Advanced Representations (Putting it all together)

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Announcements

- HW2 has been released, due 11:55pm Oct 4th
- Only ~90% of you turned in HW1. Please let me know if you're having trouble, I can't help otherwise.
- I made a mistake so everyone gets the PQ points from last Friday.
- Quiz 1 Spatial Representations + Path Planning on this Friday
  - Covering all lecture material through Wednesday (but focused on material from today and earlier)

18-34s are the least likely to go vote

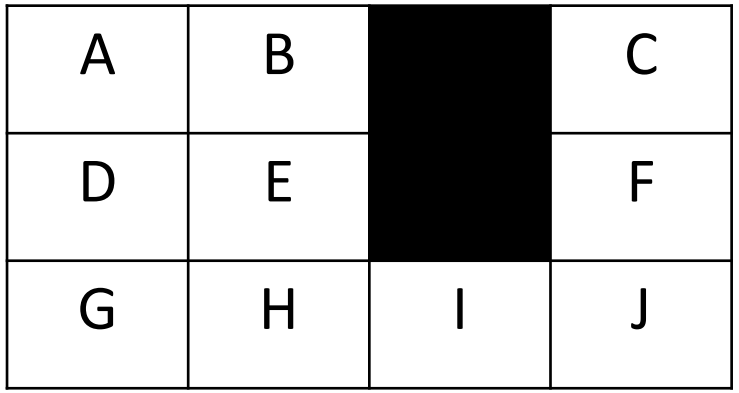
Last Time

- Review of graphs
- Review of greedy path finding
- A*
- Discussion of heuristics (estimated distance from current location to goal)

A*

```
add start to openSet
while openSet is not empty:
    current = openSet.pop()
    if current == goal:
        return reconstruct_path(current)
    closedSet.Add(current)
    for each neighbor of current:
        if neighbor in closedSet:
            continue
        gScore = current.gScore + dist(current, neighbor)
        if neighbor not in openSet:
            openSet.add(neighbor)
        else if gScore< openSet.get(neighbor).gScore
            openSet.replace(openSet.get(neighbor), neighbor)
```

A* Example (iteration=0)



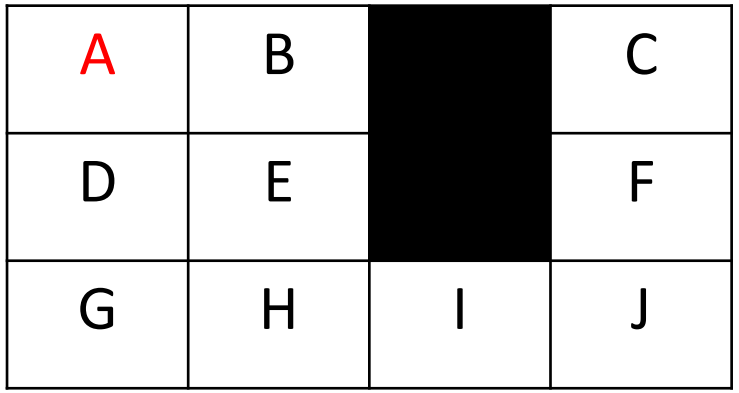
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: N/A

Open Set (Priority Queue)

Node	F Score
A	3 (g:0,h:3)

Closet Set:

A* Example (beginning of iteration=1, pop curr)



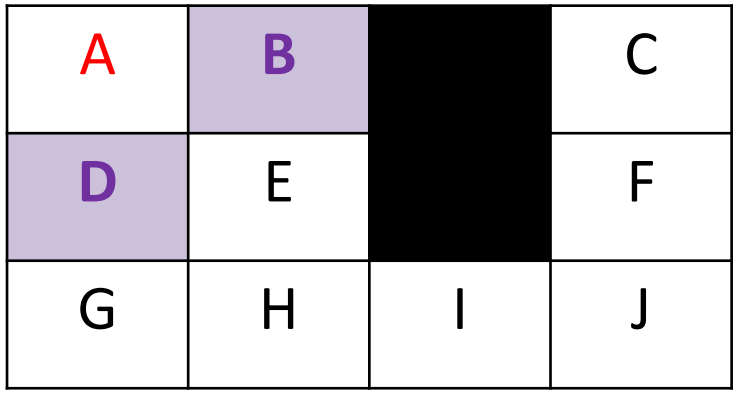
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: A

Open Set (Priority Queue)

Node	F Score

Closet Set:
A

A* Example (end of iteration=1, neighbors)



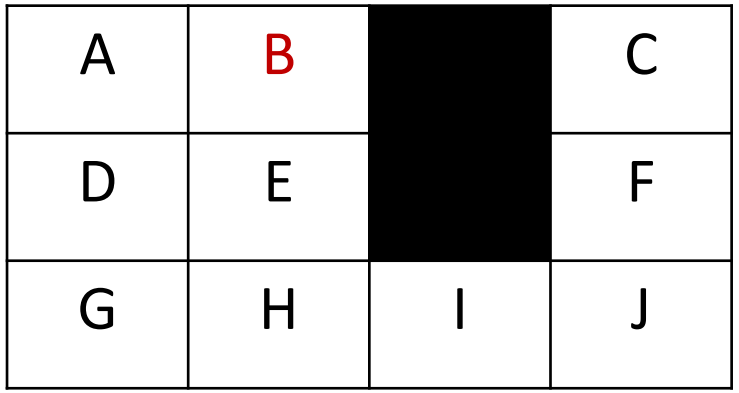
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: A

