AI Search Strategy Questions

Generated from Knowledge Graph Analysis

This document contains problem instances for various AI search problems and questions about the most appropriate solving strategies. Each problem includes instance visualizations and detailed answers based on knowledge graph analysis.

1. N-Queens

Instance 1:

Board Size: 4×4, **Pre-placed Queens:** 1

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.	.	.	.
Q	.	.	.
.	.	.	.

Question: For the N-Queens problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with Constraint Propagation
Systematically explores valid configurations, pruning invalid branches early.

Complexity: Time: O(n!), Space: O(n)

Alternative Strategies:

• **DFS**: When backtracking is implemented

• **Hill Climbing**: For quick approximate solutions

Recommended Heuristics: Number of Conflicts, Attacking Pairs

Instance 2:

Board Size: 6×6, **Pre-placed Queens:** 1

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.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	Q	.	.

Question: For the N-Queens problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with Constraint Propagation
Systematically explores valid configurations, pruning invalid branches early.

Complexity: Time: O(n!), Space: O(n)

Alternative Strategies:

• **DFS**: When backtracking is implemented

• **Hill Climbing**: For quick approximate solutions

Recommended Heuristics: Number of Conflicts, Attacking Pairs

Instance 3:

Board Size: 4×4, **Pre-placed Queens:** 2

.	Q	.	.
.	.	.	.
Q	.	.	.
.	.	.	.

Question: For the N-Queens problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with Constraint Propagation
Systematically explores valid configurations, pruning invalid branches early.

Complexity: Time: O(n!), Space: O(n)

Alternative Strategies:

• **DFS**: When backtracking is implemented

• **Hill Climbing**: For quick approximate solutions

Recommended Heuristics: Number of Conflicts, Attacking Pairs

2. Tower of Hanoi

Instance 1:

Number of Disks: 3

Initial Configuration:
Peg A: [3, 2]
Peg B: [1]
Peg C: []

Goal: All disks on Peg C

> **Question: For the Tower of Hanoi problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?**

Answer:

Best Strategy: Recursive Solution (DFS-based)
Natural recursive structure. Optimal solution in 2^n - 1 moves.

Complexity: Time: O(2^n), Space: O(n)

Properties: Optimal, Complete

Alternative Strategies:

• **BFS**: When exploring all possibilities

Recommended Heuristics: Number of Disks to Move

Instance 2:

Number of Disks: 4

Initial Configuration:
Peg A: [4, 3, 2, 1]
Peg B: []
Peg C: []

Goal: All disks on Peg C

> **Question: For the Tower of Hanoi problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?**

Answer:

Best Strategy: Recursive Solution (DFS-based)
Natural recursive structure. Optimal solution in 2^n - 1 moves.

Complexity: Time: O(2^n), Space: O(n)

Properties: Optimal, Complete

Alternative Strategies:

• **BFS**: When exploring all possibilities

Recommended Heuristics: Number of Disks to Move

Instance 3:

Number of Disks: 4

Initial Configuration:
Peg A: [4, 3, 2, 1]
Peg B: []
Peg C: []

Goal: All disks on Peg C

Question: For the Tower of Hanoi problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Recursive Solution (DFS-based)
Natural recursive structure. Optimal solution in 2^n - 1 moves.

Complexity: Time: O(2^n), Space: O(n)

Properties: Optimal, Complete

Alternative Strategies:

• **BFS**: When exploring all possibilities

Recommended Heuristics: Number of Disks to Move

3. Graph Coloring

Instance 1:

Vertices: 7, **Colors Available:** 4, **Edges:** 12

Graph Edges:
(0, 4), (1, 3), (1, 4), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6), (4, 5), (4, 6), (5, 6)

> **Question: For the Graph Coloring problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?**

Answer:

Best Strategy: Backtracking with MRV Heuristic
Most Remaining Values heuristic reduces search space significantly.

Complexity: Time: O(k^n), Space: O(n)

Alternative Strategies:

• **DFS with Pruning**: Standard CSP approach

• **Greedy Coloring**: When speed is priority over optimality

Recommended Heuristics: Degree Heuristic, Minimum Remaining Values

Instance 2:

Vertices: 6, **Colors Available:** 4, **Edges:** 8

Graph Edges:
(0, 1), (0, 4), (0, 5), (2, 3), (2, 4), (3, 4), (3, 5), (4, 5)

> **Question: For the Graph Coloring problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?**

Answer:

Best Strategy: Backtracking with MRV Heuristic
Most Remaining Values heuristic reduces search space significantly.

