Grids

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Announcements

- First participation question grades up (everyone got points for the second quiz)
- HW1 released Today, due Sept 17 11:55pm (grace period for 24 hours, if you need more time let me know ASAP).
- Today another participation question (PQ). Friday we will have a practice quiz.
- Hoping to have TA office hours ironed out this week.
- Next Thursday (Sept 16) I will host an in-person lab in ETLC E2-002 from 5pm to 7:50pm + upload helper video (soon*)

Last Classes

- Game AI is interested in simulating believable behavior with minimal resources.
- Game AI covers any decisions made in and around a game's development not made by a human.
- Basic intro to Unity.

Movement in Games

- If your game requires any representative space (2D/3D), entities must be able to move through that space.

- Problem: How to go from current location to some target location?

Isn’t this solved?

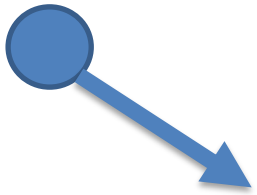
Resident Evil 2 Remake:
https://www.youtube.com/watch?v=NixiSQitPY8

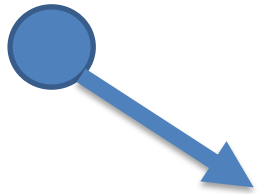
Monster Hunter World:
https://www.youtube.com/watch?v=tL0hGU_2S8Q

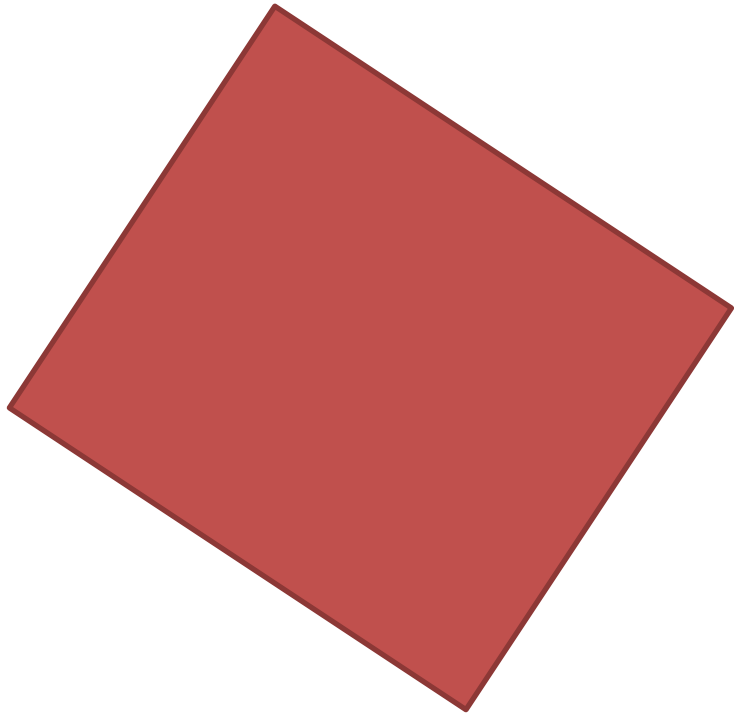
Far Cry 5: https://www.youtube.com/watch?v=bKX-3SGYlsc

Fallout 4: https://www.youtube.com/watch?v=LEYS22R1cl4

Why is this so difficult?





