CPSC 322, Practice Exercise
Solutions to Branch and Bound

1   Directed Questions

- In branch and bound (B&B), how is the upper bound (UB) calculated? **Answer:** It's the cost of the best solution found so far. If no solution has been found, the upper bound is infinite.

- How is the lower bound (LB) calculated for a path? **Answer:** LB(p) = f(p) = cost(p) + h(p)

- With B&B, when do we prune a path? **Answer:** We prune the path p if LB(p) $\geq$ UB.

2   Heuristic Search

Consider the search problem represented in Figure **??**, where a is the start node and there are goal nodes at f and j. For each node, the heuristic cost is indicated on the node, and for each arc, the arc cost is indicated along the arc. Neighbors are ordered according to the f function.

What is the UB when only the start node has been explored? Which goal node is found first by B&B? What is the UB immediately after the first goal node is found? Is the second goal found by B&B?

Answer: The UB is ∞ when only the start node has been explored. The goal node at f is found first, and the UB immediately after is 3. The second goal is not found, as its path is pruned.
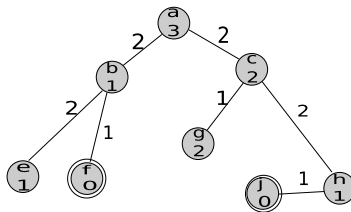

Figure 1: Branch and Bound with Two Goals

3   Learning Goals

You can:

- Define/read/write/trace/debug different search algorithms

- Implement pruning