

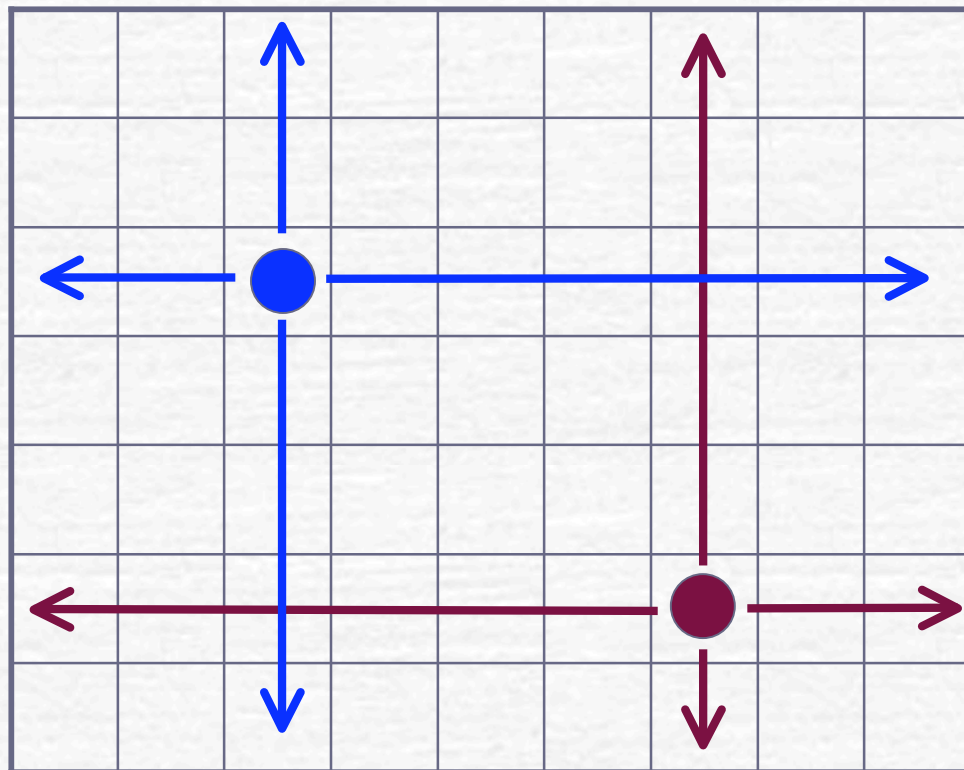


**Games Special-Session**  
**SIGCSE-03**

**David Ginat**  
**Tel-Aviv University**



# Laser War



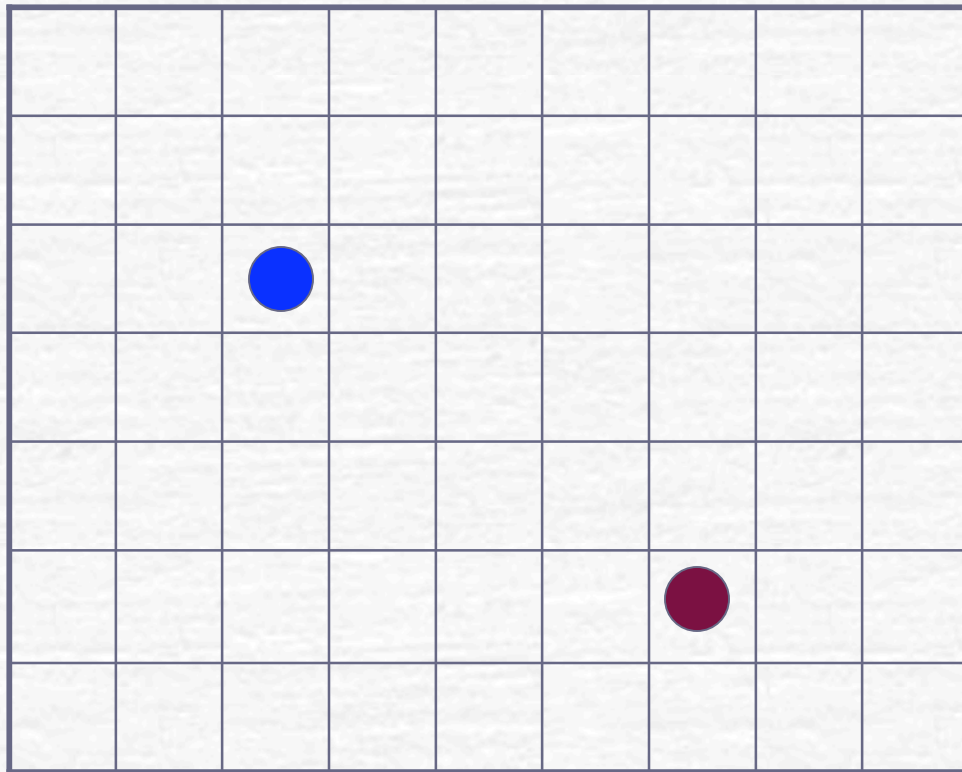
**Matrix  $M \times N$ , Robots – Red, Blue**

