

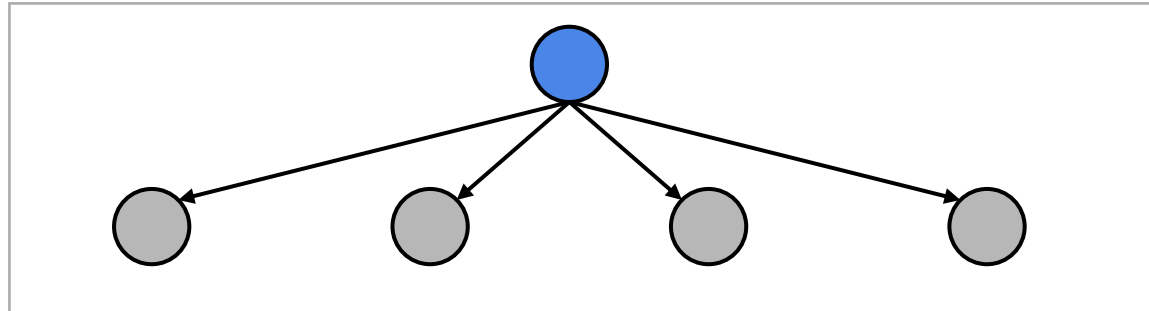


# Local Beam Search

# Local Beam Search

- Algorithm
  - Keeps track of **K** states rather than just one
  - It begins with **1** to **K** randomly generated states
  - At each step, all the successors of all **K** states are generated
  - Selects the **K** best successors from the complete list and repeats