Open Set (Priority Queue)

Node	F Score
B	3 (g:1,h:2)
D	5 (g:1,h:4)

Closet Set:
A

A* Example (beginning of iteration=2, pop curr)



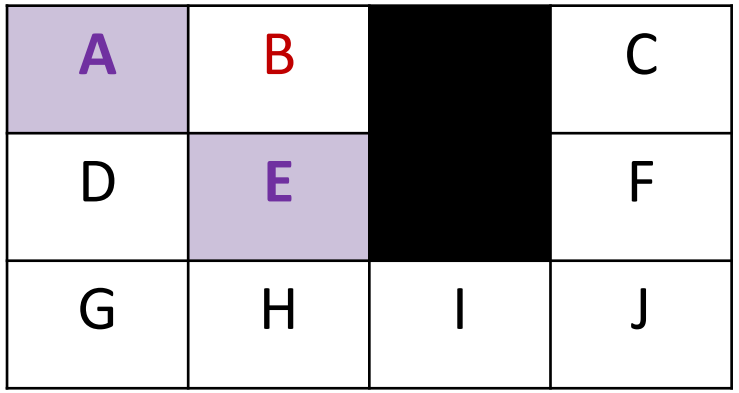
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: B

Open Set (Priority Queue)

Node	F Score
D	5 (g:1,h:4)

Closet Set:
A
B

A* Example (end of iteration=2, neighbors)



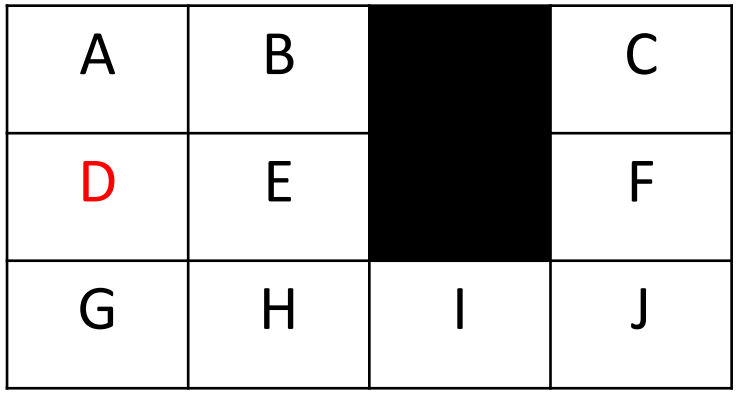
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: B

Open Set (Priority Queue)

Node	F Score
D	5 (g:1,h:4)
E	5 (g:2,h:3)

Closet Set:
A
B

A* Example (beginning of iteration=3, pop curr)



Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: D

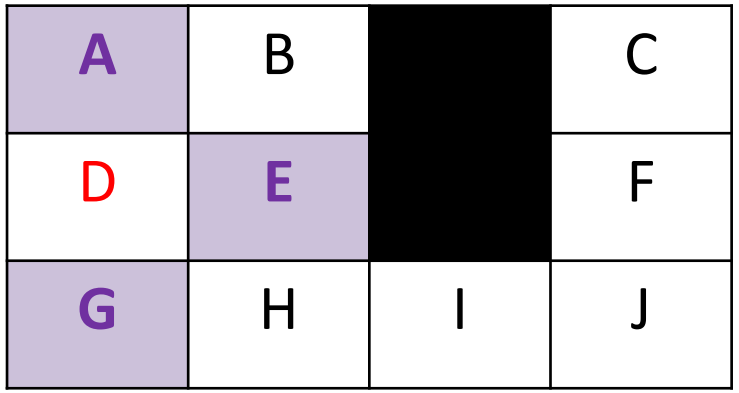
Open Set (Priority Queue)

Node	F Score
E	5 (g:2,h:3)

Closet Set:

A
B
D

A* Example (end of iteration=3, neighbors)



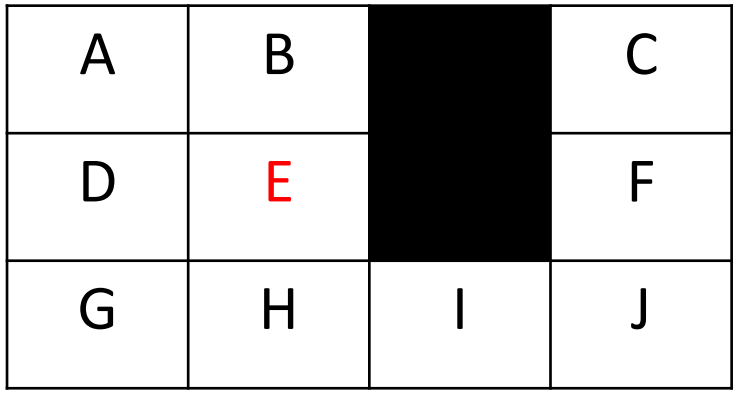
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: D