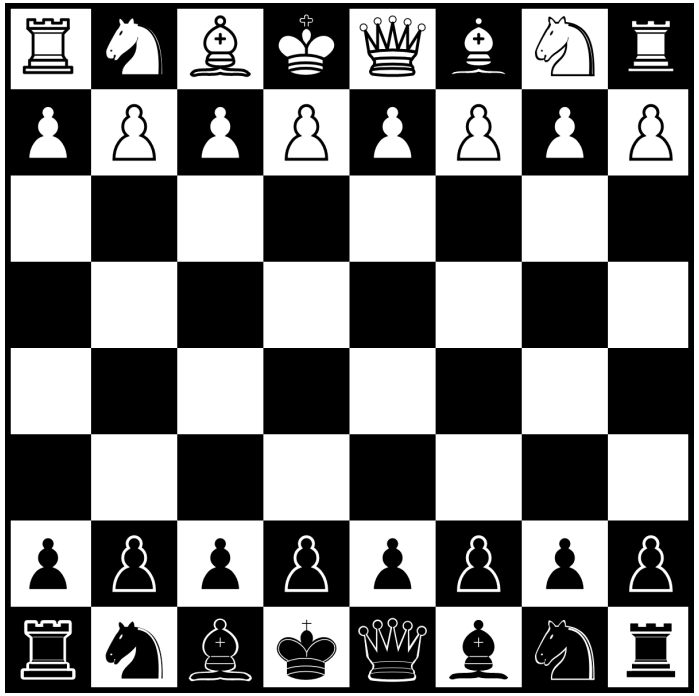


Problem: Representing Space

We need some way to represent the space to tell agents:

