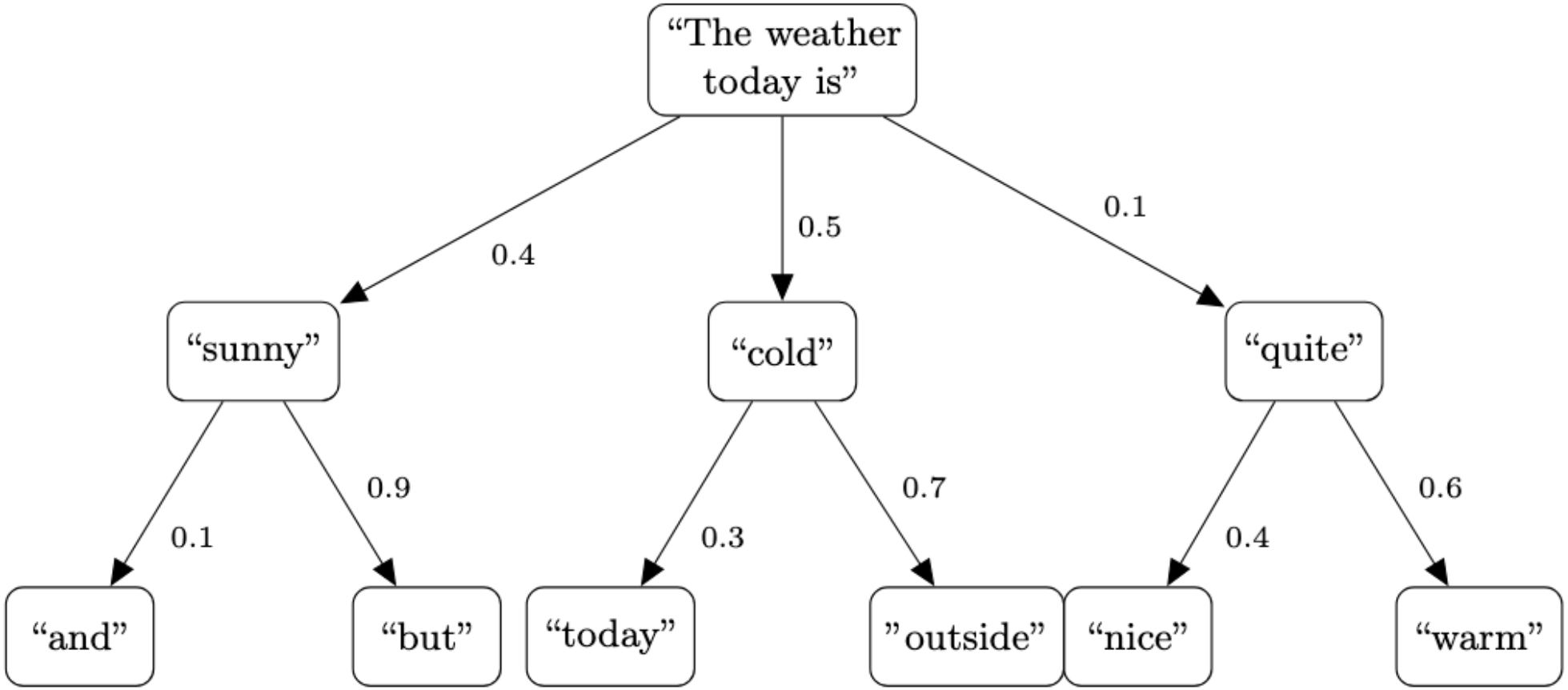