**Each move - horizontal / vertical**

**Fire-lines - horizontal & vertical**

**Crossing of fire-line – game ends**

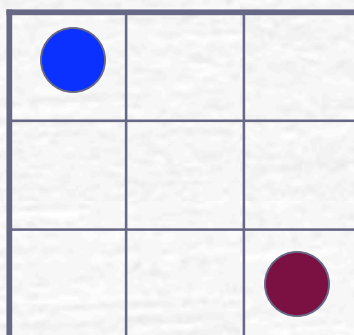
# Laser War



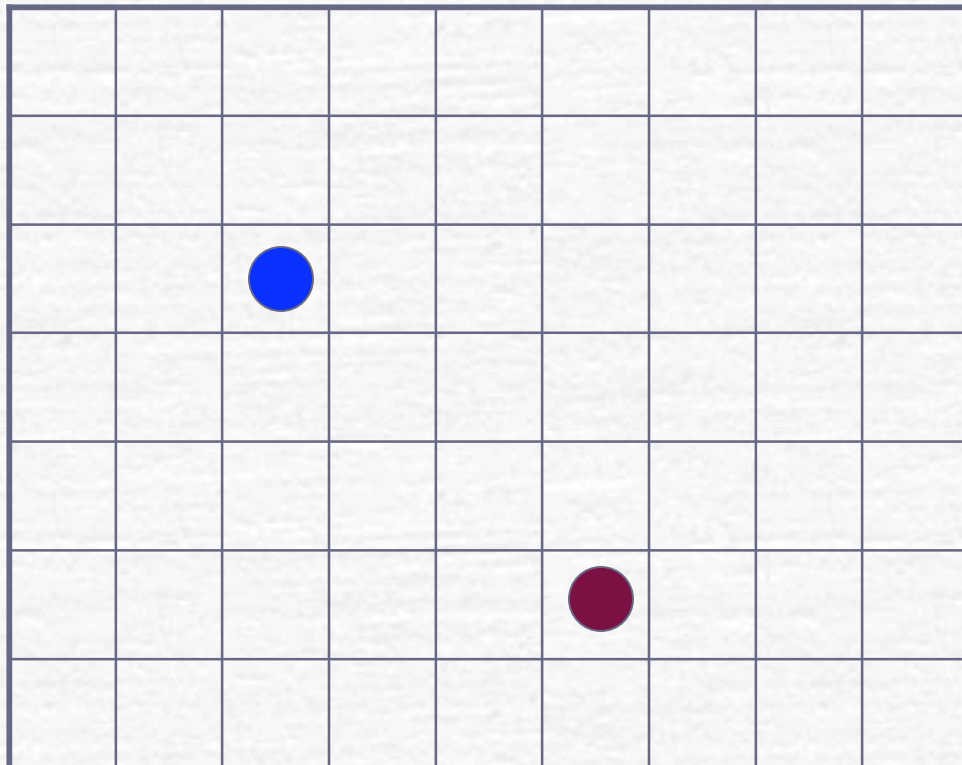
- 1. Backtracking** through all the possible game scenarios
- 2. Dynamic Programming** – up to  $(M-1) \times (N-1)$  different-size rectangles between the robots

