Learning Objectives

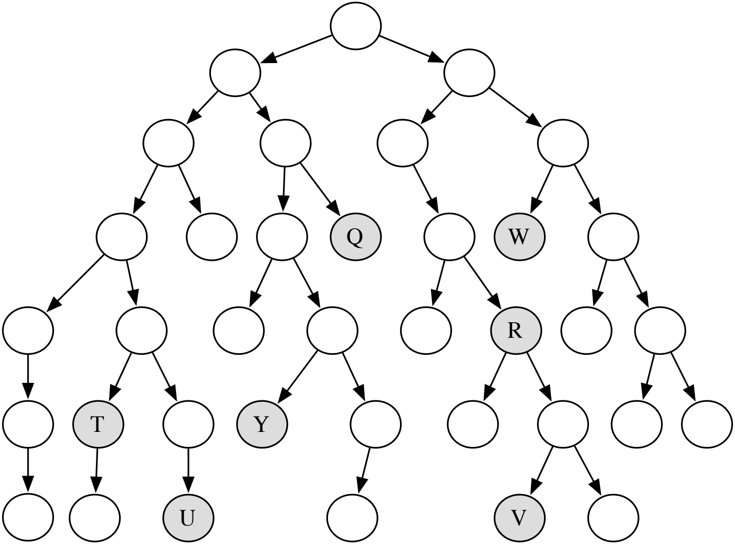
At the end of the class you should be able to:

- justify why depth-bounded search is useful
- demonstrate how iterative-deepening works for a particular problem
- demonstrate how depth-first branch-and-bound works for a particular problem

Bounded Depth-first search

- A bounded depth-first search takes a bound (cost or depth) and does not expand paths that exceed the bound.
  - explores part of the search graph
  - uses space linear in the depth of the search.
- How does this relate to other searches?
- How can this be extended to be complete?

Which shaded goal will a depth-bounded search find first?



Iterative-deepening search

- Iterative-deepening search:
  - Start with a bound $b = 0$.
  - Do a bounded depth-first search with bound b
  - If a solution is found return that solution
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- What happens if there is no path to a goal?
- Surely recomputing paths is wasteful!!!

Iterative Deepening Complexity

Complexity with solution at depth k & branching factor b:

level	breadth-first	iterative deepening	# nodes
1	1	k	b
2	1	$k-1$	b^2
...	...	...	...
$k-1$	1	2	b^{k-1}
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total			

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total	$\geq b^k$	$\leq b^k \left(\frac{b}{b-1}\right)^2$	

Depth-first Branch-and-Bound

- combines depth-first search with heuristic information.
- finds optimal solution.
- most useful when there are multiple solutions, and we want an optimal one.
- uses the space of depth-first search.

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- What if the search encounters a path p such that $cost(p) + h(p) \geq bound$?

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- Why should this use a depth-first search?

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- What can be guaranteed when the search completes?

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- What can be guaranteed when the search completes?
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- How should the bound be initialized?

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Which shaded goals will be best solutions so far?