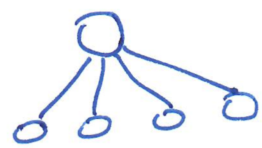
CS5811
Sep. 11, 2020
Friday 1

Previous class

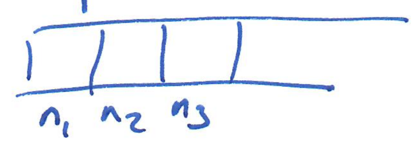
- Uniform cost search
- When to do the goal test?
- Tree and graph search algorithms
- Heuristic "informed" search

Today

- Best-first search
  - Greedy search $f(n) = h(n)$
  - A* search (uses an admissible heuristic)



frontier



ordered with respect to a "desirability" value

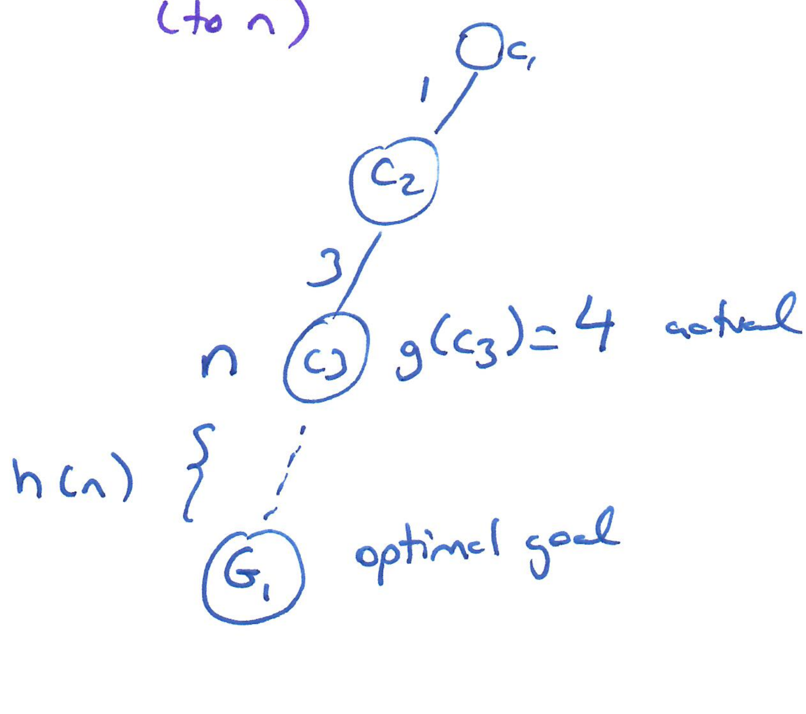
$$f(n) = g(n) + h(n)$$

f: desirability value

n: node

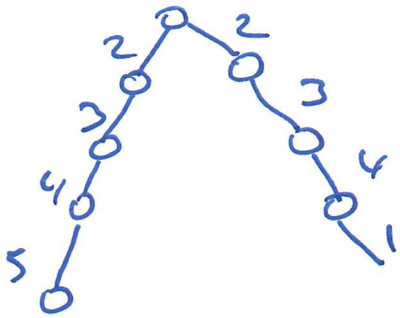
$g(n)$: actual cost so far (to n)

$h(n)$: estimated cost from n to the goal



Greedy search

orders the frontier with respect to the "h" values only.



A* search

is a best-first search with an admissible heuristic.

$$f(n) = g(n) + \underbrace{h(n)}_{}$$

is **admissible**

$h(n)$ is never an overestimation of the cost to the goal from (n).

exact cost $h^*(n)$

$h(n) \leq h^*(n)$

if n is a goal, then the distance to (cost) the goal from n is 0

an admissible heuristic always returns zero at the goal.

How can we moe from an argument (informal) to a formal proof?

For every suboptimal goal there will always be a node that has a lower cost (that node will take us to the optimal goal)

G_1 optimal goal

G_2 suboptimal goal

$f(G_1) = f(G_2)$ they would both be optimal

$f(G_2) > f(G_1)$

Can this happen?

G_2	

G_1 is also in the frontier

This cannot happen

Can this happen?

G_2		n	

Can we prove that this cannot happen using f, g, and h?

$f(G_1) < f(G_2)$

$f(G_1) =$

$f(n)$ will always be lower than $f(G_1)$ and $f(G_2)$

G_1 is a goal $h(G_1) = 0$

$f(G_1) < f(G_2)$ $h(G_1) = 0$ $h(G_2) = 0$

We are trying to prove:

G_2 not expanded before n

$f(G_2) < f(n)$ should not happen

If G_2 and n are always in the frontier,

$f(n) \leq f(G_2)$ prove this

$f(G_1) < f(G_2)$

$f(n)$ leads to G_1

$f(n) = g(n) + \underset{\text{admissible}}{h(n)} \leq \underbrace{g(n) + h^*(n)}_{f(G_1)} < f(G_2)$

actual cost to the goal

$f(n) < f(G_2)$

Therefore the node containing G_2 will never be picked up over node n.