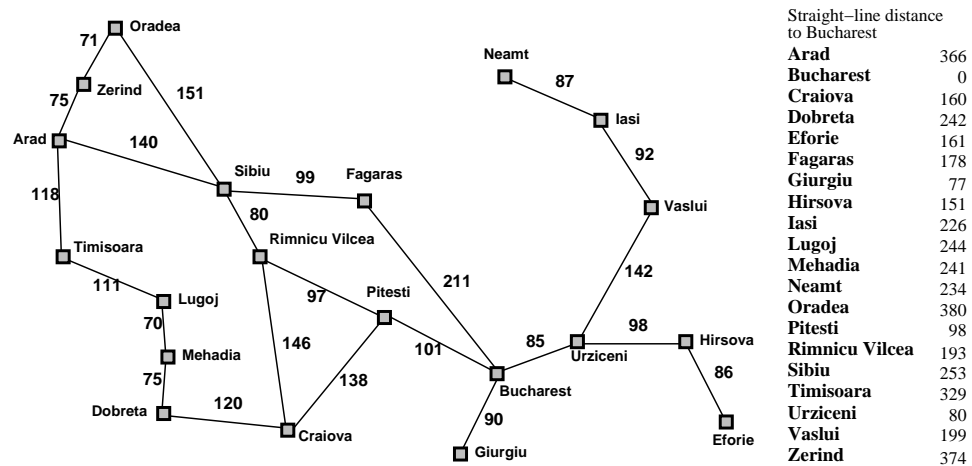


## Week 3 Exercises - Search Strategies

- This exercise concerns the route-finding problem using the Romania map from Russell & Norvig as an example:



In what order are the nodes in the state space *expanded* for each of the following algorithms when searching for a (shortest) path between Arad and Bucharest? Whenever there is a choice of nodes, you should select the one that comes first in alphabetical order. In each case, continue the algorithm until the goal node is *expanded*.

- Breadth First Search, skipping any state that has previously been expanded
  - Uniform Cost Search, skipping any state that has previously been expanded
  - Depth First Search, skipping any state that forms a *loop* (i.e. the same state occurring twice along a single path from root to leaf)
  - Iterative Deepening (Depth First) Search
  - Greedy Best First Search using the straight-line distance heuristic
  - A\*Search using the straight-line distance heuristic
- 3.13 (2nd Ed.)**
    - Describe a search space in which Iterative Deepening Search performs much worse than Depth First Search.
    - Describe a search space in which Breadth First Search performs much worse than Depth First Search.
    - Describe a search space in which Depth First Search performs much worse than Breadth First Search.

- **3.22** Prove each of the following statements, or give a counterexample:
  - (a) Breadth First Search is a special case of Uniform Cost Search
  - (b) Breadth First Search, Depth First Search and Uniform Cost Search are special cases of best-first search.
  - (c) Uniform Cost Search is a special case of A\*Search
- **3.28** The heuristic path algorithm is a best-first search in which the objective function is

$$f(n) = (2 - w)g(n) + wh(n)$$

For what values of  $w$  is this algorithm complete? For what values of  $w$  is it optimal, assuming  $h()$  is admissible? What kind of search does this perform when  $w = 0$ ? when  $w = 1$ ? when  $w = 2$ ?