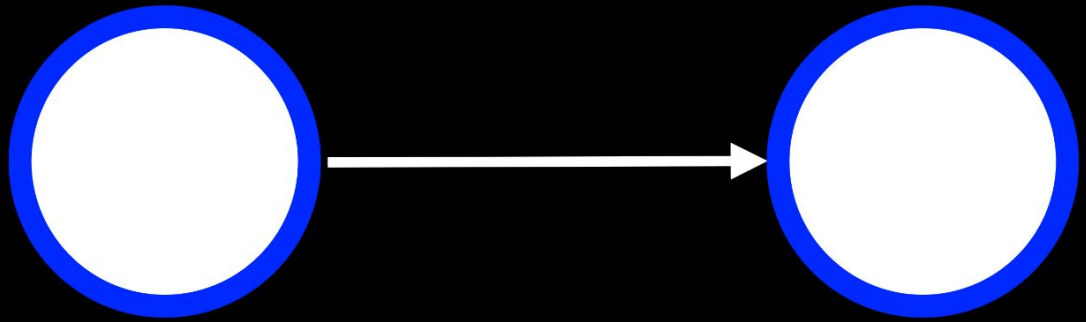
Reinforcement Learning

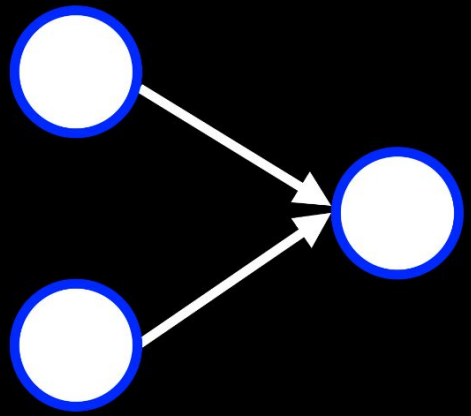
deep learning

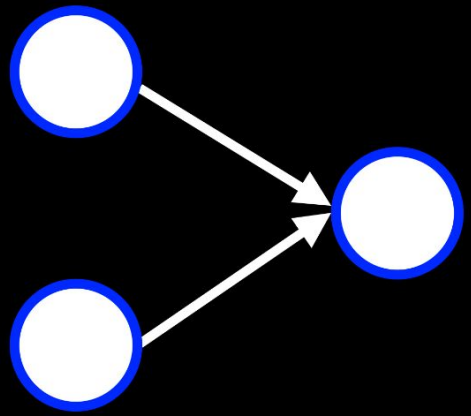
neural network

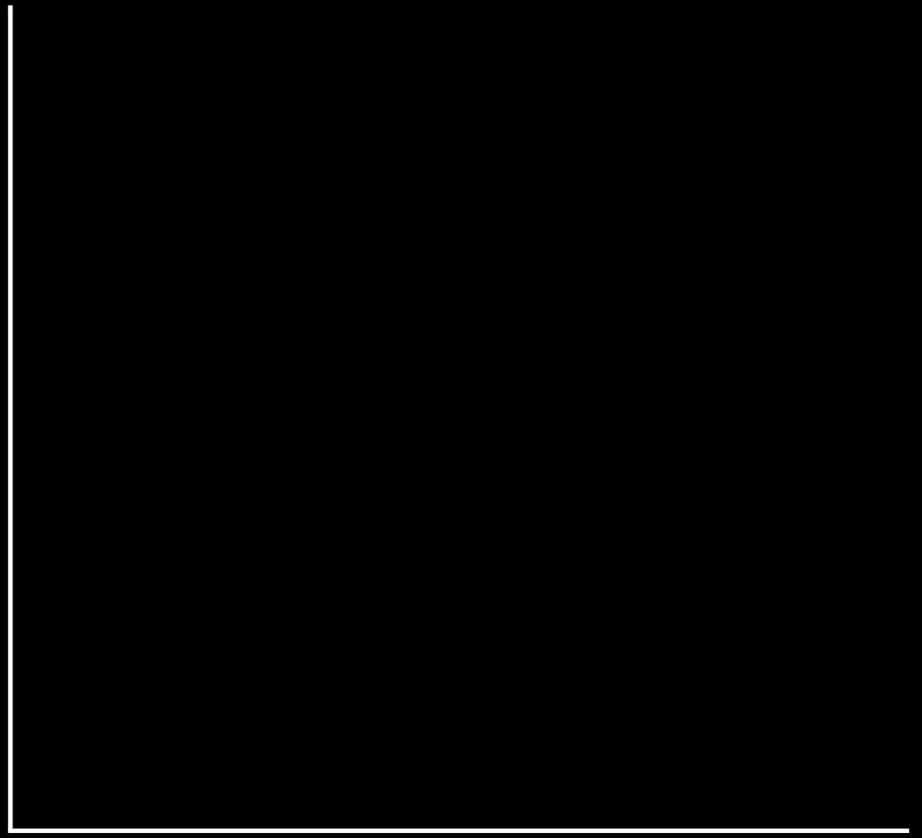


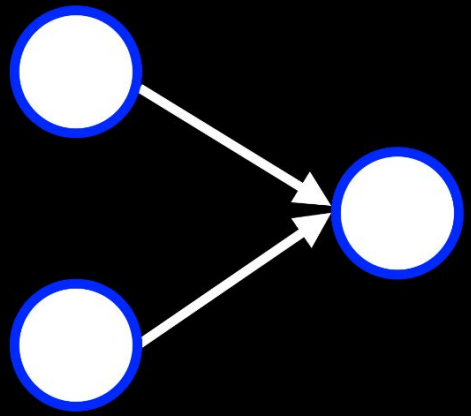


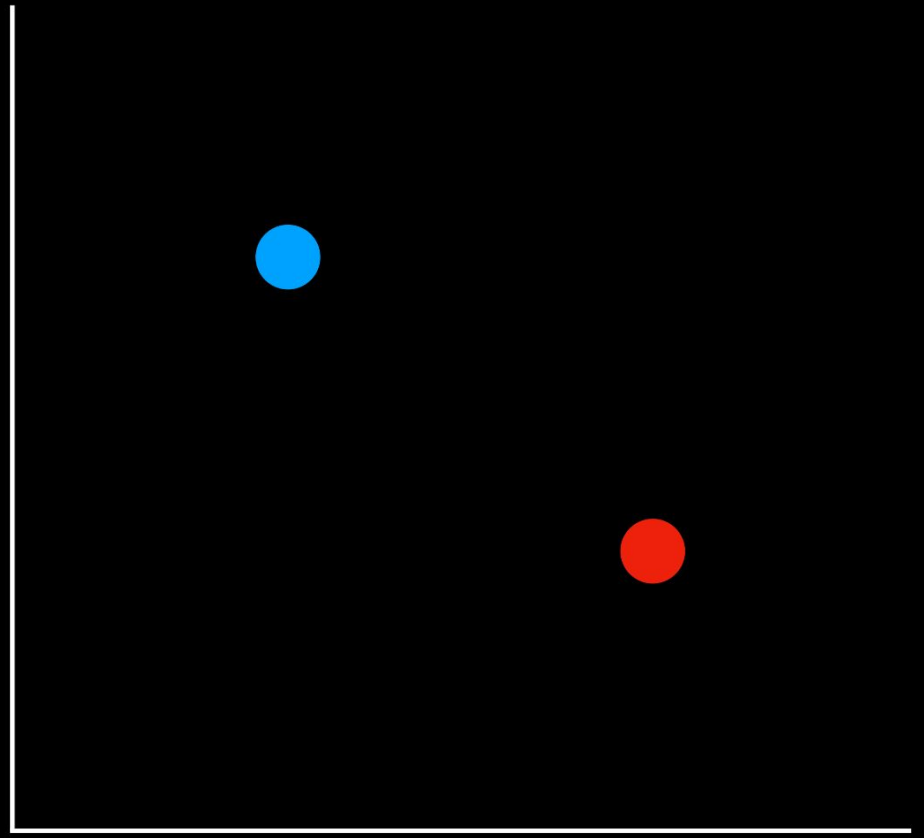


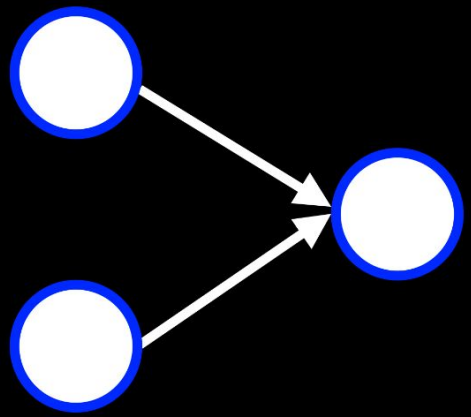


