

Pathfinding Methods

Two algorithms were used

a. Breadth First Search (BFS) for Shortest Hop Path (SHP)

- This finds the path with fewest steps (edges).
- It does not care about distance or time, just the number of connections.

b. Dijkstra's Algorithm for:

- Shortest Distance Path (SDP) – chooses the path with least kilometers.
- Shortest Time Path (STP) – chooses the path with least travel time.
- Fewest Dementors Path (FDP) – avoids the most dangerous paths.

Each path type just uses a different cost:

- Distance → for kilometers
- Time → for hours
- Dementors → for safety

Graphs

Each province in Canada is shown as a node/circle

There were four edge values:

- Hops was the number of steps it took
- Distance in kilometers
- Time in hours
- Number of Dementors the more means the more dangerous the route was

Shortest Hop Path (SHP)

- Calculated using BFS.
- Look only at the number of steps.
- Example: Harry Potter goes from British Columbia → Quebec → Ottawa (2 hops)

Shortest Distance Path (SDP)

- Uses Dijkstra's with distance.
- Shortest in kilometers.
- Example: Ginny's best route is Nova Scotia → Quebec → Ottawa (2900 km)

Shortest Time Path (STP)

- Uses Dijkstra
- Example: Hermione from Ontario → Ottawa in only 4 hours.

Fewest Dementors Path (FDP)

- Uses Dijkstra's with dementors
- Finds the safest path with the least amount of dementors

Routes for Harry Potter from British Columbia to Ottawa

Shortest Hop Path (SHP):

British Columbia → Quebec → Ottawa (2 hops)

Shortest Distance Path (SDP):

British Columbia → Quebec → Ottawa (3700 km)

Shortest Time Path (STP):

British Columbia → Quebec → Ottawa (38 hrs)

Fewest Dementors Path (FDP):

British Columbia → Quebec → Alberta → Ottawa (22 dementors)

Routes for Hermione Granger from Ontario to Ottawa

Shortest Hop Path (SHP):

Ontario → Ottawa (1 hops)

Shortest Distance Path (SDP):

Ontario → Ottawa (1450 km)

Shortest Time Path (STP):

Ontario → Ottawa (4 hrs)

Fewest Dementors Path (FDP):

Ontario → Ottawa (12 dementors)

Routes for Ron Weasley from Quebec to Ottawa

Shortest Hop Path (SHP):

Quebec → Ottawa (1 hops)

Shortest Distance Path (SDP):

Quebec → Ottawa (1800 km)

Shortest Time Path (STP):

Quebec → Ottawa (19 hrs)

Fewest Dementors Path (FDP):

Quebec → Alberta → Ottawa (15 dementors)

Routes for Luna Lovegood from NL to Ottawa

Shortest Hop Path (SHP):

NL → Alberta → Ottawa (2 hops)

Shortest Distance Path (SDP):

NL → Quebec → Ottawa (4000 km)

Shortest Time Path (STP):

NL → Quebec → Ottawa (41 hrs)

Fewest Dementors Path (FDP):

NL → Alberta → Ottawa (17 dementors)

Routes for Neville Longbottom from Saskatchewan to Ottawa

Shortest Hop Path (SHP):

Saskatchewan → Quebec → Ottawa (2 hops)

Shortest Distance Path (SDP):

Saskatchewan → Quebec → Ottawa (3800 km)

Shortest Time Path (STP):

Saskatchewan → Quebec → Ottawa (39 hrs)

Fewest Dementors Path (FDP):

Saskatchewan → Quebec → Alberta → Ottawa (21 dementors)

Routes for Ginny Weasley from Nova Scotia to Ottawa

Shortest Hop Path (SHP):

Nova Scotia → Ontario → Ottawa (2 hops)

Shortest Distance Path (SDP):

Nova Scotia → Quebec → Ottawa (2900 km)

Shortest Time Path (STP):

Nova Scotia → Ontario → Ottawa (25 hrs)

Fewest Dementors Path (FDP):

Nova Scotia → Alberta → Ottawa (17 dementors)

Challenges

- Hardest challenge was making the graph at first it was making it all in one graph so it looked messy and unclear and was in black and white so then I had to make it colorful by using the Kamada-Kawai layout which helped made it more clear as to which line is which wizards then I have to also make sure that the nodes and paths were not overlapping as many were before so to fix this I used curved lines. Another problem with the graph was the amount of arrows going to Ottawa since all the wizards were going there, as well it was confusing and had problems getting them to connect to Ottawa and some arrows did not always go to the right destination so I had to fix that. I had to make sure the edges went the right way and some only had one direction so I had to make sure those were right. Overall getting the graphs to work was the hardest and longest part and figuring out and searching how to make graphs and make them colorful took a lot of time.
- Another challenge I faced was figuring out which algorithm to use for which path was the best and most efficient. I figured that Breadth-First Search was the best and most efficient to use when I just needed to know the path with the fewest number of steps between two places, for example like counting how many provinces you have to pass through. BFS just cares and looks for the fastest route in terms of steps/hops not for the actual travel distance or time. Dijkstra's was better to use when looking at shortest distance rather than hops and for fastest travel time and for the least number of Dementors to encounter in the route.