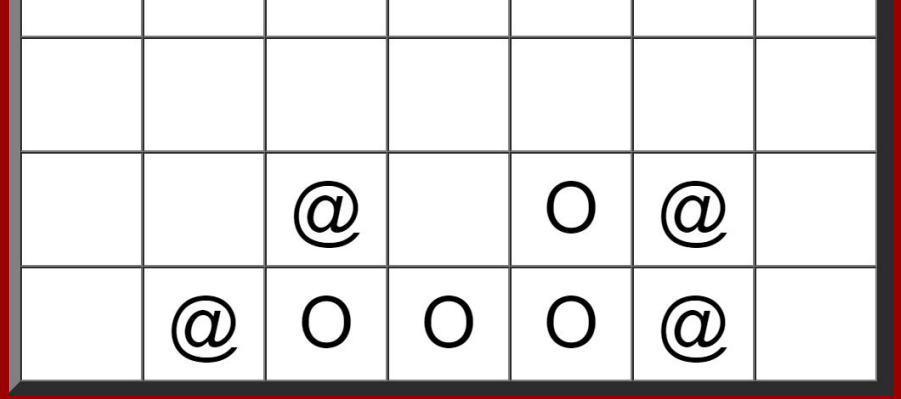


Connect Four

Connor Settle, Ricky Grannis-Vu, and Danielle Tang

GENERAL GAME PLAYING

Design AI to play arbitrary games successfully based on rules given at runtime

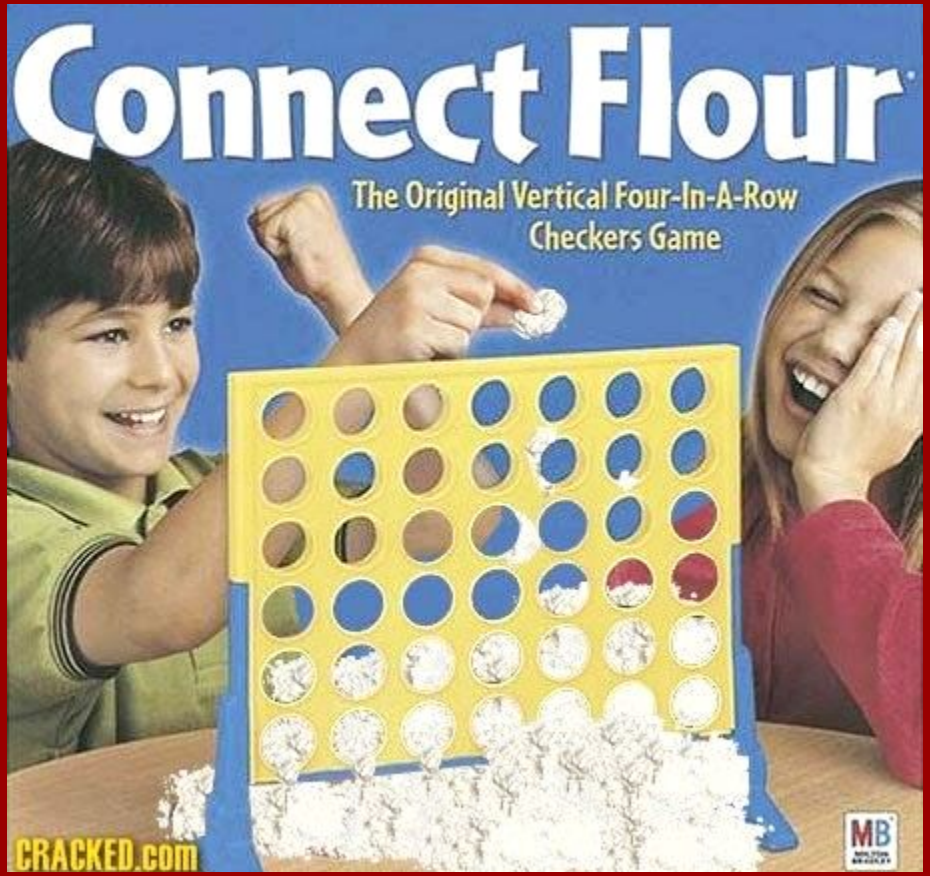
```
legal(P,mark(X,Y,M,N)) :- true(turn(P),d1) & true(cell(X,Y,M,N,blank),d1) & valid_board(X,Y)
valid_board(X,Y) :- true(board(X,Y),d1) | true(board(any,any),d1)
filled_board(X,Y) :- ~true(cell(X,Y,1,1,blank),d1) & ~true(cell(X,Y,1,2,blank),d1) & ~true(cell(X,Y,1,3,blank),d1) & ~true(cell(X,Y,2,1,blank),d1) &
~true(cell(X,Y,2,2,blank),d1) & ~true(cell(X,Y,2,3,blank),d1) & ~true(cell(X,Y,3,1,blank),d1) & ~true(cell(X,Y,3,2,blank),d1) & ~true(cell(X,Y,3,3,blank),d1)

click(mark(X,Y,M,N)) & true(turn(P),d1) ==> true(cell(X,Y,M,N,P),d1) & ~true(cell(X,Y,M,N,blank),d1)
click(mark(X,Y,M,N)) & true(turn(P),d1) & true(board(any,any),d1) ==> ~true(board(any,any),d1) & true(board(M,N),d1)
click(mark(X,Y,M,N)) & true(turn(x),d1) ==> ~true(turn(x),d1) & true(turn(o),d1)
cli                                                                                  1)

cli                                                                  (X,Y,M,N) ==> ~true(board(X,Y),d1) & ~true(board(any,any),d1) & true(board(M,N),d1)
cli                                                                  ,any),d1)
dis


ran                                                                  ad(A,B,C,D)) & legal(o,mark(A,B,C,D))
```