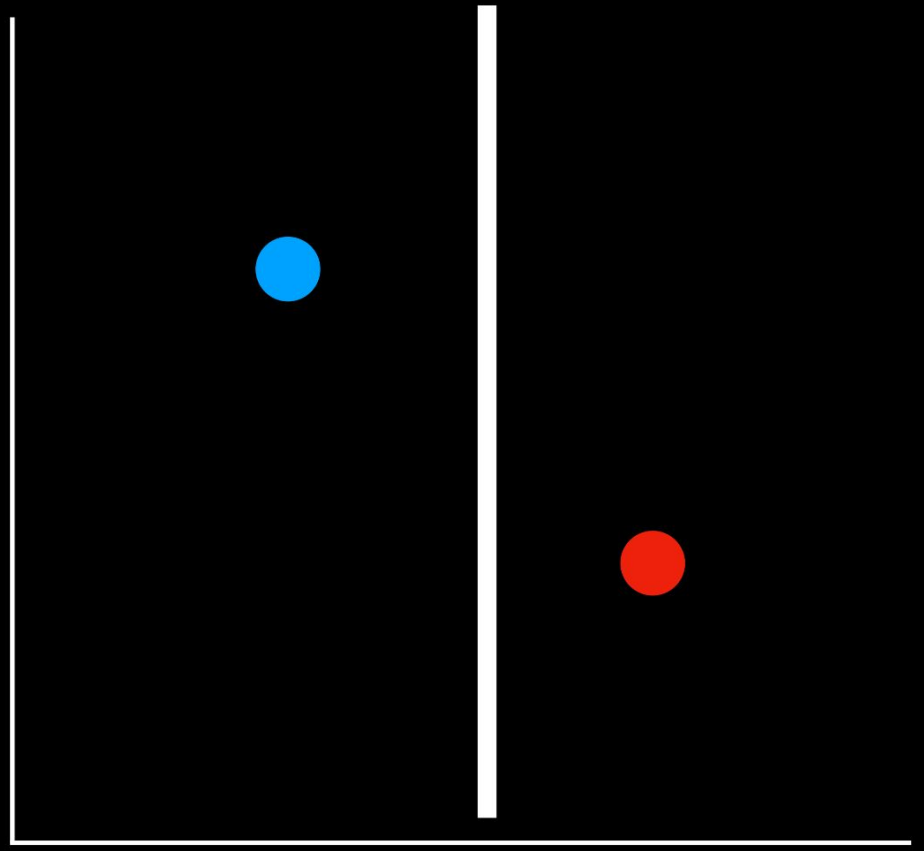


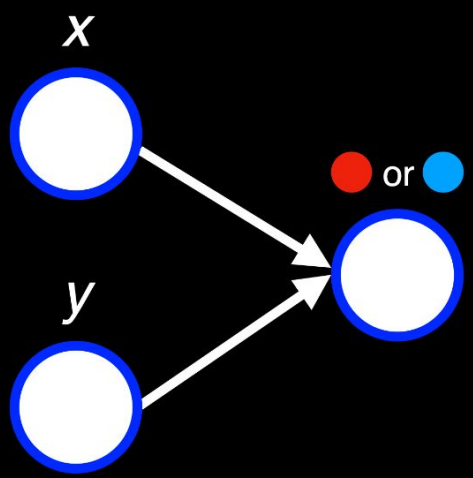








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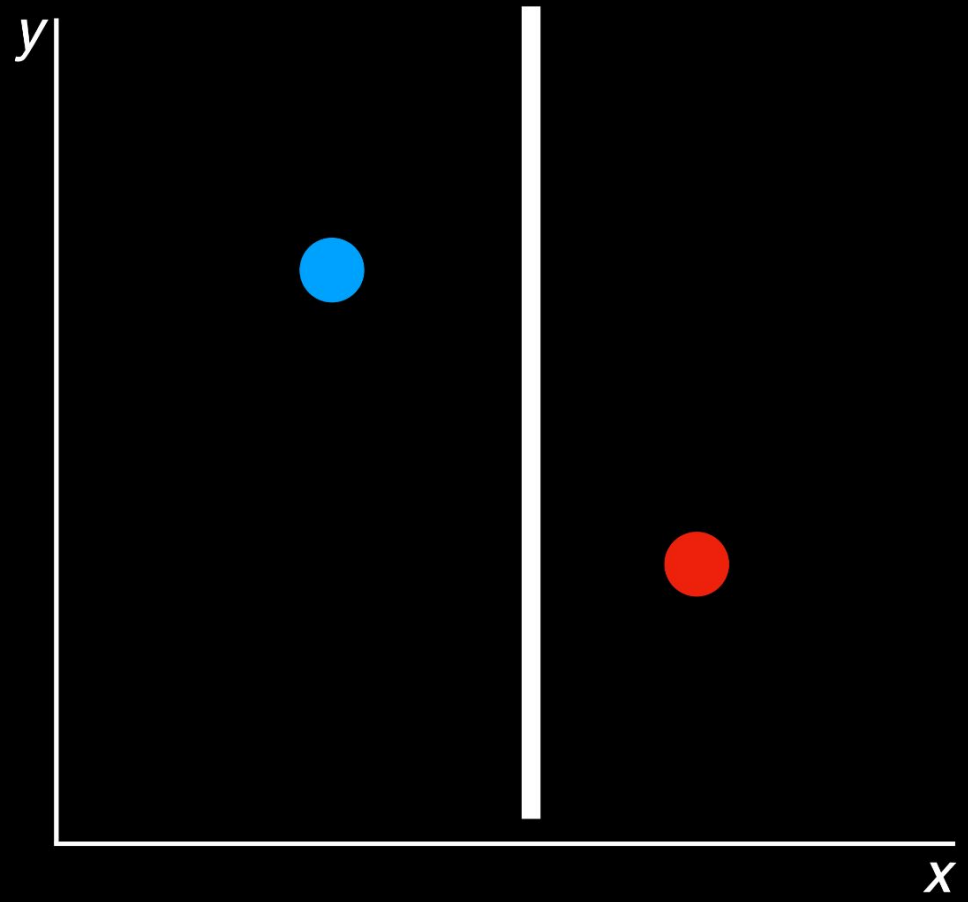
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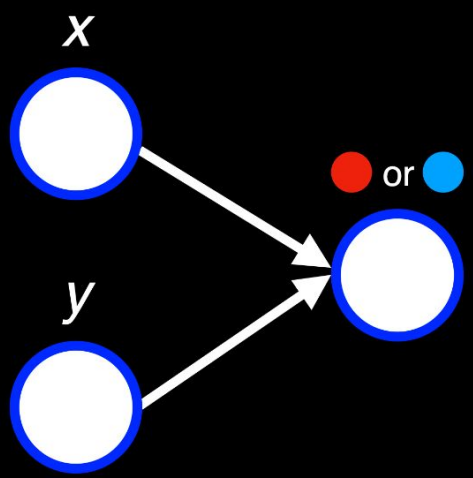
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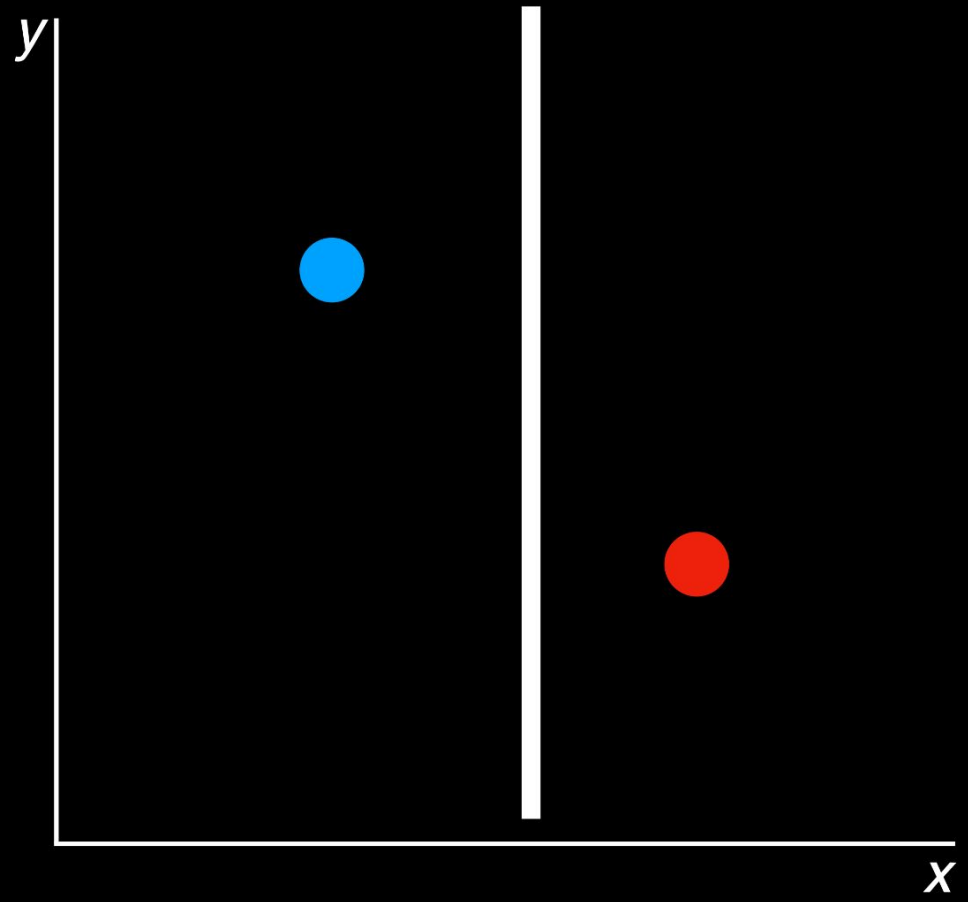
