Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

BFS: about 10^6 nodes in memory

DFS: about $10 \times 6 = 60$ nodes in memory

BFS finds the shallowest goal; DFS may find a deeper one or never finish on an infinite tree

2.2

A: A–B–C–G $= 1 + 2 + 3 = 6 \geq 5$; B: B–C–G $= 5 \geq 4$

no h is larger than the true cost, so h is admissible

2.3

MIN values 3, 2, 2

root = **3**

MAX chooses the left move

2.4

after the middle node's first leaf 2 (≤ 3), skip 4 and 6

in the right node, 14 and 5 are above 3, so all three leaves are read: 2 leaves skipped in total

3.1

(a) S ($f = 6$), A (7); B (7, reached through A with $g = 3$); C (8), G (8)

(b) S–A–B–C–G, cost $2 + 1 + 2 + 3 =$ **8**

(c) D has $f = g + h = (3 + 6) + 1 = 10$, which is more than 8, so G is taken first

3.2

(a) no: $9 > 5$

(b) S expands; B has $f = 4 + 9 = 13$, A has 7; through A, C has $f = 7 + 3 = 10$, and B is at 12; C leads to G with $f = 10$, before B: path S–A–C–G, cost **10**

(c) an overestimating heuristic can make A* return a path that is not the cheapest

3.3

(a) Manhattan distance $|x - x_g| + |y - y_g|$: each move changes x or y by 1, so no route can be shorter

(b) 10^4 cells; yes, BFS is easy at this size, but it searches in every direction

(c) h points towards the goal, so cells away from it get a large f and are rarely expanded

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(d) give busy corridors a higher cost at break times and re-plan with A* when a path is blocked; keep h as the Manhattan distance, which stays admissible because costs only go up