GAME DESCRIPTION LANGUAGE

Formal language using symbolic logic to encode the state and rules of a game

WITH GDL,
WE CAN USE LOGIC PROGRAMMING TO IMPLEMENT GAME PLAYERS

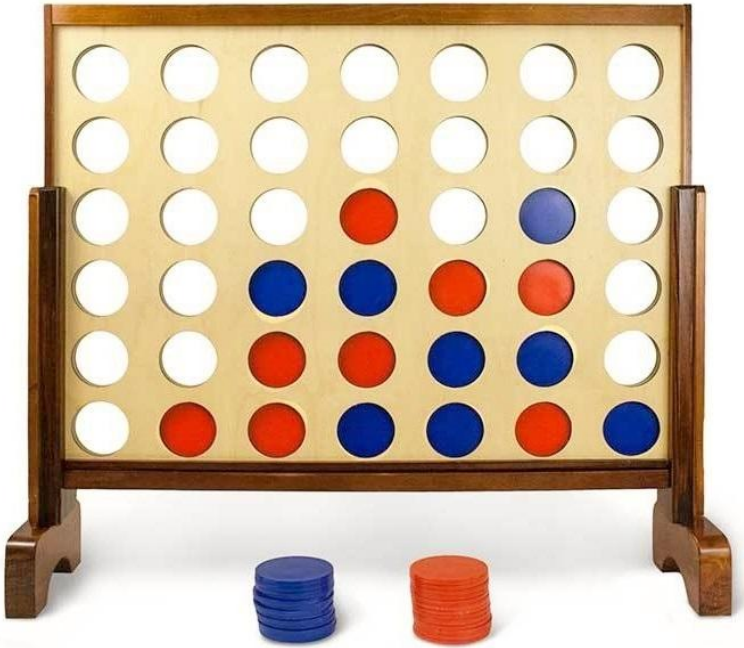
OUR TASK


Connect Flour
The Original Vertical Four-In-A-Row
Checkers Game
CRACKED.com
MB

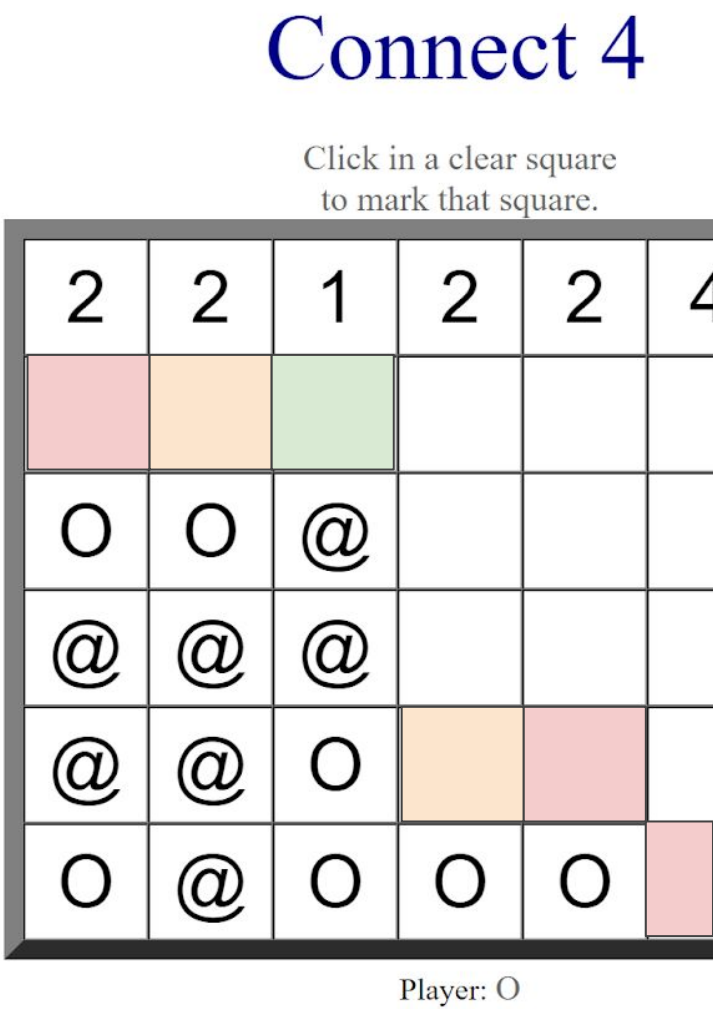
no, not that one