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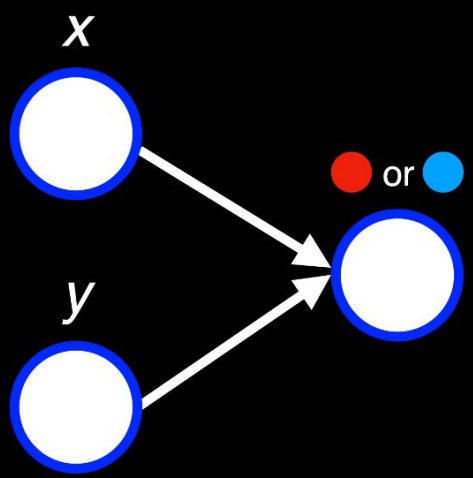
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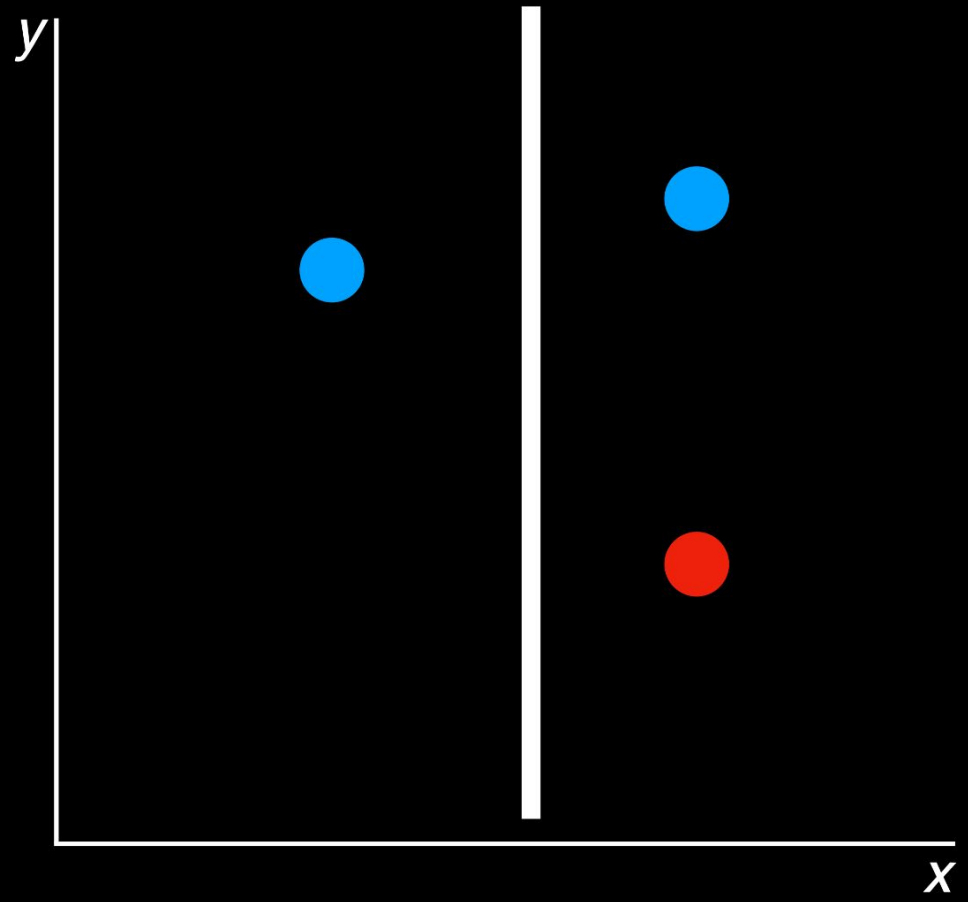
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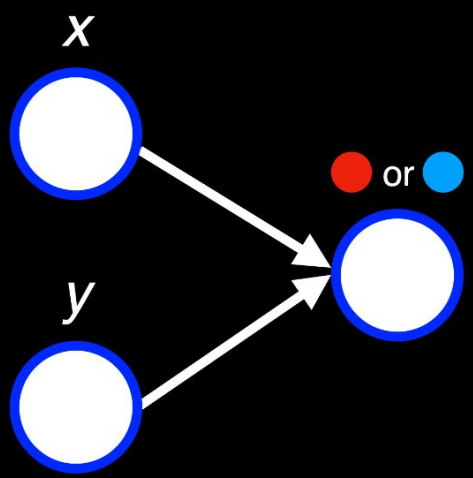
