



# SINGLE-STATE PROBLEMS

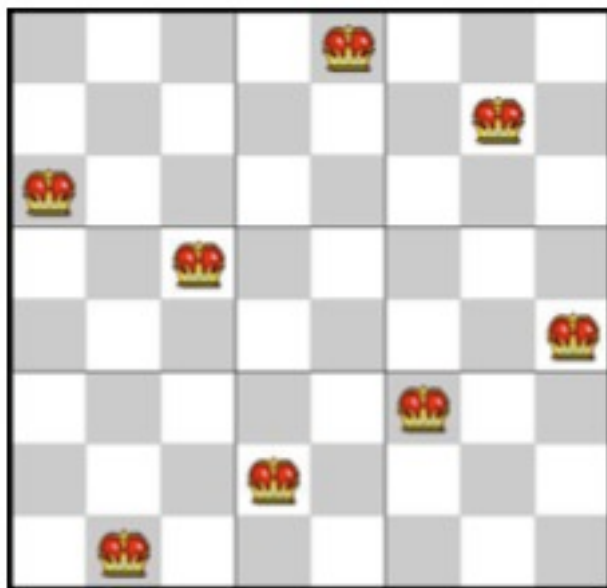
7	2	4
5		6
8	3	1

Start State

	1	2
3	4	5
6	7	8

Goal State

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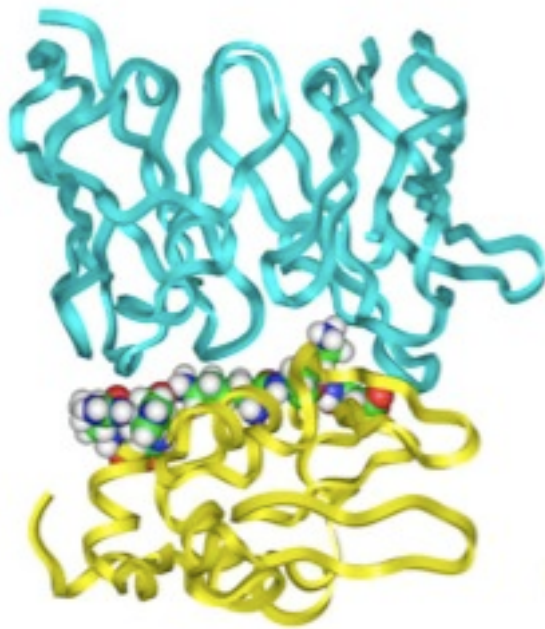


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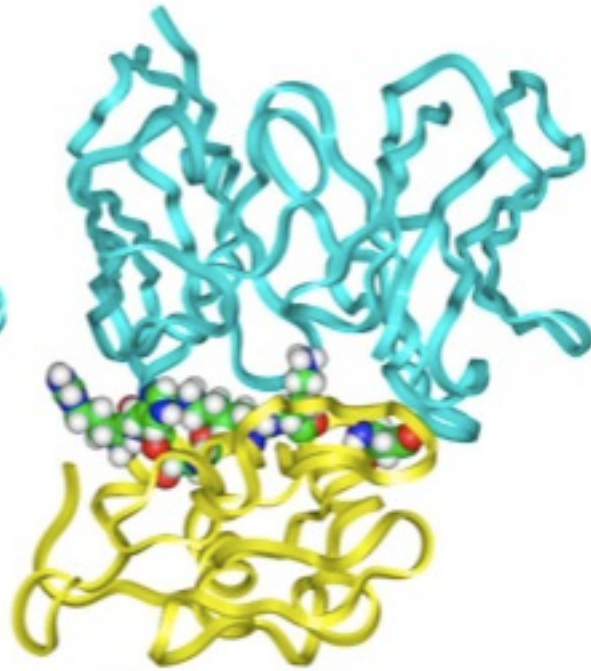








X-ray structure



MD conformer at 1 NSec

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## BLIND SEARCH

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## BREADTH-FIRST COMPLEXITY

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- Branching Factor = 10
- 100 Bytes/node
- 1000 nodes evaled/second

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## BREADTH-FIRST COMPLEXITY

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DEPTH	NODES	TIME	MEMORY
2	1100	0.11 seconds	1 megabyte
4	111100	11 seconds	106 megabytes
6	$10^7$	19 minutes	10 gigabytes
8	$10^9$	31 hours	1 terabyte
10	$10^{11}$	129 days	101 terabytes
12	$10^{13}$	35 years	10 petabytes
14	$10^{15}$	3523 years	1 exabyte