1. Where they can move freely
2. Where they cannot move freely
3. How to move between areas of (1)

Grids

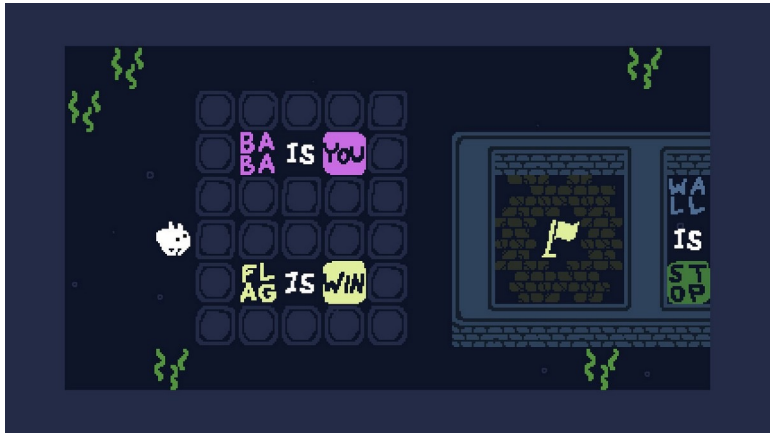


Newer Grids

Into the Breach

Fire Emblem: Three Houses

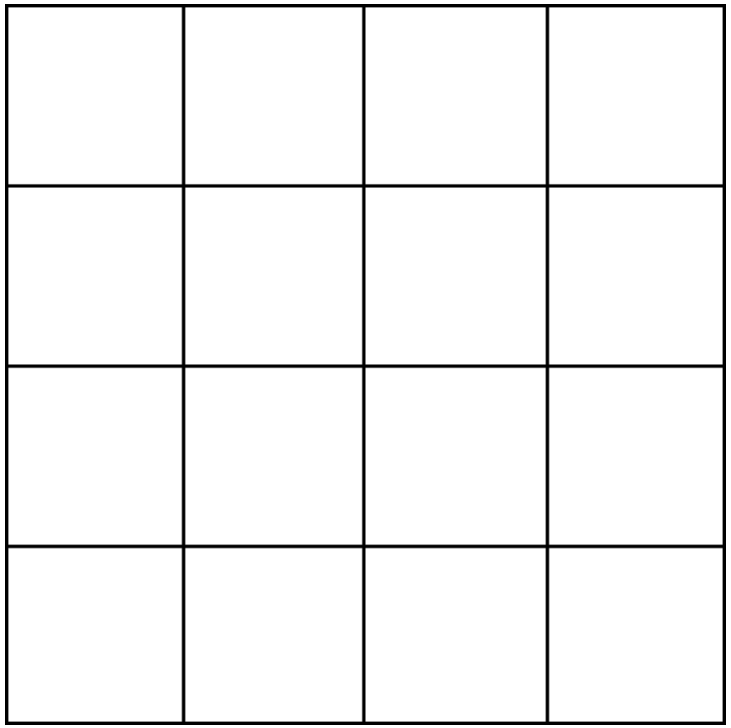
Super Mario Maker 2



Baba is You

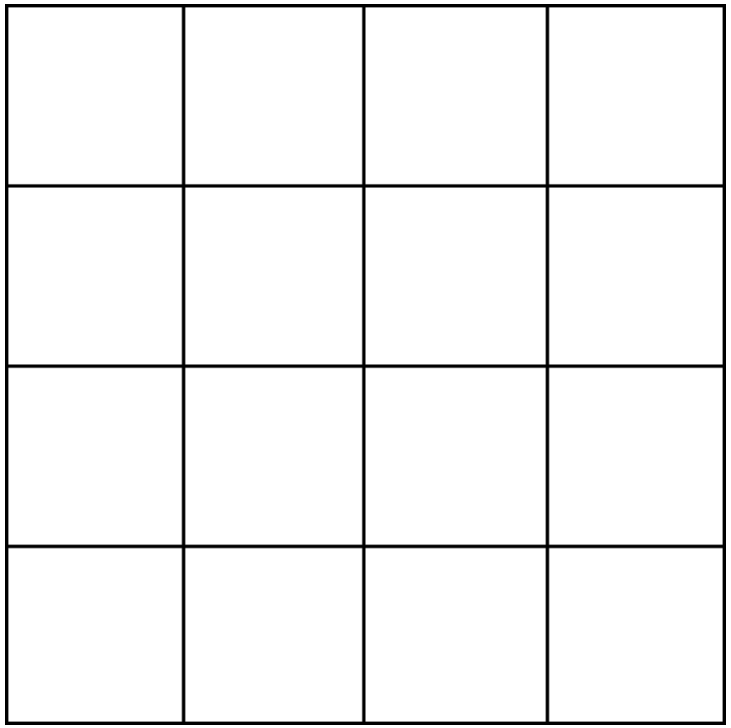
Grids

- 2D tile representation mapped to floor/level
  - Squares/hex cells
  - 8 or 4 neighbors / connectivity
  - Simplify the space
- One entity per cell.