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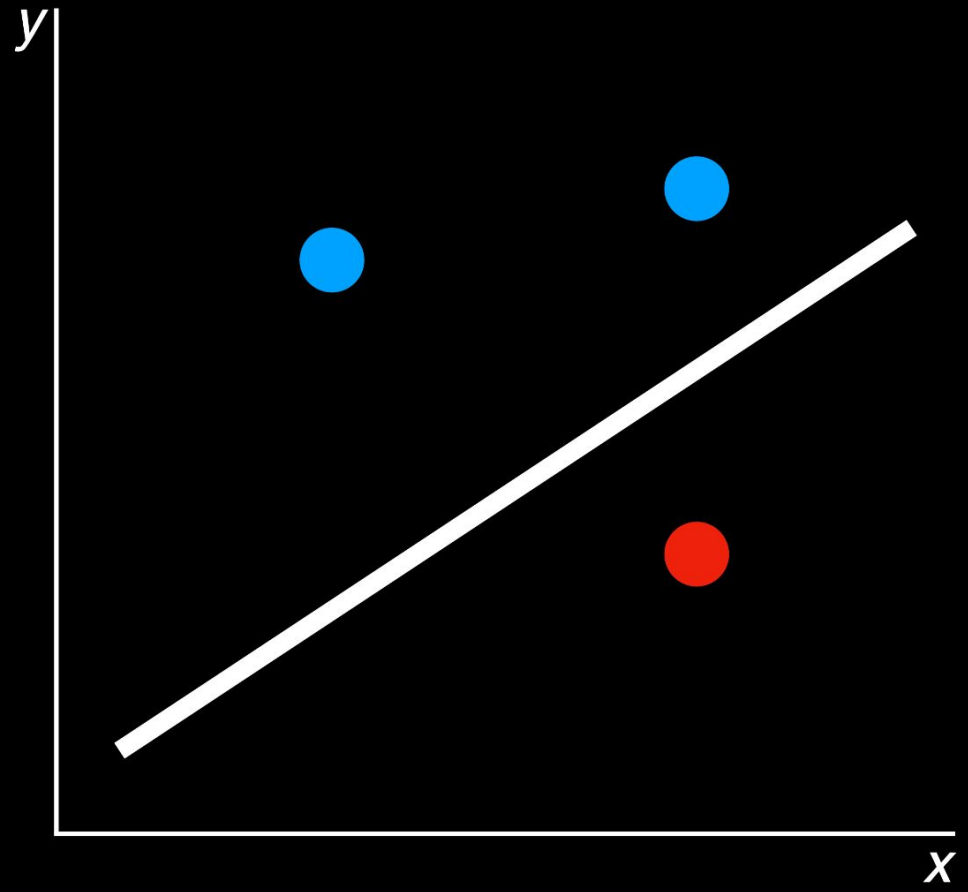
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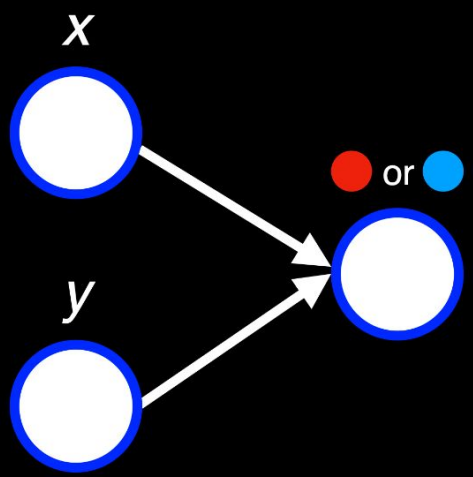
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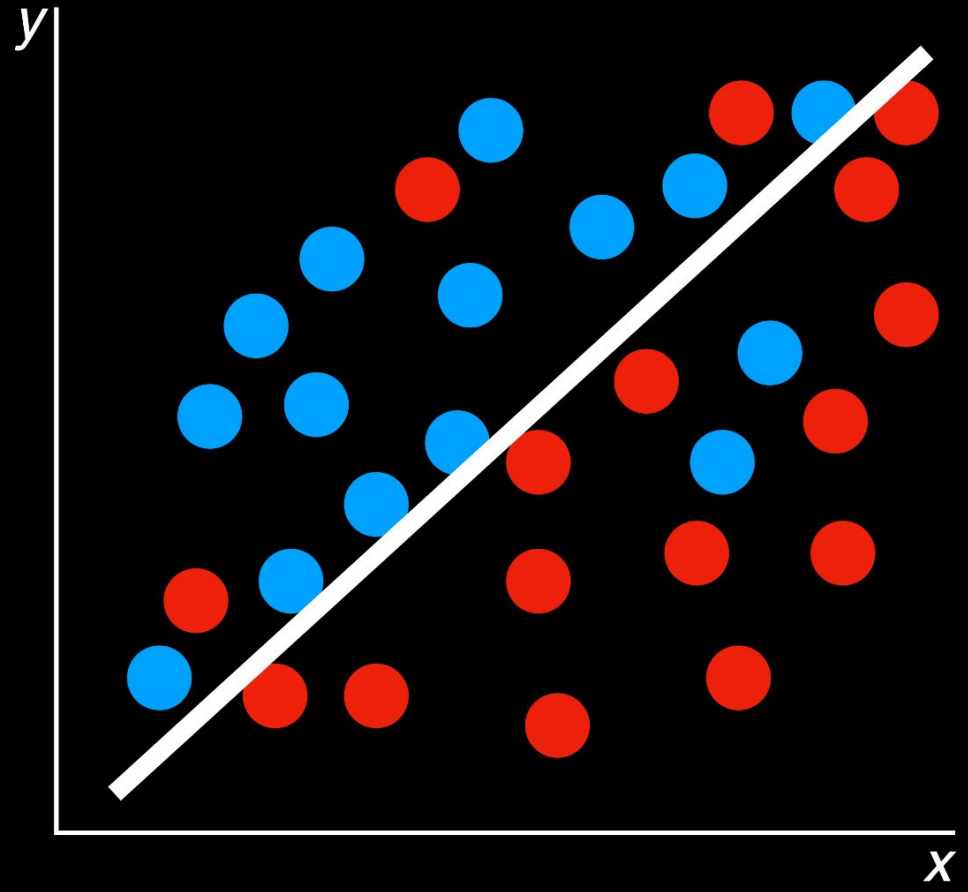
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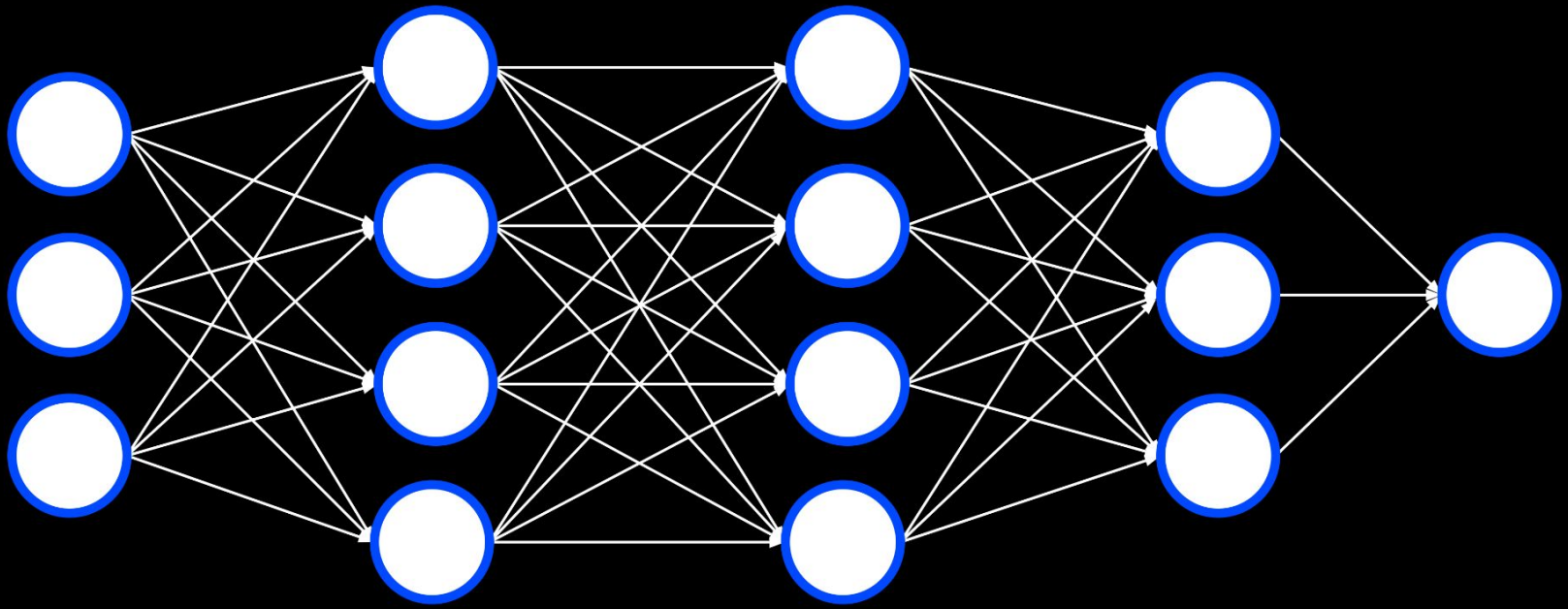

