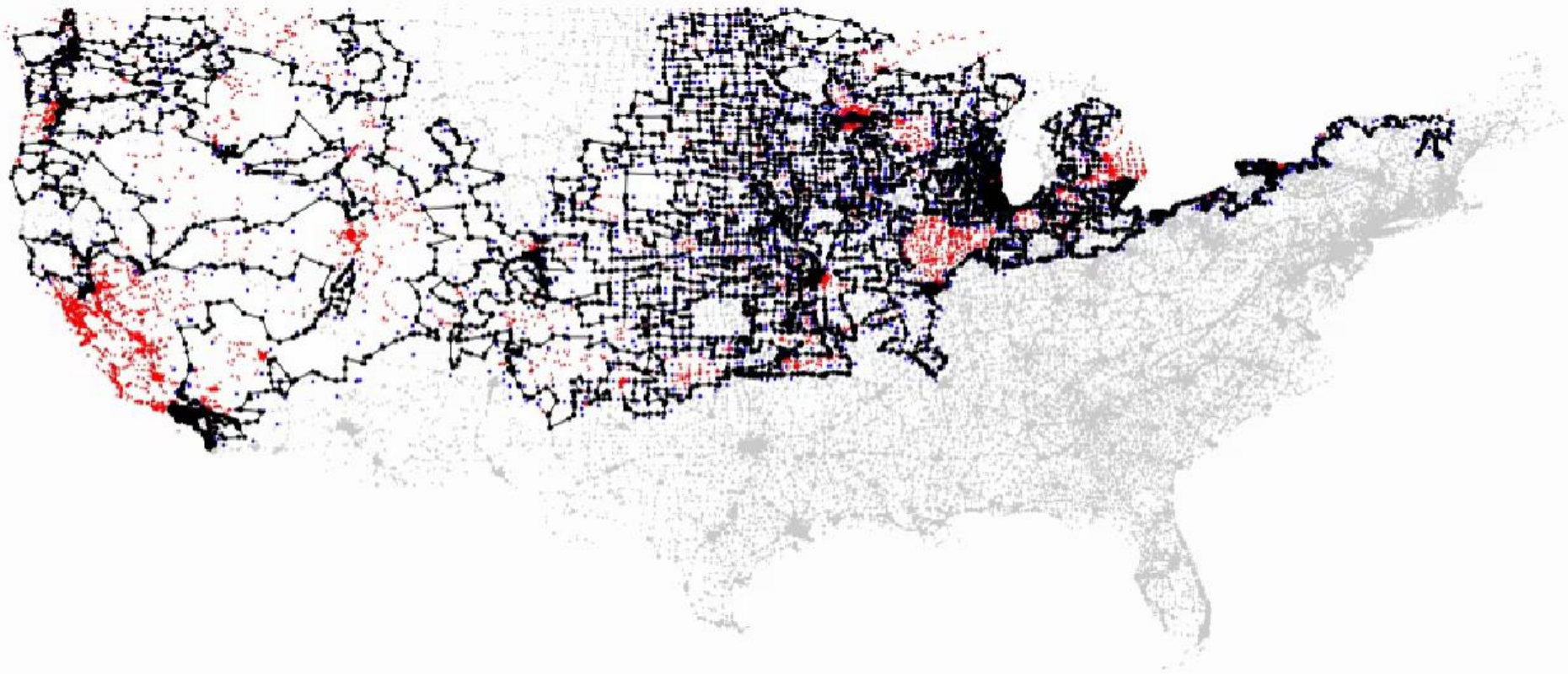


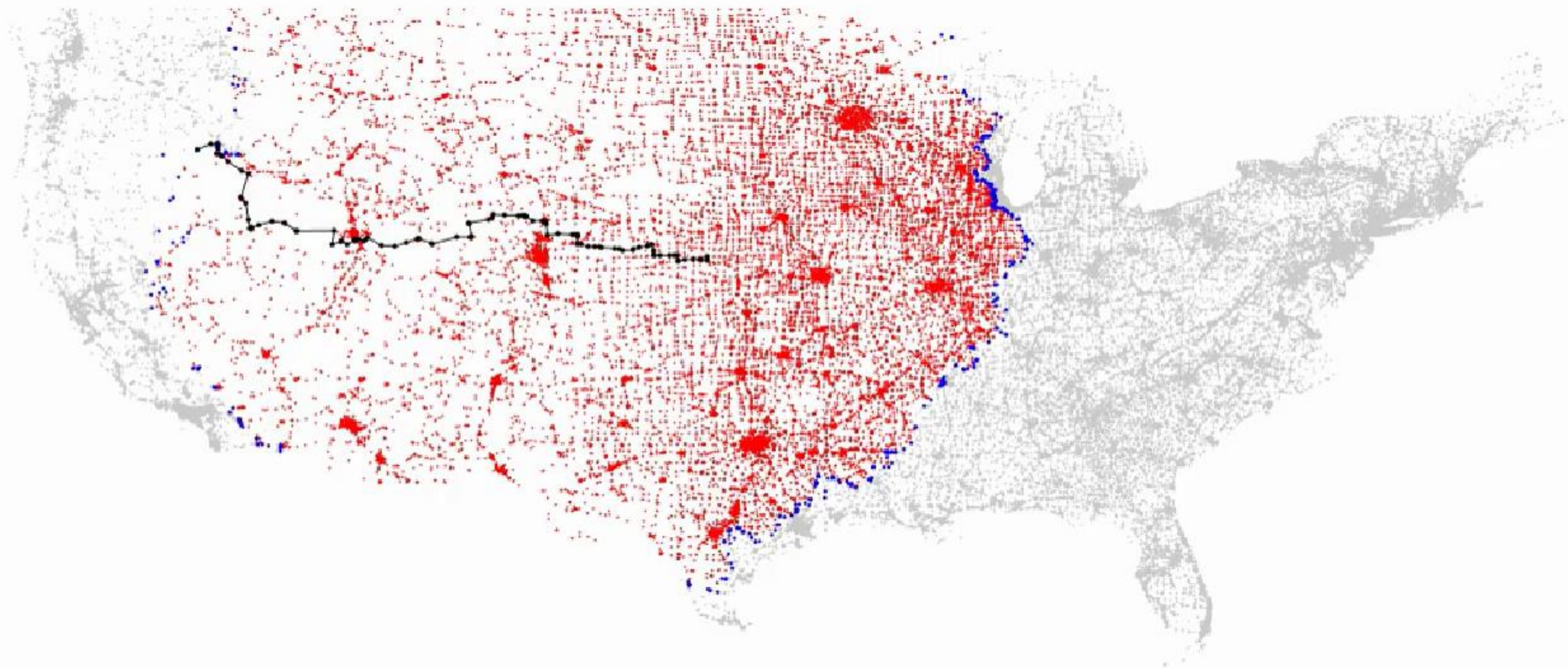
# Today's Agenda

- Graph Search, Data Representation & Snekoban
  - Storing game board concisely
  - Making a mutable board hashable (concisely)
  - Optimizing common operations to run quickly
- Other types of graph search: road maps example