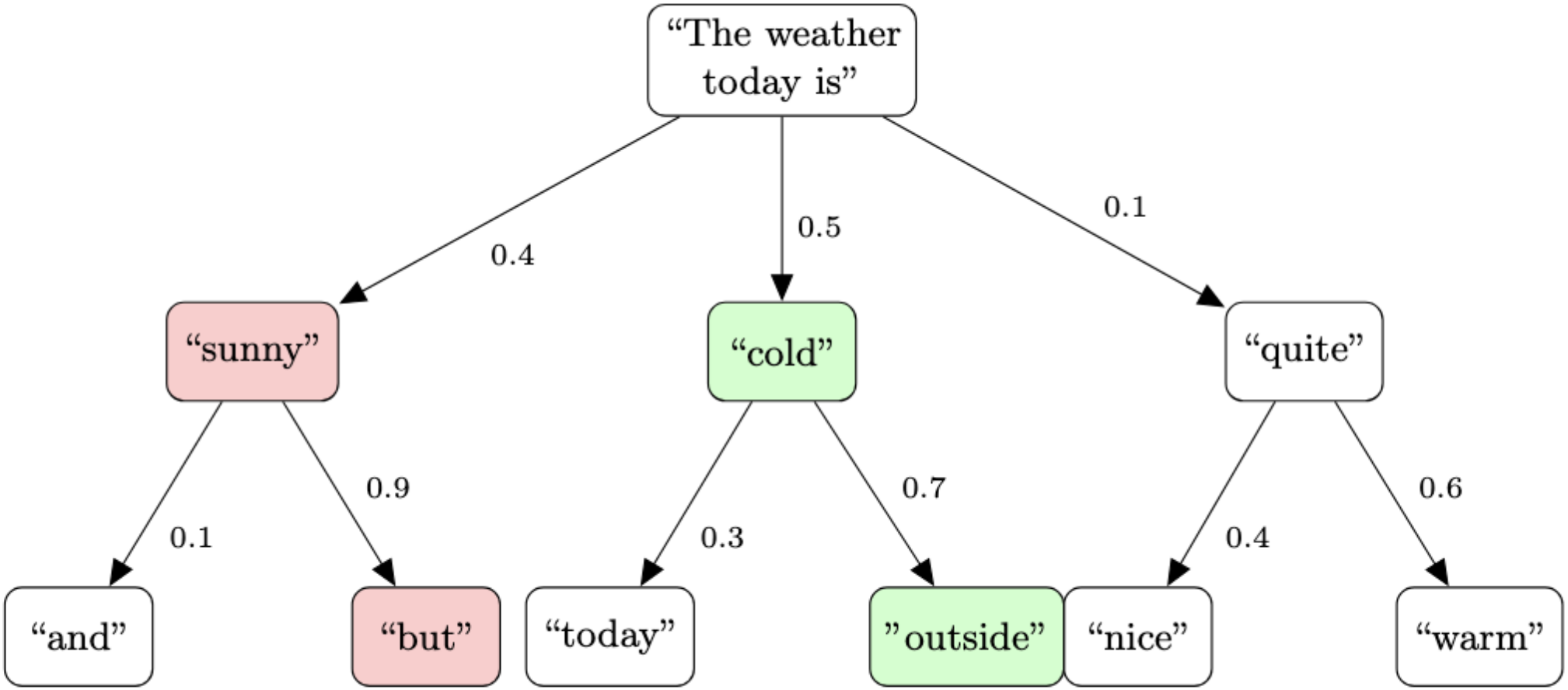
Informed Search

