16-782
Planning & Decision-making in Robotics

*Search Algorithms: Multi-goal A**

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Support for Multiple Goal Candidates

- How to compute a least-cost path to any one of the possible goals?
  - Example 1: Computing a least-cost path to a parking spot given multiple parking spaces (some are better, some are worse, some are closer, some are further)
  - Example 2: Catching a moving target whose future trajectory is known (i.e., multiple potential intercept points)
  - Example 3: Mapping/exploration (next lecture)

A* Search

Main function

$g(s_{start}) = 0$; all other g-values are infinite; $OPEN = \{s_{start}\}$;
ComputePath();
publish solution;

ComputePath function

while(s_{goal} is not expanded and $OPEN \neq 0$)
  remove s with the smallest $[f(s) = g(s)+h(s)]$ from $OPEN$;
  insert s into $CLOSED$;
  for every successor s' of s such that s' not in $CLOSED$
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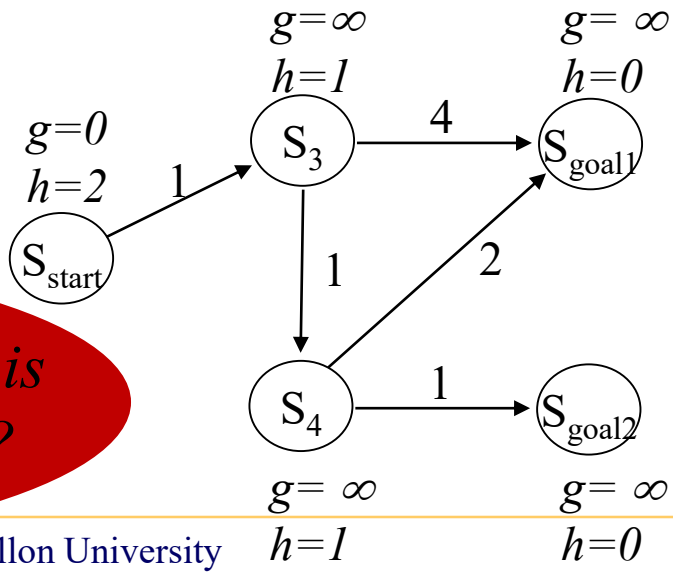

How to find a least-cost path that is lowest across all possible goals?

Introducing "**imaginary**" goal

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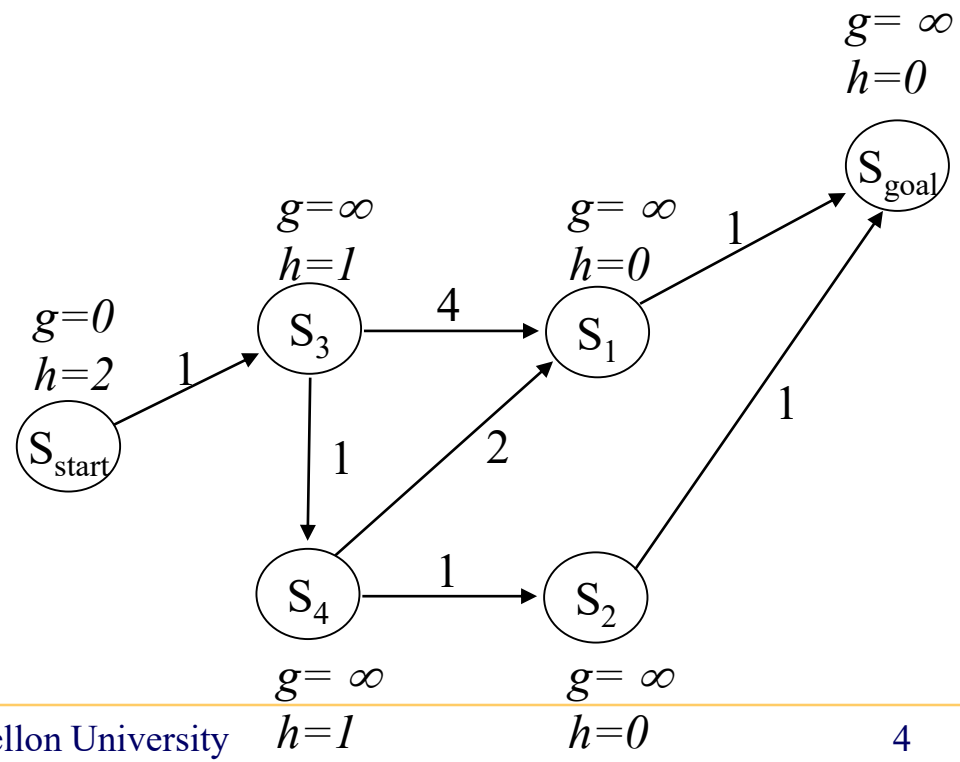
Equivalent problem but with a single goal!