# Local Beam Search (K=3)



**Figure 1.** Local beam search tree.

# Local Beam Search (K=3)

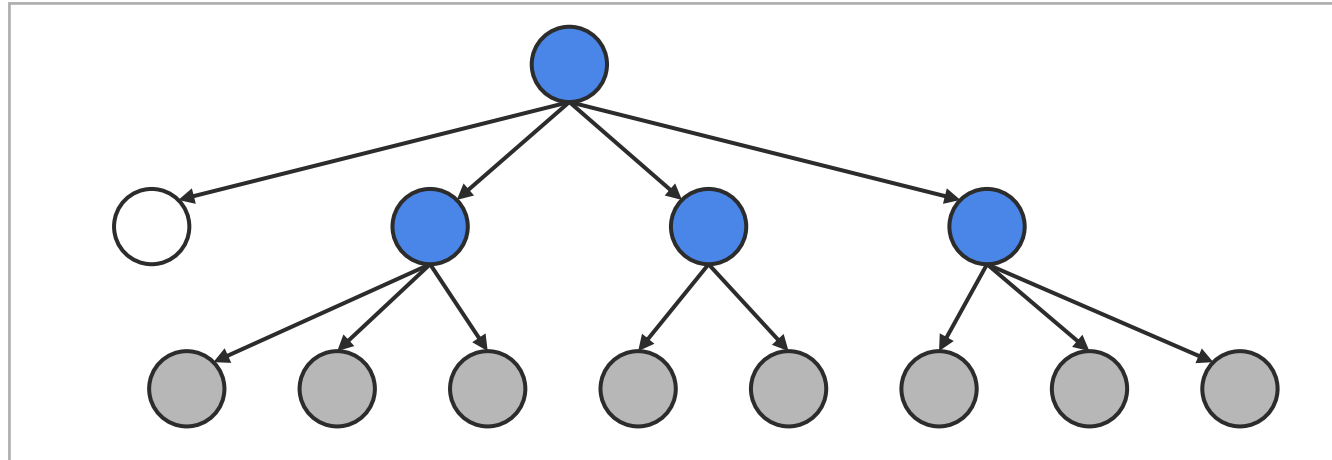
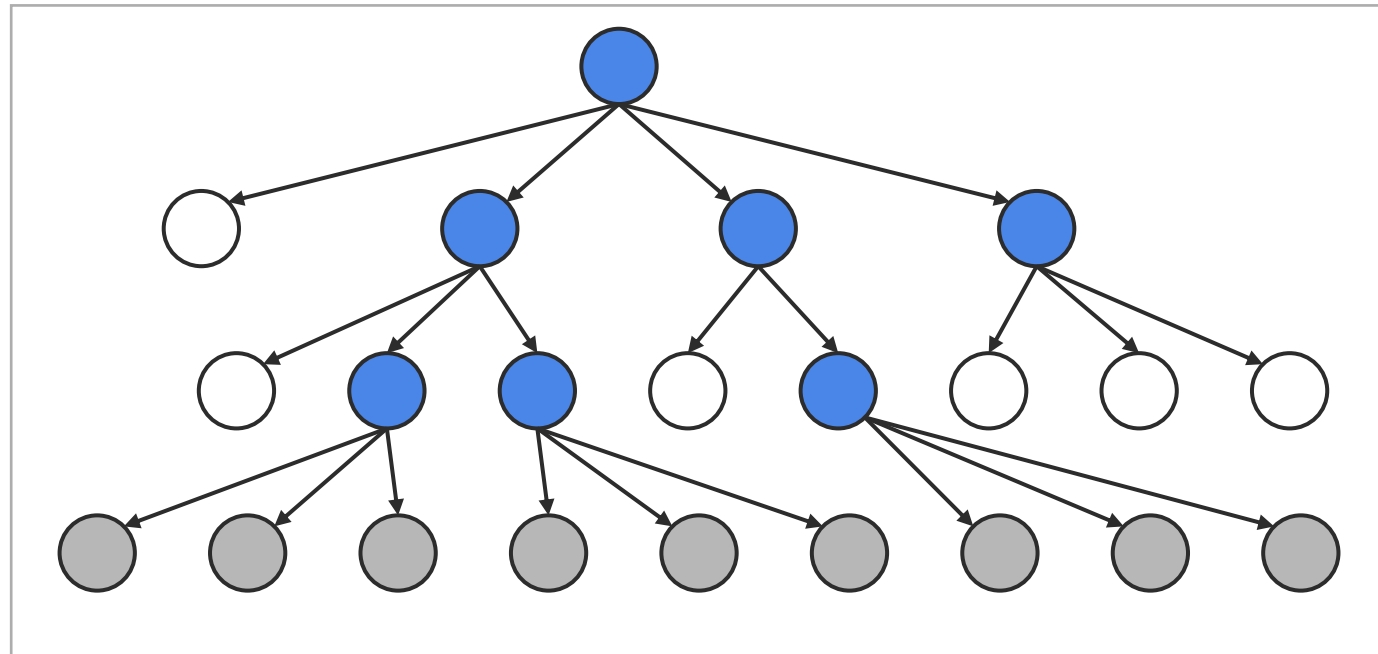


Figure 1. Local beam search tree.

