BFS+DFS

IDS — Depth first Iterative Deepening

Def (Brute force search) Blind search

Search with no info beyond: initial state, Actions, goaltest.

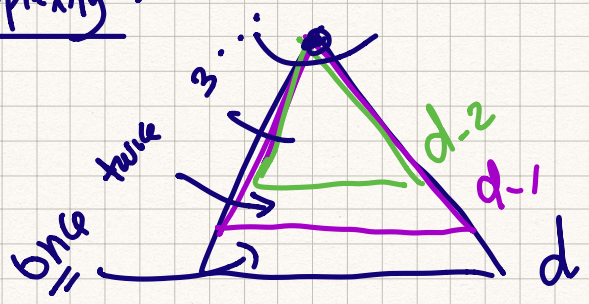
Thm (IDS) Korf 1985: (Pearl 80's).

IDS asymptotically optimal among brute force (BFS, DFS) search algorithms in terms of space, time, and cost of the solution.

Proof

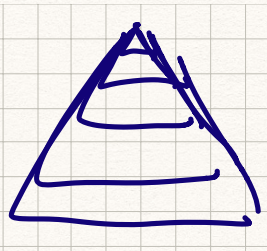
1) **optimality:** IDS explors all nodes at level L before going deeper in the tree. Garante to get the Shallowest and least cost Solution. (Constant cost).

2) **time complexity:**



#nodes generated at depth D =

$$b^d - 2b^{d-1} - 3b^{d-2} - \dots - bd$$



$$\#\text{nodes} = b^5 + 2b^4 + 3b^3 + 4b^2 + 5b$$

coeff $1 \to d$

exp $d \to 1$

$$= 1b^d + 2b^{d-1} + 3b^{d-2} + \cdots$$

$$= b^d\left(1 + 2b^{-1} + 3b^{-2} + \cdots + db^{1-d}\right)$$

$$= b^d\left(1 + 2\frac{1}{b} + 3\left(\frac{1}{b}\right)^2 + 4\left(\frac{1}{b}\right)^3 + \cdots + d\left(\frac{1}{b}\right)^{d-1}\right)$$

$$< b^d\left(1 + 2\frac{1}{b} + 3\left(\frac{1}{b}\right)^2 + \cdots\right)$$

limit of ↑ as $d \to \infty$

$$= b^d\left(1 - \frac{1}{b}\right)^{-2} \qquad b > 1$$

$$\leq C\, b^d$$

C will define how much computation time

is wasted.

C is an upper bound on that waste ($d \to \infty$)

b increases $C \to 1$. $d \to \infty$

$b \ll$ close to 1 $C \to \infty$ ($d \to \infty$)

Waste in time is negligible for large space ($b \uparrow d \uparrow$).

3) Space DFS Space Complexity.

$O(b \times d)$