# Road search (road maps in readings, plus

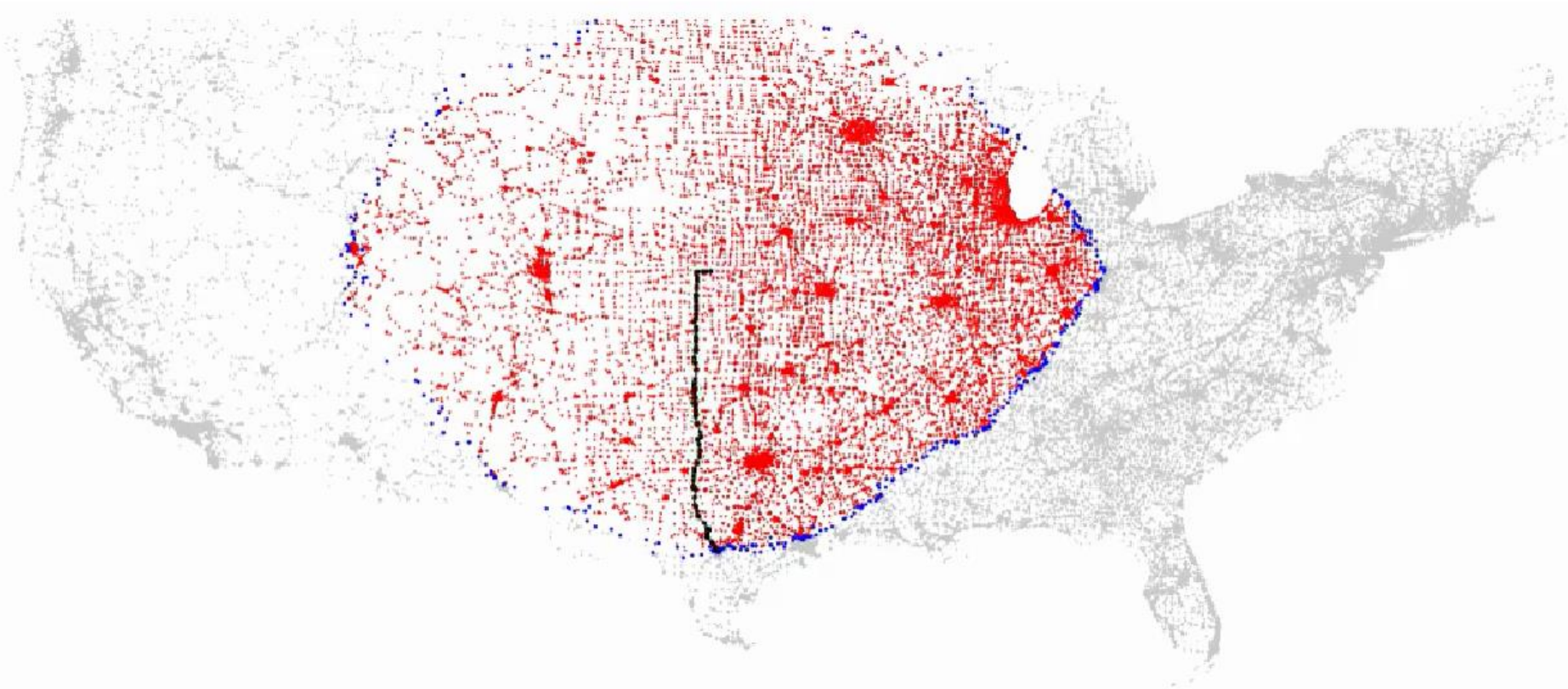
- In the US Roads Map, find shortest path from Point A (center of US) to Point B (Cambridge, MA)
- Not the path with least number of different roads!
  - That is what our default BFS and DFS do
  - See next two animations: which is BFS? DFS?





# Road search, cont'd

- Instead, need to add the *mileage* of all the road segments
- The “shortest” path is now the path with the least miles
- Found by pulling the “least cost so far” choice from the agenda each time through the agenda
  - Called “Uniform Cost” (UC) search
  - See next animation



# Example, cont'd

- Can speed up the search (in some cases) by adding a heuristic that pull next paths to try off the agenda based on some other criterion
- For example, if we estimate the remaining cost (distance) for each node, we can add that to “cost so far” for that node, and pull the estimated smallest total cost option off the agenda next
  - Called A\* (“A star”) search (if heuristic well-behaved)
  - See next animation: goes toward Cambridge very nicely!