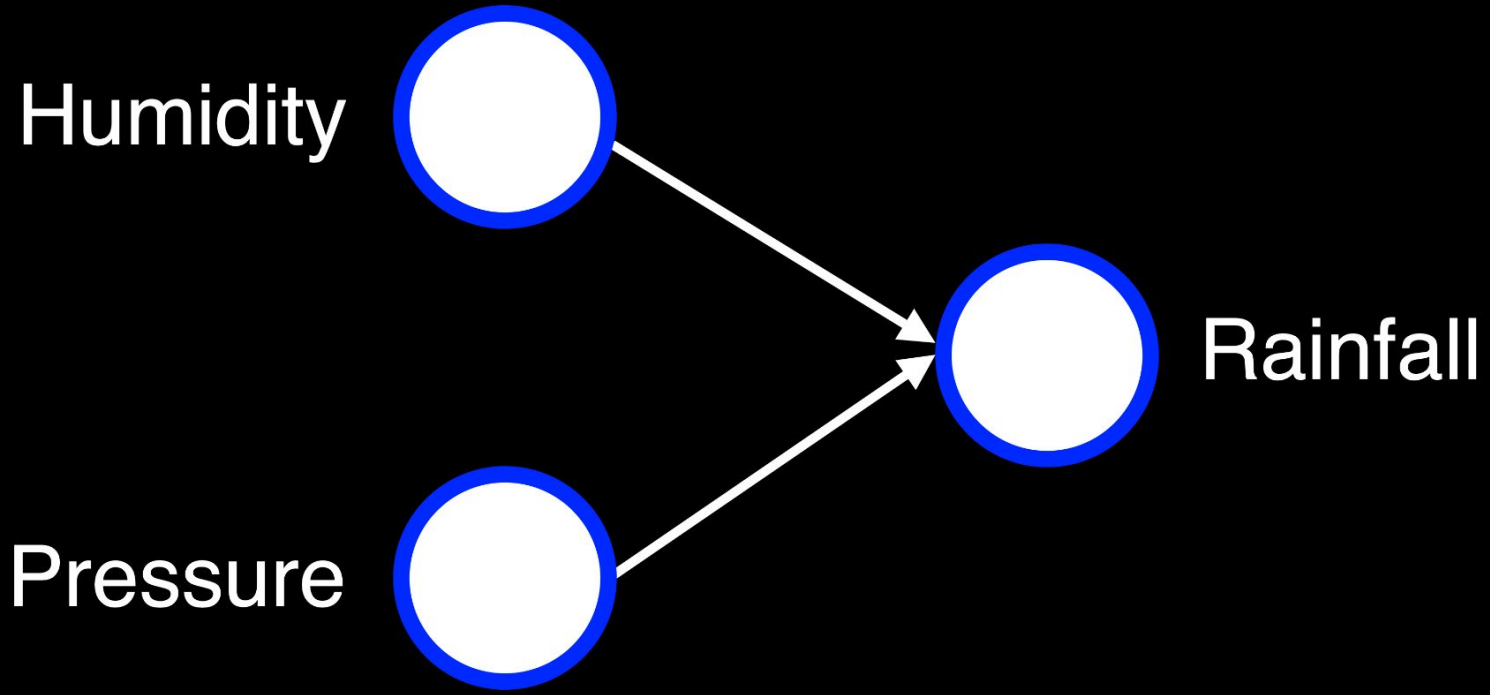
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