# Local Beam Search (K=3)



**Figure 1.** Local beam search tree.

# Local Beam Search (K=3)

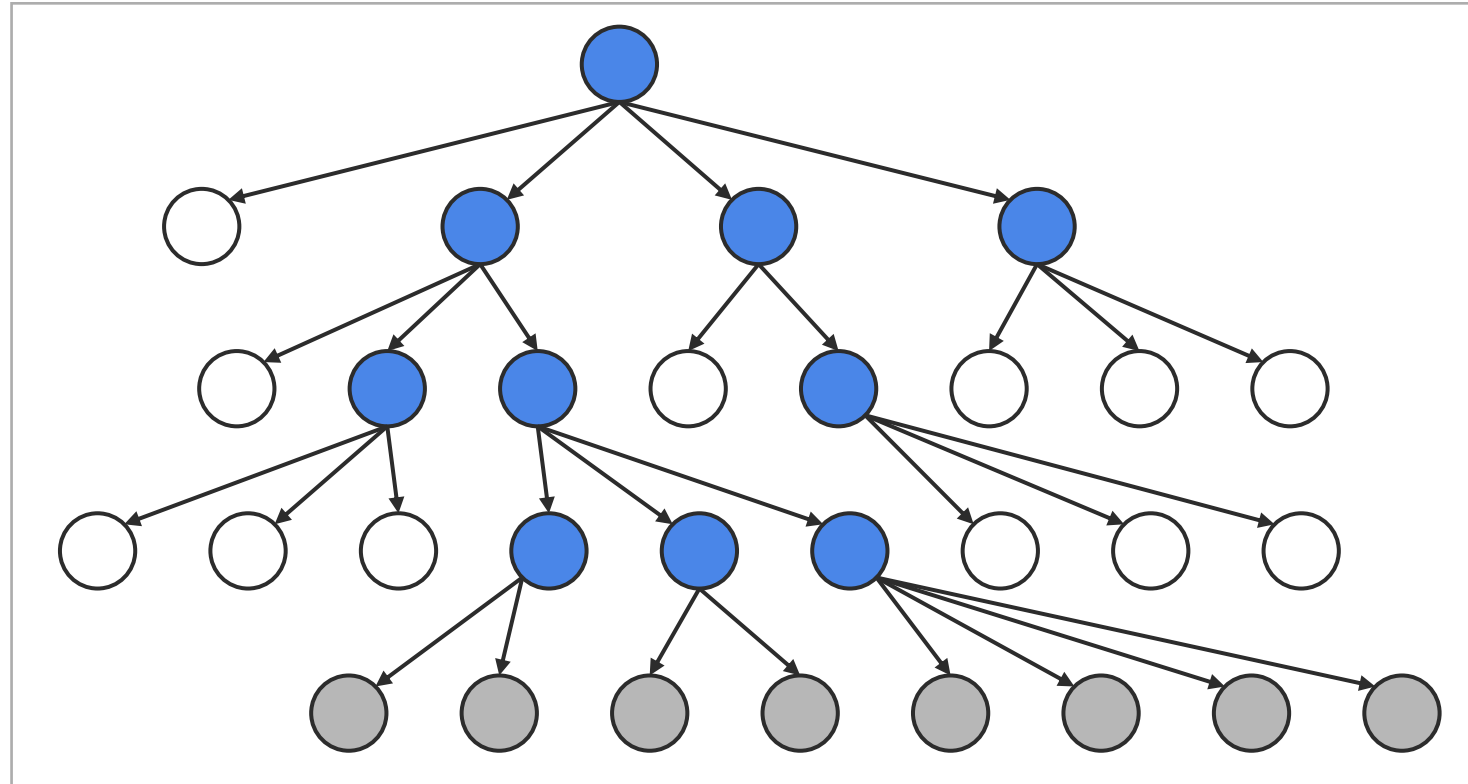


Figure 1. Local beam search tree.

