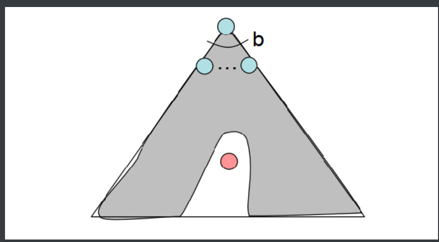
FAI lecture 4: informed search

- "Informed": search **towards the goal** instead of **all over the place**
- search heuristics: manhattan / euclidean distance

greedy

not optimal, worst case like a badly guided DFS



beam search

- keeps the *k* best paths on the frontier
- properties

  node expanded

  time complexity

  space complexity

  complete? No

  optimal? no

A* search

- combining UCS and greedy

  Uniform-cost by path cost (**backward cost**) *g(n)*

  Greedy-cost by goal (**forwards cost**) *h(n)*
- Optimal? no, **only when heuristic is admissible**
- **Admissible** heuristics （不准做悲观估计！）

- A heuristic h is *admissible* if:

$$0 \le h(n) \le h^*(n)$$

where $h^*(n)$ is the true cost to a nearest goal

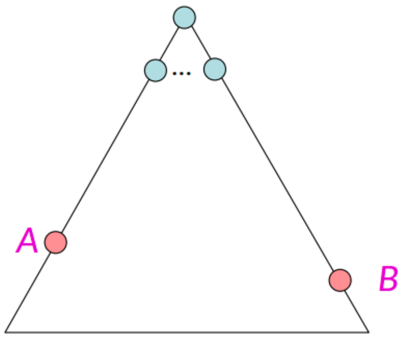
proof

Assume:

- A is an optimal goal node
- B is a suboptimal goal node
- h is admissible

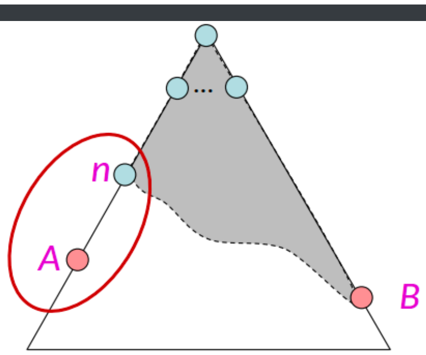
Claim:

- A will be chosen for expansion before B



Proof:

- Imagine *suboptimal* B is on the frontier
- Some ancestor n of A is on the frontier, too (maybe A itself!)
- Claim: n will be expanded before B
  1. $f(n) \le f(A)$



admissible, then f(n) <= f(A)

which means g(n) + h(n) <= g(A)

since A is optimal and B is suboptimal, we have g(A) < g(B)

then we have f(n) = g(n) + h(n) <= g(A) < g(B) = g(B) + h(B) = f(B)

so that f(n) < f(B), n will be expanded before B.

admissible heuristics