Complexity: Time: O(k^n), Space: O(n)

Alternative Strategies:

• **DFS with Pruning**: Standard CSP approach

• **Greedy Coloring**: When speed is priority over optimality

Recommended Heuristics: Degree Heuristic, Minimum Remaining Values

Instance 3:

Vertices: 5, **Colors Available:** 4, **Edges:** 5

Graph Edges:
(0, 4), (2, 3), (0, 1), (1, 2), (3, 4)

Question: For the Graph Coloring problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with MRV Heuristic
Most Remaining Values heuristic reduces search space significantly.

Complexity: Time: O(k^n), Space: O(n)

Alternative Strategies:

• **DFS with Pruning**: Standard CSP approach

• **Greedy Coloring**: When speed is priority over optimality

Recommended Heuristics: Degree Heuristic, Minimum Remaining Values

4. Knight's Tour

Instance 1:

Board Size: 5×5, **Starting Position:** (0, 2), **Visited Squares:** 7

7	4	1	·	·
·	·	·	5	2
·	6	3	·	·
·	·	·	·	·
·	·	·	·	·

Question: For the Knight's Tour problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with Warnsdorff Heuristic
Warnsdorff rule (choose square with fewest onward moves) dramatically improves success rate.

Complexity: Time: O(8^(n^2)), Space: O(n^2)

Alternative Strategies:

• **DFS with Backtracking**: When heuristic not implemented

Recommended Heuristics: Warnsdorff's Rule, Accessibility Heuristic

Instance 2:

Board Size: 6×6, **Starting Position:** (5, 5), **Visited Squares:** 8

·	·	·	4	·	·
·	5	·	·	·	3
·	·	·	·	·	·
·	·	6	·	2	·
·	·	·	·	7	·
·	·	8	·	·	1

Question: For the Knight's Tour problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with Warnsdorff Heuristic
Warnsdorff rule (choose square with fewest onward moves) dramatically improves success rate.

Complexity: Time: O(8^(n^2)), Space: O(n^2)

Alternative Strategies:

• **DFS with Backtracking**: When heuristic not implemented

Recommended Heuristics: Warnsdorff's Rule, Accessibility Heuristic

Instance 3:

Board Size: 5×5, **Starting Position:** (4, 0), **Visited Squares:** 9

3	·	·	·	·
·	·	4	9	·
·	2	·	·	7
·	5	8	·	·
1	·	·	6	·

Question: For the Knight's Tour problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: Backtracking with Warnsdorff Heuristic
Warnsdorff rule (choose square with fewest onward moves) dramatically improves success rate.

Complexity: Time: O(8^(n^2)), Space: O(n^2)

Alternative Strategies:

• **DFS with Backtracking**: When heuristic not implemented

Recommended Heuristics: Warnsdorff's Rule, Accessibility Heuristic

5. 8-Puzzle

Instance 1:

Initial State (Goal: 1-2-3-4-5-6-7-8-blank)

2	7	3
1	8	
5	6	4

Question: For the 8-Puzzle problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: A*
Optimal and complete. With Manhattan Distance heuristic, efficiently finds shortest solution.

Properties: Admissible heuristic

Alternative Strategies:

• **IDA***: When memory is limited

• **BFS**: When heuristic not available

Recommended Heuristics: Manhattan Distance, Misplaced Tiles

Instance 2:

Initial State (Goal: 1-2-3-4-5-6-7-8-blank)

5	8	2
1		3
4	7	6

Question: For the 8-Puzzle problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: A*
Optimal and complete. With Manhattan Distance heuristic, efficiently finds shortest solution.

Properties: Admissible heuristic

Alternative Strategies:

• **IDA***: When memory is limited

• **BFS**: When heuristic not available

Recommended Heuristics: Manhattan Distance, Misplaced Tiles

Instance 3:

Initial State (Goal: 1-2-3-4-5-6-7-8-blank)

1	6	2
5	3	
4	7	8

Question: For the 8-Puzzle problem and the given instance, which is the most appropriate solving strategy among those mentioned in the course (BFS, DFS, UCS, A*, GBFS, IDA*, Hill Climbing, Simulated Annealing)?

Answer:

Best Strategy: A*
Optimal and complete. With Manhattan Distance heuristic, efficiently finds shortest solution.

Properties: Admissible heuristic

Alternative Strategies:

• **IDA***: When memory is limited

• **BFS**: When heuristic not available

Recommended Heuristics: Manhattan Distance, Misplaced Tiles