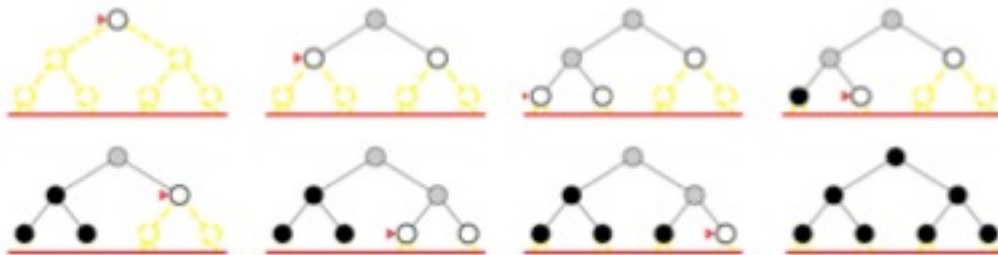
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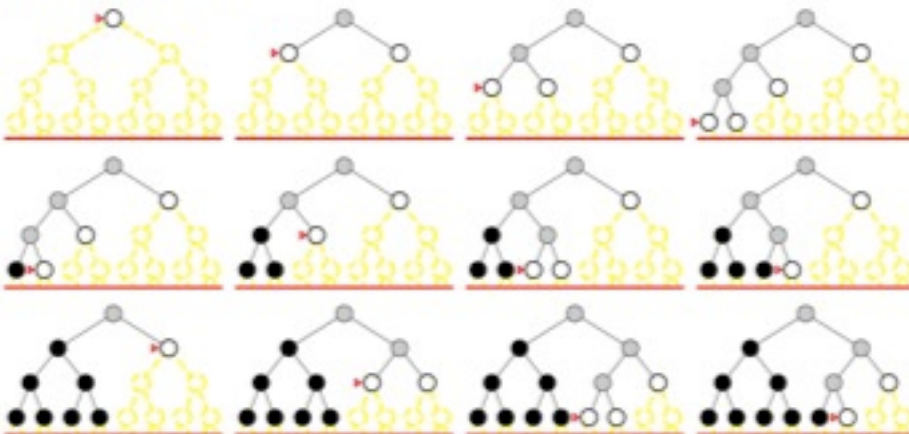
# ID-search, example

Limit=2



# ID-search, example

Limit=3



# ITERATIVE DEEPENING

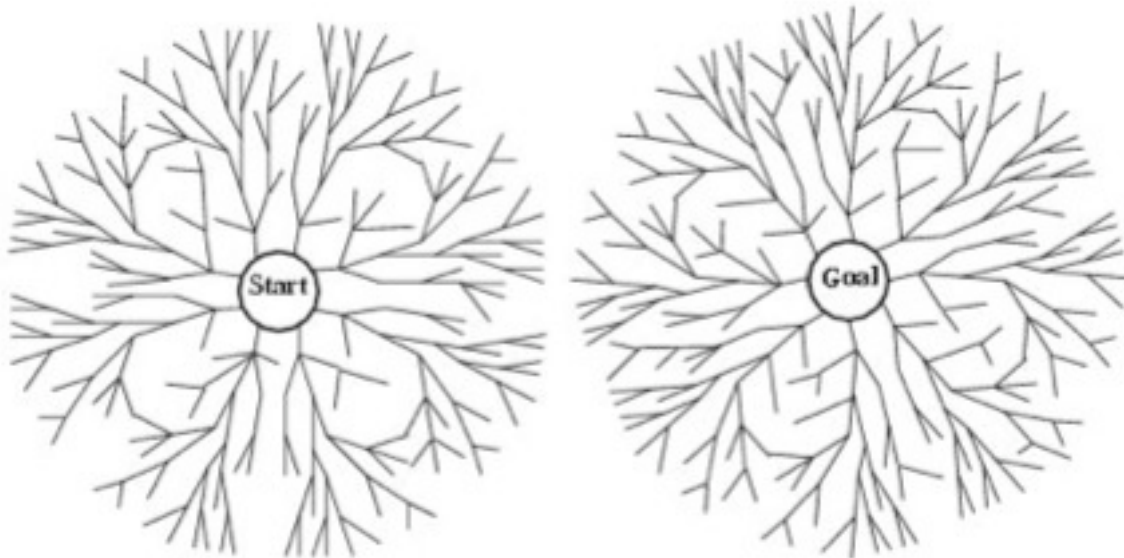
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## Preferred Uninformed Search Method

