SAARLAND UNIVERSITY ARTIFICIAL INTELLIGENCE
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Theoretical Exercise Sheet 2

Deadline Friday, April 29, 23:59

About the submission of this sheet.

- You might submit the solutions to exercises in groups of up to 3 students.
- (From this sheet on,) all students of a group need to be in the same tutorial.
- If you solved the first sheet in a different group (since you did not know your tutorial yet), it is no problem to do this sheet in another group. However, please try to keep groups stable from now on.
- Write the names of **all** students of your group on your solution.
- Hand it in **one time**, (i.e., determine one student of the group who hands in the solution using his/her account).
- Hand in the solution **in CMS**.

1. (3 points) Consider the state space depicted in Figure 1, where A is the initial state, and F and H are goal states. The transitions are annotated by their costs. List all states that are

   (i) solvable,

   (ii) dead-ends,

   (iii) not reachable from B,

   (iv) reachable from I (i.e., the state labeled I, not the initial state).

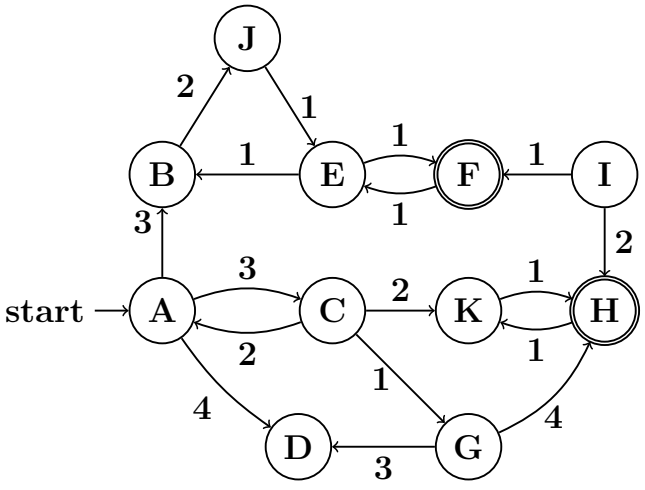


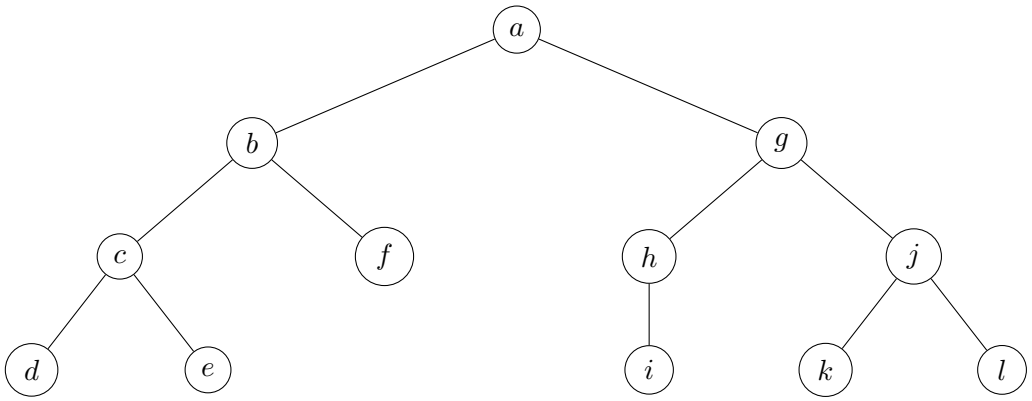
Figure 1: Illustration of the state space used in Exercise 1 and 2.

2. (8 points) Consider again the state space depicted in Figure 1.

   (a) Run Uniform Cost Search on this problem. Draw the search graph and annotate **each node** with its g **value and the order in which states are selected for expansion**. Draw duplicate nodes, and mark them accordingly by crossing them out. If the choice of the next state to be expanded is not unique, expand the lexicographically smallest state first (e.g. a before d :-)). Give the solution found by Uniform Cost Search. Is this solution guaranteed to be optimal? Justify your answer.

   (b) Run Iterative Deepening Search until it finds a solution. For each depth depict the corresponding search tree. Annotate each state with the **order in which states are selected for expansion**. If the choice of the next state to be expanded is not unique, expand the lexicographically smallest state first. Give the solution found by Iterative Deepening Search. Is this solution guaranteed to be optimal? Justify your answer.

3. (3 points) Consider the following state space with initial state a. Suppose the goal state is k. List the order in which the nodes are **selected for expansion** via **Breadth First Search**. If you need to insert successors of a node into the frontier, insert the (lexicographically) smaller state first, (e.g., a before c).



4. (3 points) Consider the same state space as before (again, initial state a, goal state k). List the order in which the nodes are **selected for expansion** via **Depth First Search**. If you need to insert successors of a node into the frontier, insert the (lexicographically) smaller state first, (e.g., a before c).