Q6.

(a)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | S | A | B | G | Admissible | Consistent |
| h1 | 0 | 0 | 0 | 0 | T | F |
| h2 | 8 | 1 | 1 | 0 | T | F |
| h3 | 9 | 3 | 2 | 0 | T | T |
| h4 | 6 | 3 | 1 | 0 | T | F |
| h5 | 8 | 4 | 2 | 0 | F | F |

h1: not consistent

h(S) ≰ h(A) + c(S, A)

0 ≰ 0 + 6

h2: not consistent

h(S) ≰ h(A) + c(S, A)

8 ≰ 1 + 6

h4: not consistent

h(A) ≰ h(B) + c(A, B)

3 ≰ 1 + 1

h5: ~admissible → ~consistent

h(A) ≰ g(G) – g(A)

4 ≰ 9 – 6

(b)

S – A – B – G

(c)

I would use heuristic h3 since it is consistent. From the proof in the lecture, a consistent heuristic would lead to the A\* graph search to be optimal. Hence, the solution path result of the algorithm using h3 is guaranteed to be optimal.

(d)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | S | A | B | G |
| h = max(h3, h5) | 8 | 4 | 2 | 0 |

The statement is untrue. For a heuristic to be admissible,

h(n) ≤ g(goal) – g(n)

However for node A:

h(A) ≰ g(G) – g(A)

4 ≰ 9 – 6

Hence, the heuristic is no admissible.

Q7.

Let the optimal path be

S0 → S1 → … → Sk → Sk+1 → … → Sg

OPT(Sk) = OPT(Sk+1) + c(Sk, Sk+1)

h(Sk) = 0.5 OPT(Sk+1) + 0.5 c(Sk, Sk+1) = h(Sk+1) + 0.5 c(Sk, Sk+1)

Since c(Sk, Sk+1) ≥ 0

0.5 c(Sk, Sk+1) ≤ c(Sk, Sk+1)

h(Sk) ≤ h(Sk+1) + c(Sk, Sk+1)

Hence, for nodes on the optimal path, the heuristic is consistent.

Let Su be a node succeeding Sk but not on the optimal path.

Since Su is not on the optimal path,

OPT(Sk) ≤ OPT(Su) + c(Sk, Su)

h(Sk) ≤ 0.5 OPT(Su) + 0.5 c(Sk, Su) ≤ h(Su) + c(Sk, Su)

Hence, for nodes adjacent but not on the optimal path, the heuristic is consistent.

Overall, the heuristic is consistent. By the lecture proof, an A\* graph search using this heuristic will be optimal.