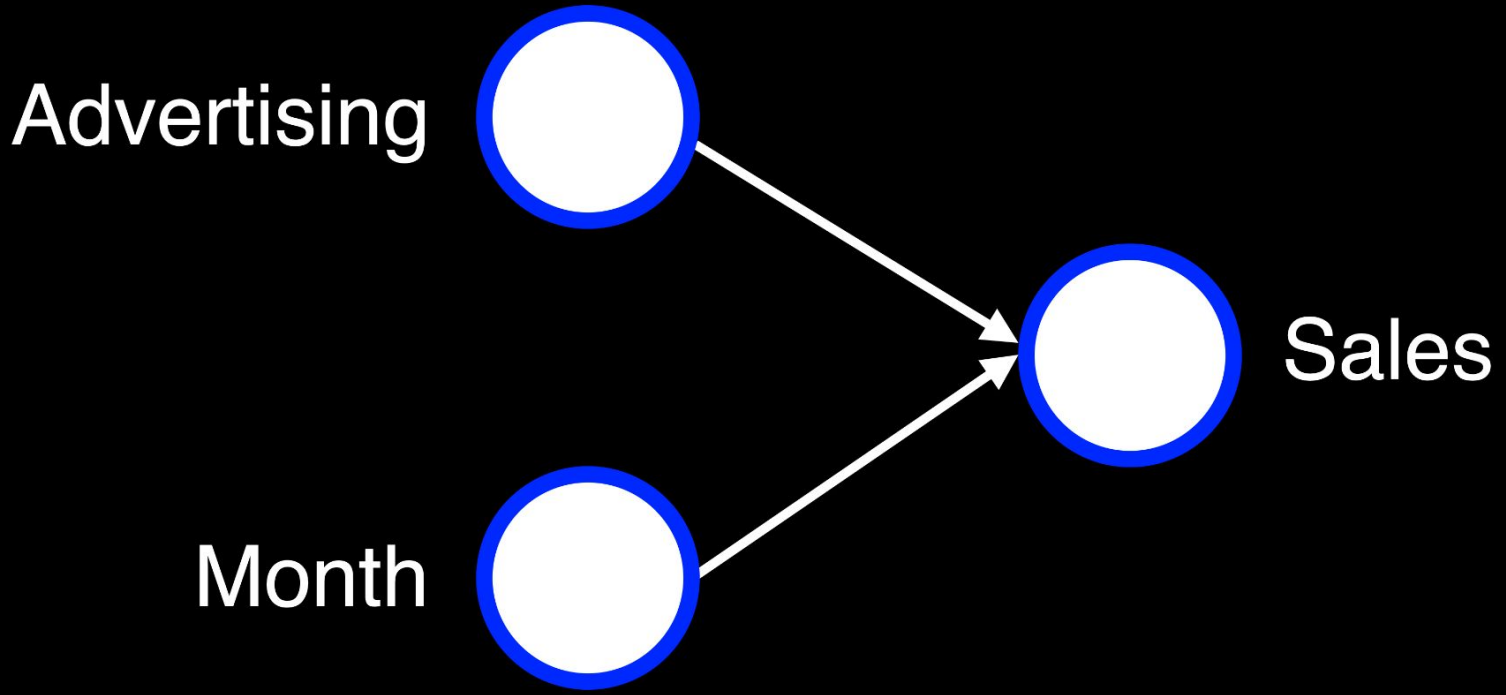
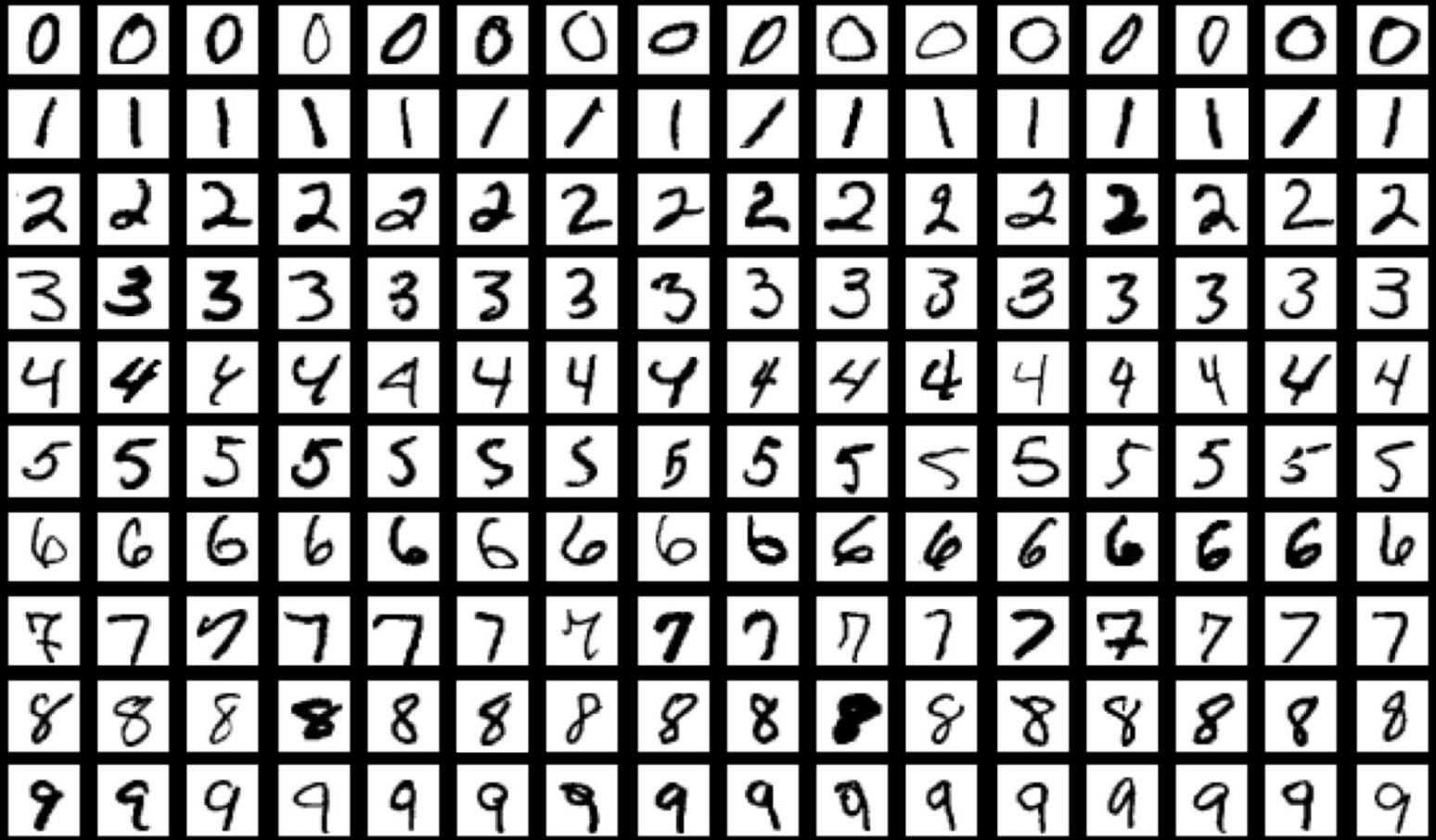
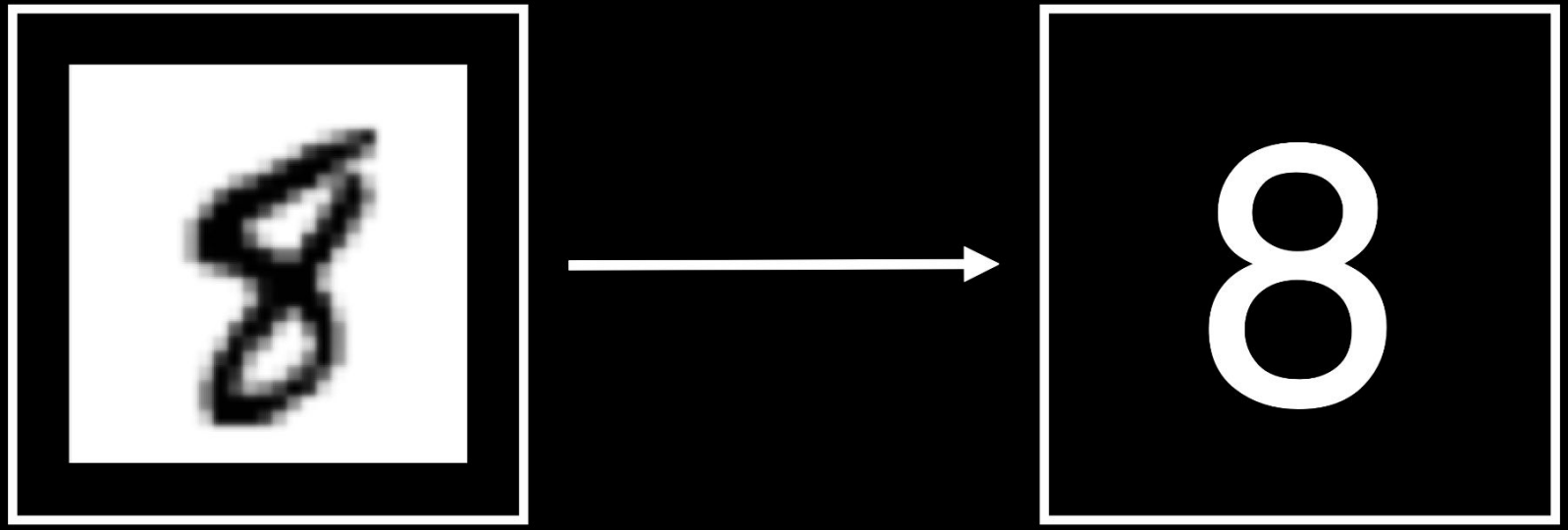