Eric Ewing

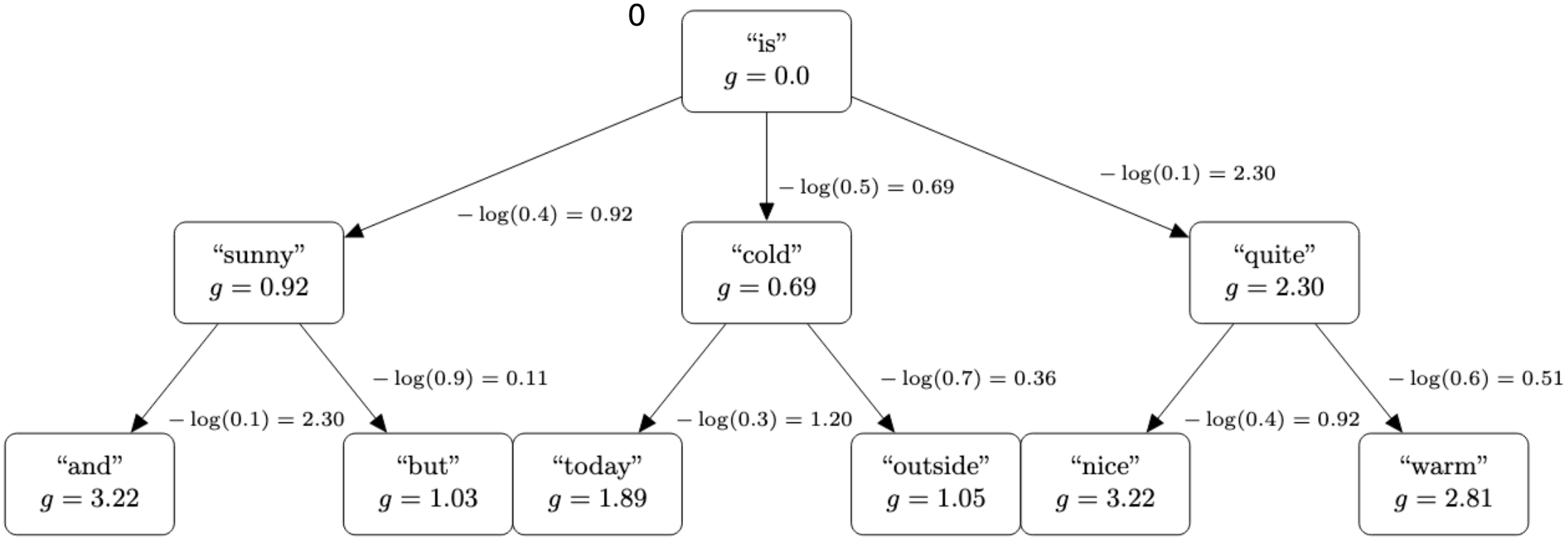


What is the best two word continuation?