Open Set (Priority Queue)

Node	F Score
E	5 (g:2,h:3)
G	7 (g:2,h:5)

Closet Set:
A
B
D

A* Example (beginning of iteration=4, pop curr)



Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: E

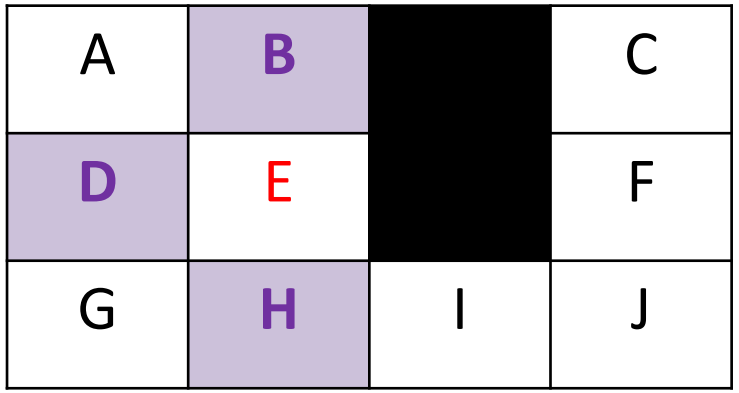
Open Set (Priority Queue)

Node	F Score
G	7 (g:2,h:5)

Closet Set:

A
B
D
E

A* Example (end of iteration=4, neighbors)



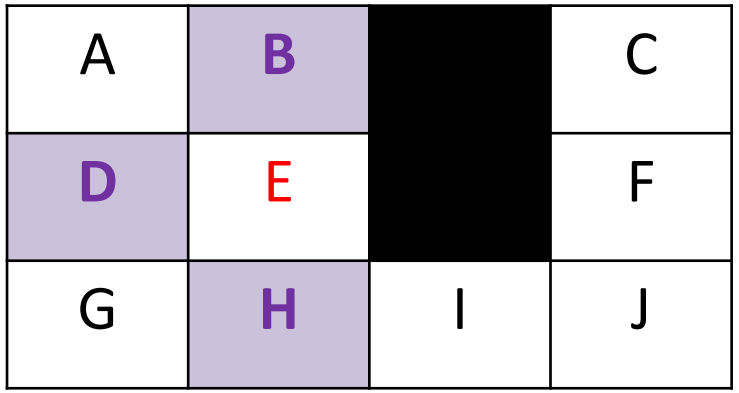
Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: E

Open Set (Priority Queue)

Node	F Score
G	7 (g:2,h:5)
H	7 (g:3,h:4)

Closet Set:
A
B
D
E

A* Example (end of iteration=4, neighbors)



Start: A
Goal: C
Heuristic: Manhattan Distance
Curr Node: E

Open Set (Priority Queue)

Node	F Score
G	7 (g:2,h:5)
H	7 (g:3,h:4)

Closet Set:
A
B
D
E

Etc...

More game AI than you'd think is in spatial representations

Example: In the Sims, items you place in your Sim's environment create special path network nodes, that tell the Sim how to use them.

Deep Dive into Sunset Overdrive

Why deep dive on a 6 year old game?

Best video example of a full pathing system, and how AI and design work together in a complete game

Alternatives?

- Not a lot! Some GDC talks, but nothing this exhaustive or technically focused (this was a GDC talk)
- Some old blog posts (e.g. http://philiponguoitgamedev.blogspot.com/2013/11/insomnaic-games-engine-resistance-2-and.html)

AI Deep Dive:
“AIIDE Keynote - Adam Noonchester”

https://youtu.be/ZIAmoRsu3Z0

Talk starts about 12 mins in.
Occasional lighting and audio issues, sorry!

Participation Question 1 (17:50 mins)

How would you change the spatial representation to solve this “boring game” problem?

https://forms.gle/XuiMQf8z1iVz37Ny8

https://tinyurl.com/guz-pq7

Volumes (~Minute 22)

- What are these volumes in the language of this class?
- Path networks, but are they hand-authored?
  - No, they're generated or procedural.
  - Templates that are automatically altered based on the obstacles of this game.
- Why didn't we talk about this method in class? Because it's explicitly not general.

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- Why didn't we talk about this method in class? Because it's explicitly not general.
- (Jump to 25:09)

What’s he talking about here? (~30 mins)

Steering!

Takeaways (after Putting it all together)

- We can generate special path networking nodes on the fly
- We can generate these nodes based on…
  - In-game obstacles
  - The player
  - Other AI entities
- Getting AI and design to work together can be tough, but can lead to unique experiences.

Next Lecture

- Cover All Pairs Shortest Paths, a completely distinct approach to path planning (plan only once!)

- Review of Quiz 1 Topics (come with questions!)