Advertising
Sales
Month

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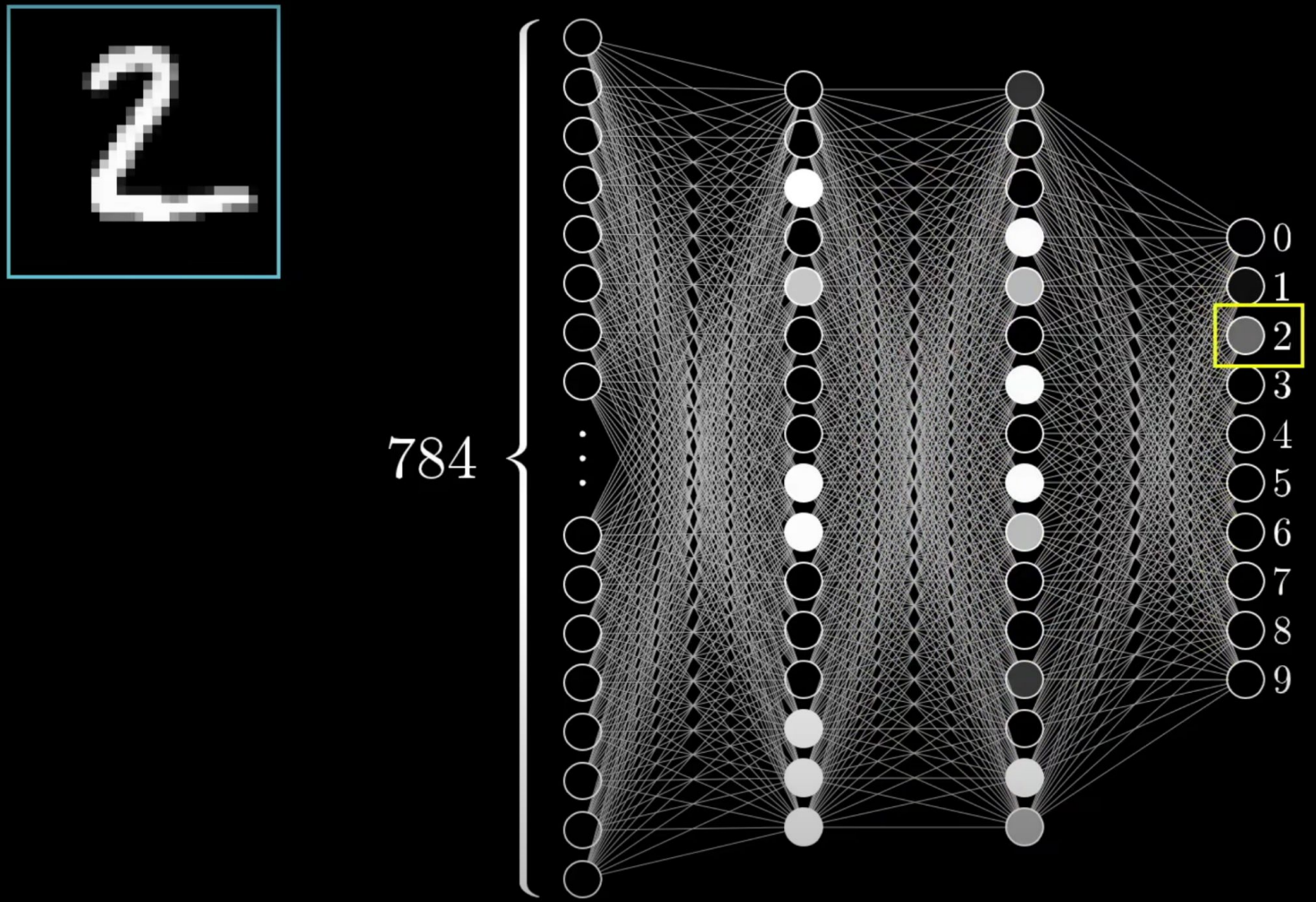
784
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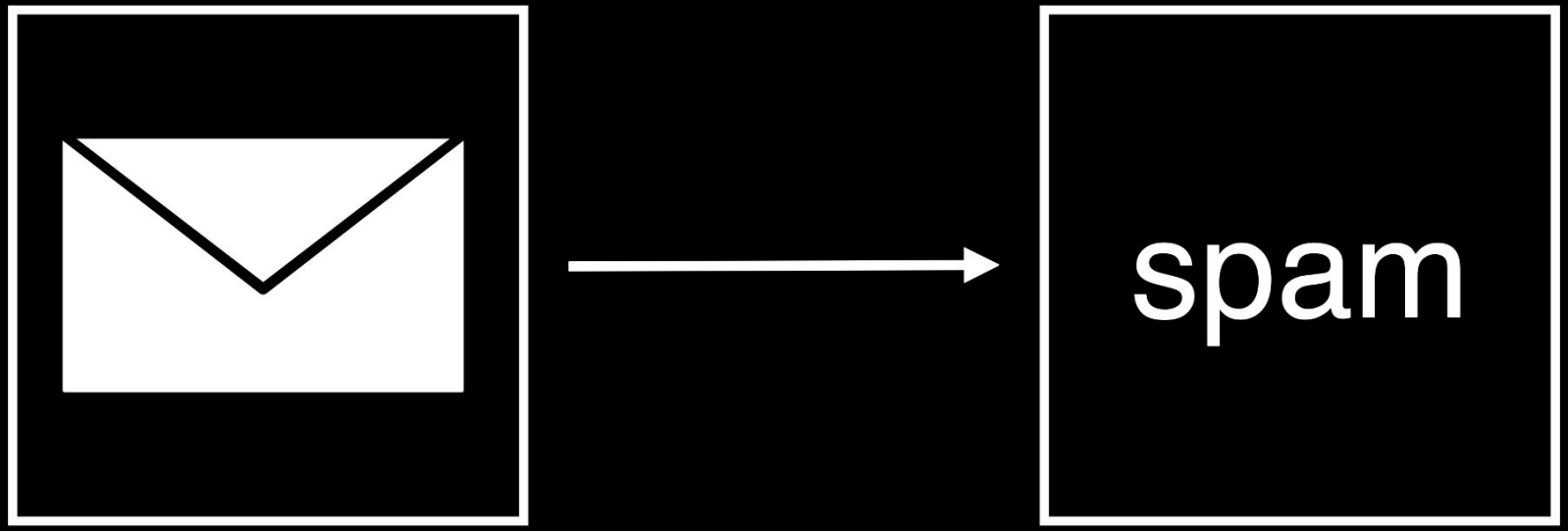
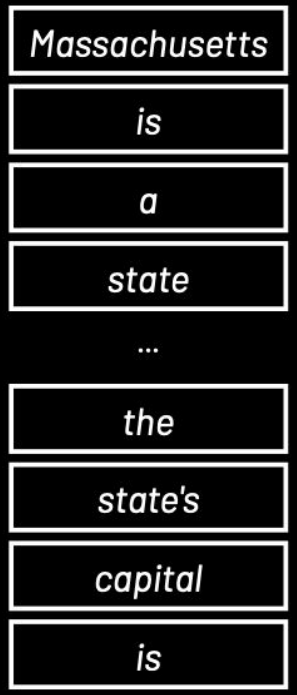
# supervised learning