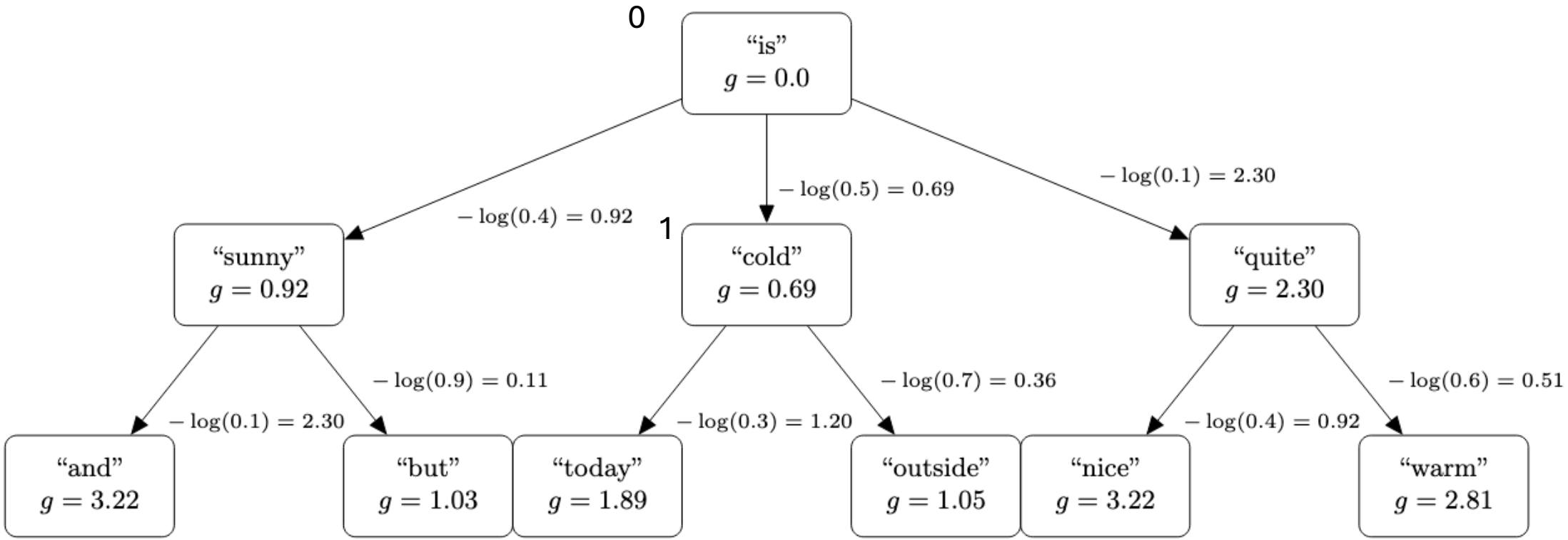


$P(The\ weather\ today\ is\ sunny\ but) = 0.4 \cdot 0.9 = 0.36$

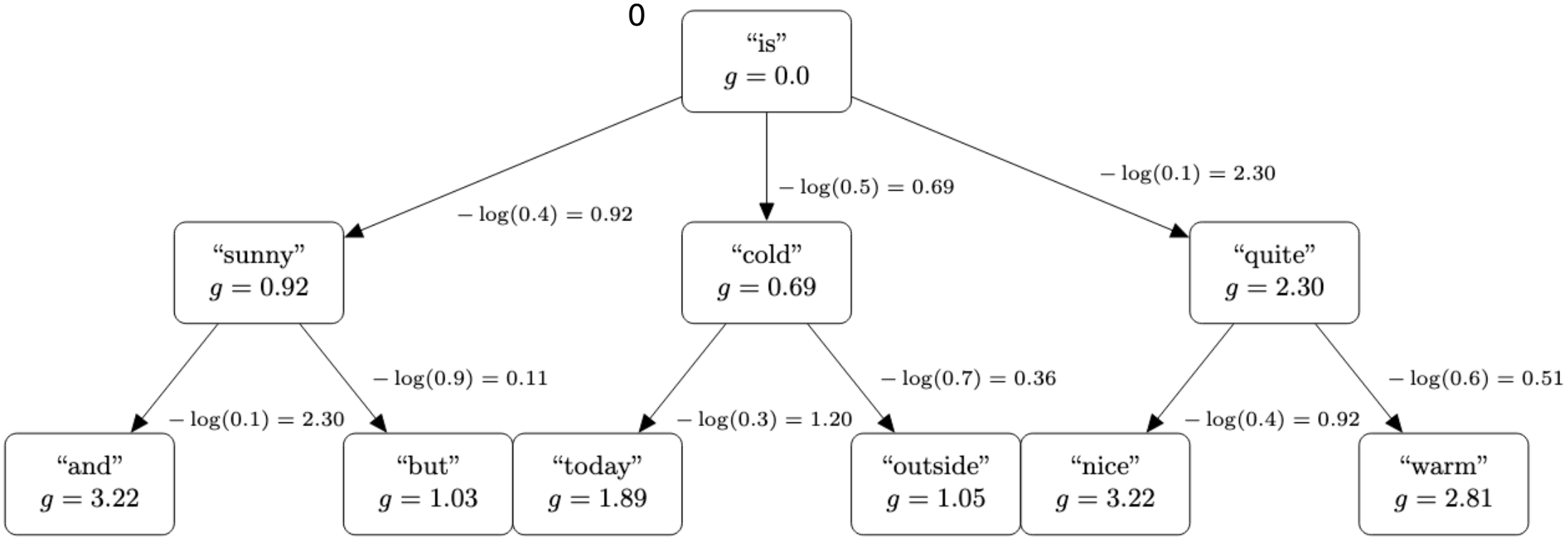
$P(\text{“}The\ weather\ today\ is\ cold\ outside\text{”}) = 0.5 \cdot 0.7 = 0.35$