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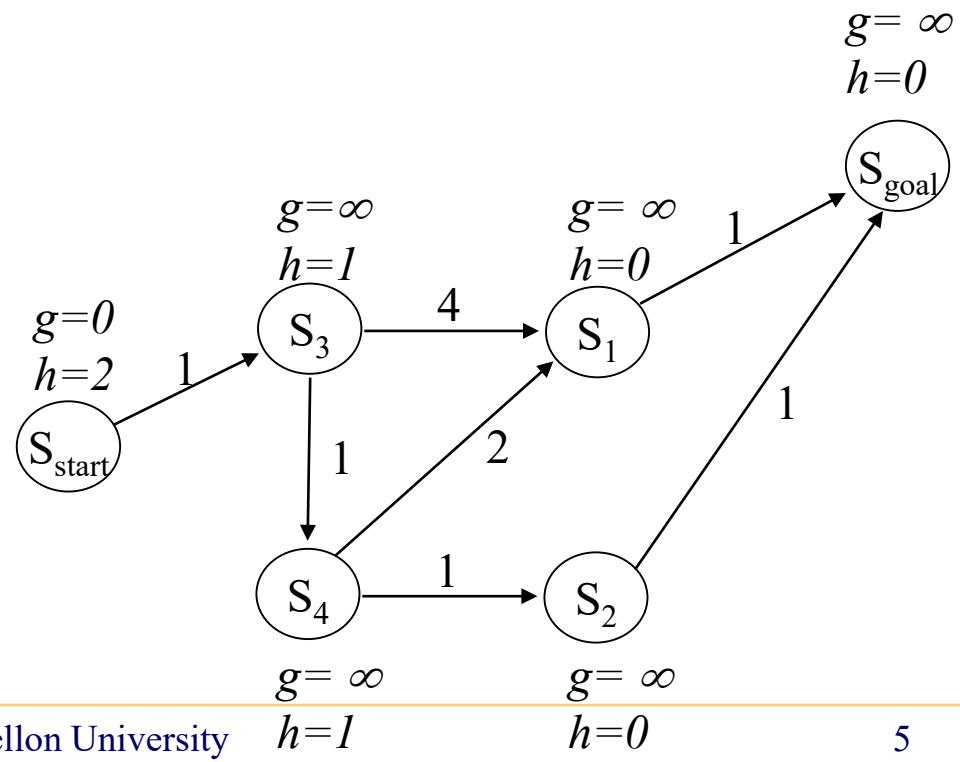
How to prove it?



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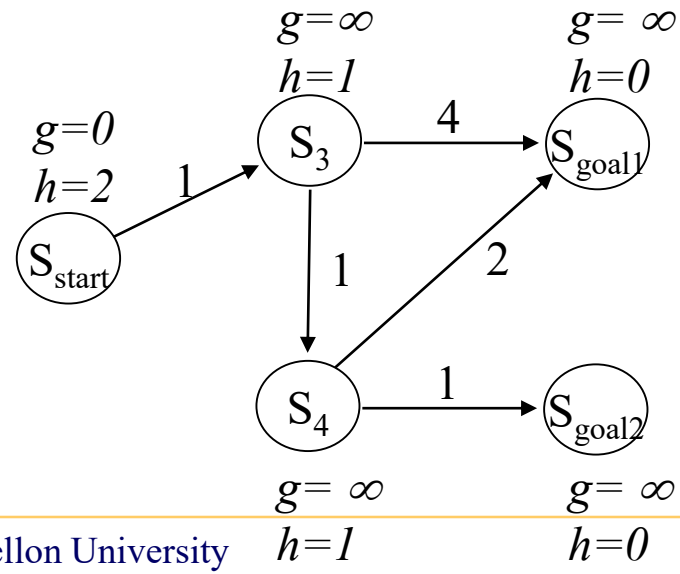