# Local Beam Search (K=3)

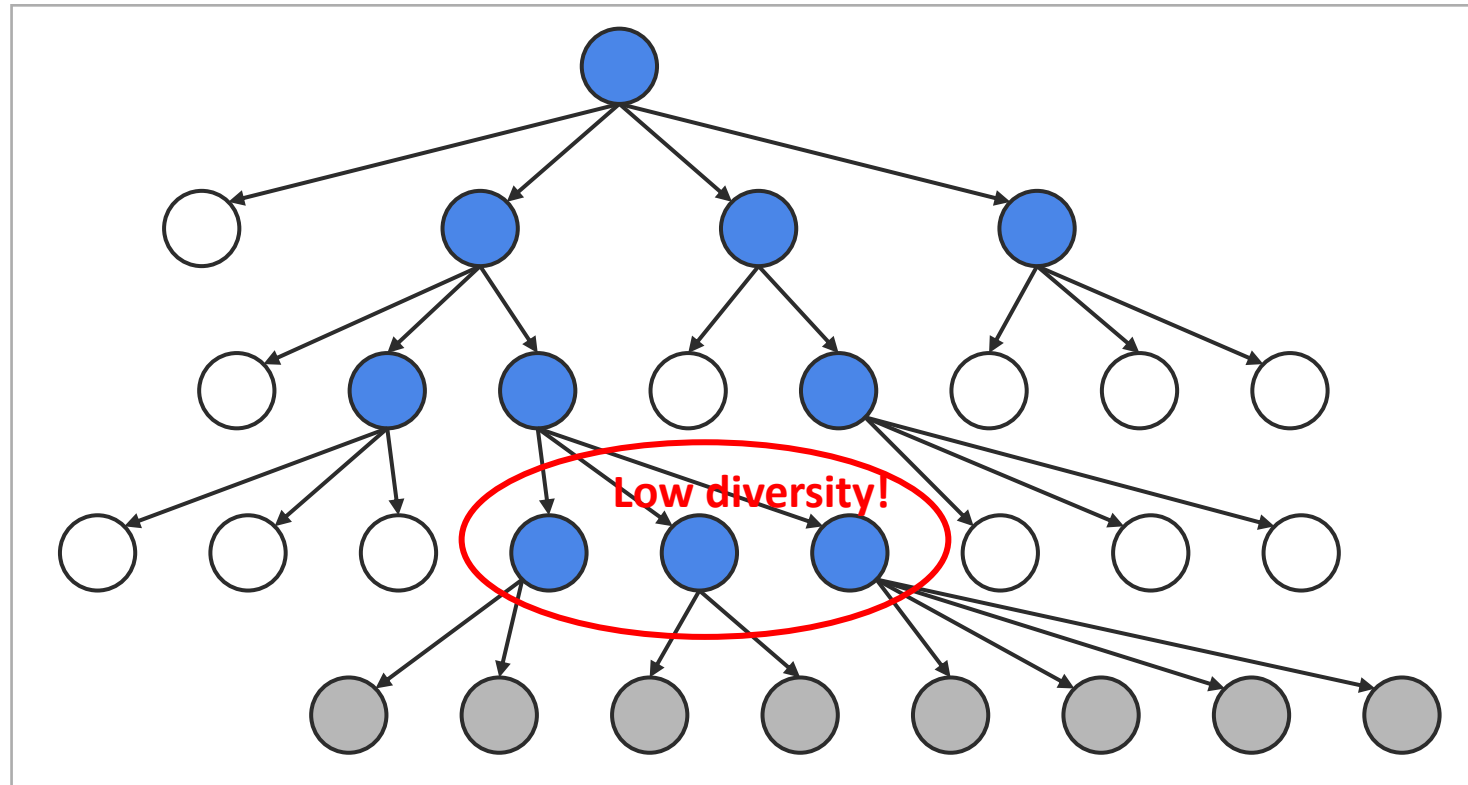


Figure 1. Local beam search tree.

# Knowledge Check 1



If you run a Local Beam Search with  $K=1$ , it will get the same results as which other algorithm?

A

Greedy Best-First Search

B

A\* Search

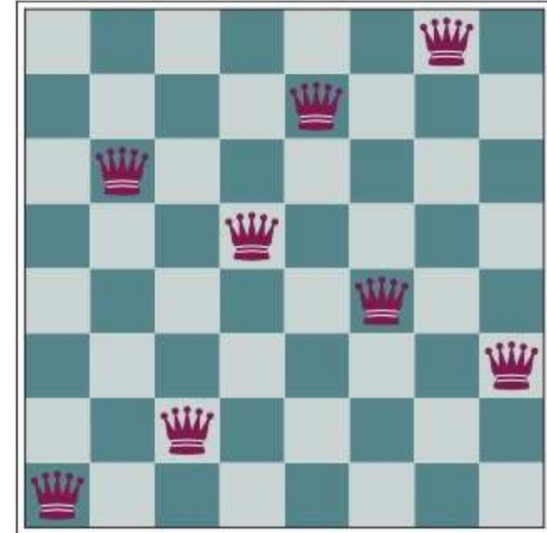
C

Hill-Climbing Search



# 8-queens

- Goal
  - Place 8 queens on a chess board so that no queen attacks another
- State
  - One queen per column
- Objective function
  - Number of queen pairs attacking each other
- State neighborhood
  - Move one queen to another row in the same column