"is"
$g = 0.0$
$-\log(0.4) = 0.92$
$-\log(0.5) = 0.69$
$-\log(0.1) = 2.30$
"sunny"
$g = 0.92$
"cold"
$g = 0.69$
"quite"
$g = 2.30$
$-\log(0.9) = 0.11$
$-\log(0.7) = 0.36$
$-\log(0.6) = 0.51$
$-\log(0.1) = 2.30$
$-\log(0.3) = 1.20$
$-\log(0.4) = 0.92$
"and"
$g = 3.22$
"but"
$g = 1.03$
"today"
$g = 1.89$
"outside"
$g = 1.05$
"nice"
$g = 3.22$
"warm"
$g = 2.81$

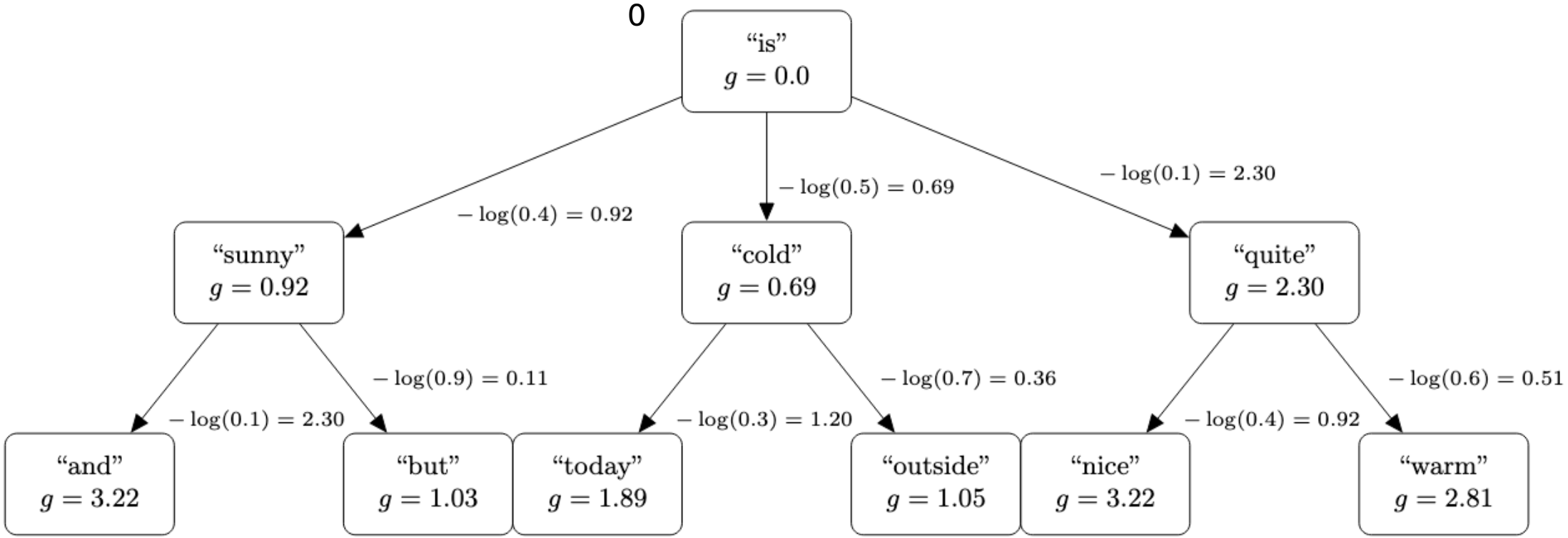
Open Set = [("is", 0)]



Open Set = [("cold", 0.69), ("sunny", 0.92), ("quite", 2.3)]



Open Set = [("sunny", 0.92), ("outside", 1.05), ("today", 1.89), ("quite", 2.3)]



Open Set = [("but", 1.03), ("outside", 1.05), ("today", 1.89), ("quite", 2.3), ("and", 3.22)]

Solving Mazes with Informed Search

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((2, 0), 4)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((1, 3), 3), ((3, 0), 5]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((0, 0), 2), ((3, 0), 5]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((0, 1), 1), ((3, 0), 5]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((1, 1), 2), ((3, 0), 5]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((2, 1), 3), ((3, 0), 5]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((3, 1), 4), ((3, 0), 5]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((3, 0), 5), ((4, 1), 5)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((4, 1), 5), ((4, 0), 6)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((5, 1), 6), ((4, 0), 6)]

Heuristic Function: Manhattan Distance

Best-h search greedily follows the heuristic. It does not provide optimal (lowest cost) paths.

