AI Planning for Autonomy

Solution Problem Set I: Blind Search

1.

Consider a set of cities V to visit in any order, a starting city location v_{start}, and a set of edges E specifying if there's an edge from two cities $\langle v, v' \rangle$:

$$
\begin{aligned}
S &= \{\langle current_v, V' \rangle | \, current_v \in V \wedge V' \subseteq V\} \\
S_0 &= \langle v_{start}, \{v_{start}\} \rangle \\
A(\langle current_v, V' \rangle) &= \{\langle current_v, v' \rangle | \, \langle current_v, v' \rangle \in E\} \\
f(\langle current_v, V' \rangle, \langle current_v, v' \rangle) &= \langle v', V' \cup v' \rangle \\
c(a, s) &= cost(edge) \\
S_G &= \{\langle current_v, V \rangle\}
\end{aligned}
$$

2.

- Which is the solution found by each algorithm?
  - BRFS,ID: $s_1 \rightarrow s_3 \rightarrow s_7$
  - DFS: Depends, could be any of the 3 solutions.
- Which is the optimal solution?
  - $s_1 \rightarrow s_4 \rightarrow s_6 \rightarrow s_7$
- Explain under which conditions the algorithms guarantee optimality?
  - BRFS and ID will be optimal if the costs are uniform. For example: all costs are 1.
- Adapt any of the previous algorithms to account for $g(n)$. Explain properties: optimality,complete,sound.
  - Dijkstra, also known as Uniform search will be optimal and complete. It's Like BRFS but expanding first the node with lowest accumulated cost, instead of the lowest length, where length is defined over the number of traversed arcs. By construction Dijktra is sound, meaning that any returned path is a path that exists in the graph.