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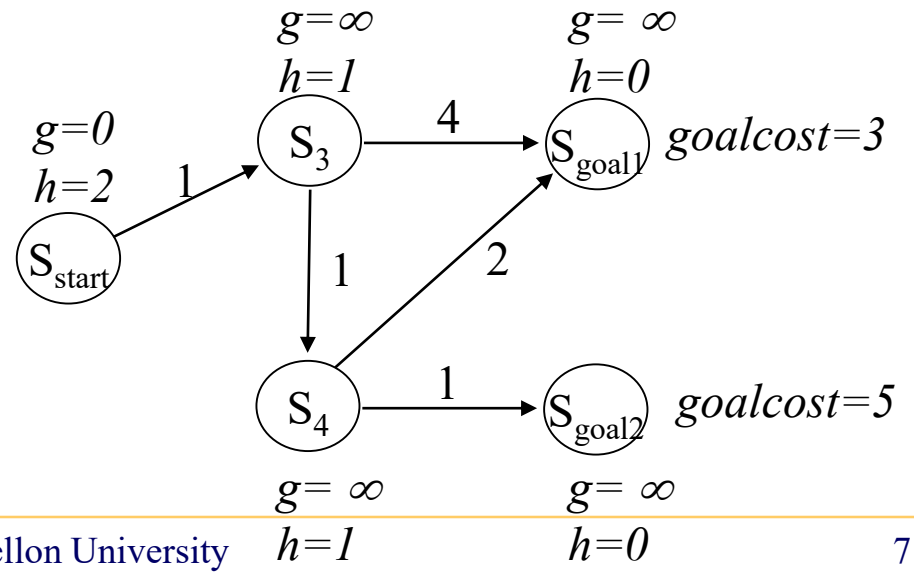

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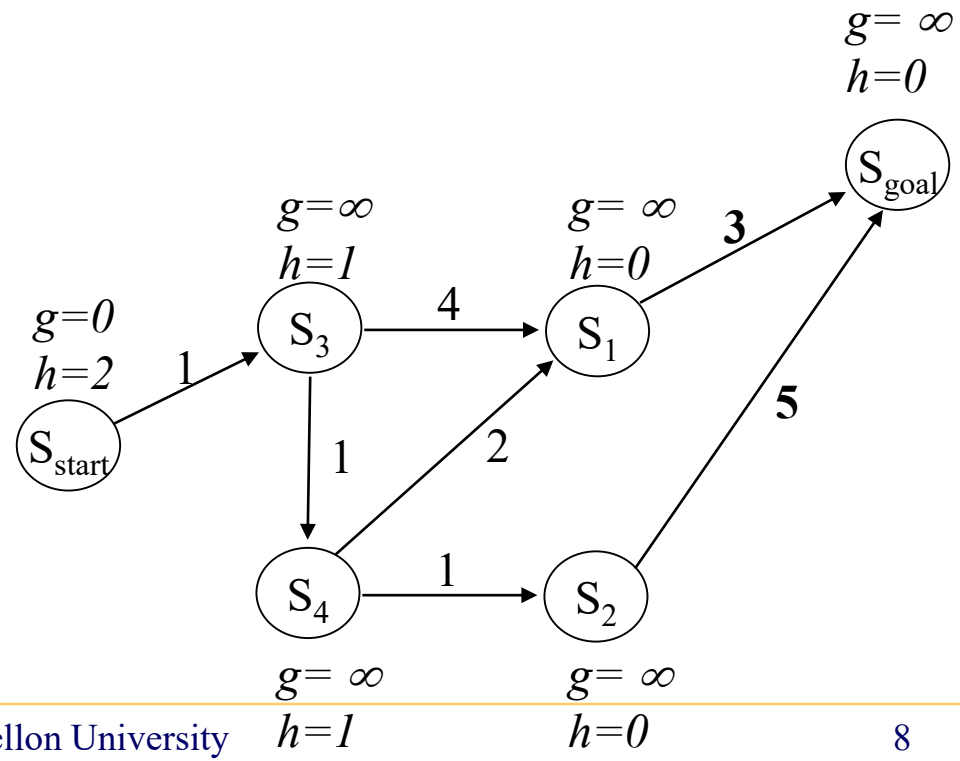