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((2, 0), 4)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((1, 0), 4), ((3, 0), 6)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((0, 0), 4), ((3, 0), 6)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((0, 1), 4), ((3, 0), 6)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6	h(5, 0) = 7
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((3, 0), 6), ((1, 1), 6)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6 g(4, 0) = 2 f(4, 0) = 8	h(5, 0) = 7
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((1, 1), 6), ((4, 0), 8)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6 g(4, 0) = 2 f(4, 0) = 8	h(5, 0) = 7
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3 g(2, 1) = 5 f(2, 1) = 8	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((4, 0), 8), ((2, 1), 8)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6 g(4, 0) = 2 f(4, 0) = 8	h(5, 0) = 7 g(5, 0) = 3 f(5, 0) = 10
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3 g(2, 1) = 5 f(2, 1) = 8	h(3, 1) = 4	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((2, 1), 8), ((5, 0), 10)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6 g(4, 0) = 2 f(4, 0) = 8	h(5, 0) = 7 g(5, 0) = 3 f(5, 0) = 10
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3 g(2, 1) = 5 f(2, 1) = 8	h(3, 1) = 4 g(3, 1) = 6 f(3, 1) = 10	h(4, 1) = 5	h(5, 1) = 6
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

Open Set: [((5, 0), 10), ((3, 1), 10)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6 g(4, 0) = 2 f(4, 0) = 8	h(5, 0) = 7 g(5, 0) = 3 f(5, 0) = 10
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3 g(2, 1) = 5 f(2, 1) = 8	h(3, 1) = 4 g(3, 1) = 6 f(3, 1) = 10	h(4, 1) = 5	h(5, 1) = 6 g(5, 1) = 10
Goal h(0, 2) = 0	h(1, 2) = 1	h(2, 2) = 2	h(3, 2) = 3	h(4, 2) = 4	h(5, 2) = 5