# Laser War

**Look for a playing strategy,  
by simplification**



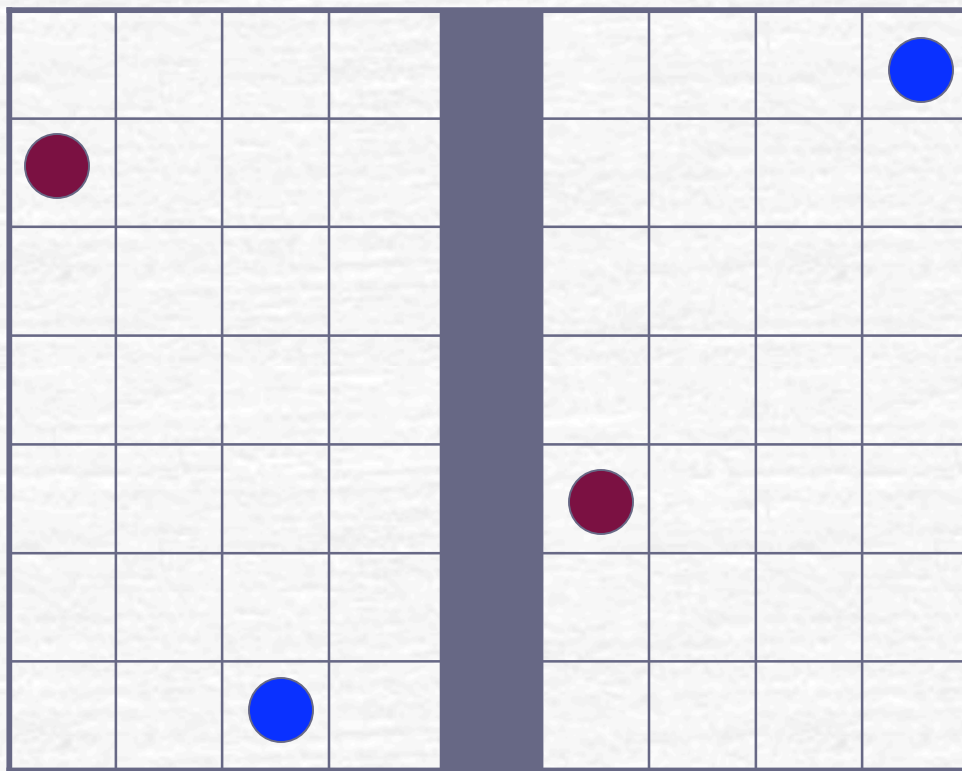
# Laser War



**Invariant property:**

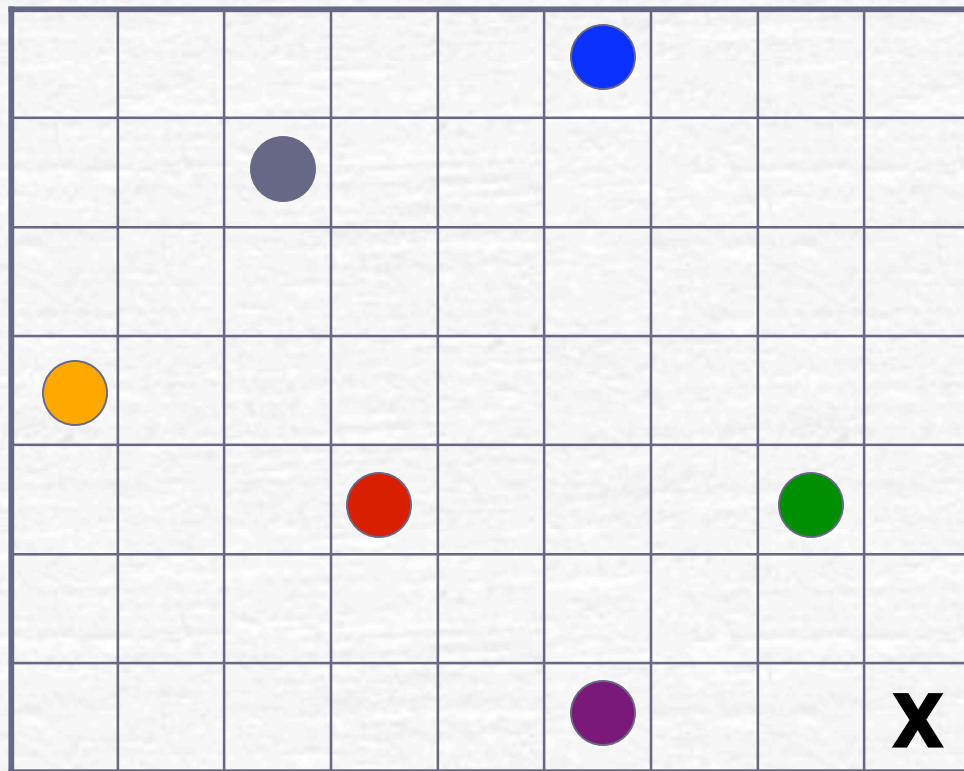
**Horiz-distance = Vert-distance**

# Laser