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.

(a) Breadth First Search, skipping any state that has previously been expanded
(b) Uniform Cost Search, skipping any state that has previously been expanded
(c) 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)
(d) Iterative Deepening (Depth First) Search
(e) Greedy Best First Search using the straight-line distance heuristic
(f) A∗Search using the straight-line distance heuristic
(g) Depth First Search again, skipping loops as before, but this time choosing nodes in reverse alphabetical order

3.13 (2nd Ed.)

(a) Describe a search space in which Iterative Deepening Search performs much worse than Depth First Search.
(b) Describe a search space in which Breadth First Search performs much worse than Depth First Search.
(c) 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 \( w = 2 \)?