CONNECT FOUR

use dynamic logic programming to build a Connect Four worksheet

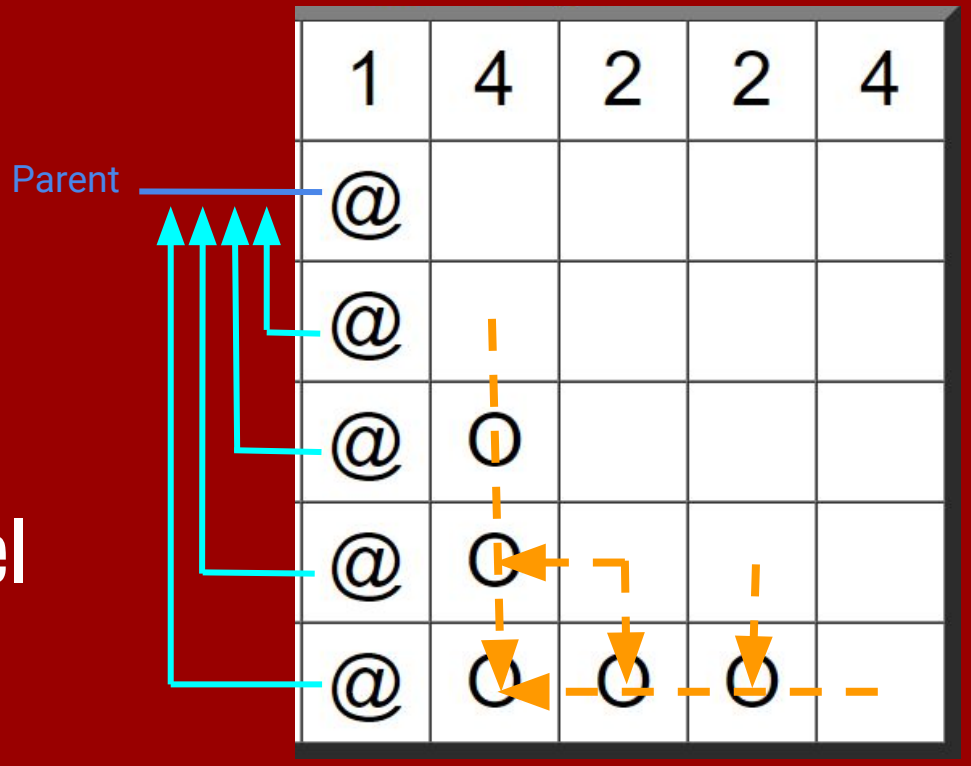


- automated greedy AI opponent
- your next move, scored
- environment helps you play



OUR APPROACH

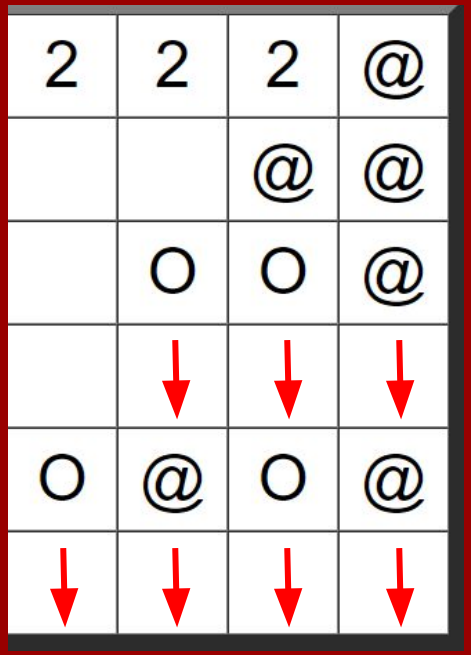
- recursive inheritance model
- “raycast” properties
- calculate next goal values