**Figure 2.** The 8-queens problem.

# Local Beam Search (K=3)



18	12	14	13	13	12	14	14
14	16	13	15	12	14	12	16
14	12	18	13	15	12	14	14
15	14	14	W	13	16	13	16
W	14	17	15	W	14	16	16
17	W	16	18	15	W	15	W
18	14	W	15	15	14	W	16
14	14	13	17	12	14	12	18

**Figure 3.** Local beam search.

# Local Beam Search (K=3)

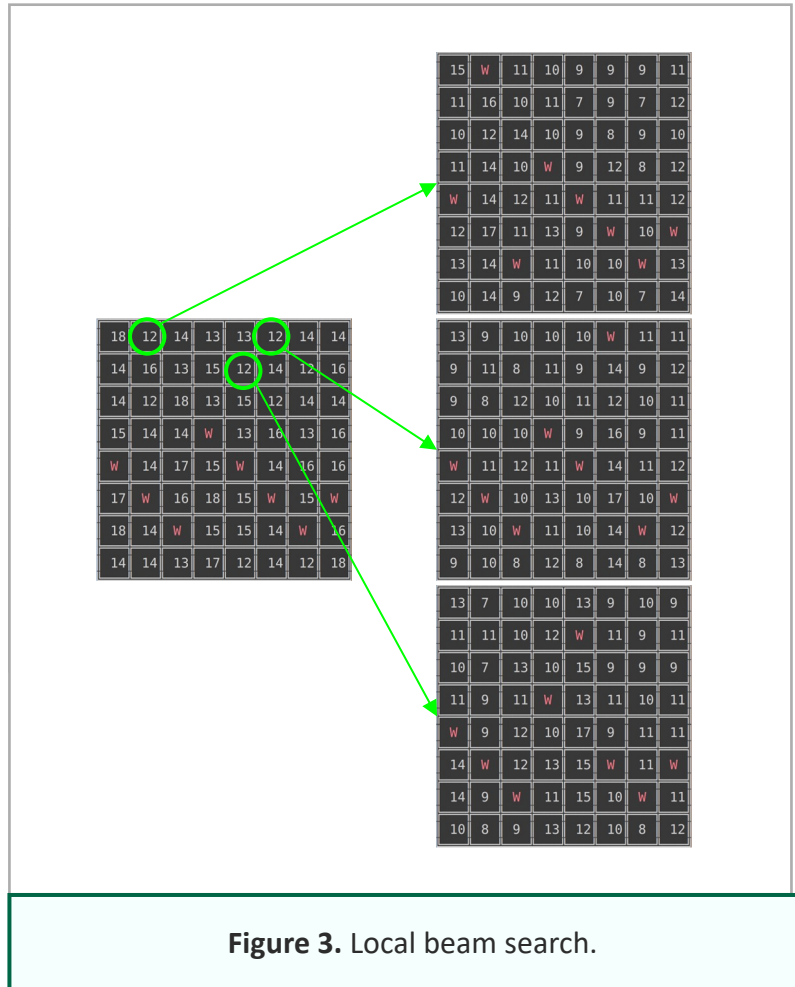
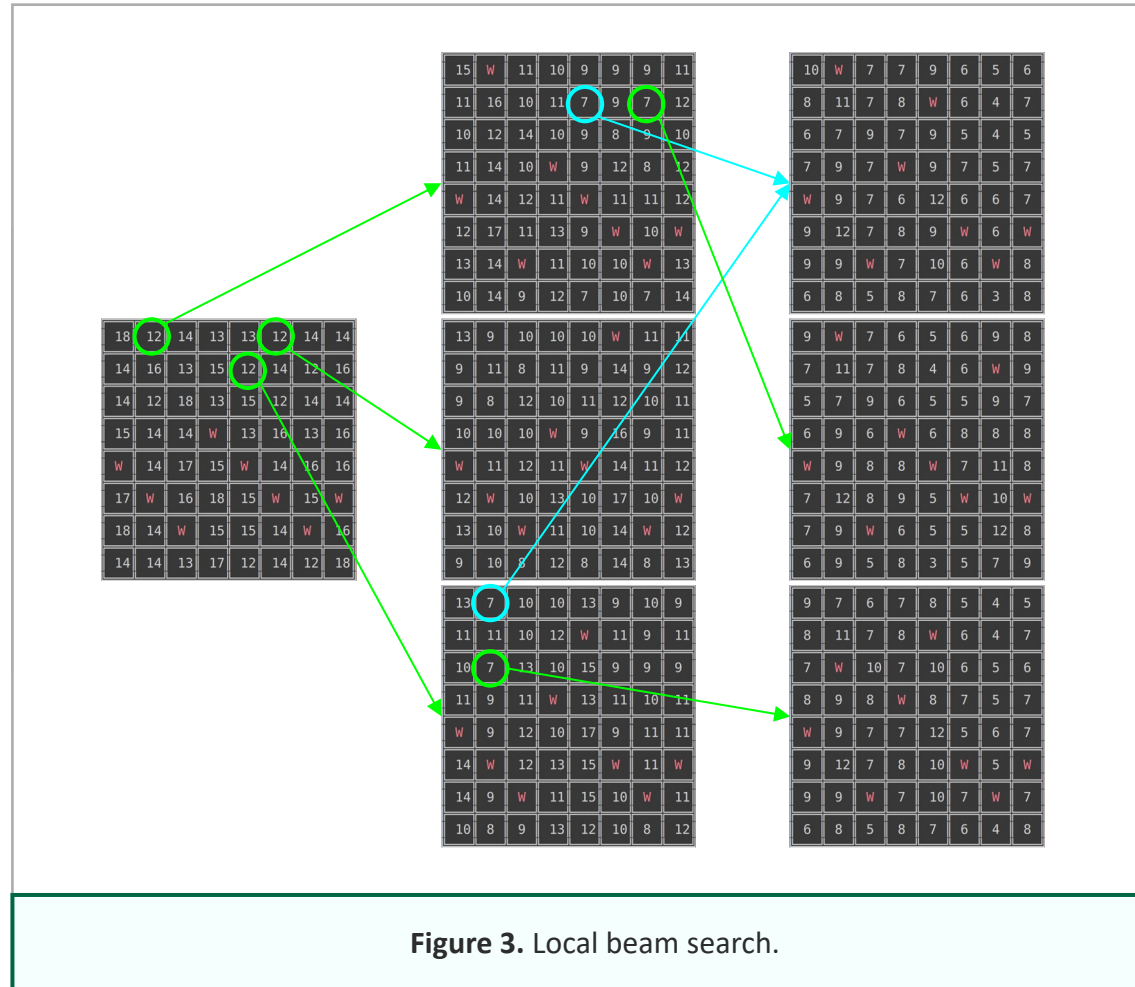