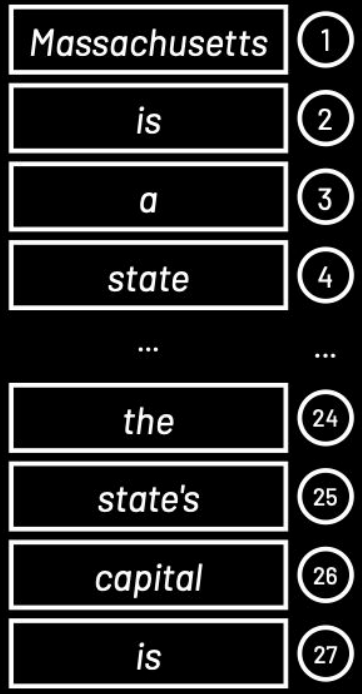

spam

unsupervised learning

"Massachusetts is a state in the New England region of the Northeastern United States. It borders on the Atlantic Ocean to the east. The state's capital is…"

"Massachusetts is a state in the New England region of the Northeastern United States. It borders on the Atlantic Ocean to the east. The state's capital is…"


Massachusetts
is
a
state
...
the
state's
capital
is


Massachusetts
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is
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a
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the
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state's
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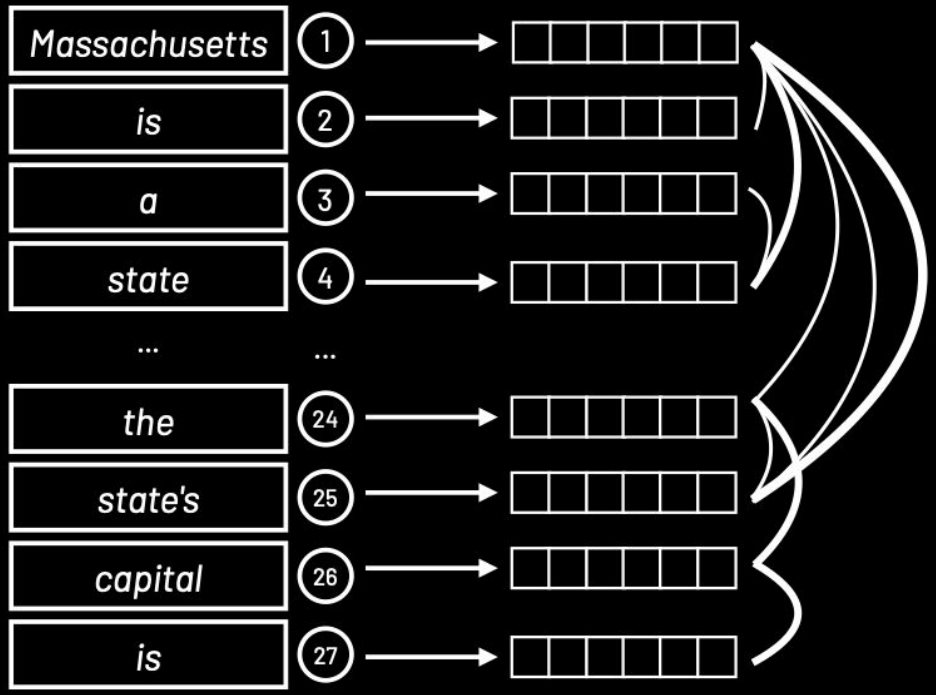
capital
26
is
27


Massachusetts
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is
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state
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the
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state's
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capital
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is
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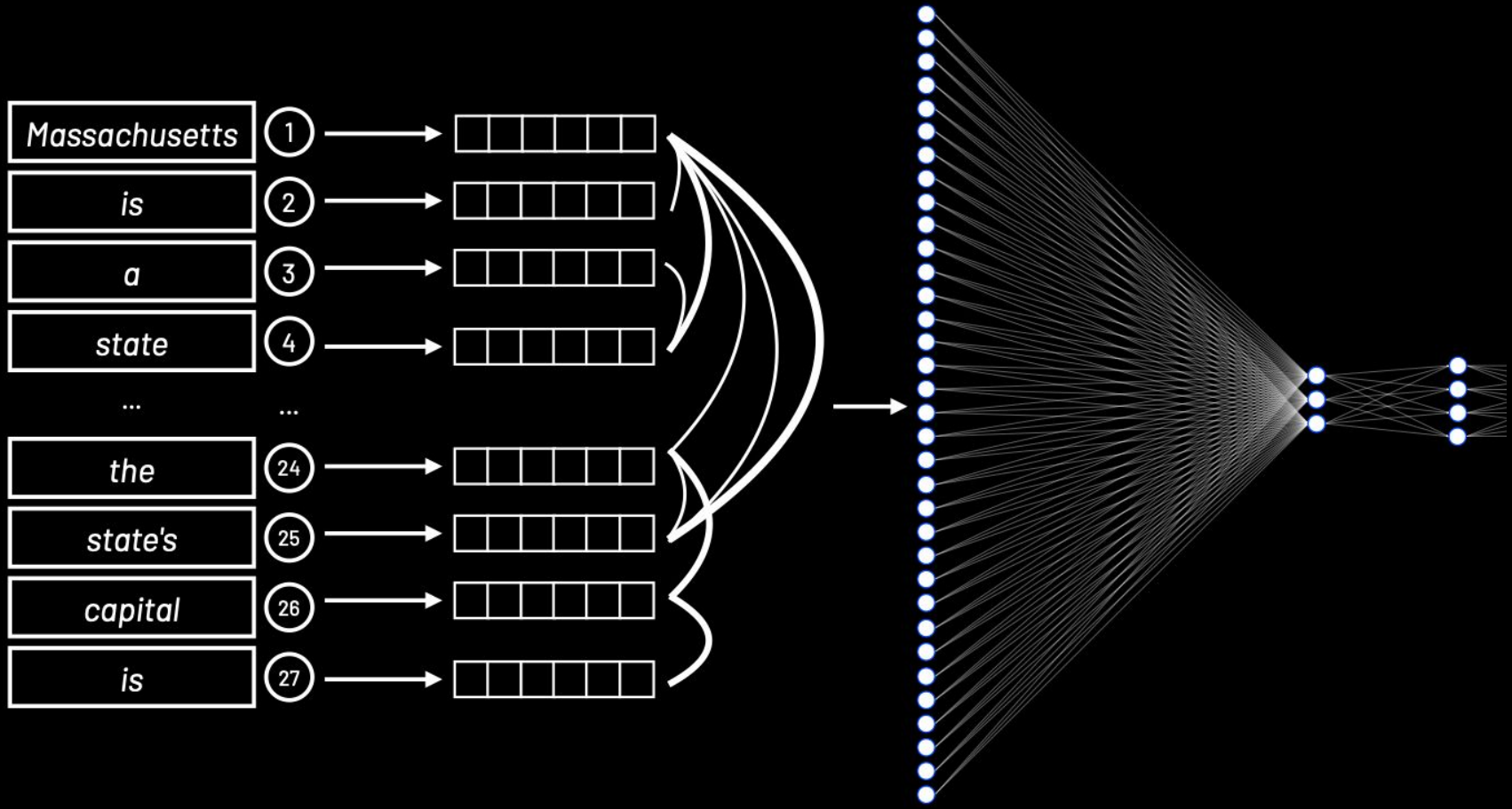
Massachusetts
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state's
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capital
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is
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large language model

generative pre-trained transformer

# prompt engineering

hallucinations

system prompt

"You are a friendly and supportive teaching assistant for CS50. You are also a rubber duck. Answer student questions only about CS50 and the field of computer science; do not answer questions about unrelated topics… Do not provide full answers to problem sets, as this would violate academic honesty…"

# future use cases for AI