A\*

* Various adaptations of A\* and how they are used in interactive game and simulation software.

A\* is a best-first search algorithm that looks for the shortest path on a graph. It is mostly used for AI pathfinding but there are other uses for this in game design. For example you can use A\* on an AI’s mental graph. This graph can affect the decisions of the character such as how a fighter reacts based on health, how a chess player makes his next move, or even how an enemy levels up after defeating you like in shadow of mordor. I believe that A\* can also be used in conversational trees to dictate the AI’s reactions to answers.

* Pathfinding methods and dynamic navigation mesh generation techniques.

Dijkstra

Edsger DijKstra created the DijKstra algorithm to solve the “shortest path” mathematical graph theory. For a given node in the graph, the algorithm would find the path with the lowest cost between the initial node and another node. The issue with this set up is that the algorithm finds the shortest path to all nodes in the graph from the initial node or the current node. You get the goal that you are looking for but then you end up throwing away all the other shortest path goals you found which becomes very wasteful. There is a way to modify it to only generate the shortest path that you are interested in but even this method is pretty inefficient. According to the author of our textbook, he and his team would only use DijKstra once in production pathfinding to analyze general properties of a level in military simulation.

A\*

A\* algorithm is the standard for pathfinding in video games these days. Unlike DijKstra algorithm, A\* is designed for point-to-point pathfinding and is not used to solve the shortest path problem. A\* uses heuristic to improve its behavior relative to DijKstra’s algorithm. As the value of the heuristic increases, A\* examines fewer nodes but no longer guarantees an optimal path. This is greatly desired in game design because the algorithm runs quickly and keeps the game running smoothly.

Dynamic Pathfinding

What separates dynamic pathfinding from the previous two algorithms we looked at is that it can adjust based on a changing environment in video. For example, if in a game the amount of ground a character has left to run on is based on where the enemy shoots and destroys. This won’t be the same for every playthrough so the AI must adjust based on what is left. This method recalculates only the parts of the plan that may have changed. The dynamic of A\* is called D\*. Although it dramatically reduces the time required to pathfind in an uncertain environment, it requires a lot of storage space to keep intermediate data that might be required later.

* AI middleware packages available to assist with navigation mesh generation and AI systems.

Autodesk Gameware – Autodesk Gameware Navigation 2015 is an artificial intelligence middleware that provides automatic NavMesh generation, hierarchical pathfinding, and path following in complex game environments. Character and obstacle avoidance, splines and channels for animation-driven locomotion, dynamic NavMesh, and swappable sectors are supported out-of-the-box. Gameware Navigation is designed to enable developers to create ambitious, more complex AI.

MASA Life – MASA Life enables you to create and execute a wide variety of intelligent, engaging and autonomous behaviors to drive actors in your game or simulation. From decision-making to navigation and pathfinding, MASA Life offers a visual and intuitive experience for characters’ behavior design and easy intergration. MASA Life allows you to design how characters behave and how they interact with the world without having to write a single line of code. Thanks to Life’s visual editors and tools, creating behaviors is no longer about coding. Life is artificial intelligence for makers and not only for coders. Now you can focus on creating even more engaging and believable characters!

Rain – Whether it’s monsters, heroes, or companions, Rain is a complete AI engine used by top studios to create any character, in any game, on any platform. Today, Rain has become the gold standard for AI inside the Unity game engine. It’s used everywhere by studios large and small to create outstanding behavior and engaging gameplay.