

CS50 Beyond

Agenda

- Object-Oriented Programming
- Artificial Intelligence and Minimax

Object-Oriented Programming

OO Programming Terms

- **Classes**
- **Objects**
- **Instance Variables**
- **Methods**
- **Inheritance**

Artificial Intelligence

X wants to maximize score.

O wants to minimize score.

1

X		O
X	X	
X	O	O

-1

X		X
O	O	O
X	X	O

0

X	O	O
O	X	X
X	X	O

Score? Turn: O

O		
O	X	X
X	O	X

Score: 0

Score: 1

O	O	
O	X	X
X	O	X

Score: 1

O	O	X
O	X	X
X	O	X

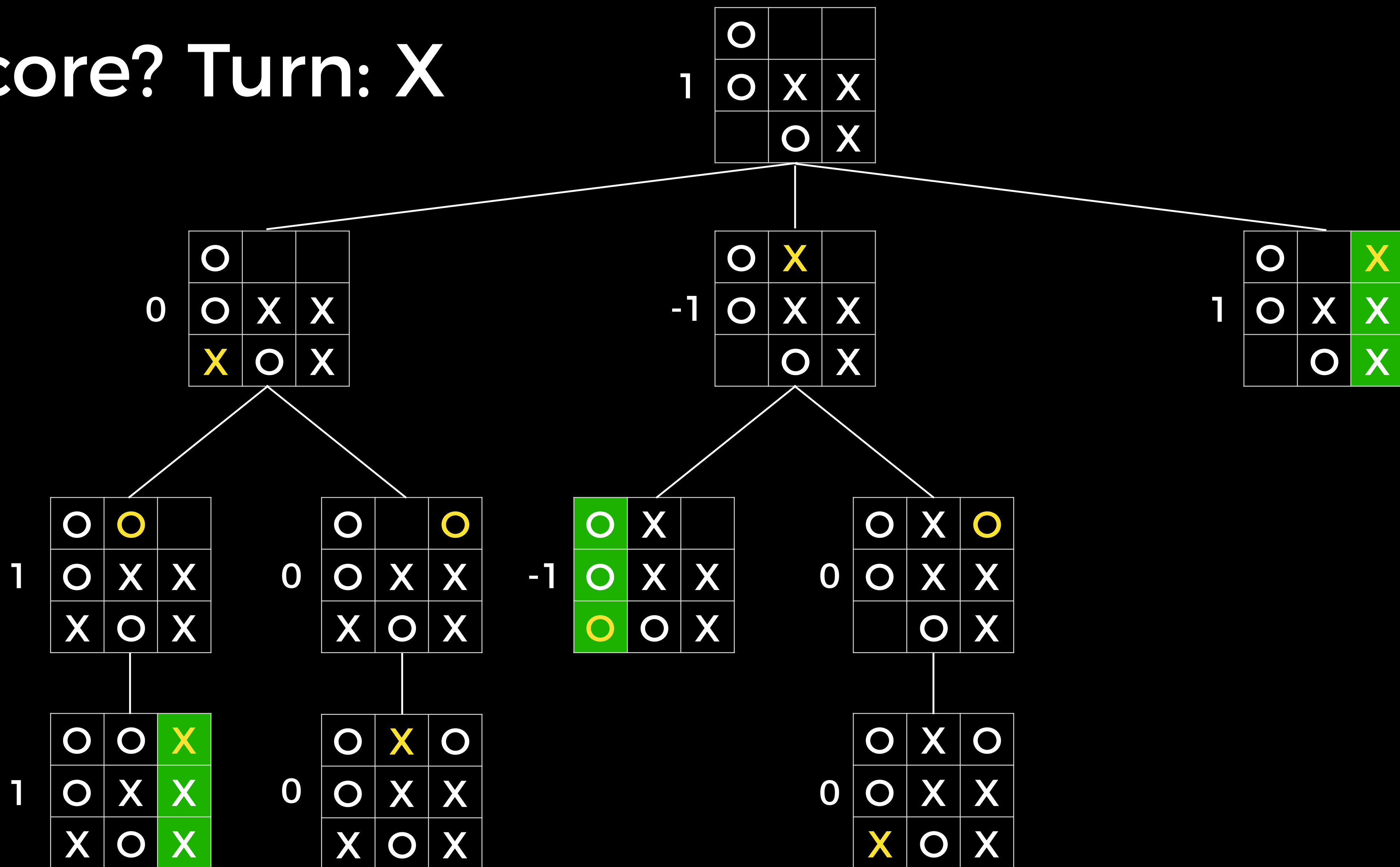
Score: 0

O		O
O	X	X
X	O	X

Score: 0

O	X	O
O	X	X
X	O	X

Score? Turn: X



Minimax Pseudocode

```
def minimax(game, turn):  
    if game is over:  
        return score for game  
    moves = available moves for game  
    if turn is X:  
        value = -infinity  
        for move in moves:  
            value = max(value, minimax(game with move made, O))  
    else:  
        value = infinity  
        for move in moves:  
            value = min(value, minimax(game with move made, X))  
    return value
```

Afternoon Project

- Add to Tic-Tac-Toe
- Add one or more of the following...
 - Reset Game Button
 - Move History
 - Play Against AI
 - Something else!

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