*(large search space)*

*(solution depth unknown)*

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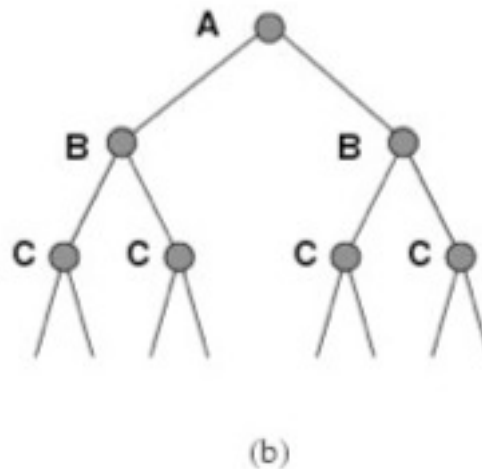
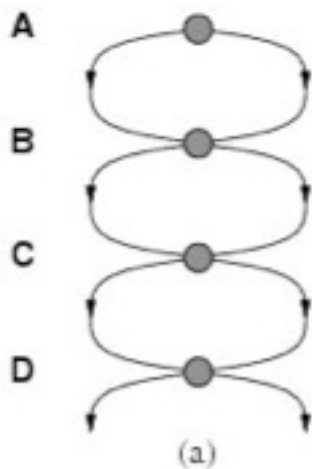
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# SUMMARY OF ALGORITHMS

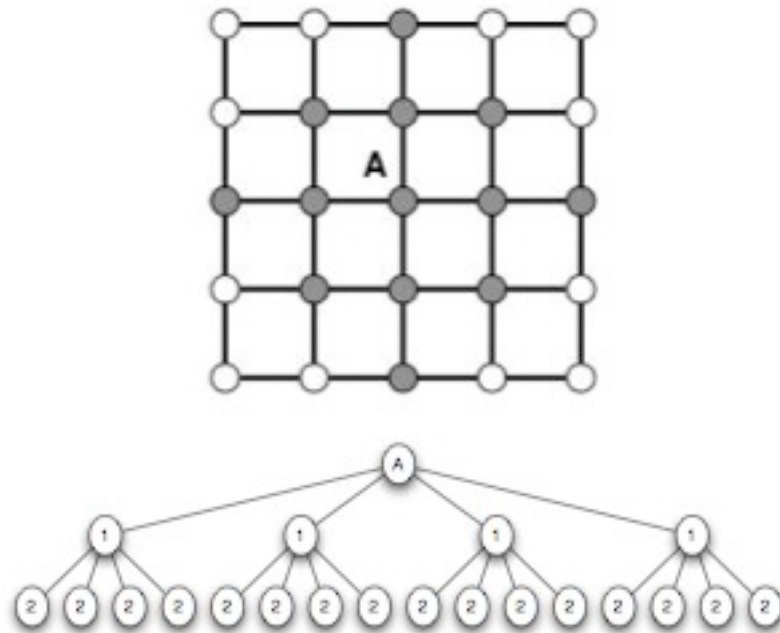
Criterion	Breadth-First	Uniform-cost	Depth-First	Depth-limited	Iterative deepening	Bidirectional search
Complete?	YES*	YES*	NO	YES, if $l \geq d$	YES	YES*
Time	$b^{d+1}$	$b^{C^*/\epsilon}$	$b^m$	$b^l$	$b^d$	$b^{d/2}$
Space	$b^{d+1}$	$b^{C^*/\epsilon}$	$bm$	$bl$	$bd$	$b^{d/2}$
Optimal?	YES*	YES*	NO	NO	YES	YES

# AVOIDING REPEATED STATES



## AVOIDING REPEATED STATES

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## AVOIDING REPEATED STATES

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*fringe* ← {initial-state}

**loop**

if (EMPTY? *fringe*)  
 then return failure

*node* ← (POP *fringe*)

if (GOAL? *node*)  
 then return *node*

*fringe* ← (APPEND  
*fringe*  
 (EXPAND *node*))

*closed* ← an empty set

*fringe* ← {initial-state}

**loop**

if (EMPTY? *fringe*)  
 then return failure

*node* ← (POP *fringe*)

if (GOAL? *node*)  
 then return *node*

if (STATE *node*) is not in *closed*  
 then add (STATE *node*) to *closed*  
*fringe* ← (APPEND *fringe*  
 (EXPAND *node*))

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