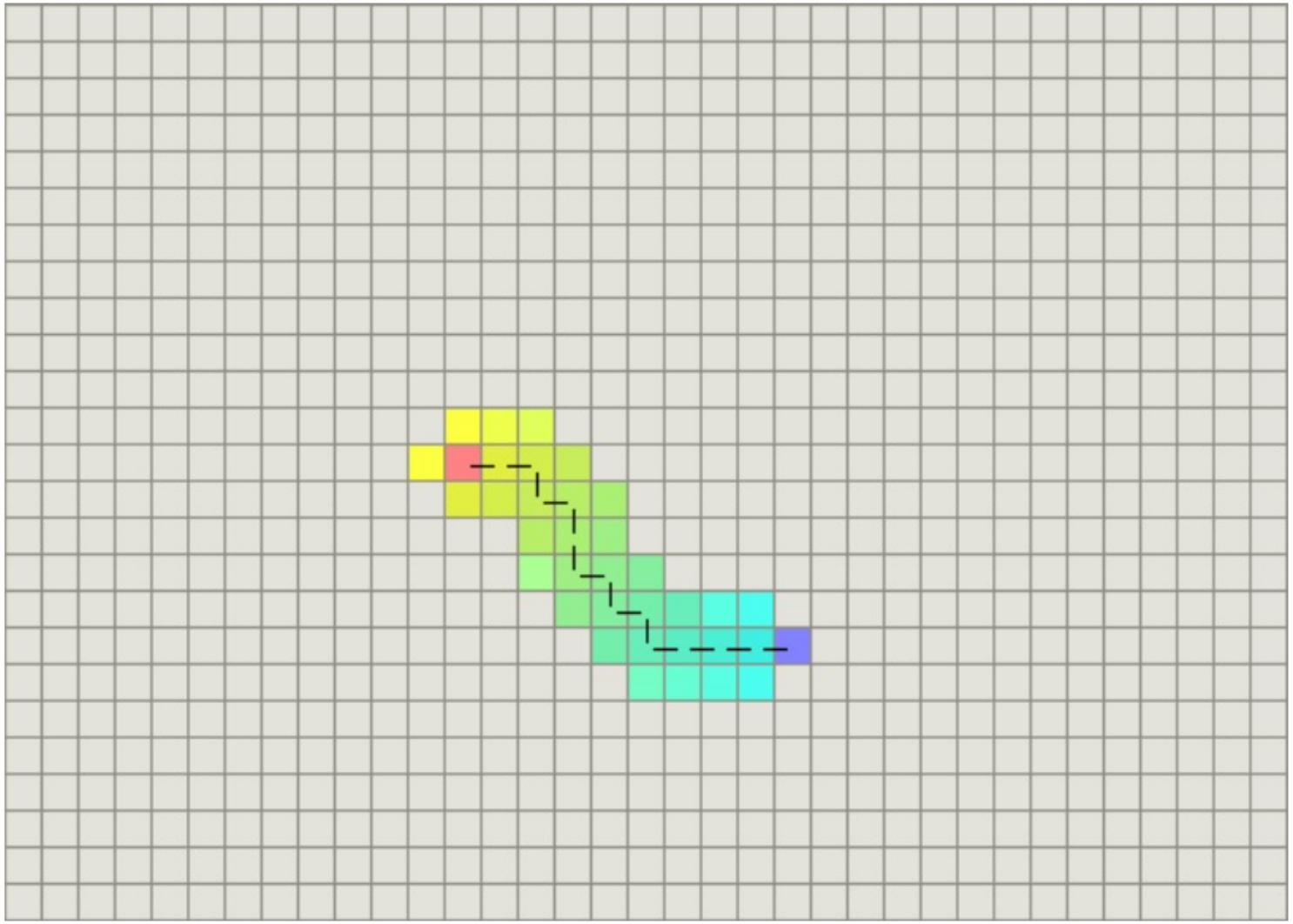


Greedy Path Movement

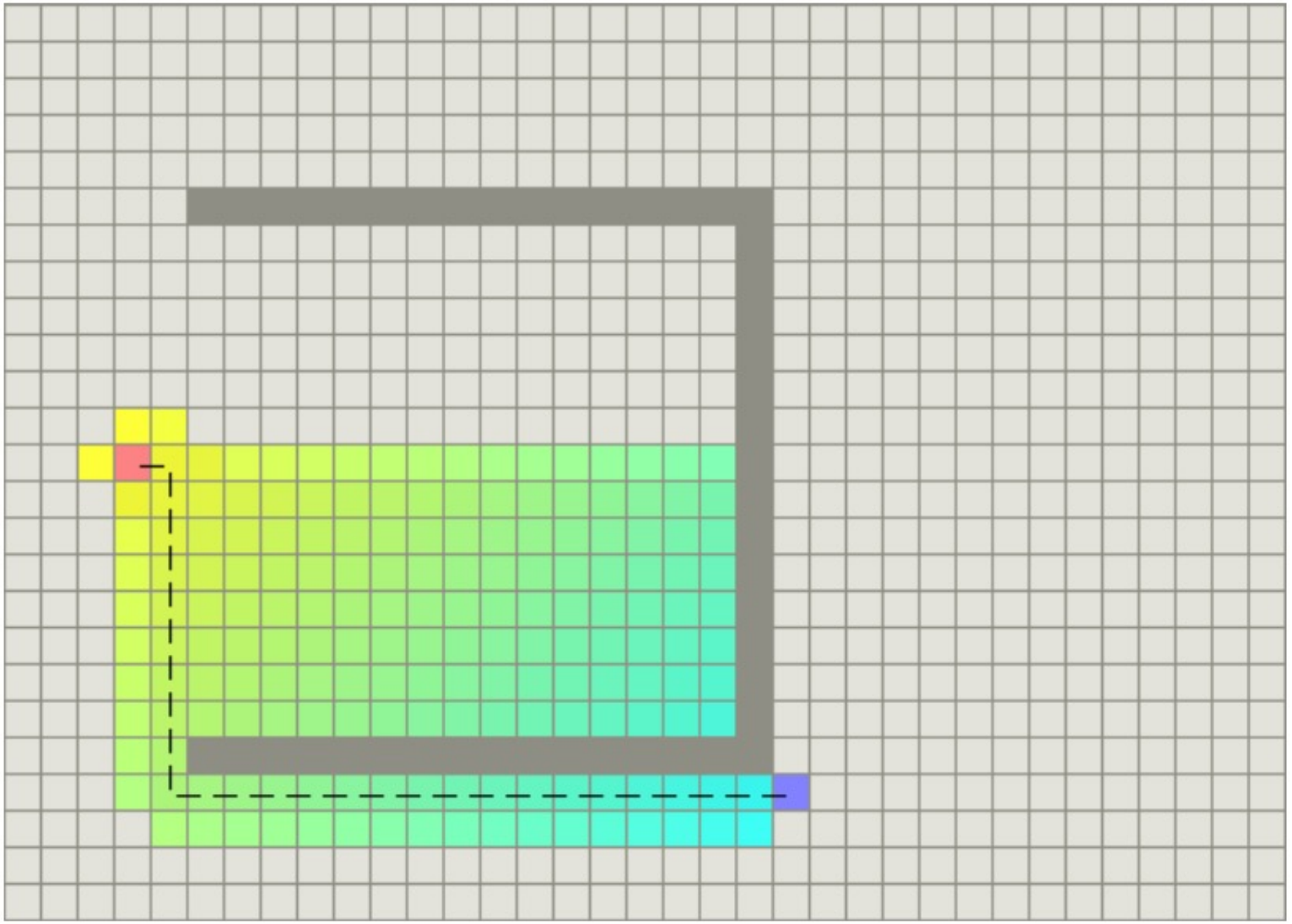
- Given current cell/node, pick the next cell that is closest to the goal cell according to some heuristic



Greedy grid movement can be fast



Greedy grid movement can be slow



Participation Question 1:

Name one (new!) pro and one con of using grids in terms of character movement/navigation.

https://tinyurl.com/guz-pq2

https://forms.gle/xnL6FDbnzgh3qzEp7

Grid navigation: pros

- Discrete space is simple
- Can be generated algorithmically at runtime
  - Meaning no cost to memory
  - (Assignment 1)
- Good for large number of units
- A*/Greedy Search works well on grids (uniform action cost, not many tricky spots)

Grid navigation: cons

- Discretization “wastes” space
- Agent movement is jagged/awkward/blocky, though can be smoothed
- Some genres need continuous spaces
- Partial-blocking hurts validity
- Search must visit a lot of nodes (cells)
- Search spaces can quickly become huge
  – E.g. 100x10 map == 100k nodes and ~78k edges