War



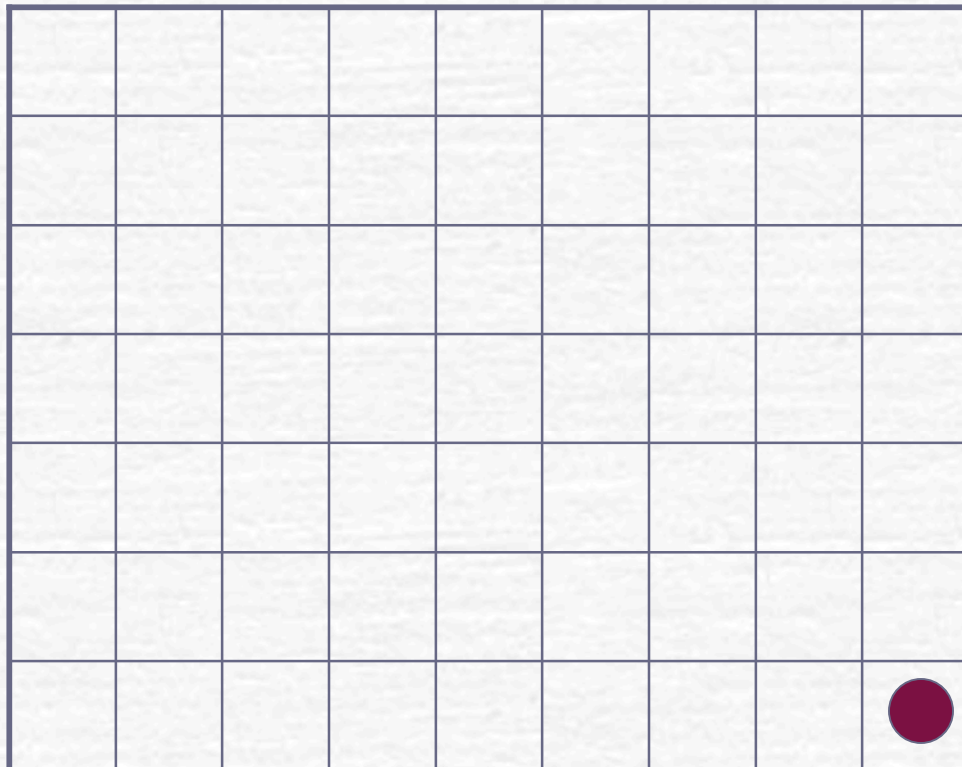
**Two rooms, concurrently**

# Wyt Rooks



**Each player chooses a rook and moves it any number of vertical xor horizontal spaces toward the X. Last to move wins (normal form).**

