Optimization & Search — Assignment Summary

Overall Summary

Task	Status	Score	Details
BFS (10%)	**OK**	10/10	Path len 11/11
A* (15%)	**OK**	15/15	Expansions 25
IDS (15%)	**OK**	15/15	Expansions 2211
Simulated Annealing (15%)	**OK**	15/15	Improvement 1.20
Heuristics (20%)	**OK**	20/20	M:✓ E:✓ C:✓
Linear Programming (12.5%)	**OK**	12.5/12.5	Z* 28
Dynamic Programming (12.5%)	**OK**	12.5/12.5	Value 29

Breadth-First Search (10%)

BFS must find the shortest unweighted path from start to goal.

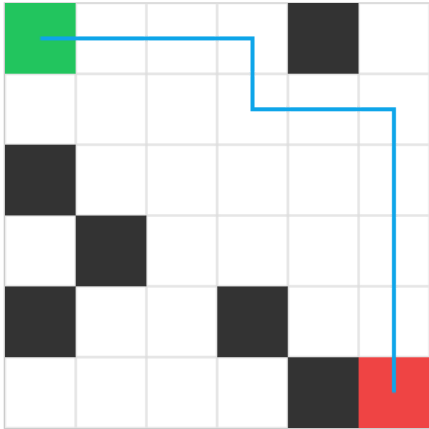Seed: 345 • Grid: 6x6 • Obstacles: 6
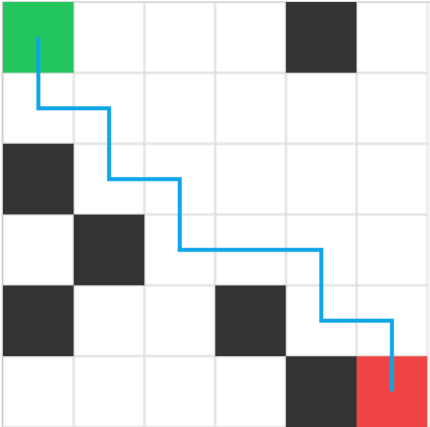
Score: 10

Justification / Design Notes (saved locally):

A* Search (15%)

A* should find an optimal path using an admissible heuristic (we grade with Manhattan).
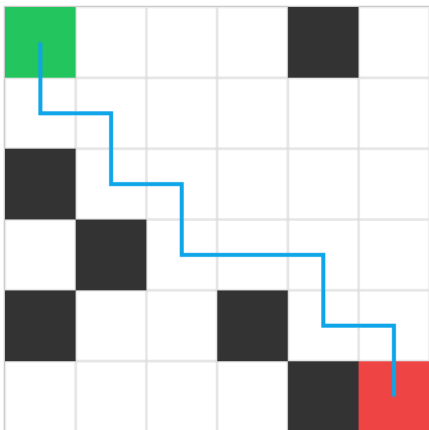
Expansions: 25 • PathLen: 11 • BestLen: 11

Score: 15

Justification / Design Notes (saved locally):

Iterative Deepening Search (15%)