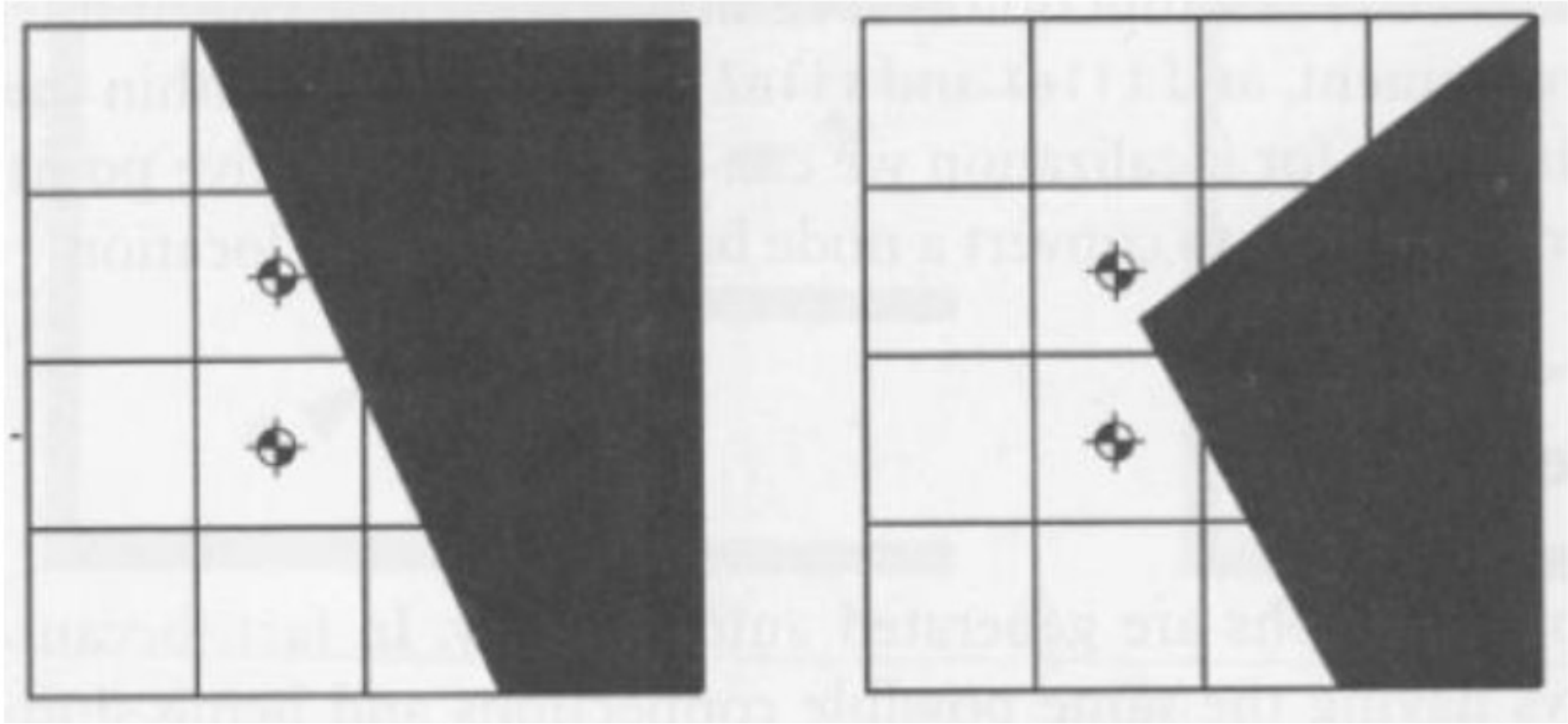
New Problems

- Generation and validity
- Awkward agent movement
- Poor coverage for certain maps
- Long search times/odd behavior with certain world configurations