Figure 3. Local beam search.

# Local Beam Search (K=3)



# Local Beam Search (K=3)

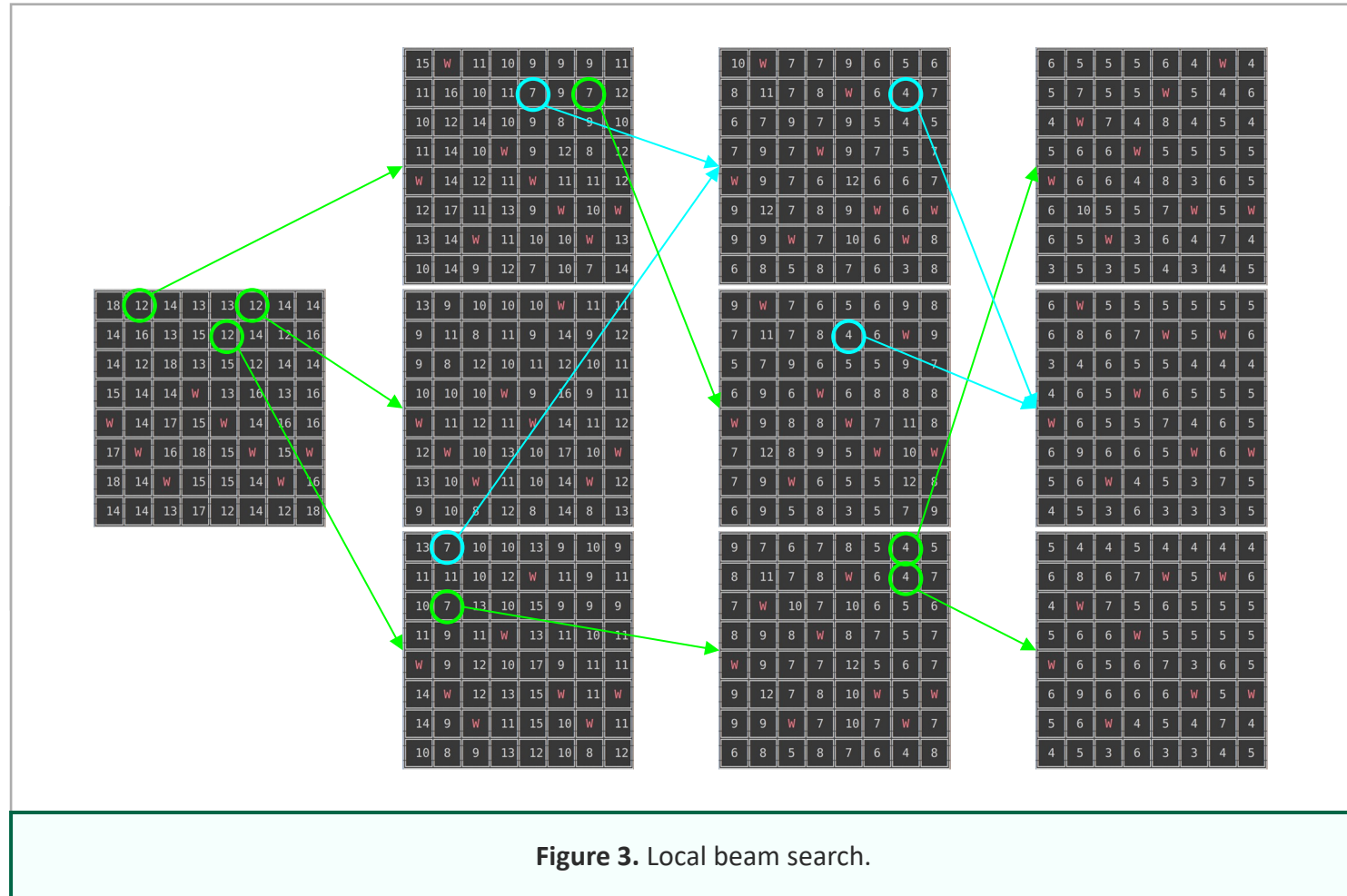


Figure 3. Local beam search.