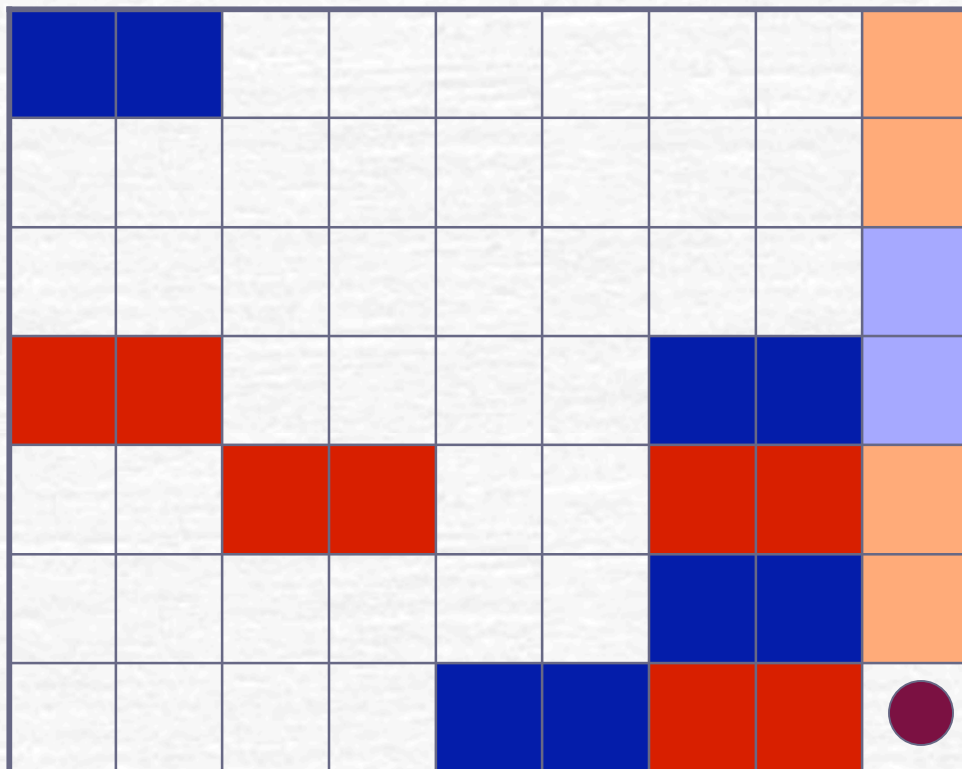
## Pawn on a Board



**Each player moves the pawn, horizontally or vertically, to an adjacent square, which was not-yet-visited. Last to move wins (normal form).**



# Pawn on a Board



**Invariant**

**+ Auxiliary coloring**

## Multiple by 2..9

Starting at  $N=1$ , two players **multiply**  $N$  **by** one of the integers **2,3,...,9**, in alternating turns.

Free choice of one of these integers in each turn.

The first to cross 1000 wins.

**Example:**

**1** □ **5** □ **45** □ **90** □ **270** □

# Multiple by 2..9

Backward reasoning:

**1000+**

**112 – 999**

**56 – 111**

**7 – 55**

**4 – 6**

**1**

# Application in Class

## Motivate, Illustrate, Exercise:

- **Invariance**
- **Design techniques, recursion**
- **Auxiliary elements**
- **Lookup table, pre-processing**
- **Mathematical patterns**
- **Problem solving heuristics**