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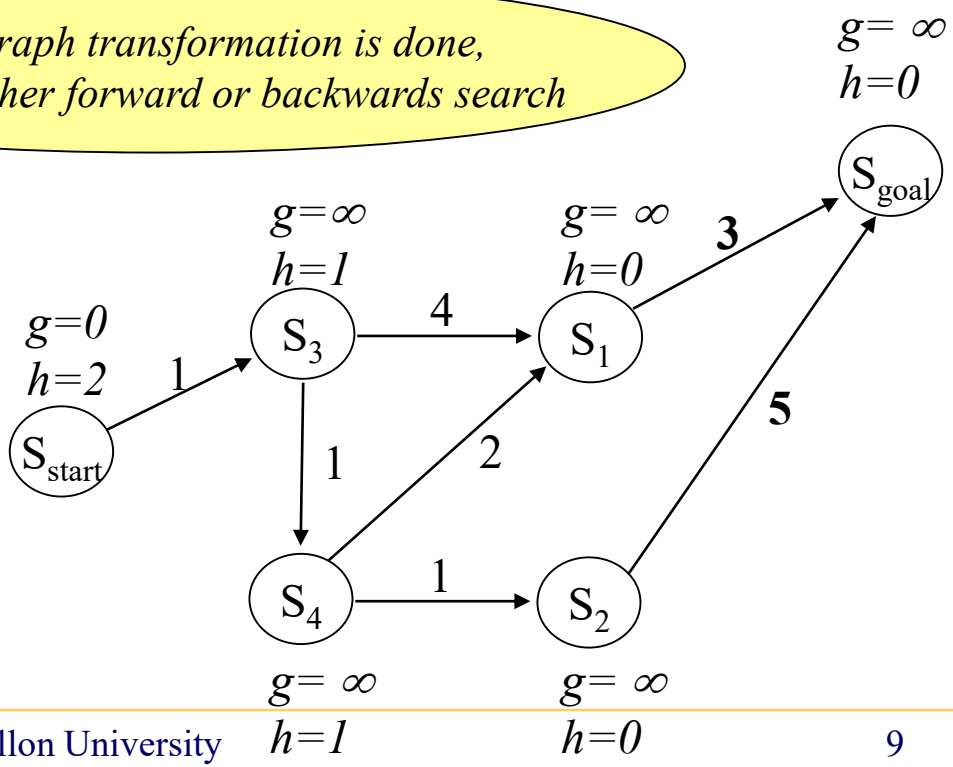

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Any impact on how heuristics is computed?

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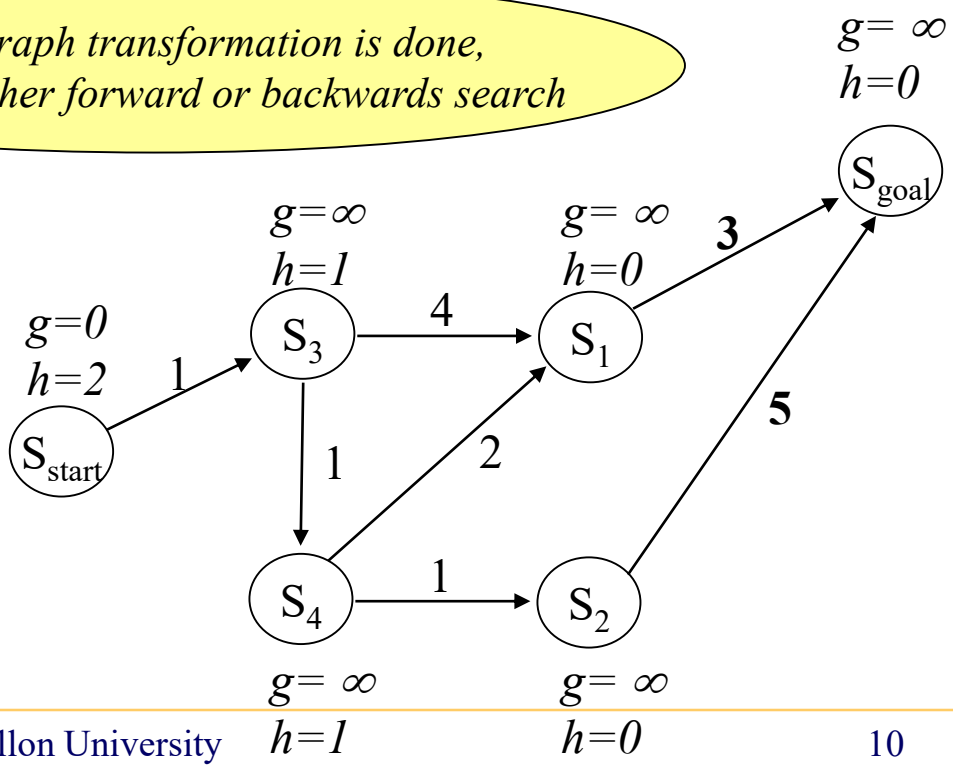

What You Should Know…

- How to search for a path that is cost-minimal given multiple potential goals with different goalcosts (e.g., know how the graph transformation using "imaginary" goal)