RESULT

- fast, responsive game
- behaves like actual connect-4
- AI player tries to win as fast as possible, but with no regard to human player

CHALLENGES



- calculating next game state
- diagonal raycasting
- optimization
- locking behaviors during real-time simulation

HERE'S HOW TO PLAY

Worksheet Database Rulebase Operation Widget Shape Help

- Operation
- Query
- Trace
- Transform
- Transition
- Check Errors

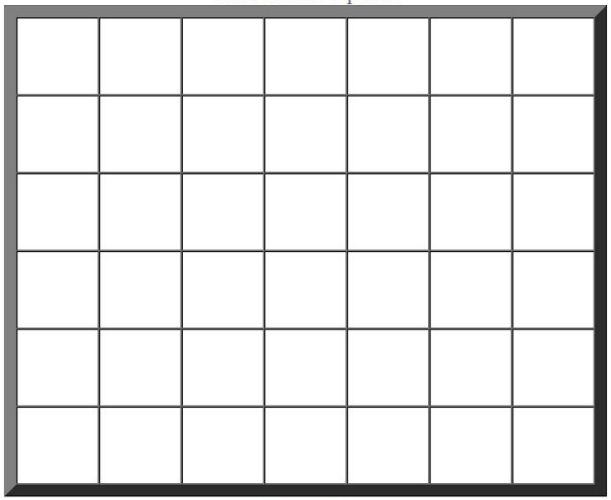
- Clone Widget(s)
- Edit Widget
- Group Widgets
- Ungroup Widget(s)
- Remove Widget(s)
- Toggle Group Outlines

- Undo
- Redo

Clear Board

Connect 4

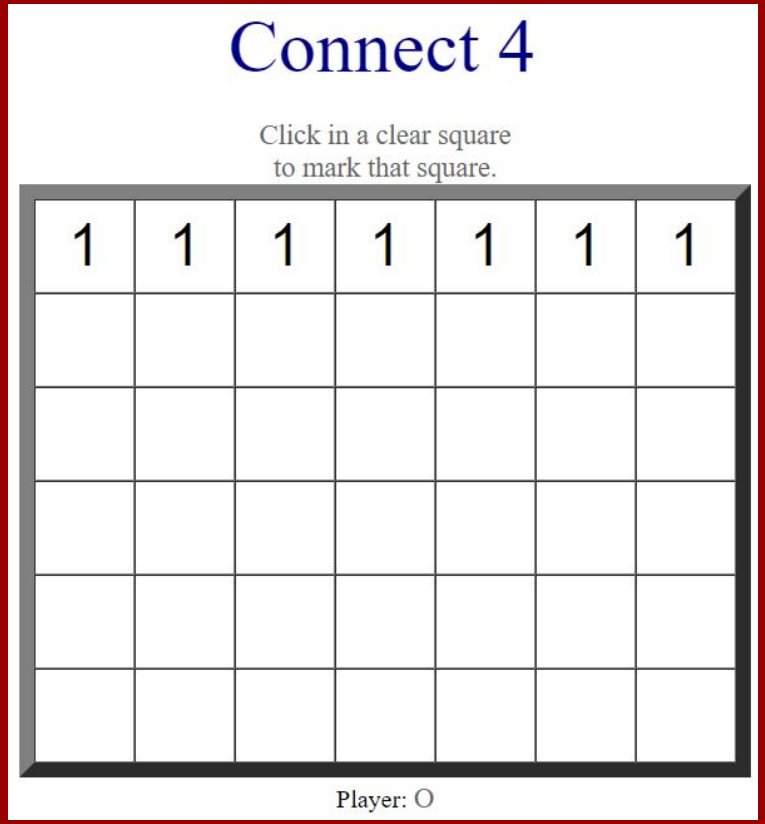
Click in a clear square
to mark that square.



Player: O

operation -> transition

enter the following values

CLICK RUN

ENTER THE WORLD OF CONNECT-4!