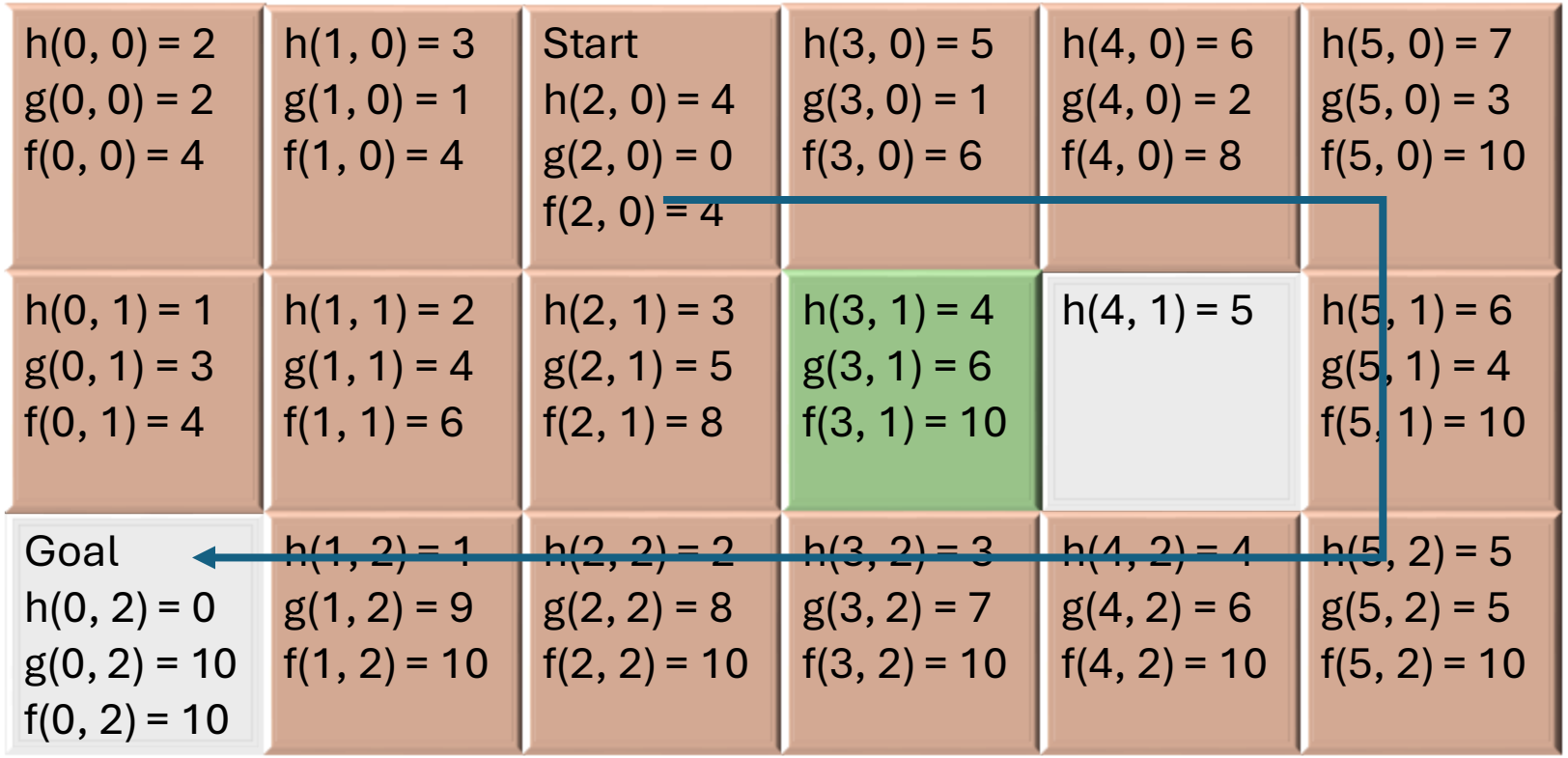
Open Set: [((5, 0), 10), ((3, 1), 10)]

Heuristic Function: Manhattan Distance

h(0, 0) = 2 g(0, 0) = 2 f(0, 0) = 4	h(1, 0) = 3 g(1, 0) = 1 f(1, 0) = 4	Start h(2, 0) = 4 g(2, 0) = 0 f(2, 0) = 4	h(3, 0) = 5 g(3, 0) = 1 f(3, 0) = 6	h(4, 0) = 6 g(4, 0) = 2 f(4, 0) = 8	h(5, 0) = 7 g(5, 0) = 3 f(5, 0) = 10
h(0, 1) = 1 g(0, 1) = 3 f(0, 1) = 4	h(1, 1) = 2 g(1, 1) = 4 f(1, 1) = 6	h(2, 1) = 3 g(2, 1) = 5 f(2, 1) = 8	h(3, 1) = 4 g(3, 1) = 6 f(3, 1) = 10	h(4, 1) = 5	h(5, 1) = 6 g(5, 1) = 4 f(5, 1) = 10
Goal h(0, 2) = 0 g(0, 2) = 10 f(0, 2) = 10	h(1, 2) = 1 g(1, 2) = 9 f(1, 2) = 10	h(2, 2) = 2 g(2, 2) = 8 f(2, 2) = 10	h(3, 2) = 3 g(3, 2) = 7 f(3, 2) = 10	h(4, 2) = 4 g(4, 2) = 6 f(4, 2) = 10	h(5, 2) = 5 g(5, 2) = 5 f(5, 2) = 10

Open Set: [((5, 0), 10), ((3, 1), 10)]

Heuristic Function: Manhattan Distance



Open Set: [((5, 0), 10), ((3, 1), 10)]