# Local Beam Search (K=3)

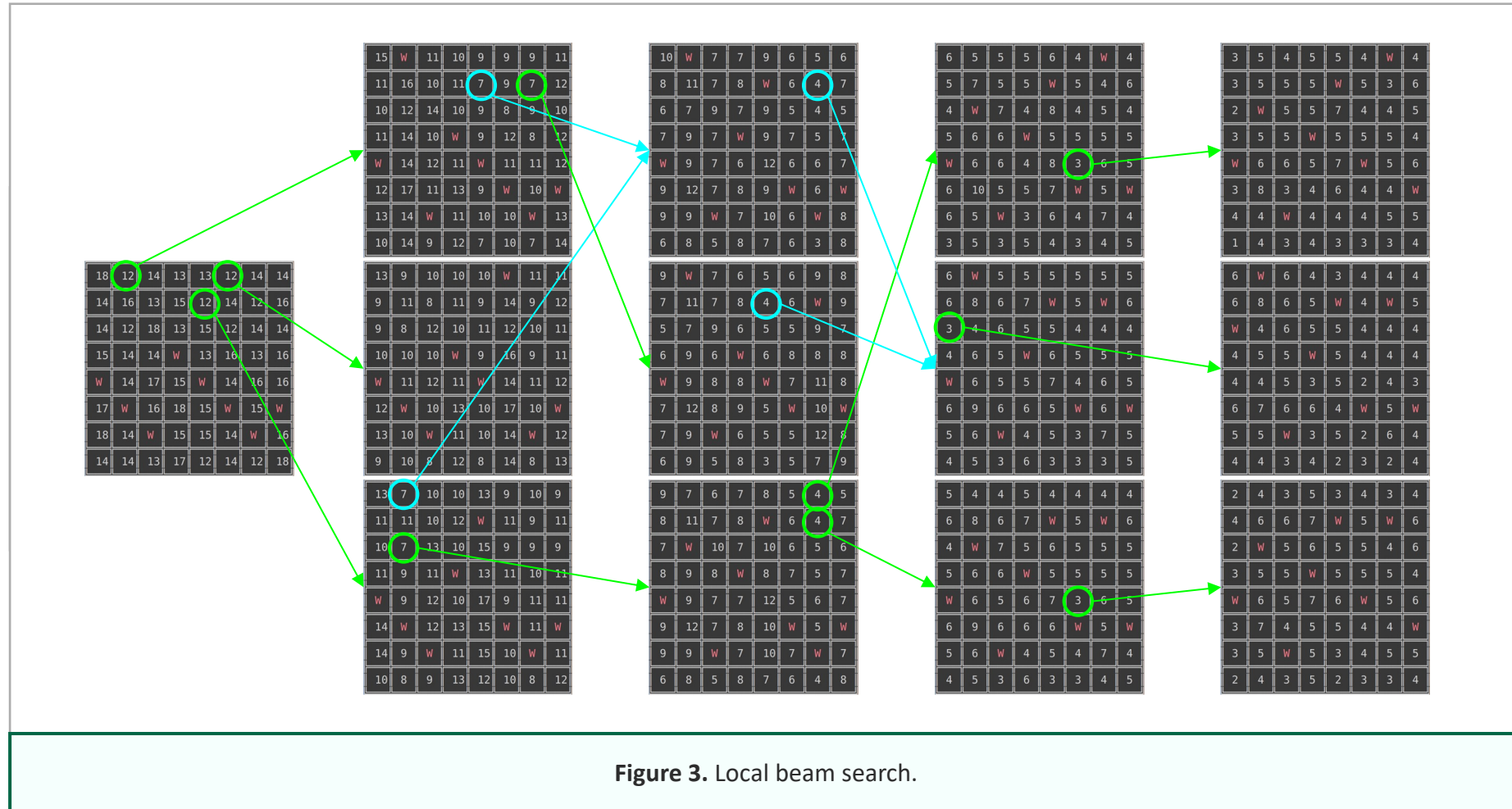


Figure 3. Local beam search.

# Local Beam Search

- Stochastic variation
  - Chooses successors with probability proportional to the successor's objective function value
  - Increases diversity

# Knowledge Check 2



If you choose successors with probability inversely proportional to their objective function value, which successors of the state in the left may be chosen?

18	12	14	13	13	12	14	14
14	16	13	15	12	14	12	16
14	12	18	13	15	12	14	14
15	14	14	W	13	16	13	16
W	14	17	15	W	14	16	16
17	W	16	18	15	W	15	W
18	14	W	15	15	14	W	16
14	14	13	17	12	14	12	18

Figure 4. Objective function values for all successors of the current state.

A

Any successor with objective function value equal to 12

B

Any successor with objective function value equal to 18

C

Any successor





You have reached the end  
of the lecture.



## Image/Figure References

Figure 1. Beam search tree. Source: Russell & Norvig, Artificial Intelligence: A Modern Approach, 4th edition, Pearson, 2021.

Figure 2. The 8-queens problem. Source: Russell & Norvig, Artificial Intelligence: A Modern Approach, 4th edition, Pearson, 2021.

Figure 3. Beam search. The objective function value for this state is 1. Source: Russell & Norvig, Artificial Intelligence: A Modern Approach, 4th edition, Pearson, 2021.

Figure 4. Objective function values for all successors of the current state. Source: Russell & Norvig, Artificial Intelligence: A Modern Approach, 4th edition, Pearson, 2021.