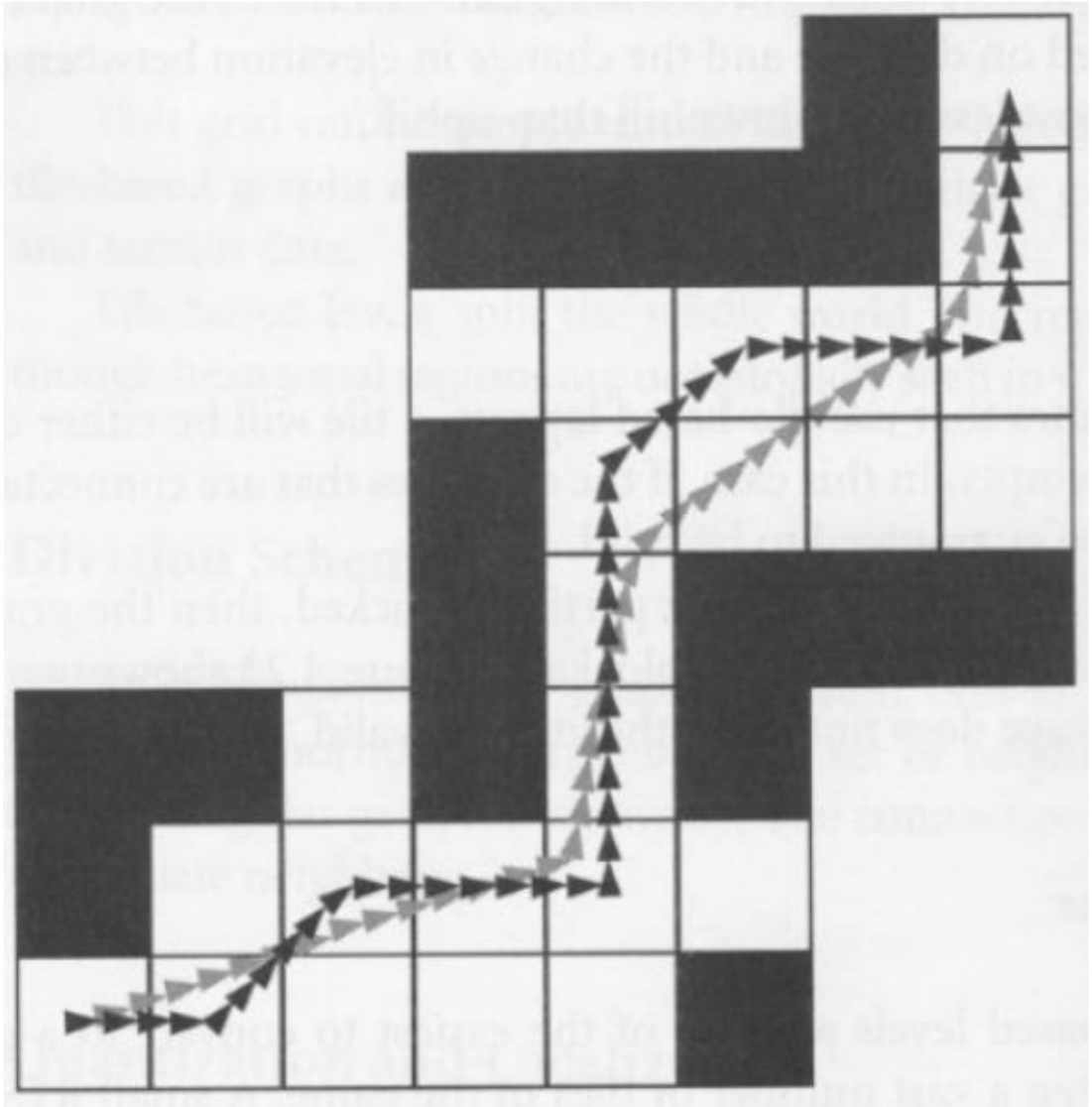
Grid Generation (Pseudocode)

```
for x in World.Width:
    for y in World.Height:
        GridCell g = new GridCell(x,y)
        if g.validityCheck(obstacles):
            grid.Add(g)
return grid
```

Validity



Correcting Agent Movement: Path Smoothing



Summary

- Grids are the simplest means of representing space in games to split navigable/unnavigable space.
- Grids are nice for games with many AI units and are well-suited to path planning approaches like A*.
- Grid however introduce a host of problems including awkward, unrealistic movement and issues around search space.

Go Over Assignment 1