IDS combines DFS space with BFS completeness; should reach the goal and match shortest depth on unweighted grid.
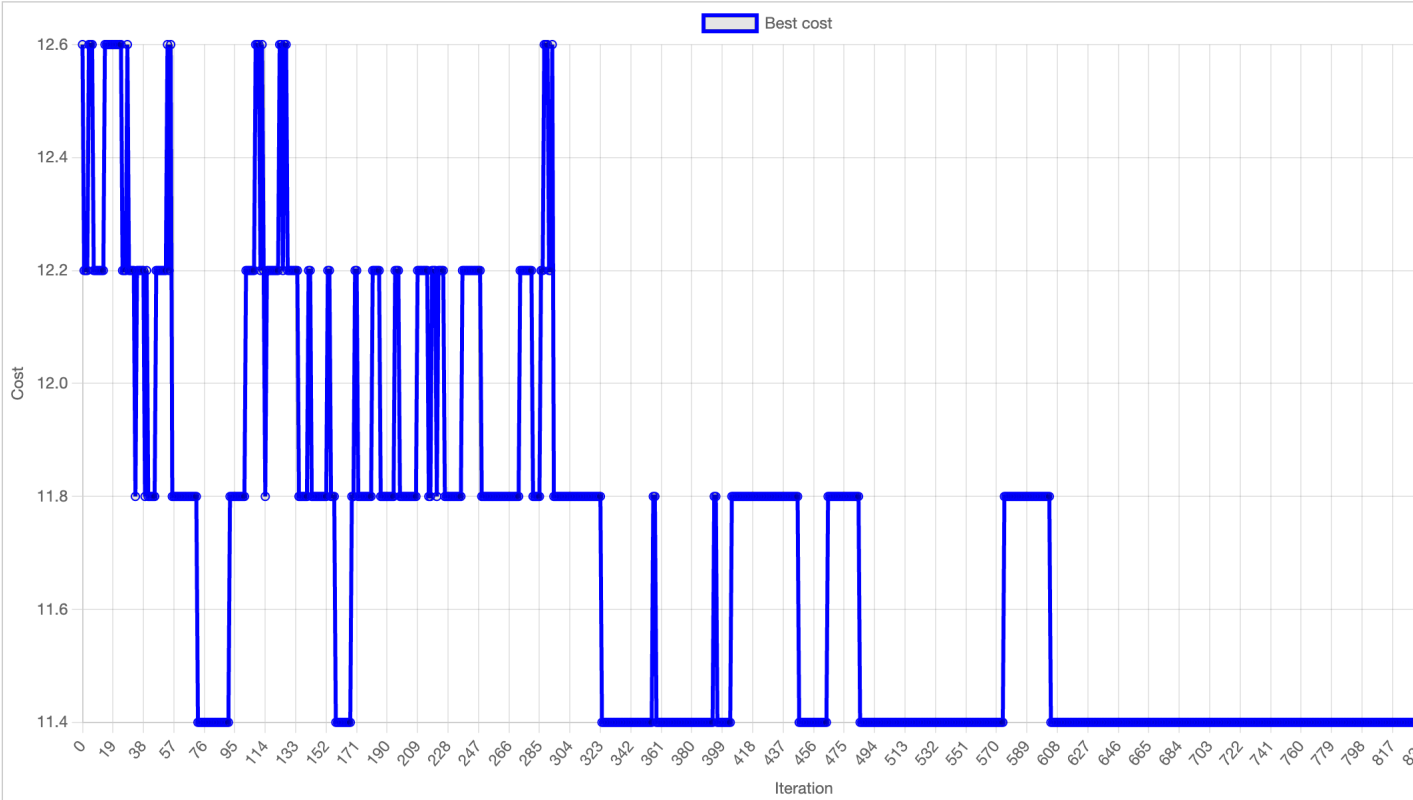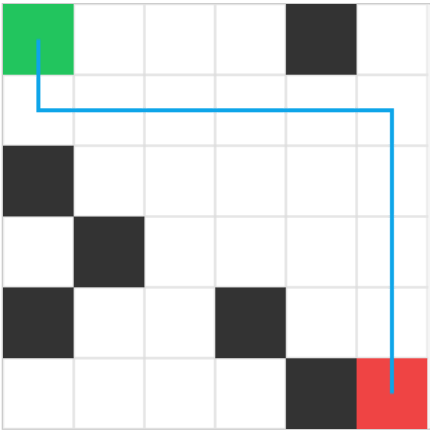
Expansions: 2211 • PathLen: 11 • BestLen: 11

Score: 15

Justification / Design Notes (saved locally):

Simulated Annealing (15%)

SA must improve on the BFS baseline and exhibit an annealing history (non-constant, multiple changes).

BFS_Cost: 12.6 • Final_Cost: 11.4 • Improvement: 1.20

Score: 15

Justification / Design Notes (saved locally):

Heuristics (20%)

We test heuristics on random states for admissibility & sanity: Manhattan (5), Straight-line (5), Custom (10).
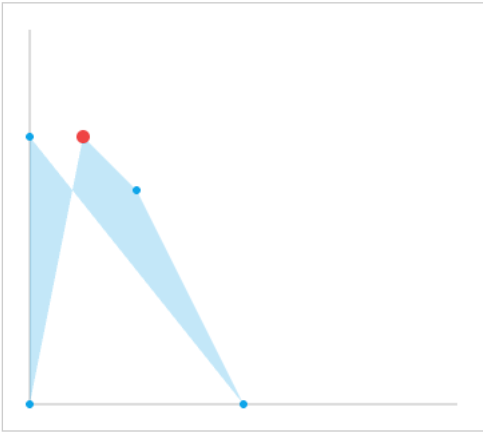
Heuristic	Status	Score	Detail
Manhattan	OK	5	ok=23/23, neg=0, above=0
Straight-line	OK	5	ok=23/23, neg=0, above=0
Custom	OK	10	ok=23/23, neg=0, above=0

Score: 20

Justification / Design Notes (saved locally):

Linear Programming (12.5%)

Graphical corner-point method on a small LP. The optimum must be at a feasible vertex.

Maximize $Z = 3x + 5y$ subject to $Ax \leq b$, $x \geq 0, y \geq 0$

Score: 12.5

Justification / Design Notes (saved locally):

Dynamic Programming – Knapsack (12.5%)

0/1 Knapsack solved via bottom-up & top-down; both should agree on the optimal value.

Capacity: 10 • Items: 5 • BottomUp: 29 • TopDown: 29

0	0	6	6	11	15	18	21	24	26	29
0	0	5	5	10	15	18	20	23	25	28
0	0	0	0	10	15	18	18	18	25	28
0	0	0	0	10	15	15	15	15	25	25
0	0	0	0	10	10	10	10	10	10	10
0	0	0	0	0	0	0	0	0	0	0

Score: 12.5

Justification / Design Notes (saved locally):

Hidden Integrity Checks

Check	Status	Details
Seed match	OK	seed=345
Trace usage	OK	BFS=29, A*=25, IDS=2211

A* heuristic admissibility	**OK**	samples=14, neg=0, above=0
SA annealing	**OK**	improve=1.200, hist_len=901, changes=70
LP best is vertex	**OK**	best=(1.0, 5.0), |V|=5
DP cross-check	**OK**	bottom_up=29, top_down=29
Hidden multi-seed run	**OK**	SA sanity on hidden seed