Solutions

2.1

- $h(n) \leq h^*(n)$ for every node: never overestimates the true remaining cost ✓.

2.2

- $f(goal) = g(goal)$, since $h(goal) = 0$ ✓.

2.3

- That f is a lower bound for every open node: no unexpanded path could be cheaper ✓.

3.1

- Pops: D $(g0, h0, f0)$; B $(g2, h6, f8)$; C $(g3, h5, f8)$; G $(g8, h0, f8)$ ✓.
- Four expansions; path D→B→C→G at cost $2 + 1 + 5 = 8$ ✓.
- A (f = 12) is never popped: its subtree cannot beat the goal's bound – and the unused A→C edge is exactly what that bound excludes ✓.
- BFS order: D, A, B, C, G (level by level) – five visits, no cost awareness ✓.

3.2

- With $h'(C) = 12$: C carries $f = 3 + 12 = 15$; pops become D, B, then G (through B, $f = 11$) – returned cost 11 ✓.
- Admissibility is violated at C ($12 > 5$): the goal pops while a cheaper open path exists ✓.
- Restoring fix: remove the direct B→G edge – then G is reachable only through C, and even the lying h' must pop C first ✓.
- Lesson: an estimate is a contract; optimality is only as honest as the tightest overestimate in the graph ✓.

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