



FALMOUTH
UNIVERSITY

COMP250: Artificial Intelligence

9: Navigation

Pathfinding



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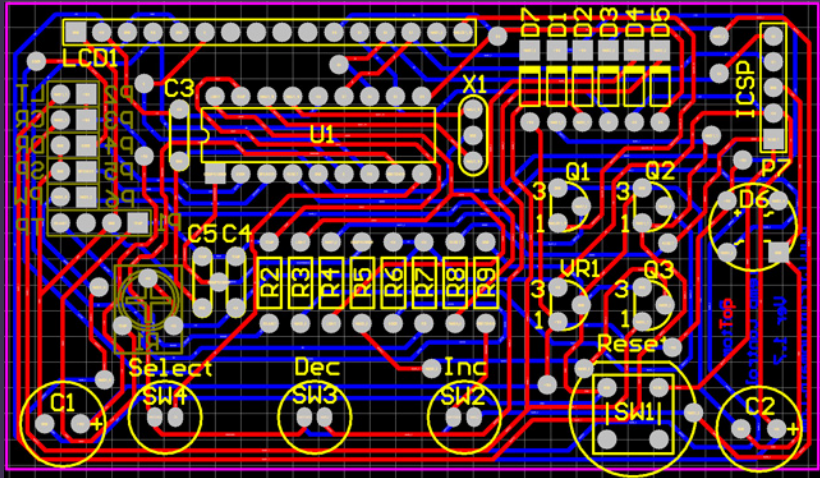
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 - ▶ “Shortest” in terms of edge lengths — could be distance, time, fuel cost, ...

Applications of pathfinding



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Pathfinding example

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- ▶ Open it in PyCharm

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 - ▶ Often implemented with a **priority queue**

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- ▶ **Is** guaranteed to find the shortest path
- ▶ ... but is not the most efficient algorithm for doing so

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 - ▶ In AI, a heuristic is an estimate based on human intuition
 - ▶ Heuristics are often used to prioritise search, i.e. explore the most promising options first

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Tweaking A^*

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- ▶ Different $h(x)$ can lead to different paths (if there are multiple “shortest” paths)

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 - ▶ Repeat until there are no more points that can be removed

Navigation meshes



Pathfinding in videogames

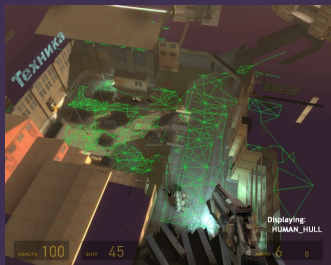
Pathfinding in videogames

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Pathfinding in videogames

- ▶ A* works on any **graph**
- ▶ But what if the game world is not a graph? E.g. complex 3D environments

Waypoint navigation



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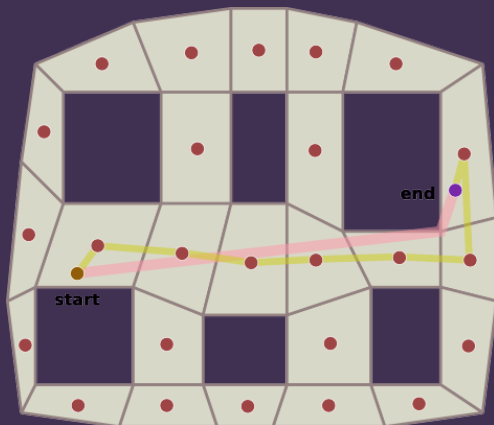
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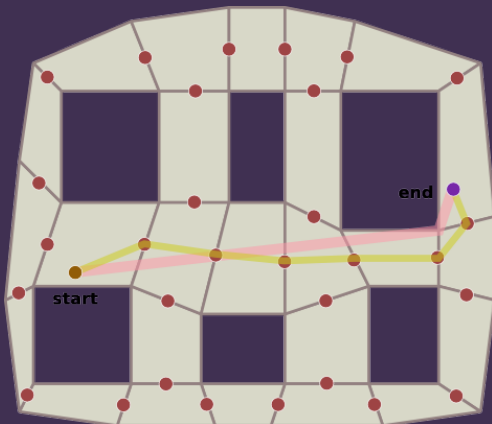
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 - ▶ Generate graph from polygons

Meshes to graphs



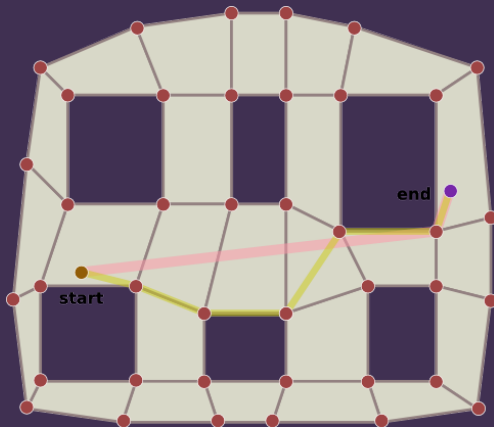
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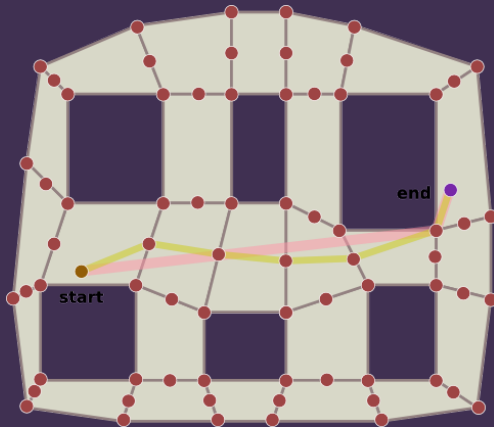
Centres of edges

Meshes to graphs



Vertices of polygons

Meshes to graphs



Hybrid approach: edges and vertices

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- ▶ **Steering:** don't have your AI agent follow the path exactly, but instead try to stay close to it
- ▶ **Dynamic environments:** may need to re-run pathfinder if environment changes (e.g. movable obstacles, destructible terrain)

The travelling salesman problem



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 - ▶ Pub crawls
- (<http://www.math.uwaterloo.ca/tsp/pubs/>)

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 - ▶ If $P \neq NP$, then there is **no** polynomial-time algorithm for solving it
- ▶ Entire research field devoted to finding efficient **search algorithms** and **heuristics**

MicroRTS



Getting started

- ▶ We now have **Java** in this room (thanks Paul!) but **Eclipse** needs to be installed per-user
- ▶ Download from
`https://www.eclipse.org/downloads/`
- ▶ Run the installer
- ▶ Select **Eclipse IDE for Java Developers**
- ▶ Set the installation folder to somewhere on the D: drive, for example `D:\eclipse`
- ▶ Now go to `https://github.com/falmouth-games-academy/comp250-bot` and follow the instructions